Model Misspecification and Bias in the Evaluation of the Macroforecasting Performance of Portfolio Managers

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Abstract

This paper develops a new model to evaluate the market-timing performance of portfolio managers. The model permits multiple levels in the portfolio beta, each of which corresponds to a separate yet prolonged rising or falling economic period. The proposed model contrasts with the more conventional dual-beta or up/down model in which up (down) markets are defined whenever the market return is positive (nonpositive). Results indicate that the conventional model yields downward biased measures of timing performance. Further, rankings of funds derived from the new model bear little resemblance to the rankings derived from the up/down model.

Introduction

The sensational growth in assets of institutional investment companies over the past quarter century has been a meaningful and widely documented trend within the capital market. From 1960 to 1985, the number of registered investment companies grew from 512 to 2,458 while their total assets soared from $20 billion to over $525 billion. Of the $525 billion, over $435 billion were represented by mutual funds.[1]

Because of this substantial transfer of capital to managed investment funds, the evaluation of fund performance has become increasingly important to financial economists. Beginning with the pioneering work of Fama [7], the analysis of portfolio managers has been segmented between micro and macroforecasting components. Microforecasting, the ability to select undervalued assets, often is evaluated through an examination of market model

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[1]The investment company information is derived from the *Annual Report* of the Securities and Exchange Commission for years 1959 and 1985.

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alphas. In contrast, macroforecasting, the ability to vary the portfolio mix during market reversals, often is evaluated through an examination of market model betas.[2]

The conventional model for market-timing evaluation, known as the up/down (UD) model, was established by Merton [15] and Henriksson and Merton [10] and has been employed in numerous studies [6, 2, 21, 9, 4] to assess the market-timing performance of mutual fund managers. The UD model assumes that to be a successful macroforecaster, the manager must produce a higher beta during up markets than during down markets. The model defines up (down) markets as periods in which the return (or return in excess of the risk free rate) on an equity market index is positive (nonpositive). Thus, the UD model is a dual-beta framework in which an up-market beta and a down-market beta are estimated and compared for each portfolio.

This paper proposes a new market-timing model that differs from the UD model. A market trend classification is used such that beta need not change in response to temporary reversals within a prolonged market phase. Further, a process is used to estimate betas separately for each major trend in the market, leading to a model exhibiting many regimes or structural changes. Two versions of the alternative model are examined. The bull/bear (BB) version classifies primary trends according to bull/bear periods in the stock market. The expansion/contraction (EC) version, on the other hand, classifies primary trends according to expansion/contraction (e.g., business cycles) periods in the U.S. economy. This paper argues that the UD model may lead to biased estimates of both systematic risk and timing performance and offers the new model as an alternative framework for market-timing evaluation.

Results from the UD, BB, and EC models differ sharply. Based on the UD (BB) model, portfolio managers appear to be inept macroforecasters, producing higher betas during down (bear) markets than during up (bull) markets. In contrast, the EC results indicate that betas for both aggressive growth and growth funds are higher during periods of business expansion than during periods of business contraction. Timing performance indices derived from the UD model typically are below those derived from the BB and EC models. Correlations of the performance rankings of the funds derived from the three models are close to zero.

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[2]Roll [17] criticizes the use of the CAPM to evaluate portfolio performance. Empirical work by Chang and Lewellen [4], however, suggests that there is little difference between APT and CAPM rankings of mutual fund performance.

The Data

Two sets of data are used to examine the market-timing performance of mutual funds. First, the monthly cash-to-portfolio value ratio aggregated across all mutual funds is examined for the 120 month period from October 1977 through September 1987. This data set is used to assess the efficacy of the UD, BB, and EC models.[3] Second, monthly returns for the same ten year period for 289 mutual funds are used to measure the market-timing performance of portfolio managers.

The sample consists of 51 aggressive growth funds, 124 growth funds, 73 growth and income funds, and 41 balanced funds. The mutual fund returns (which include dividends, capital gains, and losses) are obtained from the CDA Investment Technologies, Inc. data base. Monthly returns on the value-weighted market index (read from the monthly master tape maintained by the Center for Research in Security Prices) are used as monthly market returns. One month Treasury bill rates are used to proxy the risk free return series.

The classification of bull and bear markets for the BB model is adapted from Wiesenberger [22]. Wiesenberger identifies a new bull (bear) market when the market rises (falls) more than 10 percent from the previous low (high). The market trends identified in Wiesenberger are modified so that each bull or bear market lasts at least six months. This classification scheme produces four bull markets: 1. November 1978-August 1979; 2. May 1980-December 1980; 3. March 1982-October 1983; and 4. August 1984-September 1987 and four bear markets: 1. October 1977-October 1978; 2. September 1979-April 1980; 3. January 1981-February 1982; 4. November 1983-September 1984.

