Predicting Stock Returns Using Mutual Fund Portfolio Holdings: Implications of Fund Performance Persistence

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Abstract

This study uses reported mutual fund portfolio holdings to predict stock returns. Stocks picked by good mutual fund managers should outperform those picked by bad managers; and if fund performance persists, past performance should be informative of fund managers' stock selection ability. We develop this intuition into a statistical model and propose three stock alpha estimators that can extract information about future returns on a large cross-section of stocks from the current portfolio compositions and past performance of a relatively small number of mutual funds. Each stock alpha estimator can be further decomposed into three components, using information on recent fund purchases, recent fund sells, and lagged fund positions.

We plan to examine the performance of the stock alpha estimators and their components against various benchmarks, such as characteristics-sorted benchmark portfolios, several return-predictive effects based on mutual fund trades developed in recent studies, as well as a battery of quantitative investment signals. Since the stock selection ability of most mutual funds stems from fundamental research, we expect the information content of our stock alpha estimators to be significantly different from that of strategies popularly used by quantitative investment managers.

I. Research Objective and Literature Review

Academic studies have extensively examined the issue of mutual fund performance persistence.[1] It is generally regarded that persistently superior performance reflects genuine stock-selection ability of fund managers. Therefore, if fund performance indeed persists, information about past performance should be useful for investors when they pick mutual funds. This insight is built into the recent mutual fund selection models, such as Pastor and Stambaugh (2002) and Avramov and Wermers (2005).

In this project, we are interested in whether performance persistence is also helpful in guiding investment decision on individual stocks. Specifically, we would like to extract information about future stock returns from observed past performance and current portfolio compositions of a group of actively managed equity mutual funds. Such stock-selection exercise can be of incremental value relative to the mutual fund selection exercise because it is often more flexible to trade on individual stocks than on mutual funds, given the no short-sale rule, loads and fees, and the minimum holding-period requirement for many mutual funds.

In US, mutual funds disclose their portfolio holdings periodically. During the past two decades, mutual funds were required to file their portfolio holdings with SEC twice a year. A recent SEC amendment (SEC file no. S7-51-02) changed the filing frequency to quarterly starting from May 2004.[2] Even before the rule change, mutual funds often disclose their holdings at quarterly frequency to data vendors such as CDA/Spectrum.[3] The purpose of mandatory portfolio disclosure is to "enable interested investors, through more frequent access to portfolio information, to monitor whether, and how, a fund is complying with its

[1] See, for example, Hendricks, Patel and Zeckhauser(1993), Grinblatt and Titman (1989, 1992, 1993), Goetzmann and Ibbotson (1994), Brown and Goetzmann (1995), Gruber (1996), Carhart (1997), Zheng (1999), Bollen and Busse (2001), Lynch and Musto (2002), Ibbotson and Patel (2002), Teo and Woo (2004), among many others.

[2] Funds were also required to list their complete holdings in their semiannual reports to shareholders. However, under the new SEC rule, mutual funds only need to list their top 50 holdings in the semi-annual reports provided that the complete portfolio schedule is filed with SEC.

[3] A small number of funds even make their portfolio information available at monthly frequency to fund research firms such as Morningstar and Lipper.

stated investment objective" (SEC press, March 19, 2004). The purpose of this project, instead, is to show that timely disclosed portfolio compositions may also contain useful information about future stock returns.

One way to take advantage of disclosed portfolio information is to create "copycat funds", as in Myers, Portoba, Shackelford, and Shoven (2004). They construct portfolios that replicate the disclosed holdings of mutual funds (with a time lag), and find that after-expense returns to these copycat portfolios and actual funds are indistinguishable. Another example is Chen, Jegadeesh, and Wermers (2000), who construct measures of aggregate trading by mutual funds and find that such measures are informative of future stock returns. A common assumption of these two studies is that mutual funds have better stock selection ability than other investors. However, neither of them makes use of information on past fund performance or the differential stock selection ability across funds.

The intuition behind our approach is simple: stocks picked by a good fund managers should outperform those picked by a bad managers, where good and bad managers are defined by their stock selection ability and proxied by their past performance. We formulate this intuition into a statistical model that links future stock alphas to past fund alphas and current portfolio weights. In estimating the model, we face a technical challenge that the number of stocks is usually larger than the number of funds. To extract information about future alphas of a large number of stocks from data on a relatively small cross-section of funds, we develop three stock alpha estimators. The first estimator is intuitively the weighted average of past fund alphas, where the weights are proportional to current fund portfolio weights. The second estimator is based on a generalized inverse approach developed in the statistical literature to solve ill-posed regression problems. The third estimator is based on the Bayesian approach.

To further identify the sources of return predictive power, we decompose each stock alpha estimator into three components based on recent fund purchases, recent fund sells, and lagged fund positions respectively.

We plan to evaluate these stock alpha estimators using data on actively managed US domestic equity mutual funds. Information on fund returns is from CRSP and information on portfolio holdings is from Thomson Financial CDA/Spectrum. The following empirical

issues are the focus of our study.

First, we examine the performance of our stock alpha estimators and their various components in predicting future stock returns at horizons from one quarter to one year. Since these estimators are based on the assumption of fund performance persistence, positive evidence of their predictive power is also evidence on persistent fund performance, an issue still debated in the literature.

Second, recent studies have identified several other return-predictive effects related to mutual fund trading. For example, Chen, Jegadeesh, and Wermers (2000) document that due to superior stock selection of mutual funds as a whole, stocks experiencing more intense mutual fund purchases and less intense mutual fund sells subsequently have higher returns. Chen, Hong, and Stein (2002) construct measures of breadth of mutual fund ownership on individual stocks. They find that due to short-sale constraints, stocks with decrease breadth of ownership tend to have lower future returns. Finally, a recent study by Alexander, Cici, and Gibson (2005) shows that trade motivation matters. Stocks bought by mutual funds that experience outflows tend to outperform, while stocks sold be mutual funds that experience inflows tend to underperform. We compare our stock alpha estimators with these effects.

Third, we look into the difference in the performance of stock alpha estimators across subsamples of stocks and subsamples of funds. Subsample analysis can help us understand what stock characteristics and fund characteristics are associated with differential stock-picking ability across fund managers.

Finally, most mutual fund managers use fundamental research to select stocks. This is different from the approaches of quantitative investment managers, who select stocks following documented market anomalies with publicly available financial and accounting information. We therefore expect that our stock alpha estimators to have information content substantially different from known market anomalies. To verify this we analyze the relation of our stock alpha estimators with anomaly-based investment signals popularly employed by quantitative managers. We consider twelve such quantitative signals recently documented by Jegadeesh, Kim, Krische, and Lee (2004). The details are provided in Appendix B of this proposal.

