Applying the Grinblatt-Titman and the Conditional (Ferson-Schadt) Performance Measures: The Case of Industry Rotation Via the Dynamic Investment Model*

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ABSTRACT

This paper applies Grinblatt and Titman's portfolio change measure and Ferson and Schadt's conditional performance measure to the problem of assessing the performance of the dynamic investment model applied to industry rotation over the period 1934-1995 as well as various sub-periods. The dynamic investment model used in the study employs the empirical probability assessment approach with a rear-view moving window, both in raw form and with adjustments for estimation error based on a James-Stein, a Bayes-Stein, and a CAPM-based correction. Both tests are unanimous in their conclusion that the excess returns attained by the (unadjusted) historic, the Bayes-Stein, and the James-Stein estimators are (sometimes highly) statistically significant over the 1966-95 and 1966-81 sub-periods. This lends support to the idea that the joint empirical probability assessment approach based on the recent past, with and without Stein-based corrections for estimation error, contains information that can be profitably exploited.

I. INTRODUCTION

This paper applies Grinblatt and Titman's (1989) portfolio change measure (PCM) and Ferson and Schadt's (1996) conditional performance measure (CPM) to the problem of assessing the performance of the dynamic investment model applied to industry rotation over the period 1934-1995 as well as various sub-periods. The (discrete-time) dynamic investment model used in the study employs the empirical probability assessment approach (EPAA) with a rear-view moving window, both in raw form and with three adjustments for estimation error: a James-Stein, a Bayes-Stein, and a CAPM-based correction.

The Grinblatt-Titman PCM is employed with both one- and four-quarter lags and the Ferson-Schadt conditional measures are compared to the unconditional measures for the Jensen (1968), Henriksson and Merton (1981), and Treynor-Mazuy tests (1966). The industry breakdown is based on the industry grouping pioneered by Sharpe (1982) and Breeden, Gibbons and Litzenberger (1989) and also employed in Grauer, Hakansson, and Shen (1990). Both value- and equal-weightings of the industries are used.

The dynamic investment model, when used in conjunction with the empirical probability assessment approach, shows a surprising amount of mettle based on traditional performance measures,[1] both with and without adjustment for estimation risk, in a number of different environments (Grauer and Hakansson (1987), (1995a), (1995b), (1998), and Grauer, Hakansson and Shen (1990)). The EPAA uses the *n* most recent realized joint return vectors in raw form. Thus, by capturing all moments and co-moments, the EPAA brings considerable richness to the table even before adjustment for estimation risk.

The Grinblatt-Titman and the Ferson-Schadt conditional tests appear particularly relevant in that they add new dimensions to the performance measurement process. The Grinblatt-Titman

PCM does this by focussing on portfolio holdings as well as investment returns. The Ferson-Schadt PCM, on the other hand, attempts to untangle performance attributable to public information from that which is not. It does this by allowing for a beta which is time-varying due to market indicators such as lagged dividend yield and Treasury bill rates, and thus any implied comovement between expected returns and risk.

The main results may be summarized as follows. The conditional tests give higher performance ratings than the unconditional ones across the board. Both the Grinblatt and Titman and the conditional Jensen, Henriksson-Merton, and Treynor-Mazuy tests (as well as the naked eye test applied to Figures 1-3) come to the conclusion that the excess returns attained by the (unadjusted) historic, the Bayes-Stein, and the James-Stein estimators are (sometimes highly) statistically significant over the 1966-95 and 1966-81 sub-periods but, except for the conditional Jensen test, not over the full 1934-95 period. This is true when the industry components are value-weighted as well as equal-weighted. Only the Treynor-Mazuy conditional test judges the CAPM estimator's excess returns to be significant over the two sub-periods.

II. THE DYNAMIC INVESTMENT MODEL

The basic model used is the same as the one employed in Grauer and Hakansson (1987) and the reader is therefore referred to that paper for details. It is based on the pure reinvestment version of dynamic investment theory. In particular, if $U_n(w_n)$ is the induced utility of wealth w_n with n periods to go (to the horizon) and r is the single-period return, the important convergence result (see Hakansson (1974), also Leland (1972), and Huberman and Ross (1983))

$$U_n(w) \rightarrow \frac{1}{\gamma} w^{\gamma}, \text{ for some } \gamma < 1,$$

holds for a very broad class of terminal utility functions $U_0(w_0)$ when returns are independent (but nonstationary) from period to period. Convergence implies that use of the stationary, myopic decision rule

$$\max E\left[\frac{1}{\gamma}(1+r)^{\gamma}\right], \quad \text{for some } \gamma < 1, \tag{1}$$

in each period is optimal. Consequently, the family of decision rules (1) encompasses a broad variety of different goal formulations for investors with intermediate- to long-term investment horizons.[2] Since the relative risk aversion function (-$wU''(w)/U'(w)$) for (1) is $1-\gamma$, the family (1) incorporates the full range of risk attitudes from zero to infinity.

More specifically, at the beginning of each period *t*, the investor chooses a portfolio, x_t, on the basis of some member, γ, of the family of utility functions for returns *r* given by

$$V(1+r) = \frac{1}{\gamma}(1+r)^{\gamma}.$$

This is equivalent to solving the following problem in each period *t*:

$$\max_{x_t} E\left[\frac{1}{\gamma}(1+r_t(x_t))^{\gamma}\right] = \max_{x_t} \sum_s \pi_{ts} \frac{1}{\gamma}(1+r_t(x_t))^{\gamma} \tag{2}$$

subject to

$$x_{it} \geq 0, \;\; x_{Lt} \geq 0, \;\; x_{Bt} \leq 0, \quad \text{all} \quad i, \tag{3}$$

$$\sum_i x_{it} + x_{Lt} + x_{Bt} = 1, \tag{4}$$

$$\sum_i m_{it} x_{it} \leq 1, \tag{5}$$

$$\Pr(1 + r_t(x_t) \geq 0) = 1, \tag{6}$$

where

$r_{ts}(x_t) = \sum_i x_{its} + x_{Lt} r_{Lt} + x_{Bt} r_{Bt}^d$ is the (ex ante) return on the portfolio in period *t* if state *s* occurs,

γ = a parameter that remains fixed over time,

x_{it} = the amount invested in risky asset category *i* in period *t* as a fraction of own capital,

x_{Lt} = the amount lent in period *t* as a fraction of own capital,

x_{Bt} = the amount borrowed in period *t* as a fraction of own capital,

x_t = $(x_{1t},...,x_{nt},x_{Lt},x_{Bt})$,

r_{it} = the anticipated total return (dividend yield plus capital gains or losses) on asset category *i* in period *t*,

r_{Bt}^d = the interest rate on borrowing at the time of the decision at the beginning of period *t*,

m_{it} = the initial margin requirement for asset category *i* in period *t* expressed as a fraction, and

π_{ts} = the probability of state s at the end of period *t*, in which case the random return r_{it} will assume the value r_{its}.

Constraint (3) rules out short sales and (4) is the budget constraint. Constraint (5) serves to limit borrowing (when desired) to the maximum permissible under the margin requirements that apply to the various asset categories. Finally, constraint (6) rules out any (ex ante) probability of bankruptcy.[3]

The inputs to the model are based on the "empirical probability assessment approach" (EPAA) or a variant thereof. Consider the EPAA and suppose quarterly revision is used. Then, at the beginning of quarter *t*, the portfolio problem (2)-(6) for that quarter uses the following inputs: the (observable) riskfree return for quarter *t*, the (observable) call money rate +1 percent at the beginning of quarter *t*, and the (observable) realized returns for the risky asset categories for the previous k quarters. Each joint realization in quarters t-k through t-1 is given probability 1/k of occurring in quarter t. Thus, under the EPAA, estimates are obtained on a moving basis and used in raw form without adjustment of any kind. On the other hand, since the objective function (2) requires that the whole joint distribution be specified and used, as noted earlier, there is no information loss; all moments and correlations are implicitly taken into account.

With these inputs in place, the portfolio weights x_t for the various asset categories and the proportion of assets borrowed are calculated by solving system (2)-(6) via nonlinear programming methods.[4] At the end of quarter t, the realized returns on the risky assets are observed, along with the realized borrowing rate r_{Bt}^{r} (which may differ from the decision borrowing rate r_{Bt}^{d}).[5] Then, using the weights selected at the beginning of the quarter, the realized return on the portfolio chosen for quarter t is recorded. The cycle is then repeated in all subsequent quarters.[6]

All reported returns are gross of transaction costs and taxes and assume that the investor in question had no influence on prices. One reason for this is that other studies have generally measured performance gross of transaction costs. Second, the return series used as inputs and for comparisons also exclude transaction costs (for reinvestment of interest and dividends) and taxes.