The classification of business cycles for the EC model is derived from the January 1988 *Business Conditions Digest*. During the period of analysis, there were three expansion periods: 1. October 1977-December 1979; 2. July 1980-June 1981; and 3. November 1982-September 1987 and two contraction periods: 1. January 1980-June 1980 and 2. July 1981-October 1982. The *Business Conditions Digest* classifications for business cycles have been used previously by Fabozzi and Francis [6] and Alexander and Stover [2] in their analyses of the timing ability of mutual funds.

[3]The authors gratefully acknowledge Lisa F. Swaiman, assistant vice president of public information for the Investment Company Institute, for providing the monthly liquidity ratios for the mutual fund industry.

The Timing Performance Measure

Following Fama [7], Kon [12] defines the multiperiod measure of macroforecasting performance as:

$$(1)\ \tau_j = 1/T \sum_{t=1}^{t} \tau_{jt}$$

$$= 1/T \sum_{t=1}^{t} \beta_{jt} [R_{mt} - E(R_m)],$$

where:

β_{jt} = the systematic risk for portfolio j during period t, and
R_{mt} = the return on the market index during period t.

Although τ_j is a theoretically valid measure of timing performance, it is difficult to implement. In particular, to estimate τ_j, a judgment must be made about the frequency and timing of the changes in β_{jt}. Further, if the switch points for beta are misspecified, the corresponding market-timing model will lead to biased estimates for β_{jt} and τ_j.

The UD Model

The UD model has been employed by Fabozzi and Francis [6], Alexander and Stover [2], Veit and Cheney [21], Henriksson [9], and Chang and Lewellen [4] and can be represented as:

$$(2)\ R_{jt} = \alpha_{ju} + \beta_{ju} R_{mt} + e_{jt}, \text{ for all t when } R_{mt} > 0$$

$$(3)\ R_{jt} = \alpha_{jd} + \beta_{jd} R_{mt} + e_{jt}, \text{ for all t when } R_{mt} \leq 0.$$

Ordinary least squares can be applied to the model to estimate the beta structure, in which β_{ju} (β_{jd}) is the up (down) market beta for portfolio j.[4] The model can be recast more succinctly using dummy variables,

[4]A constant intercept ($a_{ju} = a_{jd}$) is assumed in the Chang and Lewellen [4] paper. Moreover, many studies that apply the UD model define R_{jt} and R_{mt} as returns in excess of the risk free rate. This latter convention is employed for all regressions and timing performance measures estimated in this paper.

$$(4)\ R_{jt} = \alpha_{ju}D_{ut} + \alpha_{jd}D_{dt} + \beta_{ju}R_{mt}D_{ut} + \beta_{jd}R_{mt}D_{dt} + e_{jt}.$$

The timing performance index emerges by combining equations (4) and (1):

$$(5)\ \tau_j^{ud} = 1/T \sum_{t=1}^{t} [\beta_{ju}(R_{mt} - E(R_m))D_{ut} + \beta_{jd}(R_{mt} - E(R_m))D_{dt}],$$

where:

$D_{ut} = 1$ for up market observations ($R_{mt} > 0$) only and
$D_{dt} = 1$ for down market observations ($R_{mt} \leq 0$) only.

During down (up) observations, D_{ut} (D_{dt}) equals zero. To examine the market-timing ability of portfolio j using (4), a t-test is performed on the difference between up and down market betas, $\beta_{ju} - \beta_{jd}$. A positive difference is indicative of superior market-timing ability, implying that the manager has formed a mix of assets that has been more sensitive to market changes during up versus down periods. The timing performance index, τ_j, measures the average incremental return to the portfolio attributable to the manager's macroforecasting ability.

Although the UD model is the conventional basis of market-timing assessment, it suffers from two major limitations. First, it restricts the number of portfolio betas elicited over time to two; one during up markets and the other during down markets. Beta is assumed to be constant across all up market and across all down market observations. In contrast, Francis and Fabozzi [8] and Alexander, Benson, and Eger [1] offer evidence of significant intertemporal fluctuations in portfolio betas. Second, the UD model delineates rising and falling markets solely on the basis of whether the market return (typically measured monthly) is positive or not. Thus, superior macroforecasting ($\beta_{ju} > \beta_{jd}$) emerges from the UD model only if the manager changes the portfolio beta suddenly, frequently, and significantly even during countermovements within primary trends in the equity market.