II. Stock Alpha Estimators

II.A. Assumptions

The approach of this project is based on the following assumptions.

First, the alpha of a fund equals the weighted average of alphas of the stocks held by the fund. That is,

$$\alpha^f_{jt+1} = \sum_{i=1}^{N} \omega_{ijt} \alpha^s_{it+1} \tag{1}$$

where ω_{ijt} is portfolio weight of fund j on stock i at the end of period t, or the beginning of period t+1. α^f_{jt+1} is the *pre-expense* fund alpha and α^s_{it+1} the stock alpha for the period t+1. There are M mutual funds and N stocks. Therefore, i=1,... N and j=1,..., M. The above equation naturally holds when a fund employs the buy-and-hold strategy throughout the period. If there is trading during the period, it holds approximately due to the effect of interim trading and transaction costs.

The second assumption is that performance is persistent across funds. That is, funds with higher alphas in the past tend to have higher alphas in the future. We use a linear cross-sectional model to model such persistence:

$$\alpha^f_{jt+1} = \rho \alpha^f_{jt} + \xi_{jt+1} \tag{2}$$

where ξ_{jt+1} is an error term independent of α^f_{jt}. ρ is a constant between 0 and 1. The intercept is zero, meaning that fund alphas revert to zero in the long run. Admittedly, this is a very simple model. It can be expanded, for example, to take into account the asymmetry in performance persistence documented by Carhart (1997), Lynch and Musto (2003), Brown and Goetzman (1995), or to incorporate the effects of various fund characteristics and fund flows that is predictive of fund performance.

Finally, we assume that past fund alphas are observed with noises:

$$\hat{\alpha}^f_{jt} = \alpha^f_{jt} + \epsilon_{jt} \tag{3}$$

where α^f_{jt} is the true but unobserved fund alpha, $\hat{\alpha}^f_{jt}$ the estimated alpha, and ϵ_{jt} the estimation error. Fund alphas can be estimated, for example, from past fund returns using CAPM,

the Fama-French three-factor model, the Carhart four-factor model, or the measure of stock selectivity of Daniel, Grinblatt, Titman, and Wermers (1996), which is based on past fund portfolio holdings.

Combining (1), (2), and (3), we have

$$\sum_{i=1}^{N} \omega_{ijt} \alpha^s_{it+1} = \rho(\hat{\alpha}^f_{jt} - \epsilon_{jt}) + \xi_{jt+1} \tag{4}$$

The above can be further expressed as

$$\rho \hat{\alpha}^f_{jt} = \sum_{i=1}^{N} \omega_{ijt} \alpha^s_{it+1} + e_{jt+1} \tag{5}$$

where $e_{jt+1} = \rho\epsilon_{jt} - \xi_{jt+1}$.

Now let $\hat{\Lambda}^f = (\,\hat{\alpha}^f_{1t} \quad \hat{\alpha}^f_{2t} \quad ... \quad \hat{\alpha}^f_{Mt}\,)'$, $\Lambda = (\,\alpha^s_{1t+1} \quad \alpha^s_{2t+1} \quad ... \quad \alpha^s_{Nt+1}\,)'$, and let $\Xi = (\,e_{1t+1} \quad e_{2t+1} \quad ... \quad e_{Mt+1}\,)'$. Further, let W be the M by N matrix of portfolio weights:

$$W = \begin{pmatrix} \omega_{11t} & \omega_{21t} & ... & \omega_{N1t} \\ \omega_{12t} & \omega_{22t} & ... & \omega_{N2t} \\ ... & ... & ... & ... \\ \omega_{1Mt} & \omega_{2Mt} & ... & \omega_{NMt} \end{pmatrix}$$

Then (5) can be expressed in matrix form as

$$\rho \hat{\Lambda}^f = W\Lambda + \Xi \tag{6}$$

The time subscript is dropped in the above for notational convenience. The error terms in Ξ are assumed to be white noises with zero means and covariance Ω.

II.B. Solutions

At the beginning of period t+1, we can estimate past fund alphas $\hat{\alpha}^f_{jt}$ and observe fund portfolio weights ω_{ijt}. In other words, $\hat{\Lambda}^f$ and W are known. For the time being, also treat ρ as a known constant between 0 and 1. The task is to predict stock alphas Λ from (6). In the following, we first introduce the OLS and GLS estimators and discuss several empirical issues that make these estimators infeasible to implement. We then introduce three alternative estimators that are feasible and possibly more robust.

II.B.1. OLS and GLS Estimators

Ignoring the invertibility issue for $W'W$, the OLS estimator for Λ^s, based on (6), is

$$\hat{\Lambda}_{OLS} = \rho(W'W)^{-1}W'\hat{\Lambda}^f \tag{7}$$

The GLS estimator takes into account the covariance structure of the error term Ξ:

$$\hat{\Lambda}_{GLS} = \rho(W'\Omega^{-1}W)^{-1}W'\Omega^{-1}\hat{\Lambda}^f \tag{8}$$

It is clear that ρ affects the magnitude of stock alphas proportionally. Therefore, as long as $\rho > 0$, it does not affect the cross-sectional ranking of the alphas. On the other hand, if there is no performance persistence, $\rho = 0$. Then both $\hat{\Lambda}_{OLS}$ and $\hat{\Lambda}_{GLS}$ will be zero-valued. Therefore, the stock alpha estimators are uninformatve when $\rho = 0$.

In empirical implementation, several problems render the OLS and GLS estimators impractical. First, the number of stocks (N) is often larger than the number of funds (M). Therefore $W'W$ and $W'\Omega^{-1}W$, both N×N matrices, are singular and not invertible. Second, even if M ≥ N, $W'W$ and $W'\Omega^{-1}W$ would generally be of very large dimension and numerical inversion of a large matrix is often inaccurate. Finally, for the GLS estimator, the inversion of Ω may cause additional problems.

II.B.2. Three Feasible Estimators

To overcome these problems, we consider three feasible estimators.

1. The Weighted-average Alpha

First, consider a variation of the OLS estimator (7). It seems reasonable that if we ignore the information in the term $(W'W)^{-1}$ but retain the information contained in $W'\hat{\Lambda}^f$, an estimator is generally in the form

$$\hat{\Lambda} \propto \rho W'\hat{\Lambda}^f \tag{9}$$

Based on this general form we develop a weighted-average estimator

$$\hat{\Lambda}_{WGT} = \rho[W'\hat{\Lambda}^f]./[W'\iota] \tag{10}$$

where ./ is the element-by-element division operator, and ι is a unit vector. To be more concrete, this means

$$\hat{\alpha}^s_{jt+1} = \frac{\rho \sum_{j=1}^{M} \omega_{ijt} \hat{\alpha}^f_{jt+1}}{\sum_{j=1}^{M} \omega_{ijt}} \tag{11}$$

(11) is intuitive: a stock's alpha is the weighted average of fund alphas, where the weights are proportional to the portfolio weight ω_{ijt}. Computation of the weighted average alphas does not involve numerical inversion of large matrices, and therefore is fast and potentially robust.