III. CORRECTING THE MODEL FOR ESTIMATION ERROR

Under the EPAA approach, means are not used directly but are implicitly computed from the realized returns. We denote the n-vector of historic or EPAA means at the beginning of period t as

$$\mu_{Ht} = (\bar{r}_{it}, \ldots, \bar{r}_{nt}), \tag{7}$$

where

$$\bar{r}_{it} = \frac{1}{k} \sum_{\tau = t-k}^{t-1} r_{i\tau}.$$

Ex ante means are difficult to estimate and the solution to the portfolio problem is generally extremely sensitive to changes in the means. Furthermore, the estimation risk literature suggests that we should be able to improve investment performance (substantially) by using better forecasts of the means. This study will compare the investment performance of the dynamic investment model under three classes of estimators of the means: the EPAA means; the shrinkage, or James-Stein and Bayes-Stein, estimators of the means, which are based on statistical models; and the CAPM-based estimator of the means, which is based on a model of market equilibrium. No adjustment is made to the EPAA variance-covariance structure or to the other moments.

The EPAA approach implicitly estimates the means one at a time, relying exclusively on information contained in each of the time series. Stein's (1955) suggestion that the efficiency of the estimate of the means could be improved by pooling the information across series leads to a number of so-called "shrinkage" estimators that shrink the historical means to some grand mean. A classic example is the James-Stein (JS) estimator, which takes the form[7]

$$\mu_{JSt} = (1 - w_t)\mu_{Ht} + w_t \bar{r}_{Gt} \ell, \tag{8}$$

where ℓ is a vector of ones, $\bar{r}_{Gt} = \frac{1}{n} \sum_i \bar{r}_{it}$ is the grand mean,

$$w_t = \min[1, (n-2)/(k(\mu_{Ht} - \bar{r}_{Gt}\ell)' S_t^{-1} (\mu_{Ht} - \bar{r}_{Gt}\ell))]$$

is the shrinking factor, and S_t is the sample covariance matrix calculated from the k periods in the estimation period. In this case, the simple historic means are "shrunk" toward the arithmetic average of the historic means.[8, 9]

A second example is Jorion's (1986, 1991) Bayes-Stein (BS) estimator. This estimator takes the form

$$\mu_{BSt} = (1 - w_t)\mu_{Ht} + w_t \bar{r}_{Gt} \ell , \tag{9}$$

where

$$\bar{r}_{Gt} = \ell' S_t^{-1} \mu_{Ht} / (\ell' S_t^{-1} \ell),$$

$$w_t = \lambda_t / (\lambda_t + k),$$

and

$$\lambda_t = (n+2) / ((\mu_{Ht} - \bar{r}_{Gt}\ell)' S_t^{-1} (\mu_{Ht} - \bar{r}_{Gt}\ell)).$$

In this case, the grand mean is the mean of the global minimum-variance portfolio generated from the historical data.

The second alternative class of estimators of the means is borrowed from the Sharpe (1964) - Lintner (1965) CAPM, a model of market equilibrium.[10] The CAPM estimator of the means is of the form

$$\mu_{CAPMt} = r_{Lt}\ell + (\bar{r}_{mt} - \bar{r}_{Lt})\beta_t , \tag{10}$$

where $\bar{r}_{mt} = \frac{1}{k}\sum_{\tau=t-k}^{t-1} r_{m\tau}$ and $\bar{r}_{Lt} = \frac{1}{k}\sum_{\tau=t-k}^{t-1} r_{L\tau}$, so that $\bar{r}_{mt} - \bar{r}_{Lt}$ is an estimate of the expected excess return on the market portfolio, and $\beta_t = (\beta_{lt}, \cdots, \beta_{nt})$ is the vector of betas or systematic risk coefficients. At each time *t*, β_t is estimated from the market model regressions

$$r_{i\tau} = \alpha_{it} + \beta_{it} r_{m\tau} + e_{i\tau}, \text{ for all } i \text{ and } \tau \tag{11}$$

in the *t*-*k* to *t*-l estimation period.[11] Note that there is no unambiguous choice for the proxy for the market portfolio in (10) or (11). We simply follow convention and employ the Center for Research in Security Prices (CRSP) value-weighted index as the proxy.

IV. DATA

To construct the industry indices, we obtain the returns on individual firms from the CRSP monthly returns data base. The quarterly returns are obtained by compounding the monthly ones. The universe of firms employed each month is essentially the same as CRSP uses to construct the CRSP value-weighted index. We combine the firms into twelve industry groups on the basis of the first two digits of the firms' SIC codes. The grouping procedure is similar to the twelve-industry classification of Breeden, Gibbons, and Litzenberger (1989), which in turn was influenced by the eight-industry classification of Sharpe (1982). Equal- and value-weighted industry indices are constructed from the same universe of firms. Value-weighting the returns of firms in an industry (where the value-weight of a firm at a point in time is its price times the number of shares outstanding divided by the total equity value of all firms in the industry) yields the return on what is essentially a "buy and hold" or passive strategy. On the other hand, equally weighting the returns of the firms in an industry yields the returns on a semi-active or semi-passive investment strategy that "buys the losers and sells the winners". A more detailed description of these data is presented in Grauer, Hakansson, and Shen (1990).

The riskfree asset is assumed to be 90-day U.S. Treasury bills maturing at the end of the quarter; we use the *Survey of Current Business* and the *Wall Street Journal* as sources. The borrowing rate is assumed to be the call money rate +1 percent for decision purposes (but not for rate of return calculations); the applicable beginning of period decision rate, r_{Bt}^{d}, is viewed as persisting throughout the period and thus as riskfree. For 1934-76, the call money rates are obtained from the *Survey of Current Business*; for later periods the *Wall Street Journal* is the source. Finally, margin requirements for stocks are obtained from the *Federal Reserve Bulletin*.[12]

V. INVESTMENT RESULTS

Because of space limitations, only a portion of the results can be reported here. However, Figures 1 through 3 provide a fairly representative sample of our findings. In each comparison, we calculate and include the returns on up- and down-levered value-weighted benchmark portfolio of the risky assets. The compositions of these portfolios, along with an enumeration of the asset categories included in the study, are summarized in Table 1.

Figure 1 here

Figure 1 plots the annual[13] geometric means and standard deviations[14] of the realized returns for four sets of ten power function strategies, based on γ's in (1) ranging from -50 (extremely risk averse) to 1 (risk-neutral), under quarterly revision for the 62-year period 1934-95, where the risky portion of the investment universe is twelve value-weighted U.S. industry indices. The estimating period is 32 quarters. The first set of strategies (see black dots) shows the returns generated by using the historic means, the second set (see open dots) exhibits those based on James-Stein means, the third set (see open squares) displays those based on Bayes-Stein means, and the fourth set (see triangles) depicts the returns obtained by employing CAPM means.

Consider the benchmarks first. Among the industries (see black squares), Services attains the highest geometric mean return (12.84 percent) and also has the highest variability (29.16 percent), while Transportation has the lowest geometric mean (9.36 percent) and Utilities the lowest volatility (15.36 percent). VW, the passive strategy of buying and holding a value-weighted portfolio of the 12 value-weighted industries (i.e., the CRSP value-weighted index--see open diamonds), earns a geometric mean return of 11.57 percent with a standard deviation of 16.52 percent.

Turning to the four sets of active strategies, we observe that the historic, the James-Stein, and the Bayes-Stein strategies closely track each other as well as the up- and down-levered passive strategies fairly closely. The CAPM strategies, on the other hand, earn uniformly lower geometric means and lower standard deviations than the historic, James-Stein, and Bayes-Stein strategies except for the risk-neutral power, for which the CAPM strategy dominates the historic strategy.

Figure 2 here

Figure 2 plots the corresponding results for the 30-year 1966-1995 sub-period. Among the industries, Food and Tobacco attain the highest geometric mean return (15.00 percent) and Leisure experiences the highest volatility (26.53 percent), while Transportation has the lowest geometric mean (7.81 percent) and Utilities the lowest volatility (13.88 percent). The passive strategy VW earns 10.67 percent with a volatility of 15.58 percent. It appears rather anomalous that over a 30-year period, one industry (Food and Tobacco) earns nearly twice the compound return (15.00 percent vs. 7.81 percent) of another industry (Transportation)--with lower volatility.