If managers elect not to adjust their portfolio beta whenever the return on the stock market index changes sign, then the dummy variables in equation (4) are misspecified. Moreover, the UD model may underspecify the number of dummy variables if managers employ a multi-tier beta structure over time. As shown in the appendix, these misspecifications (of switch points for beta) lead to a bias in the beta estimates that is proportional to the size of the specification error. Thus, attempts should be made to ensure that the market-timing model employed is consistent with the market-timing process used by portfolio managers.

The Alternative Model

The alternative market-timing model possesses multiple levels of systematic risk corresponding to separate and prolonged economic periods:

$$(6)\ R_{jt} = \sum_{s=1}^{S} (\alpha_{js}D_{st} + \beta_{js}R_{mt}D_{st}) + v_{jt},$$

where:

D_{st} = 1 for all observations falling within market trend s (i.e., s = 1, 2, ..., S); otherwise,
D_{st} = 0.[5]

No two D_{st} variables are invoked simultaneously during observation t. Gains from the microforecasting ability of the manager are measured by the α_{js}. The timing performance index, on the other hand, is defined as:

$$(7)\ \tau_j = 1/T \sum_{t=1}^{T} \sum_{s=1}^{S} \beta_{sj}[R_{mt} - E(R_m)]D_{st}.$$

Two versions of the alternative model will be considered. The first version defines economic trends according to the timing of bull and bear periods in the stock market. In this bull/bear or BB model, the dummy variable D_{st} equals unity for all observations (t) falling within a particular bull or bear market (s). The second version of the model defines economic trends according to the timing of expansion and contraction periods in business cycles. In this expansion/contraction or EC model, the dummy variable D_{st} equals unity for all observations (t) falling within a particular business expansion or contraction period (s).

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[5]Miller and Gressis [15], Kon and Jen [13, 14], and Kon [12] also employ a market-timing framework characterized by multiple structural shifts. Each of these papers uses maximum likelihood techniques to search for the optimal partitioning of the characteristic line for each fund. Although their procedures may lead to better estimates, the intent in this paper is to contrast results of models that assign observations directly according to market conditions.

The evaluation of market-timing can be partitioned into separate measures of the macroforecaster's ability and performance attributes. For example, market-timing ability can be measured by the difference between the manager's bull (expansion) and bear (contraction) market betas. The manager exhibits superior macroforecasting ability if, in general, he or she produces a beta that is higher during bull (expansion) versus bear (contraction) markets. Market-timing performance, on the other hand, is defined as the average incremental return produced for the portfolio as a consequence of the manager's macroforecasting ability and is measured by τ_j. The manager exhibits superior macroforecasting performance if $\tau_j > 0$.

Testable Propositions

Four primary issues are addressed. First, the assumptions of the market-timing models are evaluated by testing the propositions that the mutual fund liquidity ratio is higher during down versus up markets, bear versus bull markets, and contraction versus expansion markets for the UD, BB, and EC models, respectively. A model is considered to be valid if the proposition is supported by the data. Second, macroforecasting ability of each fund is assessed by testing the propositions that $\beta_{ju} > \beta_{jd}$, $\beta_{jl} > \beta_{jr}$, and $\beta_{je} > \beta_{jc}$ for the UD, BB, and EC models, respectively. Third, this section tests the propositions, for each fund, that $\tau_j^{bb} > \tau_j^{ud}$ and $\tau_j^{ec} > \tau_j^{ud}$. Rejection of these hypotheses indicates that funds will appear to perform better when evaluated by the BB or EC models versus the UD model. Finally, the proposition that rankings of funds based on τ indices are uncorrelated across the three models is examined. All statistical tests are performed at the .05 significance level.

Analysis of Mutual Fund Industry Liquidity Ratios

Over the 120 month period from October 1977 through September 1987, there were 78 up months ($R_{mt} > 0$) during which time the average monthly liquidity ratio was 8.96 percent. During the same time span, there were 42 down months ($R_{mt} \leq 0$), during which time the average monthly liquidity ratio was 9.19 percent, only slightly above the up-market ratio. To be consistent with the assumptions of the UD model, the liquidity ratio should be significantly higher during down versus up periods, $LQ_d > LQ_u$. The t-statistic for the difference for the mean liquidity ratio between down and up markets, however, is just 1.08, indicating that the null hypothesis H_0: $LQ_d \leq LQ_u$ cannot be rejected. Thus, analysis of the liquidity ratios indicates that the UD model does not properly specify the market-timing process of fund managers.