2. The Generalized-inverse Alpha

The statistical literature has actually developed techniques to deal with the singularity or near-singularity issue in the regression problem of (6). Here we adopt an approach of generalized inverse. Let V be the N×N matrix of eigenvectors for $W'W$, and D be the N×N diagonal matrix of eigenvalues. By definition $W'W = VDV'$. When $W'W$ is non-singular, it is known that $(W'W)^{-1} = VD^{-1}V'$. When $W'W$ is singular, some diagonal elements of D are zeros, and therefore D is not invertible. Now let d_{ii} be the i-th diagonal element of D and define D^+ as a diagonal matrix with the i-th element d^+_{ii}. Let $d^+_{ii} = d^{-1}_{ii}$ if $d_{ii} > 0$ and $d^+_{ii} = 0$ if $d_{ii} = 0$. The generalize inverse of $W'W$ is then VD^+V', and our generalized-inverse estimator is

$$\hat{\Lambda}_{GIV} = \rho(VD^+V')W'\hat{\Lambda}^f \tag{12}$$

3. The Bayesian Alpha

Finally, we consider the Bayesian approach. Suppose that in our prior belief the distribution for stock alpha is $\Lambda \sim N(\mu, \Sigma)$. Combining this prior with (6), and with the assumption $\Xi \sim N(0, \Omega)$, the expected stock alpha under the posterior distribution is

$$\hat{\Lambda}_{BYS} = \rho(W'\Omega^{-1}W + \Sigma^{-1})^{-1}(W'\Omega^{-1}\hat{\Lambda} + \Sigma^{-1}\mu) \tag{13}$$

Under the reasonable prior that $\mu = 0$ and $\Sigma = I\sigma^2$ (I is the identity matrix), the Bayesian estimator reduces to

$$\hat{\Lambda}_{BYS} = \rho(W'\Omega^{-1}W + I\sigma^{-2})^{-1}W'\Omega^{-1}\hat{\Lambda}^f \tag{14}$$

Since $(W'\Omega^{-1}W + I\sigma^{-2})$ is the sum of a semi-positive definite matrix and a diagonal matrix, it is alway positive definite and invertible.

For illustration purpose, we have treated the estimated fund alpha $\hat{\Lambda}^f$ as observed in the above. In practice, of course, it needs to be estimated from data, and the distribution for the estimation error ϵ_{jt} in (3) is not necessarily normal. A full-fledged Bayesian estimator has to take this into account. In empirical implementation, our Bayesian estimator starts from hierarchical priors about the parameters of the fund return process, and use simulations to obtain posterior distributions of fund alphas and ultimately stock alphas. The details of this approach are provided in Appendix A of this proposal.

The Bayesian estimator in (14) can also be derived using the frequentist *ridge* regression approach. See, for example, Hoerl and Kennard (1970).

II.B.3. Relation with Fund Performance Measure of Cohen, et al. (2005)

It is interesting to note that our stock alpha estimators are related to the fund performance measure of Cohen, Coval, and Pastor (2005). Motivated by the intuition that skilled fund managers tend to make similar investment decisions, they measure the performance of a fund as the weighted average of alphas of all funds in the sample, where the weight is essentially proportional to the covariance of portfolio holdings of two funds. Cohen et al. interpret the performance measure they propose as a smoothed estimator of fund alphas. They find that the performance measure they propose outperforms fund alphas estimated from past fund returns in predicting future performance.

Interestingly, in light of the assumptions that lead to our stock alpha estimators, their fund performance measure has an alternative interpretation. To be specific, following the expression (4) in their paper, their fund performance measure $\bar{\delta}^*_m$ is

$$\bar{\delta}^*_m = \sum_{i=1}^{N} \omega_{m,n} \bar{\bar{\delta}}_n$$

where $\bar{\bar{\delta}}_n$ is their stock quality measure, equivalent to our weighted-average stock alpha estimator (11), and $\omega_{m,n}$ is the portfolio weight at the end of the previous period or the beginning of the future period. This expression is the same as (1) in our paper. Since $\hat{\Lambda}_{WGT}$ is a predictor of future stock return, naturally $\bar{\delta}^*_m$ can be interpreted as a predictor of future

fund alpha using information about how the stocks in their portfolios will perform. Both our stock alpha estimators and their fund performance measure are based on the assumption of performance persistence. If $\hat{\Lambda}^s_{WGT}$ does well in predicting stock alphas, $\bar{\delta}^*_m$ should also do well in predicting fund alphas.

II.C. Trade-based Alphas

The various estimators above are all based on the portfolio weights W. They can be easily extended by using information on mutual fund trades instead of portfolio holdings. To be specific, we can decompose portfolio weights into:

$$W_t = W_{t-1} + \Delta W = W_{t-1} + \Delta W^+ + \Delta W^- \tag{15}$$

where W_t is the portfolio weight matrix at the beginning of period t, W_{t-1} is the lagged portfolio weight matrix, and ΔW is the matrix of portfolio weight change from t-1 to t. Further, ΔW^+ is the positive part of ΔW, i.e, the matrix of portfolio weight change due to mutual fund buys, and ΔW^- is the negative part of ΔW_t, due to fund sells.

Based on the decomposition of W_t in (15), the weighted-average estimator of stock alpha (10) can be decomposed into:

$$\hat{\Lambda}_{WGT,lag} = \rho[W'_{t-1}\hat{\Lambda}^f]./[W'\iota] \tag{16}$$

$$\hat{\Lambda}_{WGT,trade} = \rho[(\Delta W)'\hat{\Lambda}^f]./[W'\iota] \tag{17}$$

$$\hat{\Lambda}_{WGT,buy} = \rho[(\Delta W^+)'\hat{\Lambda}^f]./[W'\iota] \tag{18}$$

$$\hat{\Lambda}_{WGT,sell} = \rho[(\Delta W^-)'\hat{\Lambda}^f]./[W'\iota] \tag{19}$$

It is easy to see that $\hat{\Lambda}_{WGT} = \hat{\Lambda}_{WGT,lag} + \hat{\Lambda}_{WGT,trade}$ and $\hat{\Lambda}_{WGT,trade} = \hat{\Lambda}_{WGT,buy} + \hat{\Lambda}_{WGT,sell}$.

