October 2005

Northfield News

Quarterly Newsletter for the Friends and Clients of Northfield Information Services

A Unified Approach to Monitoring and Evaluating Investment Managers *By Dan diBartolomeo and Sandy Warrick*

Introduction

Using specific techniques from our ART software (as have been described in previous editions of this newsletter), we have formulated a new process for monitoring and evaluating investment managers. Extensive empirical studies on this technique suggest that it is effective in predicting one-year end relative manager performance to a degree which is both statistically and economically significant.

Investors are constantly looking to invest with superior active managers, but have a hard time finding the managers that will be superior in the future. Typically, active managers are evaluated by looking at simple performance measures over fixed past time periods. In our process, we use a combination of returns based style analysis, CUSUM analysis and a Bayesian framework for past excess returns.

To hire active managers we must believe at least one of three things;

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Modeling Short-Sale Transactions in Optimization *By Dan diBartolomeo*

Realistic representation of short-selling in optimization cases is an issue of rapidly growing interest among investment practitioners. The Northfield Open Optimizer has allowed simultaneous long positions and short-selling since its inception. Many years ago, we also made provision for constraints on leverage, so as to facilitate compliance with gearing limits imposed either by regulation or investment policy.

In addition, there are a number of properties of short-sale transactions at the individual security level that our clients may wish to incorporate in their analysis. Among these are:

a. In order to short a stock, that security must be borrowed from a shareholder. Such loans of stock come at cost of some periodic rate of interest

b. Many markets have "uptick" rules or other special transaction costs associated with short sales

c. There may be additional risk associated with short-selling

d. In some jurisdictions (e.g. the US) there are special capital gain tax rules applied to short sales

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Inside this Issue

Special points of Interest:

Newport Summer Seminar Wrap-up

Tennis Hall of Fame • Newport, RI • June 10, 2005

Northfield's annual summer seminar took place at the International Tennis Hall of Fame, in Newport, RI on June 10th. The seminar presented recent research and technical advances to an audience of Northfield clients and friends.

The agenda consisted of 5 presentations including: "Exploiting Performance Divergence Across Styles," "Equity Risk Modeling: Innovations in Methods & Best Practices," "Optimal Algorithmic Trading," "Active Risk Budgeting with Optimization Tools," and "Active Returns from Passive Management: An Updated Look."

As is customary, the seminar coincided with the USA Professional Championship of Court Tennis. Following the presentations, attendees viewed a court tennis demonstration by Northfield President Dan diBartolomeo, and then a Semi-Final Match between world champion Rob Fahey of Australia and Mike Gooding of the US. Fahey won the match and went on to win the championship. Court Tennis, or "real tennis" is the medieval sport that is the progenitor of all modern racquet sports. To learn more, visit the US Court Tennis Association site at **http://www.uscourttennis.com**.

After tennis on Friday evening, everyone enjoyed a relaxing oceanfront dinner party at Johnnie's Atlantic Beach Club and Pavilion in nearby Middletown RI. Complete proceedings have been posted to our website at **http://www.northinfo.com/papersearch.cfm.** Northfield does not charge attendance for this event, however, we do take donations on behalf of Boston's Pine Street Inn, and the Charles River Public Internet Center. This years participants donated over $4,600 to the Pine Street Inn. Donations to the center were sent directly to the Charles River Public Internet Center.

Northfield Annual Research Conference Wrap-up

The Fairmont Le Château Montebello • Montebello, Quebec, Canada • July 18-20, 2005

Northfield's annual Research Conference took place at the The Fairmont Le Château Montebello, in Montebello, Quebec, Canada. The Château Montebello is an acclaimed resort famed for its rugged luxury and natural Canadian beauty. In addition, it is a family-friendly venue with a broad range of recreational opportunities, including the simple enjoyment of the Canadian outdoors.