Turning to the four sets of active strategies, three features stand out. First, the strategies based on CAPM means are clearly "dominated" by the other three. Second, the strategies based on historic, James-Stein, and Bayes-Stein means appear to attain "superior" performance when compared to the up- and down-levered value-weighted benchmark portfolios--whether this in fact is the case will be formally addressed in the next section. Third, for each of these three strategies, the logarithmic utility function (power 0) achieves the highest geometric mean return (16.69 percent for Bayes-Stein, 14.44 percent for James-Stein, and 14.23 percent for the historic case)--which is asymptotically the case when the <u>correct</u> probability distribution is used. Since each point in Figure 2 is based on 120 quarterly portfolio choices, a sizable number of observations, the suggested interpretation here is that each of the three estimators (historic EPAA, James-Stein, and Bayes-Stein) are unbiased.

Figure 3 here

Figure 3 displays the results for the (inflationary) 16-year sub-period 1966-1981. Petroleum has the highest geometric mean (11.2 percent) and Leisure the highest standard deviation (33.62 percent). Consumer durables experience the lowest geometric mean (4.19 percent) and Utilities the lowest volatility (13.63 percent). Note that the compound return on the risk-free asset is 6.98 percent per year vs. 6.44 percent for the value-weighted portfolio of all stocks, i.e., the 16-year period 1966-81 experiences a one half percent per year <u>negative</u> realized risk premium! It is therefore perhaps not surprising that the rear-view approach of the EPAA generates rather conservative investment portfolios, as is reflected in Table 3.

VI. PERFORMANCE TESTS

There are a number of commonly accepted ways of testing for abnormal investment performance. This study employs (i) Grinblatt and Titman's (1993) portfolio change measure (PCM) and (ii) Ferson and Schadt's (1996) (see also Ferson and Warther (1996)) conditional performance measure (CPM) applied to the unconditional Jensen, Henriksson-Merton, and Treynor-Mazuy tests. The null hypothesis is that there is no superior investment performance and the alternative hypothesis is that there is. Thus, we report the results of one-tailed tests. All regressions except the unconditional Jensen regression are corrected for heteroscedasticity using White's (1980) correction.

The unconditional Jensen model is

$$r_{pt} = \alpha_p + \beta_p r_{mt} + u_{pt}, \tag{12}$$

where r_{pt} is the excess return on portfolio *p* over the treasury bill rate, r_{mt} is the excess return on the CRSP value-weighted index, α_p is the unconditional measure of performance, and β_p is the unconditional beta.

Ferson and Schadt (1996a) suggest that a portfolio's risk should be related to market indicators such as dividend yield and short-term Treasury yield lagged one period. We employ the same variables only we measure the t-bill yield as of the beginning of the period. Thus,

$$\beta_p = b_0 + b_1 dy_{t-1} + b_2 tb_t \, , \tag{13}$$

where dy_{t-1} is the CRSP NYSE-AMEX value-weighted index annual dividend yield as of the beginning of period *t* and tb_t is the (observable) beginning-of-quarter treasury bill rate, both measured as deviations from their estimation period means. Substituting (13) into (12), the conditional Jensen model is

$$r_{pt} = \alpha_{cp} + b_{0p} r_{mt} + b_{1p}[dy_{t-1} r_{mt}] + b_{2p}[tb_t r_{mt}] + e_{pt} \, , \tag{14}$$

where α_{cp} is the conditional measure of performance, b_{0p} is the conditional beta, and b_{1p} and b_{2p} measure how the conditional beta varies with respect to dividend yields and treasury bill rates.

The unconditional regression specification for the Treynor-Mazuy model is

$$r_{pt} = \alpha_p + \beta_p r_{mt} + \gamma_p r_{mt}^2 + u_{pt} \, , \tag{15}$$

where α_p is the measure of selectivity, β_p is the unconditional beta, and γ_p is the market timing coefficient. The conditional regression specification is

$$r_{pt} = \alpha_{cp} + b_{0p} r_{mt} + b_{1p}[dy_{t-1} r_{mt}] + b_{2p}[tb_t r_{mt}] + \gamma_p r_{mt}^2 + e_{pt} \, , \tag{16}$$

where α_{cp} is the conditional measure of performance, b_{0p} is the conditional beta, b_{1p} and b_{2p} measure how the conditional beta varies with respect to dividend yields and treasury bill rates, and γ_p is the market timing coefficient.

The unconditional Henriksson-Merton model is

$$r_{pt} = \alpha_p + \beta_{dp} r_{mt} + \gamma_p \max(0, r_{mt}) + u_{pt}, \tag{17}$$

where once again r_{pt} is the excess return on the portfolio over the treasury bill rate and r_{mt} is the excess return on the CRSP value-weighted index, β_{dp} is the down-market beta, α_p is the measure of selectivity, and γ_p is the market timing coefficient, i.e., the difference between the up- and down-market beta. Following Ferson and Schadt (1996a), the conditional Henriksson-Merton model is

$$r_{pt} = \alpha_{cp} + b_{dp} r_{mt} + b_{1p}[dy_{t-1} r_{mt}] + b_{2p}[tb_t r_{mt}] + \gamma_p r^*_{mt} + b^*_{1p}[dy_{t-1} r^*_{mt}] + b^*_{2p}[tb_t r^*_{mt}] + e_{pt}, \tag{18}$$

where r^*_{mt} is the product of the excess return on the CRSP value-weighted index and an indicator dummy for positive values of the difference between the excess return on the index and the conditional mean of the excess return. (The conditional mean is estimated by a linear regression of the excess return of the CRSP value-weighted index on dy_{t-1} and tb_t.) In this case, the most important coefficients are b_{dp} the conditional down-market beta and γ_p the market timing coefficient--the difference between the up- and down-market conditional beta.

In contrast to most other performance measures, Grinblatt and Titman's (1993) portfolio change measure (PCM) employs portfolio holdings as well as rates of return and does not require a benchmark portfolio. In order to motivate the PCM, assume that uninformed investors perceive that the vector of expected returns is constant, while informed investors can predict whether expected returns vary over time. Informed investors can profit from changing expected returns by increasing (decreasing) their holdings of assets whose expected returns have increased (decreased). The holding of an asset that increases with an increase in its conditional expected rate of return will exhibit a positive unconditional covariance with the asset's returns. The PCM is constructed from an aggregation of these covariances. For evaluation purposes, the PCM is defined as

$$\text{Performance Change Measure} = \sum_t \sum_i \left[r_{it} (x_{it} - x_{i,t-j}) / T \right], \tag{19}$$

where r_{it} is the quarterly rate of return on asset *i* time *t*, x_{it} and $x_{i,t-j}$ are the holdings of asset *i* (e.g. its portfolio weights) at time *t* and time *t-j*, respectively, and *T* is the total number of time periods. In (19), r_{it} and $x_{i,t-j}$ are proxies for asset *i*'s expected rate of return and expected holding. In their empirical analysis of mutual fund performance, Grinblatt and Titman work with two values of *j* that represented one- and four-quarter lags. We employ the same two lags. The inner summation, over assets, provides an estimate of the covariance between returns and weights at a point in time. Alternatively, it can be viewed as the return on zero-weight portfolio. The PCM test itself is a simple *t*-test based on the time series of zero-weight portfolio returns, i.e.,

$$t = (\text{PCM/Standard Deviation})\sqrt{T}\,. \tag{20}$$

The PCM seems particularly apropos in the present study because the portfolio weights are chosen according to a prespecified set of rules over the same quarterly time interval as performance is measured. Thus, we do not have to worry about possible gaming or window dressing problems that face researchers trying to gauge the performance of mutual funds.

Table 2 shows the results of the Grinblatt-Titman tests with both one-quarter and four-quarter lags for each of the four mean estimators (historic, Bayes-Stein, James-Stein, and

CAPM). Each test incorporates ten relative risk aversion attitudes ranging from 51 to 0 (corresponding to powers -50 to 1) for the three periods 1934-95, 1966-95, and 1966-81.

Several observations strike the reader. First, the test based on a one-quarter lag tends to give higher marks than the one based on a four-quarter lag, especially for the James-Stein and CAPM estimators. Second, the CAPM estimator receives low scores in all cases except for the very risk-averse powers during 1966-81 in the one-quarter lag case. Third, excess returns at the 5 percent level of significance are earned by most powers in both the 1966-95 and the 1966-81 sub-periods when the historic, Bayes-Stein, and James-Stein estimators are employed, while fewer such instances occur over the full 1934-95 period. These findings are consistent with overall impression conveyed by Figures 1, 2 and 3.