Table 1 presents summary statistics for the liquidity ratio during bull/bear periods and during expansion/contraction periods. Aggregating across all bull (bear) market observations over the period October 1977-September 1987, the average monthly liquidity ratio, LQ_l (LQ_r), for the mutual fund industry is 8.91 (9.28) percent. The t-statistic for the difference between LQ_r and LQ_l is 1.81, indicating that the null hypothesis H_0: $LQ_r \leq LQ_l$ is rejected in favor of the alternative hypothesis H_a: $LQ_r > LQ_l$. Aggregating across all expansion (contraction) periods, the average monthly liquidity ratio, LQ_e (LQ_c), for the mutual fund industry is 8.76 (10.3) percent. The t-statistic for the difference between LQ_c and LQ_e is 7.11, indicating that H_0: $LQ_c \leq LQ_e$ is rejected in favor of H_a: $LQ_c > LQ_e$. Thus, the liquidity ratio evidence indicates that the BB and EC models are better specifications of the timing process of fund managers than is the UD model.[6] As indicated in the appendix, the larger specification errors associated with the UD model will lead to larger estimation bias.

Analysis of Systematic Risk Estimates

Table 2 presents summary statistics for the differences, $\hat{\beta}_u - \hat{\beta}_d$, $\hat{\beta}_l - \hat{\beta}_r$, and $\hat{\beta}_e - \hat{\beta}_c$, derived for each of the 289 funds using the UD, BB, and EC models, respectively. Results are classified according to mutual fund objective, with aggressive growth, growth, growth and income, and balanced funds summarized in panels A-D, respectively. Panel E presents aggregate results for all 289 funds sampled.

On average, the down-market beta, $\hat{\beta}_d$, exceeds its up-market counterpart, $\hat{\beta}_u$, for all fund categories. Of the 289 funds sampled, 59 percent exhibit down-market betas that exceed their up-market betas (from Panel E, middle two columns).[7] Forty-three funds (15 percent of the sample and 77 percent of the sample reporting statistical significance, from panel E, last two columns) display significantly poor timing ability (i.e., a significantly negative t-statistic

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[6]Many of the t-tests (not reported) for differences of mean liquidity ratios between separate bull and bear or between separate expansion and contraction markets are statistically significant. Of the 16 differences computed for the liquidity ratio between the four bull markets and four bear markets, eight are statistically significant. Further, of the six differences for the liquidity ratio computed between pairs of bull markets, four are statistically significant, and all of the six differences computed between pairs of bear markets are statistically significant. Similar results emerge from the EC model for separate expansion and contraction periods.

[7]Similar results are found by Chang and Lewellen [4] and Henriksson [9] in which sample-wide average down-market betas exceed sample-wide average up-market betas.

for H_0: $\beta_u = \beta_d$). The number of significantly superior macroforecasters inferred from the UD model is less than that inferred from either the BB or EC for each fund category (from last two columns of each panel).

Results from the BB model indicate that, in general, fund managers do not exhibit superior market-timing ability. On average, the bear market beta, $\hat{\beta}_r$, exceeds the bull market beta, $\hat{\beta}_l$, for all categories of funds. Additionally, 16 percent of the sample exhibit significantly inferior timing ability versus 12 percent that exhibit significantly superior timing ability (from panel E, last two columns). The balanced fund group, however, stand out as an exception to this finding. For the BB model, the number of balanced funds (from panel D, last two columns) exhibiting significantly superior timing ability (17 percent of the balanced fund group) exceeds the number (12 percent of the balanced fund group) exhibiting significantly inferior timing ability.

In contrast to the results derived from the UD and BB models, the findings derived from the EC model suggest that managers of both aggressive growth and growth funds are superior market-timers.[8] Of the 51 aggressive growth funds (124 growth funds) examined, 37, or 73 percent (85, or 69 percent), possess a higher beta during expansion periods than during contraction periods (from panel E, middle two columns). Moreover, 16 (13) percent of the aggressive growth (growth) funds display significantly superior macroforecasting ability according to the EC model (from panel E, last two columns).[9]

To examine the market-timing ability jointly across funds by objective, the null hypothesis that none of the funds exhibit either superior or inferior macroforecasting ability can be tested: that is, H_0: $\beta_{1u} - \beta_{1d} = \beta_{2u} - \beta_{2d} = ... = \beta_{Nu} - \beta_{Nd} = 0$ (across all N funds). To account for dependencies across fund returns, a seemingly unrelated regression (Zellner [23]) is estimated and a test of

[8]Results from the significance tests indicate that balanced funds perform better when evaluated with the BB versus the EC model (see Table 2, panel E, last two columns). As indicated in Table 1, expansion (contraction) periods typically lag bull (bear) markets. Thus, superior BB timing ability is associated with inferior EC timing ability.