Le Chateau Montebello

The conference presented recent research and technical advances to an audience of Northfield clients and friends. The agenda consisted of twelve presentations. Topics included: "Beyond the Torpedo Effect-An Examination of Factor – Based Portfolio Construction Techniques," "Size and Sector effects in Momentum Returns," "The Dynamics of Active Portfolios," "Applied Fixed Income Risk Modeling," "Risk, Uncertainty, Horizon and Investment Decisions," "Optimal Hedge Fund Allocations: Do Higher Moments Matter?," "Is Alpha-Beta Analysis Useful for Constructing Fund of Hedge Funds Portfolio?," "Alpha the Most Abused Term in Finance!," "Everything You Wanted to Know about Asset Management for High Net Worth Investors," "Return Forecasting and Portfolio Construction: A Quantile Regression Approach," "Honest EPS: A Measure of GAAP Earnings Relative to Proforma Earnings," and "Risk Budgeting: Concept, Interpretation and Applications."

As is Northfield tradition, the working sessions were accompanied by a complete recreational and social calendar. The conference started on Sunday evening with the "unofficial" welcome reception which took place on a river boat on the Ottawa River.

Monday morning was reserved for recreational pursuits with outings for white water river rafting, ATV guided tours, canoeing, or a trip to a fish hatchery and a chance to catch some trout. Monday evening featured the traditional Northfield elegant "black tie" gala. Dinner was accompanied by live jazz music. Following dinner, the party kicked into high gear with music, drinks and dancing.

The final evening on Tuesday featured a "Camp Northfield" themed event with fun family activities and dinner at nearby White Fish Lake. Complete seminar proceedings have been posted at **http://www.northinfo.com/papersearch.cfm.**

Northfield Asia Seminar Series – Research on Investment Management and Risk
Tokyo ● Sydney ● Hong Kong

Northfield will be hosting three one day seminars in Tokyo, Sydney, and Hong Kong in the month of November. The purpose of the seminars is to showcase our research on various topics in investment and risk management to our growing list of Australian and Far East clients and prospects.

The presentations for each are listed below. The complete agendas have been posted to our website.

Tokyo:
October 31, 2005, 8:30 am - 3:30 pm ● Radisson Miyako Hotel, Shirokanedai, Tokyo

- Risk Factors, Models and Techniques
- Optimal Algorithmic Trading
- Active Returns through Passive Management: Portfolio Formation through Cointegration
- Estimation Error in Portfolio Optimization
- A New and Unified Method for Evaluating and Monitoring Managers


Radisson Miyako Tokyo

A complete agenda has been posted soon to **http://www.northinfo.com/events.cfm**

Hong Kong:
November 2, 2005, 8:30 am – 3:30 pm ● Ritz Carlton Hotel, Central, Hong Kong

- Risk Factors, Models and Techniques
- Optimal Algorithmic Trading
- Active Returns through Passive Management: Portfolio Formation through Cointegration
- Estimation Error in Portfolio Optimization
- A New and Unified Method for Evaluating and Monitoring Managers


Ritz Carlton Hong Kong

A complete agenda has been posted soon to **http://www.northinfo.com/events.cfm**

Sydney:
November 4, 2005, 8:30 am - 3:30 pm ● The Observatory Hotel, Kent Street, The Rocks, Sydney

- Risk Factors, Models and Techniques
- Optimal Algorithmic Trading
- Active Returns through Passive Management: Portfolio Formation through Cointegration
- Estimation Error in Portfolio Optimization
- A New and Unified Method for Evaluating and Monitoring Managers


Observatory Hotel, Sydney

A complete agenda has been posted soon to **http://www.northinfo.com/events.cfm**

Space is limited, so a prompt RSVP is suggested. Please RSVP to Nick Wade in Tokyo, **+81 3 5403 4655** or e-mail: **nick@northinfo.com**.

(Modeling Short Sale Transactions, Continued from page 1)

To accomplish a short sale, the short-seller borrows stock from a shareholder of the firm, and sells the stock in the open market. The cash proceeds of the sale are placed in an account that accrues interest. Typically, part of interest earned is paid to the short-seller and is called the "rebate" rate. The balance of the interest is paid to the lender of the stock as the fee for the stock loan. In some cases, the interest earned on the cash proceeds is less than the loan rate, and the remaining interest cost is charged directly to the short-seller. According to a recent study of the US stock loan market (Cohen, Diether and Malloy, 2005), loan fees as small as .05% per annum are observed for very liquid, large capitalization stocks, while loan rates of more than 7% per annum are observed for obscure, illiquid firms. Eventually, the short-seller closes the position by purchasing the stock in the open market and repaying the stock loan by delivering the shares bought back to the lender.