Table 3 shows the quarterly returns and portfolio choices made by the power -5 investor when the Bayes-Stein estimator is used for the 24 quarters from 1972 through 1977. It is apparent that the portfolios chosen during this period are quite conservative. Note also that portfolio changes from quarter to quarter are quite small, implying only modest transaction costs.

Table 4 summarizes the average alphas and betas for nine powers ranging from -50 to .5 obtained from the conditional and unconditional Jensen tests. The table incorporates each of the aforementioned four estimators over the same three periods as in Table 2, both when the twelve industry sectors are value-weighted as well as when they are equal-weighted. The upper part of Table 7 provides the details for the value-weighted case of the Bayes-Stein estimator over the 1966-95 sub-period.

The most striking aspect of Table 4 is that the conditional test uniformly ranks the various investors' performance higher than the unconditional one. Based on the conditional

Jensen test, the historic, Bayes-Stein, and James-Stein estimators' excess returns are highly significant in each period.

Table 5 reveals that the Henriksson-Merton conditional test also ranks the return sequences higher than the unconditional one does. However, accolades for excess returns are given by the conditional Henriksson-Merton test to the historic, Bayes-Stein, and James-Stein estimators only for the 1966-95 and 1966-81 sub-periods. On the other hand, the Henriksson-Merton conditional test rates the CAPM estimators' performance in those two periods higher than the corresponding Jensen test does.

Table 6 summarizes the Treynor-Mazuy unconditional and conditional alphas and timing coefficients for the same nine powers as in Tables 4 and 5, as well as for the same estimators and periods and for both the value- and equal-weighted cases. Details for the conditional value-weighted Bayes-Stein strategies are given in the lower part of Table 7. As in the Jensen and Henriksson-Merton tests, the Ferson conditional test gives higher marks than the unconditional one (which finds no statistically significant excess returns) across the board. Somewhat surprisingly, all four estimators achieved superior excess returns over the 1966-95, and especially the 1966-81, periods according to the Treynor-Mazuy conditional test.

Table 7 also shows the regression coefficients on the lagged dividend yield (b_1) and on treasury bill rates (b_2). As was the case in Ferson and Warther (1996b), the coefficients on the dividend yield are negative and often significant while those on Treasury bills are positive. Thus, these two indicators do indeed give rise to time variation of the portfolio beta for any given power or risk attitude in a manner consistent with that observed for real-world mutual funds (see Ferson and Warther (1996b)).

VII. SUMMARY

This paper employs the Grinblatt and Titman portfolio change measure with one- and four-quarter lags and Ferson and Schadt's conditional performance measure to the problem of assessing the performance of the dynamic investment model applied to industry rotation over the period 1934-1995 as well as various sub-periods. The dynamic investment model used in the study employs the empirical probability assessment approach with a 32-quarter rear-view moving window, both in raw form and with adjustments for estimation error based on a James-Stein, a Bayes-Stein, and a CAPM-based correction. Portfolio choices are implemented for a wide range of risk attitudes.

The verdicts of the various tests are remarkably unanimous. The Grinblatt-Titman and the conditional Jensen, Henriksson-Merton, and Treynor-Mazuy tests come to the conclusion that the excess returns attained by the (unadjusted) historic, the Bayes-Stein, and the James-Stein estimators are (in some cases highly) statistically significant over the 1966-95 and 1966-81 sub-periods. Only the conditional Jensen test rates the full 1934-95 performance superior. The CAPM estimator, on the other hand, performs poorly except in the eyes of the conditional Treynor-Mazuy test over the 1966-95 and 1981-95 sub-periods. This evidence suggests that the empirical probability assessment approach based on the recent past, with and without Stein-based corrections for estimation error, contains information beyond dividend yields and short-term interest rates embedded in its moment-comoment structure that can be profitably exploited.

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FOOTNOTES

[1] In particular, the Jensen, Henriksson-Merton, Treynor-Mazuy tests, and the paired *t*-test applied to the difference in geometric mean returns.

[2] The simple reinvestment formulation does ignore consumption of course.

[3] The solvency constraint (6) is not binding for the power functions with $\gamma < 1$ and discrete probability distributions with a finite number of outcomes because the marginal utility of zero wealth is infinite. Nonetheless, it is convenient to explicitly consider (6) so that the nonlinear programming algorithm used to solve the investment problems does not attempt to evaluate an infeasible policy as it searches for the optimum.

[4] The nonlinear programming algorithm employed is described in Best (1975).

[5] The realized borrowing rate was calculated as a monthly average.

[6] Note that if k = 32 under quarterly revision, then the first quarter for which a portfolio can be selected is b+32, where b is the first quarter for which data is available.

[7] For discussion of James-Stein estimators, see Efron and Morris (1973, 1975, 1977).

[8] As Jorion has noted, this conclusion is difficult to reconcile with the generally accepted trade-off between risk and expected return, unless all stocks fall within the same risk class.

[9] Having calculated the James-Stein and historic means for asset i, we add the difference $(\bar{r}_{JSit} - \bar{r}_{it})$ where $\bar{r}_{JSit}$ and $\bar{r}_{it}$ are the James-Stein and historic means for asset i at time t, to each actual return on asset i in the estimation period. That is, in each estimation period, we replace the raw return series with the adjusted return series

$$r_{i\tau}^{A} = r_{i\tau} + (\bar{r}_{JSit} - \bar{r}_{it}), \quad \text{for all } i \text{ and } \tau .$$

Thus, the mean vector of the adjusted series is equal to the James-Stein means of the original series; all other moments are unchanged.

[10] We do not assume, however, that the CAPM holds. Both the market portfolio and β exist independently of the CAPM. What this estimator tries to capture, then, is the observation, well documented in most countries, that over intermediate to long periods, realized average returns on financial assets are an increasing function of systematic risk.

[11] At this point, we proceed as in the James-Stein and Bayes-Stein means-cases, adding the difference between the CAPM means and the historic means to the actual returns in the estimation period. Consequently, the mean vector of the adjusted series is equal to the CAPM means; all other moments are unchanged.

[12] There was no practical way to take maintenance margins into account in our programs. In any case, it is evident from the results that they would come into play only for the more risk-tolerant strategies, and even for them only occasionally, and that the net effect would be relatively neutral.

[13] Annual returns were obtained by compounding the quarterly realized returns.

[14] For consistency with the geometric mean, the standard deviation is based on the log of one plus the rate of return. This quantity is very similar to the standard deviation of the rate of return for levels less than 25 percent.

Table 1

Asset Category and Fixed-Weight Portfolio Symbols

RL	Risk-Free Lending	VW	Value-Weighted Portfolio of Risky Assets in Investment Universe
B	Borrowing		
PETR	Petroleum	V5	50% in VW, 50% in RL
FINA	Finance-Real Estate	V15	150% in VW, 50% in B
CDUR	Consumer Durables	V20	200% in VW, 100% in B
BASI	Basic Industries		
FOOD	Food & Tobacco		
CONS	Construction		
CAPG	Capital Goods		
TRAN	Transportation		
UTIL	Utilities		
TEXT	Textiles & Trade		
SERV	Services		
LEIS	Leisure		

Table 2

Grinblatt-Titman Portfolio Change Measures Based on One Quarter and Four Quarter Lags for the Power Policies When the Means are Based on Historic, Bayes-Stein, James-Stein, and CAPM Estimators. Twelve Value-Weighted Industry Groups, 1934-1995, 1966-1995, 1966 1981. Quarterly Portfolio Revision, 32 Quarter Estimation Period, Borrowing Permitted.