Similarly, we can decompose the generalized-inverse estimator (12) and the Bayesian estimator (14) into:

$$\hat{\Lambda}_{GIV,lag} = \rho V D^+ V' W'_{t-1}\hat{\Lambda}^f \tag{20}$$

$$\hat{\Lambda}_{GIV,trade} = \rho V D^+ V'(\Delta W)'\hat{\Lambda}^f \tag{21}$$

$$\hat{\Lambda}_{GIV,buy} = \rho V D^+ V'(\Delta W^+)'\hat{\Lambda}^f \tag{22}$$

$$\hat{\Lambda}_{GIV,sell} = \rho V D^+ V'(\Delta W^-)'\hat{\Lambda}^f \tag{23}$$

and

$$\hat{\Lambda}_{BYS,lag} = \rho(W'\Omega^{-1}W + I\sigma^{-2})^{-1}W'_{t-1}\Omega^{-1}\hat{\Lambda}^f \tag{24}$$

$$\hat{\Lambda}_{BYS,trade} = \rho(W'\Omega^{-1}W + I\sigma^{-2})^{-1}(\Delta W)'\Omega^{-1}\hat{\Lambda}^f \tag{25}$$

$$\hat{\Lambda}_{BYS,buy} = \rho(W'\Omega^{-1}W + I\sigma^{-2})^{-1}(\Delta W^+)'\Omega^{-1}\hat{\Lambda}^f \tag{26}$$

$$\hat{\Lambda}_{BYS,sell} = \rho(W'\Omega^{-1}W + I\sigma^{-2})^{-1}(\Delta W^-)'\Omega^{-1}\hat{\Lambda}^f \tag{27}$$

Note that in all stock alphas estimators, ρ plays a role of constant multiplier. In empirical implementation, we assume that $\rho = 1$. We use sorted portfolios and cross-sectional regressions to evaluate the performance of stock alpha estimators. As long as $\rho > 0$, our conclusions will not be affected by assuming a specific value for ρ.

III. Data and Empirical Methodology

III.A. Data

Thomson Financial CDA/Spectrum data provide information on mutual fund portfolio holdings at either quarterly or semi-annual frequency. CRSP survivor-bias free mutual fund data provides information on monthly fund returns as well as information on fund characteristics such as total net assets, loads, and expense ratios. Funds in these two datasets are matched together using the scheme described by Wermers (2000). Since our focus is on actively managed US equity funds, we only include funds with one of the following three investment objectives in the CDA data: aggressive growth, growth, and growth and income.

Stock returns are from CRSP. Accounting information is from Compustat. Data on analysts' forecasts are from IBES.

III.B. Estimating Fund Alphas

We estimate fund alphas Λ^f from the Fama-French three-factor model:

$$r_t - r_{ft} = \alpha + \beta_1(r_{mt} - r_{ft}) + \beta_2 \mathrm{SMB}_t + \beta_3 \mathrm{HML}_t + e_t \tag{28}$$

where r_t is the *pre-expense* monthly fund return, computed as fund net return plus the amortized monthly expense ratio. r_{ft} is the monthly riskfree rate, proxied by the yield of T-bills with one-month maturity from CRSP. r_{mt} is the monthly market return, proxied by the CRSP value-weighted index return. SMB_t and HML_t are monthly size and book-to-market factors. The regression is performed on a rolling basis at the end of every quarter, using monthly fund returns during the past 12 months.

There are various alternative ways to measure past fund performance. For example, one can use the Carhart four-factor model, which controls for the effect of momentum trading. The purpose of this project, however, is to identify all possible sources of persistent stock selection ability, including momentum trading. Therefore we do not control for momentum at the stage of evaluating fund performance. We do control for the momentum effect at the later stage of evaluating the performance of estimated stock alphas.

III.C. Characteristics-adjusted Stock Returns

To evaluate the performance of various stock alpha estimators in predicting future stock returns, we compute the characteristics-adjusted returns for individual stocks using the characteristics benchmarks developed by Daniel, Grinblatt, Titman, and Wermers (1997). In June of every year, we sort all stocks into 125 characteristics portfolios by a sequential triple sort procedure. To be specific, we first sort all stocks on size into five groups using NYSE size breakpoints. Then, within each size quintile, we sort stocks on book-to-market ratio (BM) further into 5 groups. Finally, within each of the 25 size-and-BM sorted groups, we sort stocks on momentum. Size is the market capitalization at the end of June. Book-to-market ratio is the book value of equity at the end of the previous fiscal year divided by size. Momentum is the total return during the past 12 months. The portfolio designation for each stock is fixed during the next 12 months until the reconstitution of the characteristics portfolios in next June. Sometimes, a stock has missing characteristics and therefore cannot be assigned to any of the above portfolios. An additional portfolio is created for these stocks. We compute equal-weighted returns for the 126 portfolios and use them as benchmarks. The characteristics-adjusted stock return is the individual stock return in excess of the return to the benchmark portfolio it belongs to.

III.D. Evaluating the Performance of Stock Alpha Estimators

Stock alpha estimators are evaluated using the sorted-portfolio approach. During the sample period, at the end of each quarter (referred to as the portfolio formation quarter, or Q0), we estimate stock alphas using various estimators developed in Section II. Then, we sort stocks into equal-weighted decile portfolios according to the estimated stock alphas, and examine the performance of these portfolios in the next four quarters (denoted as Q1 to Q4). Recall that the stock alpha estimators are constructed based on the assumption of performance persistence ($\rho > 0$). If there is no performance persistence, there should be no difference in the future returns across these portfolios.

To ensure that the portfolios are realistic, we impose several restrictions. First, to avoid biases due to microstructure issues as well as to limit the impact of transaction costs, at the end of Q0, we require the stocks to have a minimum price of \$5 to be included in any of the decile portfolios. Second, if a stock becomes delisted during one of the four evaluation quarters (Q1 to Q4), we assume that the return of this stock during the remaining of the quarter is the CRSP delisting return. Following Shumway (1997), if the delisting return is missing and the delisting is performance related, we replace it with -30%. For other missing delisting returns, we assume it is zero. Finally, portfolios are rebalanced to have equal weights at the beginning of each of the next four quarters (Q1 through Q4); delisted stocks are no longer included in the portfolio during the subsequent quarters. For example, if a stock is delisted during the second month of Q3, we assume that its return for the second and the third month of Q3 is the CRSP delisting return. For Q4, the decile portfolio that it originally belongs is equally weighted in the stocks that still exist at the end of Q3.