[9]Because individual security betas are known to change over time, fund betas may vary even if a portfolio is managed passively. Fabozzi and Francis [6] randomly form portfolios and find that 9 percent, 7 percent, and 8 percent of the portfolios display significantly different betas between up/down, bull/bear, and expansion/contraction periods, using the UD, BB, and EC models, respectively. For the sample of 289 funds examined in this paper, 19 percent, 28 percent, and 20 percent exhibit significantly different betas between up/down, bull/bear, and expansion/contraction periods, respectively, (see Table 2, panel E). These results indicate that the percentage of funds exhibiting significant timing ability is substantially more than one would expect from a group of passively managed portfolios.

equality of β_u - β_d across the N equations is performed. The test statistic follows an $F_{N,116N}$ distribution. Similar F-tests can be performed to examine the analogous joint hypothesis for the BB and EC models.

Table 3 presents the respective F-tests for the UD, BB, and EC models. All F-statistics reported in the table are statistically significant, rejecting the null hypotheses that differences between up/down, bull/bear, and expansion/contraction betas are equal to zero across funds. These findings, when combined with results presented in Table 2, confirm that timing ability of fund managers is understated when it is inferred from the UD model versus the BB and EC models.

Analysis of Macroforecasting Performance Measures

Summary statistics for $\hat{\tau}$ are presented in Table 4. The Wilcoxon signed rank statistic (DeGroot [5]) is used to test the hypotheses for each fund that $\tau^{ud} = 0$, $\tau^{bb} = 0$, and $\tau^{ec} = 0$ against the two-sided alternative that the respective performance index is nonzero. The nonparametric technique is used because the monthly timing estimates appear to follow nonnormal distributions (according to the studentized range statistics computed for each $\hat{\tau}$).

On average, managers exhibit more inferior timing performance with the UD model than with either the BB or EC models for each fund category. Further, the percentage of aggressive growth and growth funds displaying superior timing performance ($\hat{\tau} > 0$) is substantially higher using the EC model (70 percent) versus the BB (51 percent) and UD (44 percent) models (from Table 3, panels A and B). The percentage of balanced funds displaying superior timing performance is higher using the BB model (44 percent) versus the EC (20 percent) and UD (39 percent) models. When subjected to significance testing, however, the hypothesis of null performance ($\tau = 0$) cannot be rejected (except for one of the 289 funds).[10]

Two conclusions emerge from these findings. First, the macroforecasting performance of fund managers generally appears better when measured by the BB or EC model verses the UD model. Second, funds do not exhibit statistically significant (superior or inferior) timing performance using any of the models examined.[11]

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[10]The results for t are consistent with those reported by Kon [12] for his timing performance measure based on a switching regression model.

[11]Betas are assumed to be constant within up and down, bull and bear, or expansion and contraction periods. Violation of this assumption may lead to spurious results. For example, a fund might produce a low beta at the beginning and end of a bull market and a high beta during the middle months. If market returns during the beginning and end of the period are unusually high, the fund

To examine the discordant results of the three models more closely, the Wilcoxon matched pairs signed rank statistic is computed for the differences $\hat{\tau}^{bb} - \hat{\tau}^{ud}$ and $\hat{\tau}^{bc} - \hat{\tau}^{ud}$ of timing performance indices. The descriptive statistics appear in the last two rows of each panel of Table 4. On average, $\hat{\tau}^{bb} - \hat{\tau}^{ud}$ and $\hat{\tau}^{ec} - \hat{\tau}^{ud}$ are positive for each fund category. Of the total sample (panel E), 61 (58) percent of the $\hat{\tau}^{bb} - \hat{\tau}^{ud}$ ($\hat{\tau}^{ec} - \hat{\tau}^{ud}$) differences are positive and 48 (46) percent are significantly positive. Of the statistically significant differences, 68 (63) percent of the $\hat{\tau}^{bb} - \hat{\tau}^{ud}$ ($\hat{\tau}^{ec} - \hat{\tau}^{ud}$) differences are positive. These results indicate that for a majority of the funds, the BB and EC models lead to significantly greater timing performance values than those derived from the UD model.

As a final comparison of the three models, separate rankings of the funds based on $\hat{\tau}^{ud}$, $\hat{\tau}^{bb}$, and $\hat{\tau}^{ec}$ are calculated and examined. Funds have been ranked routinely over the years using average return, average risk premium, standard deviation, beta, alpha (Jensen [11]), and return-to-risk ratios (Treynor [20] and Sharpe [18]). Thus, orderings based on a macroforecasting performance index ($\hat{\tau}$) represent an important alternative. Table 5 presents Spearman rank correlations of fund $\hat{\tau}$ rankings computed from each model. Only one of the positive correlations is statistically significant (between UD and BB models for growth funds). Thus, fund rankings from the three models bear little, if any, relationship to one another.