	One Quarter Lag		Four Quarter Lag	
Power	**Portfolio Change Measure**	**1-tail prob**	**Portfolio Change Measure**	**1-tail prob**
Historic 1934-1995				
-50	0.05	0.06	0.01	0.28
-30	0.08	0.02	0.02	0.29
-15	0.13	0.04	0.07	0.14
-10	0.14	0.06	0.07	0.18
-5	0.25	0.03	0.24	0.03
-3	0.24	0.07	0.34	0.01
-1	0.26	0.10	0.37	0.03
0	0.36	0.11	0.60	0.01
0.5	0.46	0.11	0.45	0.09
1	0.35	0.25	0.91	0.01
Historic 1966-1995				
-50	0.04	0.03	0.04	0.05
-30	0.06	0.03	0.06	0.05
-15	0.12	0.03	0.12	0.05
-10	0.17	0.03	0.17	0.05
-5	0.34	0.02	0.31	0.04
-3	0.36	0.06	0.49	0.02
-1	0.43	0.07	0.46	0.09
0	0.55	0.11	1.03	0.02
0.5	0.94	0.03	1.16	0.02
1	-0.01	0.51	1.67	0.01
Historic 1966-1981				
-50	0.04	0.02	0.04	0.05
-30	0.06	0.02	0.06	0.05
-15	0.12	0.02	0.12	0.05
-10	0.18	0.02	0.18	0.05
-5	0.32	0.02	0.33	0.05
-3	0.37	0.04	0.52	0.03
-1	0.32	0.18	0.64	0.06
0	0.32	0.30	1.24	0.02
0.5	1.12	0.07	1.47	0.03
1	-0.49	0.67	1.92	0.03

Table 2 Continued

Power	One Quarter Lag: Portfolio Change Measure	One Quarter Lag: 1-tail prob	Four Quarter Lag: Portfolio Change Measure	Four Quarter Lag: 1-tail prob
Bayes-Stein 1934-1995				
-50	0.05	0.08	0.01	0.32
-30	0.08	0.03	0.01	0.33
-15	0.12	0.04	0.04	0.27
-10	0.11	0.07	0.05	0.25
-5	0.19	0.04	0.17	0.06
-3	0.30	0.02	0.29	0.02
-1	0.35	0.03	0.45	0.01
0	0.47	0.02	0.63	0.00
0.5	0.52	0.04	0.72	0.01
1	0.49	0.17	0.97	0.01
Bayes-Stein 1966-1995				
-50	0.03	0.06	0.03	0.07
-30	0.05	0.06	0.05	0.07
-15	0.09	0.06	0.09	0.07
-10	0.13	0.06	0.13	0.07
-5	0.25	0.03	0.25	0.06
-3	0.40	0.02	0.40	0.03
-1	0.48	0.04	0.70	0.02
0	0.84	0.02	1.03	0.01
0.5	0.94	0.03	1.45	0.00
1	0.28	0.35	1.99	0.00
Bayes-Stein 1966-1981				
-50	0.03	0.02	0.03	0.05
-30	0.05	0.02	0.05	0.05
-15	0.10	0.02	0.11	0.05
-10	0.14	0.02	0.15	0.05
-5	0.26	0.02	0.28	0.05
-3	0.36	0.03	0.44	0.04
-1	0.50	0.06	0.88	0.02
0	0.79	0.06	1.26	0.02
0.5	0.83	0.13	1.70	0.01
1	-0.07	0.53	2.42	0.01

Table 2 Continued

	One Quarter Lag		Four Quarter Lag	
Power	Portfolio Change Measure	1-tail prob	Portfolio Change Measure	1-tail prob
James-Stein 1934-1995				
-50	0.06	0.04	0.01	0.36
-30	0.08	0.02	0.01	0.36
-15	0.13	0.04	0.05	0.23
-10	0.14	0.04	0.05	0.27
-5	0.28	0.01	0.19	0.07
-3	0.38	0.01	0.31	0.02
-1	0.43	0.01	0.32	0.05
0	0.27	0.15	0.49	0.03
0.5	0.47	0.06	0.32	0.17
1	0.68	0.05	0.85	0.01
James-Stein 1966-1995				
-50	0.04	0.02	0.03	0.09
-30	0.07	0.02	0.05	0.09
-15	0.13	0.02	0.10	0.08
-10	0.17	0.02	0.14	0.08
-5	0.37	0.01	0.24	0.08
-3	0.47	0.01	0.39	0.06
-1	0.58	0.03	0.37	0.14
0	0.56	0.10	0.76	0.05
0.5	0.87	0.04	0.97	0.03
1	0.58	0.19	1.57	0.00
James-Stein 1966-1981				
-50	0.05	0.00	0.03	0.07
-30	0.08	0.00	0.06	0.07
-15	0.15	0.00	0.11	0.07
-10	0.22	0.00	0.16	0.07
-5	0.40	0.00	0.29	0.06
-3	0.49	0.01	0.45	0.05
-1	0.53	0.04	0.54	0.09
0	0.48	0.15	0.98	0.04
0.5	0.79	0.14	1.03	0.07
1	0.51	0.31	1.79	0.02

Table 2 Continued

	One Quarter Lag		Four Quarter Lag	
Power	Portfolio Change Measure	1-tail prob	Portfolio Change Measure	1-tail prob
CAPM 1934-1995				
-50	0.01	0.19	-0.02	0.83
-30	0.02	0.19	-0.04	0.83
-15	0.05	0.14	-0.04	0.72
-10	0.07	0.10	-0.07	0.80
-5	0.08	0.12	-0.04	0.65
-3	0.05	0.30	0.05	0.36
-1	-0.02	0.57	0.11	0.27
0	0.15	0.20	0.17	0.23
0.5	0.16	0.25	0.27	0.20
1	0.47	0.07	0.21	0.27
CAPM 1966-1995				
-50	0.01	0.11	0.00	0.38
-30	0.02	0.11	0.01	0.38
-15	0.03	0.11	0.02	0.38
-10	0.05	0.10	0.02	0.38
-5	0.09	0.10	0.04	0.38
-3	0.14	0.10	0.07	0.37
-1	0.22	0.13	0.23	0.21
0	0.39	0.09	0.11	0.39
0.5	0.48	0.09	0.58	0.11
1	0.83	0.01	0.86	0.05
CAPM 1966-1981				
-50	0.01	0.03	0.01	0.32
-30	0.02	0.03	0.01	0.32
-15	0.03	0.03	0.03	0.32
-10	0.05	0.03	0.04	0.31
-5	0.10	0.02	0.08	0.31
-3	0.14	0.02	0.12	0.29
-1	0.14	0.13	0.21	0.27
0	0.24	0.17	0.42	0.21
0.5	0.42	0.11	0.36	0.28
1	1.23	0.03	1.18	0.10

Table 3

Quarterly Returns and Optimal Portfolio Choices for Power -5 When the Means are Based on James-Stein Estimators. Twelve Value-Weighted Industry Groups, 1972-1977. Quarterly Portfolio Revision, 32-Quarter Estimation Period, Borrowing Permitted.

		Portfolio Weights							
Quarter	**Return**	**Lending**	**Petroleum**	**Basic**	**Food**	**Capital Goods**	**Utilities**	**Textiles**	**Leisure**
1972-1	4.45	0.35	0.05		0.33	0.10		0.16	
1972-2	1.26	0.43			0.22	0.17		0.19	
1972-3	0.86	0.48			0.22	0.28		0.02	
1972-4	1.71	0.61	0.01		0.01	0.36			
1973-1	-0.82	0.57			0.11	0.32			
1973-2	-0.54	0.72	0.01			0.27			
1973-3	1.43	0.85				0.15			
1973-4	-0.32	0.87				0.10			0.03
1974-1	1.94	1.00							
1974-2	2.06	1.00							
1974-3	1.94	1.00							
1974-4	1.81	1.00							
1975-1	1.62	1.00							
1975-2	1.94	0.95			0.05				
1975-3	0.62	0.89	0.09		0.02				
1975-4	1.52	1.00							
1976-1	1.47	0.95			0.05				
1976-2	1.73	0.86	0.04	0.04			0.06		
1976-3	1.44	0.98					0.01		
1976-4	1.26	0.99							
1977-1	0.78	0.94	0.01	0.01			0.04		
1977-2	1.27	0.97	0.01	0.01			0.02		
1977-3	0.89	0.91	0.02	0.02			0.05		
1977-4	1.43	0.96	0.01	0.01			0.02		

1. The units of the returns are percentage per quarter.
2. The portfolio weights are reported as decimal fractions. Except for rounding, the fractions in a quarter sum to one.
3. Borrowing, Finance and Real Estate, Consumer Durables, Construction, Transportation, and Services were not chosen in this time period.

Table 4

Jensen Unconditional and Conditional Average Alphas and Betas for Nine Power Policies (Ranging from -50 to 0.5) When the Means are Based on Historic, Bayes-Stein, James-Stein, and CAPM Estimators. Twelve Equal- and Value-Weighted Industry Groups, 1934-1995, 1966-1995, 1966-1981. Quarterly Portfolio Revision, 32-Quarter Estimation Period, Borrowing Permitted.