To evaluate the performance of estimated stock alphas, we compute the quarterly net returns and characteristics-adjusted returns of the decile portfolios during Q1, Q2, Q3, and Q4 and report their time-series averages. We will also compute the difference between returns to the top and bottom deciles and report their time-series averages.

IV. Practical Value of the Project and Timetable

A direct outcome of the project is various return-predictive stock alpha estimators. They can be used to form profitable investment strategies.

The project is perhaps particularly useful for investment managers who use quantitative models to make stock selection decisions. A majority of mutual funds use fundamental research to select stocks. Information produced by good fundamental fund managers likely has low correlation with signals commonly used by quantitative managers. Our stock alpha estimators quantify such fundamental information; they can be combined with other investment strategies to improve the quantatitive stock selection process.

Currently, we have completed data construction and have performed some preliminary empirical analysis, with very encouraging results. A polished first draft is expected by December 2005. After circulating the paper for comments, we schedule to submit a revised draft to INQUIRE and to a top academic journal by June 2006.

APPENDIX

A. The Bayesian Stock Alpha Estimator

The Bayesian stock alpha estimator is developed under a random coefficients model with hierarch priors. Details for such models can be found, for example, in Rossi, McCulloch and Allenby (1996). Assumptions on data generating processes are as follows.

At a given time t, we consider fund returns for a past period from $\tau - K$ to τ ($\tau \leq t$). For mutual fund j,

$$r_{j\tau-k} = \alpha^f_{jt} + f_{\tau-k} b_j + \epsilon_{j\tau-k}, \text{ for k=0,...,K} \tag{29}$$

$$\alpha^f_{jt+1} = \rho \alpha^f_{jt} + e_{jt+1} \tag{30}$$

$$\alpha^f_{jt+1} = \sum \alpha^s_{it+1} w_{ijt} \tag{31}$$

where $r_{j\tau-k}$ fund return at time $\tau - k$, α^f_{jt} is the fund alpha at time t, $f_{\tau-k}$ is a row vector of factor realizations at time $\tau - k$, b_j is a vector of factor loadings. We assume that α^f_{jt} and b_j stay constant during the period $\tau - K$ to τ. α^s_{it+1} is the stock alpha at time t+1 and w_{ijt} is the portfolio weight. α^f_{it+1} is the fund alpha at time t+1. Further, $e_{jt+1} \sim N(0, \sigma^2_e)$ and $\epsilon_{j\tau-k} \sim N(0, \sigma^2)$. Let α^s denote the vector of α^s_{it+1}. Our prior on α^s is:

$$\alpha^s \sim N(\underline{\alpha}^S, \underline{\Sigma}) \tag{32}$$

Let $\beta_j = (\alpha^f_{jt}, b_j)$. Assume that the vector β_j is drawn from a joint normal distribution,

$$\beta_j \sim N(\mu_\beta, V_\beta) \tag{33}$$

We assume that for different funds β_j are drawn independently.

Estimation of α^f_{jt} in this hierarchical framework entails a second layer of hierarchical priors. We assume the prior on μ_β is $\mu_\beta \sim N(\underline{\mu}_\beta, \underline{\sigma}^2_\beta)$. V_β is assumed to be the same for all mutual funds. The prior for V_β is $V_\beta \sim \text{Wishart}(n, \underline{V}^{-1}_\beta)$. We set n=4 so that the prior is pretty noninformative.

For simplicity, we assume an Inverted Gamma distribution as the prior on the variance of the error term $\epsilon_{j\tau-k}$: $\sigma^2 \sim IG(s^{-2}, m_1)$, and on the variance of e_{jt+1}: $\sigma^2_e \sim IG(s^{-2}, m_2)$. We assume $m_1 = m_2 = 1/2$ (we choose this so that $m_1 + m_2 = 1$ and only this sum is relevant in estimation).

The conditional posteriors for the β_j's are independent of each other, with $\beta_j | R, \sigma^2, \mu_\beta, V_\beta \sim N(\bar{\beta}_j, \bar{V}_j)$, where,

$$\bar{V}_i = (\frac{1}{s^2} F'_t F_t + \underline{V}^{-1}_\beta)^{-1} \tag{34}$$

$$\bar{\beta}_j = \bar{V}_j (\frac{1}{s^2} F'_t R_t + \underline{V}^{-1}_\beta \mu_\beta) \tag{35}$$

where $F_t = (1, f_t)$. The first element of β_j is the estimated α^F_{jt}. The conditional posterior for the α^S_{it+1} is

$$\alpha^s | W, \hat{\alpha}^f \sim N(\bar{\alpha}^s, \bar{\Sigma}) \tag{36}$$

where $\bar{\alpha}^s = (\underline{\Sigma}^{-1} + W'W)^{-1}(\underline{\Sigma}^{-1}\underline{\alpha}^s + W'\hat{\alpha}^f)$ and $\bar{\Sigma} = (\underline{\Sigma}^{-1} + W'W)^{-1}$.

To estimate the posterior mean of α^s_{it+1}, we use the Gibbs sampler to sequentially draw from the full conditional densities of all parameters and integrate over a high-dimensional state space (see Geweke (1997) for details of the Gibbs sampler procedure). We discard the first 1,000 draws as a burn-in. The estimator of α^s_{it+1} is the average of the subsequent 9,000 draws.

B. Quantitative Investment Signals

This appendix describes the twelve quantitative signals used in the study. The variables are constructed following Jegadeesh, Kim, Krische, and Lee (2004). All variables are winsorized at the 1 and 99 percentiles within each quarter. [text] refers to the data source, where D# is the item number from Quarterly Compustat. For use of exposition, firm specific subscripts have been omitted. In all cases, the related consensus recommendation levels and changed are collected at the end of quarter t, which has month-end m. q denotes the most recent quarter for which an earnings announcement was made. We require the announcement to be made at least two months prior to the end of quarter t, and that q$\geq$ t-4.