Summary and Conclusions

This paper examines the market-timing process exhibited by a large sample of mutual funds during the period October 1977 to September 1987. Results from an analysis of mutual fund liquidity ratios indicate that the standard UD model, in which managers are hypothesized to switch from one portfolio mix when $R_m > 0$ to another when $R_m \leq 0$, misspecifies the market-timing process observed by fund managers. The evidence further indicates that a model in which managers are hypothesized to forecast prolonged trends in the stock market (the

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might produce a poor return yet still exhibit a relatively high b and t. To assess the degree to which this problem exists in the data, t was recomputed by permitting beta to exhibit three levels within each trend (bull, bear, expansion or contraction), corresponding to the first two months, last two months, and the middle months. New estimates of t were obtained from the expanded beta structure for the 36 (28) funds whose bull (expansion) period betas significantly exceeded their bear (contraction) period betas (refer to Table 2, panel E). Significant differences between the t's computed from the expanded and constant beta structures were found in only four of the 64 cases. Thus, within-trend beta instability does not appear to have a significant effect on the t results reported in this section.

BB model) or in business activity (the EC model) is a more appropriate medium of analysis. The estimation bias associated with misspecified market-timing models also is demonstrated.

An analysis of betas estimated for each fund reveals that the UD model routinely understates the macroforecasting ability of fund managers relative to the BB and EC models. Managers of both aggressive growth and growth fund managers exhibit better timing ability when evaluated with the EC model versus the BB or UD models. Balanced fund managers, however, exhibit better timing ability as inferred from the BB model.

The performance index (τ) estimated from the UD model typically is below the τ index estimated from the BB and EC models. Moreover, correlations of the rankings of funds produced by the three models are close to zero. These findings indicate the macroforecasting evaluation for a fund in isolation or for one fund relative to another clearly depends on the type of market-timing model employed.

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Table 1

Summary Statistics of Mutual Fund Liquidity Ratios

	Market Period	Number of Months	Mean	Standard Deviation
	Panel A. Bull Markets			
1.	Nov 1978-Aug 1979	10	10.03	1.03
2.	May 1980-Dec 1980	8	9.81	0.55
3.	Mar 1982-Oct 1983	20	9.07	1.25
4.	Aug 1984-Sept 1987	38	8.33	0.80
	All Bull Markets	76	8.91	1.19
	Panel B. Bear Markets			
1.	Oct 1977-Oct 1978	13	8.73	0.96
2.	Sept 1979-Apr 1980	8	10.22	0.80
3.	Jan 1981-Feb 1982	14	9.46	0.90
4.	Nov 1983-Jul 1984	9	8.94	0.90
	All Bear Markets	44	9.28	1.11

Table 1 (continued)
Summary Statistics of Mutual Fund Liquidity Ratios

Market Period		Number of Months	Mean	Standard Deviation
	Panel C. Expansion Markets			
1.	Oct 1977-Dec 1979	27	9.33	0.92
2.	Jul 1980-Jun 1981	12	9.17	0.66
3.	Nov 1982-Sep 1987	59	8.42	0.81
	All Expansion Markets	98	8.76	0.85
	Panel D. Contraction Markets			
1.	Jan 1980-Jun 1980	6	10.68	0.57
2.	Jul 1981-Oct 1982	16	10.15	0.95
	All Contraction Markets	22	10.30	0.78

Table 2

Summary Statistics for Systematic Risk Estimates

Beta Estimates	Mean	Standard Deviation	Total Positive	Total Negative	Significant Positive	Significant Negative
Panel A. Aggressive Growth Funds (N=51)						
$\beta_u - \beta_d$	-0.13	.340	18	33	1	7
$\beta_l - \beta_r$	-0.07	.238	24	27	2	9
$\beta_e - \beta_c$	0.09	.111	37	14	8	2
Panel B. Growth Funds (N=124)						
$\beta_u - \beta_d$	-0.07	.279	59	65	9	17
$\beta_l - \beta_r$	-0.02	.181	65	59	17	18
$\beta_e - \beta_c$	0.04	.088	85	39	15	4
Panel C. Growth & Income Funds (N=73)						
$\beta_u - \beta_d$	-0.10	.237	27	46	3	13
$\beta_l - \beta_r$	-0.05	.182	33	40	10	14
$\beta_e - \beta_c$	-0.03	.101	30	43	4	9
Panel D. Balanced Funds (N=41)						
$\beta_u - \beta_d$	-0.10	.171	16	25	0	6
$\beta_l - \beta_r$	-0.02	.138	18	23	7	5
$\beta_e - \beta_c$	-0.10	.037	8	33	1	14

Table 2 (continued)