	Unconditional					Conditional				
Category	**Alpha**	**Prop<0**	**1-tail p-value**	**Prop ≤0.05**	**Beta**	**Alpha**	**Prop<0**	**1-tail p-value**	**Prop ≤0.05**	**Beta**
Historic										
VW 1934-1995	0.53	0.00	0.08	0.22	0.70	0.62	0.00	0.04	0.89	0.74
EW 1934-1995	0.62	0.00	0.05	0.78	0.80	0.69	0.00	0.03	0.78	0.83
VW 1966-1995	0.63	0.00	0.10	0.00	0.71	1.00	0.00	0.02	1.00	0.75
EW 1966-1995	0.84	0.00	0.03	1.00	0.81	1.12	0.00	0.00	1.00	0.82
VW 1966-1981	-0.05	0.44	0.52	0.00	0.42	0.60	0.00	0.10	0.00	0.49
EW 1966-1981	0.90	0.00	0.10	0.11	0.62	1.52	0.00	0.00	1.00	0.66
Bayes-Stein										
VW 1934-1995	0.54	0.00	0.06	0.44	0.51	0.65	0.00	0.03	1.00	0.56
EW 1934-1995	0.64	0.00	0.03	0.89	0.59	0.76	0.00	0.02	1.00	0.64
VW 1966-1995	0.71	0.00	0.08	0.11	0.55	1.01	0.00	0.01	1.00	0.60
EW 1966-1995	0.82	0.00	0.02	1.00	0.66	1.02	0.00	0.00	1.00	0.69
VW 1966-1981	0.16	0.00	0.33	0.00	0.25	0.59	0.00	0.06	0.22	0.31
EW 1966-1981	0.79	0.00	0.06	0.33	0.44	1.16	0.00	0.01	1.00	0.49
James-Stein										
VW 1934-1995	0.56	0.00	0.05	0.44	0.60	0.62	0.00	0.03	0.78	0.65
EW 1934-1995	0.60	0.00	0.04	0.89	0.70	0.63	0.00	0.03	0.89	0.73
VW 1966-1995	0.56	0.00	0.12	0.00	0.60	0.89	0.00	0.02	1.00	0.65
EW 1966-1995	0.61	0.00	0.08	0.11	0.68	0.98	0.00	0.01	1.00	0.71
VW 1966-1981	-0.03	0.22	0.49	0.00	0.30	0.51	0.00	0.09	0.00	0.37
EW 1966-1981	0.36	0.00	0.34	0.00	0.44	1.08	0.00	0.03	1.00	0.51
CAPM										
VW 1934-1995	0.19	0.00	0.23	0.00	0.51	0.25	0.00	0.18	0.00	0.56
EW 1934-1995	0.27	0.00	0.23	0.00	0.54	0.30	0.00	0.20	0.00	0.59
VW 1966-1995	0.08	0.11	0.46	0.00	0.49	0.42	0.00	0.08	0.11	0.53
EW 1966-1995	0.05	0.11	0.41	0.00	0.50	0.39	0.00	0.10	0.00	0.55
VW 1966-1981	-0.03	0.89	0.63	0.00	0.28	0.58	0.00	0.10	0.33	0.35
EW 1966-1981	0.16	0.11	0.37	0.00	0.30	0.79	0.00	0.03	1.00	0.38

1. The units for the alphas are percentage per quarter.
2. The figures denoted as p-values measure the significance of the coefficients relative to zero. In the conditional model, the p-values are heteroscedasticity-consistent.

Table 5

Henriksson-Merton Unconditional and Conditional Average Alphas and Timing Coefficients for Nine Power Policies (Ranging from –50 to .5) When the Means are Based on Historic, Bayes-Stein, James-Stein, and CAPM Estimators. Twelve Equal- and Value-Weighted Industry Groups, 1934-1995, 1966-1995, and 1981-1995. Quarterly Portfolio Revision, 32-Quarter Estimation Period, Borrowing Permitted.

	Unconditional							Conditional						
Category	**Alpha**	**Prop<0**	**2-tail p-value**	**Gamma**	**Prop<0**	**1-tail p-value**	**Prop ≤0.05**	**Alpha**	**Prop<0**	**2-tail p-value**	**Gamma**	**Prop<0**	**1-tail p-value**	**Prop ≤0.05**
Historic														
VW 1934-1995	0.74	0.00	0.25	-0.06	0.89	0.63	0.00	0.40	0.00	0.39	0.07	0.00	0.36	0.00
EW 1934-1995	0.37	0.22	0.31	0.08	0.67	0.55	0.00	0.11	0.22	0.34	0.19	0.33	0.32	0.22
VW 1966-1995	0.17	0.11	0.79	0.14	0.00	0.37	0.00	0.03	0.22	0.84	0.35	0.00	0.06	0.33
EW 1966-1995	0.29	0.00	0.64	0.16	0.00	0.34	0.00	0.20	0.00	0.67	0.32	0.00	0.04	0.89
VW 1966-1981	0.05	0.33	0.95	-0.03	0.44	0.52	0.00	0.03	0.89	0.89	0.21	0.00	0.06	0.67
EW 1966-1981	0.61	0.00	0.69	0.08	0.00	0.38	0.00	0.10	0.67	0.75	0.48	0.00	0.01	1.00
Bayes-Stein														
VW 1934-1995	0.90	0.00	0.13	-0.11	1.00	0.71	0.00	0.42	0.00	0.30	0.07	0.00	0.38	0.00
EW 1934-1995	0.79	0.00	0.19	-0.04	0.78	0.67	0.00	0.42	0.11	0.23	0.11	0.44	0.41	0.11
VW 1966-1995	0.23	0.00	0.69	0.15	0.00	0.39	0.00	0.11	0.11	0.75	0.33	0.00	0.10	0.33
EW 1966-1995	0.36	0.00	0.53	0.14	0.00	0.38	0.00	0.28	0.00	0.50	0.27	0.00	0.07	0.33
VW 1966-1981	0.09	0.11	0.87	0.02	0.11	0.44	0.00	0.09	0.11	0.88	0.18	0.00	0.06	0.33
EW 1966-1981	0.42	0.00	0.77	0.10	0.00	0.27	0.00	0.08	0.67	0.70	0.37	0.00	0.01	1.00
James-Stein														
VW 1934-1995	0.86	0.00	0.15	-0.09	1.00	0.69	0.00	0.52	0.00	0.24	0.02	0.11	0.46	0.00
EW 1934-1995	0.52	0.11	0.24	0.02	0.67	0.59	0.00	0.31	0.11	0.27	0.10	0.33	0.39	0.00
VW 1966-1995	-0.02	0.33	0.72	0.18	0.00	0.36	0.00	-0.16	0.44	0.75	0.40	0.00	0.05	0.56
EW 1966-1995	0.16	0.00	0.80	0.14	0.00	0.35	0.00	-0.05	1.00	0.90	0.39	0.00	0.01	1.00
VW 1966-1981	-0.12	0.44	0.93	0.03	0.00	0.46	0.00	-0.09	1.00	0.82	0.22	0.00	0.03	0.89
EW 1966-1981	0.14	0.67	0.65	0.06	0.11	0.34	0.00	-0.31	0.78	0.35	0.49	0.00	0.00	1.00
CAPM														
VW 1934-1995	0.40	0.00	0.36	-0.06	1.00	0.66	0.00	0.07	0.11	0.49	0.07	0.00	0.41	0.00
EW 1934-1995	0.15	0.11	0.44	0.04	0.67	0.57	0.00	-0.12	0.22	0.52	0.15	0.00	0.36	0.11
VW 1966-1995	-0.03	0.11	0.91	0.04	0.44	0.50	0.00	-0.11	1.00	0.77	0.24	0.00	0.09	0.22
EW 1966-1995	-0.34	0.33	0.83	0.12	0.00	0.43	0.00	-0.45	1.00	0.49	0.35	0.00	0.03	0.89
VW 1966-1981	-0.05	0.78	0.59	0.01	0.22	0.42	0.00	-0.05	0.78	0.29	0.23	0.00	0.02	1.00
EW 1966-1981	0.02	0.78	0.81	0.04	0.00	0.38	0.00	-0.09	0.89	0.52	0.32	0.00	0.01	1.00

1. The units for the alphas are percentage per quarter. Gamma is the timing coefficient.
2. The figures denoted as p-values measure the significance of the coefficients relative to zero. The p-values are hetroscedasticity-consistent.

Table 6

Treynor-Mazuy Unconditional and Conditional Average Alphas and Timing Coefficients for Nine Power Policies (Ranging from -50 to 0.5) When the Means are Based on Historic, Bayes-Stein, James-Stein, and CAPM Estimators. Twelve Equal- and Value-Weighted Industry Groups, 1934-1995, 1966-1995, and 1966-1981. Quarterly Portfolio Revision, 32-Quarter Estimation Period, Borrowing Permitted.