Variable	Description	Computation Details
1. RETP	Cumulative market adjusted return for the preceding six months (months -6 through -1)	$[\Pi_{i=m-6}^{m-1}(1 + \text{monthly return}_i)] - 1$ -$[\Pi_{i=m-6}^{m-1}(1 + \text{value-weighted market monthly return}_i] - 1$, where m=month-end of quarter t [CRSP]
2. RET2P	Cumulative market-adjusted return for the second preceding six months (months -12 through -7)	$[\Pi_{i=m-12}^{m-7}(1 + \text{monthly return}_i)] - 1$ -$[\Pi_{i=m-12}^{m-7}(1 + \text{value-weighted market monthly return}_i] - 1$, where m=month-end of quarter t [CRSP]
3. TURN	Average daily volume turnover	Percentile rank $\frac{\sum_{i=1}^{n} \text{Daily Volume/Shares Outstanding}}{n}$ by exchange, where n = number of days available for 6 months preceding the end of quarter t (months m-6 though m-1) [CRSP]
4. SIZE	Market cap (natural log)	Size_t = LOG (P_t * $\text{Shares Outstanding}_t$) = LOG (price at the end of the quarter t [D14], multiplied by common shares outstanding at the end of quarter t [D61])
5. FREV	Analyst earnings forecast revisions to price	$\sum_{i=0}^{5}(\frac{f_{m-i}-f_{m-1-i}}{P_{m-1-i}})$, where f_m = mean consensus analyst FY1 forecast at month m, the month-end of quarter t [IBES] P_{m-1} = price at the end of month m-1, relative to the month-end of quarter t [CRSP]. Thus, $\sum_{i=0}^{5}(\frac{f_{m-i}-f_{m-1-i}}{P_{m-1-i}})$=rolling sum of preceding six months revisions to price ratios
6. LTG	Long-term growth forecast	Mean consensus long-term growth forecast at end of quarter t [IBES]

7. SUE	Standardized unexpected earnings	$\frac{(\text{EPS}_q - \text{EPS}_{q-4})}{s_q}$, where q = most recent quarter for which an earnings announcement was made a minimum two months prior to the end of quarter t, with $q \geq t-4$ $\text{EPS}_q - \text{EPS}_{q-4}$= unexpected earnings for quarter q, with EPS defined as earnings per share (diluted) excluding extraordinary items [D9], adjusted for stock distributions [D17] σ_q = standard deviation of unexpected earnings over eight preceding quarters (quarters q-7 though q)
8. SG	Sales growth	$\frac{\sum_{i=0}^{3} \text{Sales}_{q-i[D2]}}{\sum_{i=0}^{3} \text{Sales}_{q-4-i[D2]}}$ where q = most recent quarter for which an earnings announcement was made a minimum two months prior to the end of quarter t, with $q \geq t-4$ Thus, $\sum_{i=0}^{3} \text{Sales}_{q-i}$=rolling sum of sales for preceding four quarters and $\sum_{i=0}^{3} \text{sales}_{q-i}$=rolling sum of sales for second preceding set of four quarters
9. TA	Total accruals to total assets	($\triangle$Current Assets$_q$ [D40] -$\triangle$Cash$_q$[D36])(based on balance sheet accounts) -($\triangle$Current Liabilities$_q$ [D49] -$\triangle$Current LTD$_q$ [D45]) -$\triangle$Deferred Taxes$_q$ [D35] $\frac{-\text{Depreciation and Amortization}_q[\text{D5}]}{(TA_q + TA_{q-4})/2 \text{ [D44]}}$ q = most recent quarter for which an earnings announcement was made a minimum of two months prior to the end of quarter t, with $q \geq t-4$ $\triangle X_q = X_q - X_{q-4}$e.g., $\triangle$Current Assets$_{t-1}$ = Current Assets$_{t-1}$ $-$Current Assets$_{t-5}$
10. CAPEX	Capital expenditures to total assets	$\frac{\text{CAPEX}_q}{(TA_q + TA_{q-4})/2[D44]}$ q = most recent quarter for which an earnings announcement was made a minimum two months prior to the end of quarter t, with $q \geq t-4$ CAPEX$_q$ = rolling sum of four quarters (quarters q-3 through q) of Capital Expenditures [D90] (As D90 is fiscal-year-to-date, adjustments are made as needed to calculate the rolling sum of the preceding four quarters.)
11. BP	Book to price	$\frac{\text{Book value of common equity}}{\text{Mktcap}}$, where q = most recent quarter for which an earnings announcement was made a minimum two months prior to the end of quarter t, with $q \geq t-4$ Book value of common equity$_q$ = book value of total common equity at the end of quarter q [D59] Mktcap$_t$ = P_t * Shares Outstanding$_t$ = price at the end of the quarter t [D14], multiplied by common shares outstanding at the end of quarter t [D61]
12. EP	Earnings to price	$\frac{\sum_{i=0}^{3} \text{EPS}_{q-i}}{P_t}$, where q = most recent quarter for which an earnings announcement was made a minimum two months prior to the end of quarter t, with $q \geq t-4$ EPS_q= earnings per share before extraordinary items for quarter q[D19] P_t = price at the end of the quarter t [D14] Thus, $\frac{\sum_{i=0}^{3} \text{EPS}_{q-i}}{P_t}$=rolling sum of EPS for preceding four quarters, deflated by price

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"Corporate Accounting Deadline," comments made on the August 14, 2002 deadline for corporate CEOs to sign a statement endorsing their corporate accounting statements—a radio segment on "All Things Considered," *National Public Radio*, July 26, 2002
"A Matter of Style: The Causes and Consequences of Style Drift," *Canadian Investment Review*, Summer 2002
"Bet With the Pros," *Forbes.com*, May 13, 2002
"Do Fund Management Stars Really Exist?" *European Pensions & Investments News*, April 29, 2002
"Leave Sector Decisions to Experts in the Field," *Asian Wall Street Journal*, April 12, 2002
"Banking Experts Agree: Never Too Early to Invest," *The Diamondback* (University of Maryland student newspaper), March 20, 2002
"Portfolio Profiling: Which System is Fairest of All?" *The Wall Street Journal*, December 3, 2001
"How to Nurture a Stock Portfolio," *The Baltimore Sun*, September 16, 2001
"Is More Knowledge Bad for Investors?" *The New York Times*, July 22, 2001
"Fund Companies Oppose More Disclosure, But Consumer Groups Say They Should Divulge Holdings More Often," *Investor's Business Daily*, July 18, 2001
"High Turnover Helps 'Hot' Managers Sustain Runs," *Investment News*, July 2, 2001
"Looking Backward: Can Investors Foretell the Future by Peering Into the Past?" *Money*, July 2001
"Academics Practice What They Teach When it Comes to their Own Investments," *Pensions and Investments*, May 14, 2001
"Study Seeks to Predict Style Shifts" (describes new study that applies my performance attribution technique to pension funds), *Pensions and Investments*, March 5, 2001
"Trusting Your Money to a Fund of Funds," and "Can Two Stock-Pickers Pick Stocks Better than One? The Virtues of Multi-Manager Funds," *Optimus* (a publication of UBS), Fall 2000
"Beating the Market, Until the Expenses Pile Up," *The New York Times*, Sunday, September 3, 2000
"A New Peril In Earnings Season," *The Washington Post*, Sunday, September 3, 2000
"Can Mutual Fund Managers Beat the Market?" lead article at http://www.europeinvestordirect.com, April 2000
"Un Professeur de Finance Américain Réhabilite la Gestion Active" (An American finance professor resuscitates the value of active fund management), article in *L'Agefi* (newspaper in Geneva, Switzerland), April 10, 2000
"Putting Stock in Future," *Colorado Daily*, February 4-6, 2000
"The Investment Club," documentary program on *Knowledge Television*, February 12, 1999