Summary Statistics for Systematic Risk Estimates

Beta Estimates	Mean	Standard Deviation	Total Positive	Total Negative	Significant Positive	Significant Negative
Panel E. All Funds (N=289)						
$\beta_u - \beta_d$	-0.09	.266	120	169	13	43
$\beta_l - \beta_r$	-0.04	.187	140	149	36	46
$\beta_e - \beta_c$	0.01	.108	160	129	28	29

Table 3

F-Tests for the Joint Hypothesis that No Fund
Exhibits Superior or Inferior Macroforecasting Ability

Type of Fund	Degrees of Freedom		Macroforecasting Model		
	Numerator	Denominator	UD	BB	EC
Agressive Growth	51	5,916	3.13	5.29	3.42
Growth	124	14,384	81.88	270.99	143.65
Growth and Income	73	8,468	7.11	7.06	6.70
Balanced	41	4,756	3.77	4.79	4.36

Table 4

Summary Statistics for the Timing Performance Measures

Estimate	Mean	Standard Deviation	Total Positive	Total Negative	Significant Positive	Significant Negative
Panel A: Aggressive Growth Funds (N = 51)						
$\hat{\tau}^{ud}$	-.00198	.0052	18	33	1	0
$\hat{\tau}^{bb}$	-.00021	.0012	24	27	0	0
$\hat{\tau}^{ec}$	-.00002	.0006	37	14	0	0
$\hat{\tau}^{bb} - \hat{\tau}^{ud}$	.00177	.0047	33	18	27	10
$\hat{\tau}^{ec} - \hat{\tau}^{ud}$	.00196	.0053	32	19	28	11
Panel B: Growth Funds (N - 124)						
$\hat{\tau}^{ud}$	-.00106	.0044	59	65	0	0
$\hat{\tau}^{bb}$	-.00001	.0009	65	59	0	0
$\hat{\tau}^{ec}$	-.00015	.0003	85	39	0	0
$\hat{\tau}^{bb} - \hat{\tau}^{ud}$	.00105	.0038	70	54	55	32
$\hat{\tau}^{ec} - \hat{\tau}^{ud}$	.00092	.0043	65	59	54	38

Table 4 (continued)

Summary Statistics for the Timing Performance Measures

Estimate	Mean	Standard Deviation	Total Positive	Total Negative	Significant Positive	Significant Negative
Panel C: Growth & Income Funds (N = 73)						
$\hat{\tau}^{ud}$	-.00161	.0037	27	46	0	0
$\hat{\tau}^{bb}$	-.00013	.0009	33	40	0	0
$\hat{\tau}^{ec}$	-.00027	.0004	30	43	0	0
$\hat{\tau}^{bb} - \hat{\tau}^{ud}$	.00148	.0032	45	28	35	14
$\hat{\tau}^{ec} - \hat{\tau}^{ud}$	.00134	.0036	44	29	31	19
Panel D: Balanced Funds (N = 41)						
$\hat{\tau}^{ud}$	-.00150	.0027	16	25	0	0
$\hat{\tau}^{bb}$	-.00029	.0006	18	23	0	0
$\hat{\tau}^{ec}$	-.00026	.0003	8	33	0	0
$\hat{\tau}^{bb} - \hat{\tau}^{ud}$	.00121	.0023	28	13	22	8
$\hat{\tau}^{ec} - \hat{\tau}^{ud}$	.00124	.0026	26	15	19	10

Table 4 (continued)

Summary Statistics for the Timing Performance Measures

Estimate	Mean	Standard Deviation	Total		Significant	
			Positive	Negative	Positive	Negative
			Panel E: All Funds (N = 289)			
$\hat{\tau}^{ud}$	-.00142	.0042	120	169	1	0
$\hat{\tau}^{bb}$	-.00012	.0009	140	149	0	0
$\hat{\tau}^{ec}$	-.00017	.0004	160	129	0	0
$\hat{\tau}^{bb} - \hat{\tau}^{ud}$	.00131	.0037	176	113	139	64
$\hat{\tau}^{ec} - \hat{\tau}^{ud}$	.00125	.0041	167	122	132	78

Table 5

Spearman Rank Correlations of Fund Timing Performance Rankings
(t-statistics in parentheses)

Fund Objective	UD vs BB	UD vs EC	BB vs. EC
Aggressive Growth	-0.15	0.15	0.14
	(-1.04)	(1.04)	(0.96)
Growth	0.24	-0.11	-0.25
	(2.74)	(-1.28)	(-2.82)
Growth & Income	0.07	0.20	-0.06
	(0.59)	(1.70)	(-0.51)
Balanced	0.10	0.01	-0.02
	(0.64)	(0.06)	(-0.14)
All Funds	0.07	0.03	-0.004
	(1.15)	(0.44)	(-0.07)