	Unconditional							Conditional						
Category	Alpha	Prop<0	2-tail p-value	Gamma	Prop<0	1-tail p-value	Prop ≤0.05	Alpha	Prop<0	2-tail p-value	Gamma	Prop<0	1-tail p-value	Prop ≤0.05
Historic														
VW 1934-1995	0.87	0.00	0.05	-0.0046	1.00	0.82	0.00	0.57	0.00	0.11	0.0007	0.11	0.42	0.00
EW 1934-1995	0.77	0.00	0.12	-0.0021	0.78	0.74	0.00	0.51	0.00	0.15	0.0027	0.33	0.40	0.00
VW 1966-1995	0.44	0.00	0.42	0.0027	0.00	0.41	0.00	0.35	0.00	0.44	0.0130	0.00	0.04	0.56
EW 1966-1995	0.63	0.00	0.22	0.0028	0.00	0.40	0.00	0.60	0.00	0.19	0.0103	0.00	0.04	0.78
VW 1966-1981	-0.05	0.89	0.88	0.0000	0.11	0.47	0.00	0.19	0.00	0.72	0.0076	0.00	0.02	1.00
EW 1966-1981	0.76	0.00	0.42	0.0089	0.00	0.38	0.00	0.98	0.00	0.14	0.0100	0.00	0.02	0.78
Bayes-Stein														
VW 1934-1995	0.95	0.00	0.01	-0.0056	1.00	0.88	0.00	0.58	0.00	0.06	0.0011	0.00	0.42	0.00
EW 1934-1995	0.98	0.00	0.03	-0.0046	1.00	0.85	0.00	0.67	0.00	0.04	0.0013	0.44	0.49	0.00
VW 1966-1995	0.53	0.00	0.29	0.0026	0.33	0.44	0.00	0.42	0.00	0.31	0.0116	0.00	0.07	0.33
EW 1966-1995	0.65	0.00	0.15	0.0023	0.22	0.44	0.00	0.59	0.00	0.59	0.0087	0.00	0.06	0.33
VW 1966-1981	0.07	0.00	0.91	0.0011	0.11	0.35	0.00	0.25	0.00	0.52	0.0062	0.00	0.00	1.00
EW 1966-1981	0.57	0.00	0.42	0.0027	0.00	0.28	0.00	0.74	0.00	0.17	0.0077	0.00	0.02	0.89
James-Stein														
VW 1934-1995	0.94	0.00	0.02	-0.0052	1.00	0.86	0.00	0.65	0.00	0.05	-0.0005	0.78	0.53	0.00
EW 1934-1995	0.77	0.00	0.10	-0.0023	0.78	0.76	0.00	0.56	0.00	0.11	0.0011	0.44	0.49	0.00
VW 1966-1995	0.33	0.00	0.45	0.0031	0.11	0.42	0.00	0.22	0.00	0.50	0.0132	0.00	0.04	0.56
EW 1966-1995	0.44	0.00	0.37	0.0023	0.00	0.41	0.00	0.38	0.00	0.37	0.0118	0.00	0.02	0.89
VW 1966-1981	-0.13	1.00	0.84	0.0012	0.00	0.40	0.00	0.09	0.00	0.76	0.0077	0.00	0.00	1.00
EW 1966-1981	0.21	0.67	0.70	0.0019	0.00	0.34	0.00	0.48	0.00	0.59	0.0110	0.00	0.01	0.89
CAPM														
VW 1934-1995	0.56	0.00	0.08	-0.0050	1.00	0.87	0.00	0.23	0.00	0.32	0.0003	0.56	0.51	0.00
EW 1934-1995	0.52	0.00	0.15	-0.0035	1.00	0.80	0.00	0.19	0.11	0.42	0.0018	0.33	0.44	0.00
VW 1966-1995	0.08	0.00	0.84	0.0000	0.78	0.53	0.00	-0.02	0.78	0.88	0.0086	0.00	0.07	0.22
EW 1966-1995	-0.06	0.22	0.75	0.0016	0.56	0.49	0.00	-0.17	0.33	0.87	0.0111	0.00	0.02	1.00
VW 1966-1981	-0.08	0.89	0.55	0.0007	0.00	0.40	0.00	0.15	0.67	0.57	0.0079	0.00	0.00	1.00
EW 1966-1981	0.06	0.67	0.85	0.0012	0.00	0.38	0.00	0.31	0.00	0.46	0.0089	0.00	0.00	1.00

1. The units for the alphas are percentage per quarter. Gamma is the timing coefficient.
2. The figures denoted as p-values measure the significance of the coefficients relative to zero. The p-values are hetroscedasticity-consistent.

Table 7

Complete Results for the Conditional Jensen and Treynor-Mazuy Models for Ten Power Policies When the Means are Based on Bayes-Stein Estimators. Twelve Value-Weighted Industry Groups, 1966-1995. Quarterly Portfolio Revision, 32-Quarter Estimation Period, Borrowing Permitted.

Panel A: The Conditional Jensen Model $r_{pt} = \alpha_{cp} + b_{0p} r_{mt} + b_{1p}[dy_{t-1} r_{mt}] + b_{2p}[tb_t r_{mt}] + e_{pt}$

Power	α_c	1-tail p-value	b_0	b_1	2-tail p-value	b_2	2-tail p-value	R^2
-50	0.11	0.01	0.06	-0.03	0.02	0.00	0.76	0.49
-30	0.18	0.01	0.10	-0.05	0.02	0.01	0.75	0.49
-15	0.34	0.01	0.19	-0.10	0.02	0.01	0.75	0.49
-10	0.49	0.01	0.28	-0.15	0.02	0.02	0.75	0.49
-5	0.88	0.01	0.46	-0.23	0.02	0.02	0.81	0.50
-3	1.12	0.01	0.65	-0.32	0.03	0.03	0.83	0.51
-1	1.71	0.01	0.99	-0.41	0.04	0.03	0.89	0.51
0	2.23	0.01	1.25	-0.35	0.25	0.01	0.98	0.51
0.5	2.07	0.02	1.41	-0.41	0.21	0.05	0.86	0.55
1	0.88	0.19	1.68	-0.39	0.26	0.22	0.55	0.61
Average	1.01	0.01	0.60	-0.23	0.07	0.02	0.82	0.50

Panel B: The Conditional Treynor-Mazuy Model $r_{pt} = \alpha_{pc} + b_{0p} r_{mt} + b_{1p}[dy_{t-1} r_{mt}] + b_{2p}[tb_t r_{mt}] + \gamma_p r_{mt}^2 + e_{pt}$

Power	α_c	2-tail p-value	b_0	b_1	2-tail p-value	b_2	2-tail p-value	γ	1-tail p-value	R^2
-50	0.05	0.26	0.06	-0.04	0.00	0.02	0.21	0.0010	0.12	0.51
-30	0.09	0.26	0.10	-0.07	0.00	0.03	0.21	0.0017	0.12	0.51
-15	0.17	0.26	0.20	-0.14	0.00	0.05	0.21	0.0032	0.12	0.51
-10	0.25	0.26	0.29	-0.20	0.00	0.08	0.21	0.0047	0.12	0.51
-5	0.43	0.23	0.49	-0.33	0.00	0.13	0.20	0.0089	0.06	0.53
-3	0.53	0.30	0.69	-0.45	0.00	0.17	0.24	0.0116	0.09	0.53
-1	0.59	0.42	1.06	-0.67	0.00	0.30	0.21	0.0220	0.01	0.55
0	0.87	0.36	1.32	-0.66	0.04	0.34	0.31	0.0269	0.00	0.54
0.5	0.81	0.42	1.48	-0.70	0.04	0.36	0.31	0.0248	0.00	0.57
1	0.44	0.70	1.70	-0.49	0.16	0.33	0.40	0.0087	0.12	0.61
Average	0.42	0.31	0.63	-0.36	0.01	0.16	0.23	0.0116	0.07	0.53

1. The units for the alphas are percentage per quarter. In the Treynor-Mazuy model, gamma is the timing coefficient.
2. The figures denoted as p-values measure the significance of the coefficients relative to zero. All p-values are heteroscedasticity-consistent.
3. The p-values of the conditional beta, b_0, are zero (to two decimal places) in two-tail tests.
4. The average values are for the nine risk-averse powers (-50 to .5).

Figure 1

Geometric Means and Standard Deviations of Annual Portfolio Returns for the Power Policies When the Means Are Based on Historic, James-Stein, Bayes-Stein, and CAPM Estimators. Twelve Value-Weighted Industry Groups, 1934-1995. Quarterly Portfolio Revision, 32-Quarter Estimation Period, Borrowing Permitted.