CURRENT RESEARCH INTERESTS

Investments: (1) Empirical studies of the impact of institutional investor trading on stock markets, (2) Performance evaluation, (3) Measurement of survivorship bias and performance persistence

Security Market Efficiency Studies: (1) Returns to momentum investing strategies, (2) Returns to growth stocks vs. value stocks widely held and traded by mutual funds

DISSERTATION

"**Essays on the Investment Behavior of Institutional Investors**": Investigates the interaction between institutional investors and the markets in which they trade, focusing on investment strategies that are based on market information, and on the impact of institutional trades on markets. The first chapter, *Momentum Investment Strategies, Portfolio Performance, and Herding,* documents the use of past returns (technical analysis) by the institutions to achieve abnormal performance. The second chapter, *Herding, Trade Reversals, and Cascading by Institutional Investors*, investigates the tendency of institutional investors to mimic each other's trades, and the tendency of some investors to follow the prior investment decisions of others; this chapter also studies the impact of institutional investors on market prices. The third chapter, *Serial Correlation, Performance Persistence, and Survivorship Bias,* measures the magnitude of survivorship bias in studies of mutual fund performance, and the relation of investment "style" to performance persistence and survivorship bias

TEACHING EXPERIENCE

University of Colorado (1994 to 2000):

Undergraduate Investments [Average Student Evaluation (1994-2000) = A] (Average class size = 50)

Undergraduate Special Topics in Investment Management [Average Student Evaluation (2000) = A+] (Average class size = 30)

MBA Advanced Corporate Finance [Average Student Evaluation (1995-1996) = A-] (Average class size = 55)

PhD Empirical Methods [Average Student Evaluation (1996-1997) = A+] (Average class size = 15)

PhD Finance Theory [Average Student Evaluation (1999) = A+] (Average class size = 15)

University of Maryland (2000 to 2004):

MBA Investment Management [Average Student Evaluation (2002-2004) = 4.2/5.0] (Average class size = 27)

Undergraduate Investments [Average Student Evaluation (2004) = 4.57/5.0] (Average class size = 21)

MBA Applied Security Analysis and Portfolio Management [New Preparation, Two Sections: 3.35/5.0 and 3.90/5.0] (Average class size = 32)

FAME Certificate Program (Executive Education in Geneva, Switzerland; 2001-2004):

Performance Evaluation and Attribution: Theory and Practical Application (One-Week Course in September of Each Year) [Four-Year Average: 4.6/5.0]

Stockholm University (2003, 2004):

Performance Evaluation and Attribution: Theory and Practical Application (Two-Week Masters-Level Course) [5.0/5.0]

Chulalongkorn University (Thailand) (2004, 2005):

Performance Evaluation and Attribution: Theory and Practical Application (One-Week Masters-Level Course) [5.0/5.0]

TEACHING AWARDS

Finalist (Finished in Top Three Faculty on Entire Campus), Teaching Award, Student Organization for Alumni Relations (SOAR)—a University of Colorado Campus-Wide Teaching Award, 1999-2000

Received Rating of "Excellent" in Teaching in Reappointment Evaluation at Department Level and in Dean's Letter at The University of Colorado (and Reappointed with Unanimous Vote at All Levels), 1999

ADVISING ACTIVITIES

Co-Chair, Dissertation Committee for Nerissa Brown (University of Maryland Accounting Student, 2003-present)
Member, Dissertation Committee for Naveen Daniel (Arizona State University, 2000-2001)
Faculty Advisor; Finance, Banking, and Investment Society, 2000-2001

SERVICE ACTIVITIES

University of Maryland at College Park:

University Senator, 2003-present
Finance Department Scheduling Coordinator, 2003-present
Founding Director, Netcentricity Financial Trading Laboratory, 2000-present
Luncheon Speaker at University of Maryland Retirees Association, November 19, 2002
Member, Recruiting Committee, 2001-2004
Member, Dean's Task Force on Communication Strategy, 2001-2002
Salary Merit Review Committee for Smith School, Spring 2001
Member, Information Technology Strategy Committee, 2000-2001

University of Colorado at Boulder:

Chair, Finance Ph.D. Program Committee, 1998/1999
Member, Dissertation Committee for Inchul Suh, 1998/1999
Recruiting Committee, 1995/1996 and 1997/1998
Ph.D. Program Committee, 1995-1999
Finance Workshop Coordinator, 1995-1998
Finance Advisory Board Committee, 1996/1997
Finance Division Newsletter Committee, 1996/1997
Real Estate Strategy Committee, 1995/1996

OTHER EMPLOYMENT

Research Assistant, Anderson Graduate School of Management at UCLA:

Professor Eduardo Schwartz, 1992-93
Professors Mark Grinblatt and Sheridan Titman, 1989-1992

Econometrician, Unocal Refining & Marketing Division, Los Angeles, CA, Summers of 1990, 1991, and 1992. Developed ARIMA time-series forecasting models of gasoline and diesel wholesale prices on the West Coast. Worked with Professor Joel Fingerman of Roosevelt University, Chicago, IL

Financial Analyst / Chemical Engineer, Unocal Refining & Marketing Division, Los Angeles, CA, 1981-1989

Research Assistant, The University of Idaho:

Professor Roger Korus, Chairman, Department of Chemical Engineering (Biochemical Engineering research), 1980-1981
Professor Patrick Taylor, Chairman, Department of Metallurgy (Extractive Metallurgical Engineering research), 1979-1981

CONSULTING EXPERIENCE

Expert Consultant for the Analysis Group, Los Angeles
Expert Consultant for the Securities and Exchange Commission, Boston
Mutual Fund Risk/Return Study, the Commonfund Institute
Consultant for Various Members of the Pension Fund Community
Expert Consultant for the Investment Company Institute, Washington, D.C.
Risk Management for Electricity Products, Stratus Consulting, Inc., Boulder, Colorado (Principal Co-Architect of "Portfolio Optimizer," a Risk Management System for Duke Solutions, an Energy Trading Firm)
CFA Exam Study Materials Developer, Allen Resources