Appendix

To demonstrate the bias for the estimates of equation (4), first transform the model so that the second intercept and slope equal the change in the intercept and slope of the model when moving from one regime (i.e., up markets) to the other (i.e., down markets),

(A.1) $R_{jt} = \alpha_{ju} + a_{jd}D_{dt} + \beta_{ju}R_{mt} + b_{jd}R_{mt}D_{dt} + e_{jt}$,

where D_{dt}, α_{ju}, and β_{ju} are defined in equation (4). Now, a_{jd} equals the difference between the down market alpha and the up market alpha. Likewise, b_{jd} equals the difference between the down market beta and the up market beta. In matrix form, equation (A.1) becomes

(A.2) $R_j = [X_1 : X_2] (\varphi_{ju}' : \varphi_{jd}')' + e_j$,

where:

X1 = whose t'th row equals $(1, R_{mt})$ is the first N x 2 partition of the N x 4 explanatory matrix X, and

X2 = whose t'th row equals $(D_{dt}, R_{mt}D_{dt})$, is the other N x 2 partition of X, $\varphi_{ju} = (\alpha_{ju}, \beta_{ju})'$ and $\varphi_{jd} = (a_{jd}, b_{jd})'$.

Assume the true market-timing model is

(A.3) $R_j = [X_1 : Z] (g_{jo}' : g_{jl}')' + w_j$,

where:

$g_{jo} = (\alpha_{jo}, \beta_{jo})'$,

Z = the N x 2k partition of the N x (2k + 2) explanatory matrix reflecting k structural changes in the model, row t of Z equals $(d_{1t}, d_{1t}R_{mt}, d_{2t}, d_{2t}R_{mt}, \ldots, d_{kt}, d_{kt}R_{mt})$;

d_{st} = a dummy variable equal to unity for all observations (t) falling in regime s (i.e., s = 1, 2, ..., k), otherwise d_{st} equals zero;

g_{jt} = the 2k x 1 vector of parameters $(a_{j1}, b_{j1}, a_{j2}, b_{j2}, \ldots, a_{jk}, b_{jk})'$ where each a_{js} parameter equals the difference between the intercept for the model during the regime s from the intercept for the model during the base regime α_{jo}, and, similarly, each b_{js} parameter equals the difference between the slope for the model during regime s and the slope for the model during the base regime β_{jo}.

Using the partition matrix inversion rule (Theil [19]) on equation (A.2), the ordinary least squares estimator for φ is

$$(A.4)\quad \begin{bmatrix} \hat{\varphi}_{ju} \\ \hat{\varphi}_{jd} \end{bmatrix} = \begin{bmatrix} (X_1'M_2X_1)^{-1}, & -(X_1'M_2X_1)^{-1} X_1'X_2(X_2'X_2^{-1}) \\ -(X_2'M_1X_2)^{-1} X_2'X_1(X_1'X_1)^{-1}, & (X_2'M_1X_2)^{-1} \end{bmatrix} \begin{bmatrix} X_1' \\ X_2' \end{bmatrix} R_j,$$

where:

$M_1 = I - X_1'(X_1'X_1)^{-1}X_1$; and

$M_2 = I - X_2'(X_2'X_2)^{-1}X_2$.

It follows that

$$(A.5)\ E(\hat{\varphi}_{ju}) = E(\hat{\alpha}_{ju}, \hat{\beta}_{ju})' = (\alpha_{jo}, \beta_{jo})' + (X_1'M_2X_1)^{-1} X_1'M_2\varepsilon g_{j2},$$

and

$$(A.6)\ E(\hat{\varphi}_{jd}) = E(\hat{a}_{jd}, \hat{b}_{jd})' = (a_{j1}, b_{j1})' + (X_2'M_1X_2)^{-1} X_2'M_1\varepsilon g_{j2},$$

where:
ε = the specification error, equals $Z - [X_2: 0]$;
0 = an N x (2k - 2) null matrix.

Thus, from equation (A.5), the mean of the OLS estimate of the parameters $(\alpha_{ju}, \beta_{ju})'$ for the base regime in the estimated model equals the parameters $(\alpha_{jo}, \beta_{jo})'$ for the base regime of the true model plus an error proportional to ε. Likewise, from equation (A.6), the mean of the OLS estimate of the parameters $(a_{jd}, b_{jd})'$ for the alternative regime in the estimated model equals the parameters $(a_{j1}, b_{j1})'$ for regime 1 of the true model plus an error proportional to ε. A similar proof, using an event-time context, is provided by Brown, Lockwood, and Lummer [3].