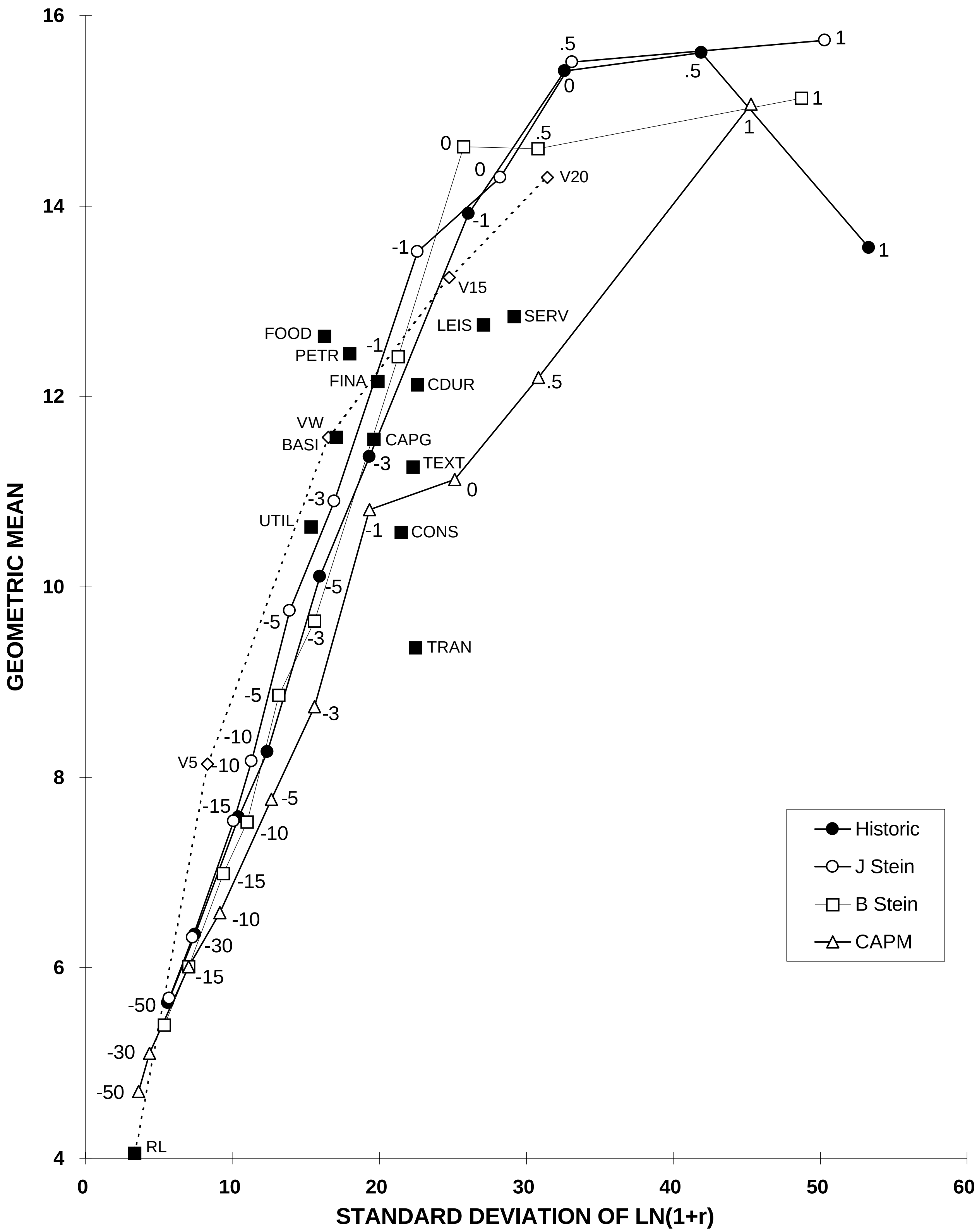

Figure 2

Geometric Means and Standard Deviations of Annual Portfolio Returns for the Power Policies When the Means Are Based on Historic, James-Stein, Bayes-Stein, and CAPM Estimators. Twelve Value-Weighted Industry Groups, 1966-1995. Quarterly Portfolio Revision, 32-Quarter Estimation Period, Borrowing Permitted.

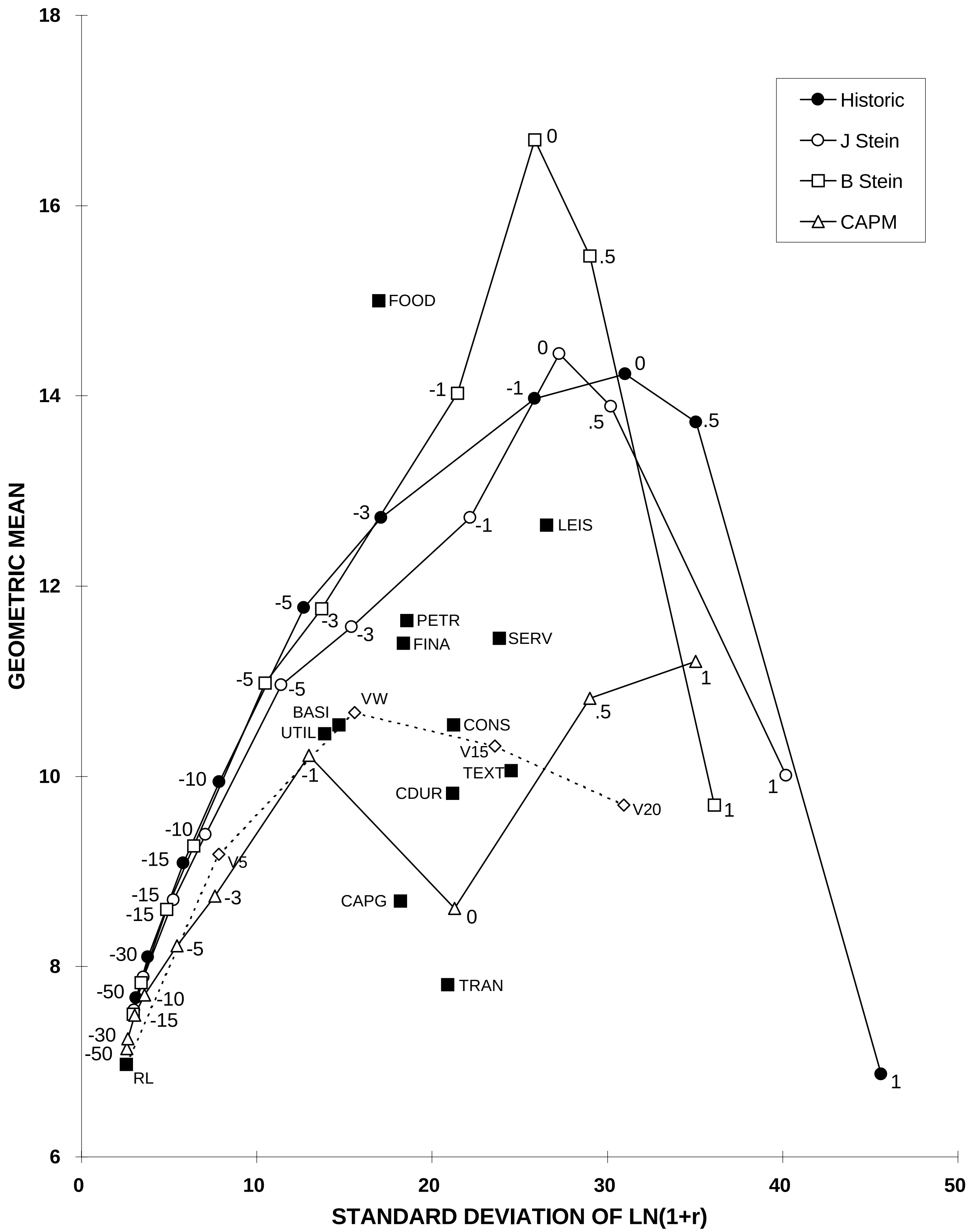

Figure 3

Geometric Means and Standard Deviations of Annual Portfolio Returns for the Power Policies When the Means Are Based on Historic, James-Stein, Bayes-Stein, and CAPM Estimators. Twelve Value-Weighted Industry Groups, 1966-1981. Quarterly Portfolio Revision, 32-Quarter Estimation Period, Borrowing Permitted.