DETAILED INDUSTRY EXPERIENCE

Trading Analyst, Unocal International Crude Trading Department, March 1988-September 1989. Traded Brent Crude Oil Contracts. Analyzed worldwide crude trading opportunities for Unocal. Analyzed arbitrage opportunities, long-term contracts, and price hedging of contracts. Provided backup for crude shipment operations personnel—scheduled VLCC crude oil tanker shipments from Asian markets to the West Coast

Financial Analyst, Unocal Refining and Marketing Division, July 1986-February 1988. Prepared monthly forecasts of the amount and timing of earnings and cashflows, and presented results to top division executives. Developed several financial models to forecast earnings

Financial Planner, Unocal Refining and Marketing Division, August 1983-June 1986. Performed capital budgeting analysis for 200 MM$ in projects at Unocal refineries (esp. gasoline lead phasedown and electricity cogeneration projects). Prepared position papers, executive speeches, and strategic plans. Developed substantial expertise in linear programming (LP), and taught a three-week class in LP

Refinery Engineer, Unocal Los Angeles Refinery, June 1981-July 1983. Held four assignments, including Water Treatment Engineer, Crude Distillation Unit Engineer, Project Design Engineer, and Refinery Modeling Engineer

Citations
(As of January 24, 2005)

Wermers' Cited Paper	# Citations	Journal with Citation of Paper
Momentum Investment Strategies, Portfolio Performance, and Herding: A Study of Mutual Fund Behavior (published in the American Economic Review, 1995)	79	Citations available at: http://www.rhsmith.umd.edu/faculty/rwermers/AER_citations.xls
Mutual Fund Herding and the Impact on Stock Prices (published in the Journal of Finance, 1999)	41	Citations available at: http://www.rhsmith.umd.edu/faculty/rwermers/Herding_citations.xls
Measuring Mutual Fund Performance With Characteristic-Based Benchmarks (published in the Journal of Finance, 1997)	52	Citations available at: http://www.rhsmith.umd.edu/faculty/rwermers/DGTW_citations.xls
Mutual Fund Performance: An Empirical Decomposition into Stock-Picking Talent, Style, Transactions Costs, and Expenses (published in the Journal of Finance, 2000)	22	Citations available at: http://www.rhsmith.umd.edu/faculty/rwermers/JF2000_citations.xls
The Value of Active Mutual Fund Management: An Examination of the Stockholdings and Trades of Fund Managers	5	Citations available at: http://www.rhsmith.umd.edu/faculty/rwermers/JFQA_citations.xls
Momentum Investment Strategies of Mutual Funds, Performance Persistence, and Survivorship Bias	13	
Is Money Really "Smart"? New Evidence on the Relation Between Mutual Fund Flows, Manager Behavior, and Performance Persistence	1	
The Potential Effects of More Frequent Portfolio Disclosure on Mutual Fund Performance	1	

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EDUCATION

Ph.D. in Finance, Boston College, Chestnut Hill, MA, 2001
B.A. in international economics, Fudan University, Shanghai, 1991

CURRENT EMPLOYMENT

Assistant Professor, Department of Finance, University of Arizona, 2001-present
Courses taught: Advanced Corporate Finance (undergraduate), Empirical Investments (PhD)

WORKING PAPERS

1. Testing Heterogeneous-agent Models: An Alternative Aggregation Approach, with Pierluigi Balduzzi
2. Evaluating Dynamic Trading Strategies: The Free Lunch Was No Banquet, with Eric Jacquier
3. Systematic Momentum
4. The Consensus-beating Game, with Mark Liu
5. Why Does Analysts' Forecast Dispersion Predict Stock Returns? A Corporate Guidance Perspective, with Mark Liu and Danielle Xu
6. Do Mutual Funds Time the Market? Evidence from Portfolio Holdings, with George Jiang and Tong Yu
7. Prudent Man or Agency Problem? On the Performance of Insurance Mutual Funds, with Xuanjuan Chen and Tong Yu
8. The Information Content of Idiosyncratic Volatility, with Georege Jiang and Dianelle Xu
9. Do Mutual Funds Profit from the Accruals and NOA Anomalies? with Ashiq Ali, Xuanjuan Chen, and Tong Yu

CONFERENCE PRESENTATIONS AND INVITED SEMINARS

1999: FMA doctoral student session
2000: Chinese Finance Association, FMA
2001: AFA, USC, UT Austin, University of Arizona, PanAgora Asset Management, WFA, Risk-Waters MathWeek
2002: China International Conference in Finance (discussant), CQA
2003: European Finance Association, FMA, Florida International University
2004: WFA, China International Conference in Finance, American Accounting Association, European Finance Association, Eastern Finance Association, Western Risk and Insurance Association, American Risk and Insurance Association, Wharton Mutual Fund Conference (discussant), International Insurance Society, FMA, Decision Science Institute
2005: AFA, China International Conference in Finance, WFA (discussant), FMA

AWARDS
Chicago Quantitative Alliance, Academic Paper Competition, Third Prize, 2002
International Insurance Society, Shin Research Excellence Award, 2004
Decision Science Institute, Distinguished Paper Award, 2004

MEDIA COVERAGE
When Analysts Agree, by Paul Sturm, SmartMoney Magazine, November 2004

REFEREEING ACTIVITY
Ad hoc referee for: Journal of Finance, Journal of Business and Economic Statistics, China Economic Review, Journal of Applied Economics

OTHER EXPERIENCES
Quantitative analyst, Numeric Investors, Cambridge, MA, summer 2001
Quantitative analyst, State Street Research and Management, Boston, MA, summer 1998
Project officer, Bank of Communications, Head Office, Shanghai, 1991-1994

PROFESSIONAL PUBLICATIONS (in CHINESE)
Forecasting Exchange Rates of Major Currencies, *New Finance*, Jan. 1994, with Puhua Cai
Comparison of Securities Collateral Practices, *New Finance*, Dec. 1993, with Xiaomen Wu
Comparison of Mortgage Lending Practices, *New Finance*, Oct. 1993, with Xiaomen Wu
Comparison of Credit Guarantee Practices, *New Finance*, Aug. 1993, with Xiaomen Wu
Reform of US Banking System in the 1990s, *International Financial Studies*, April 1991, with Tiejun Sun
Recent Trends in US Banking System Restructuring, *Financial Times*, Feb. 21, 1991, with Tiejun Sun

AFFILIATIONS
Member of AFA, WFA, EFA, FMA, and AAA

OTHER SERVICES
Program committee, FMA 2005
Dissertation Committee, Danielle Xu and Jane Zhao
Department faculty recruiting committee, 2003-2005
Department seminar organizer, 2005