In some markets, a short-sale may only be undertaken if the most recent trade in that stock was at a higher price than the previous trade. This limitations is known as an uptick rule. Effectively, this increases the transaction cost of entering into the position.

Some investors prefer to model short positions in a stock as being intrinsically riskier than a comparable long position. This additional risk is presumed to arise in two ways. First is the issue of stock loan recall. Normally, when a stock loan is made, the borrower may be required to immediately repay the loan by delivering the shares of stock back to the lender upon request from the lender. To the extent that the recall demand is made at a time when the price of the stock has risen, this will disadvantageous to the short-seller.

In addition, short positions have theoretically unlimited risk. While the value of a long position can only fall to zero, a value of a stock that has been shorted could continue to rise without limit over sufficient time. Finally, we may also wish to consider that we take long positions in stocks that we believe will rise in value. When we are wrong and they fall in value, those positions also become a smaller percentage of the value of our portfolio (and hence contribute less risk to future returns). On the other hand, we short stocks when we believe they will fall in value. If we are wrong and they rise instead, those positions will become an increasing percentage of the value of portfolio (and hence contribute even more risk to future returns).

Short-sale positions may also be subject to different tax regimes than long positions. For example, in the US a lower rate of tax is applied to capital gains if a long position is held for more than twelve months. For short-sales, the capital gain tax is equivalent to the higher, short-term tax rate irrespective of the length of the holding period.

Let us now turn to the issues of actually representing the peculiar properties of a short-sale in the Northfield Optimizer. *The most popular way of addressing these issues is to ignore them altogether.* If we are investing a tax exempt account, of liquid securities in a market where uptick costs are small, it is likely that all these effects are economically immaterial as their impact on portfolio optimality is likely to be far smaller than our confidence intervals on more basic inputs such as the expected return of different securities.

If the circumstances of our particular portfolio suggest that attention be paid to the specific character of short-sales, there are a couple ways in which we may proceed. The first decision we need to make is whether or not we wish to run the optimization in a "sign-constrained" fashion. In a sign-constrained case, we define in advance of the optimization two disjoint sets of securities, one set of potential long positions and one set of potential short-sale positions. Position size minimum and maximum values can then be set to constrain the weight of a security to either be positive or negative as required.

At first glance, sign-constraining an optimization may be unappealing. However, on close examination most practitioners are comfortable sign-constraining optimization cases as they find that sign constraining the problem is really not a meaningful impediment to any reasonable portfolio construction. Most people make the a prior decision to only go long positive alpha (excess return over the benchmark) stocks and only go short negative alpha stocks. This makes rather good intuitive sense, but some investors will bring up the issue of "what if I want to go short a positive alpha stock for diversification reasons?" This really is rarely relevant for two reasons:

a) In a long/short you are unlikely to take any position that has an alpha close to zero. If you don't have a view on the relative performance of a stock its just dead weight in the portfolio (plus a cost to trade), as compared to a long only portfolio that has to adhere closely to a benchmark index. Investors rationally want to go long the high alpha stocks and short the low alphas. Shorting a high alpha stock makes no sense, and neither does allocating capital to a security where no differential return is expected.

b) Since long/shorts are normally done with a cash benchmark, the asset specific risk contribution of a stock in the same whether it is long or short. The only thing that would force a stock to the wrong side (e.g. shorting a large positive alpha) is a constraint on a factor exposure. However,

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factor exposures are linear combinations of stock exposures so there is an infinite number of combinations of different stocks that can be formed to get any factor exposure you like. Unless the desired factor exposures are perverse (e.g. you have all negative alphas on banks, but you want to be net long them anyway), this situation just does not arise to a statistically or economically material extent.

If you are willing to sign-constrain your optimization, you can simply set the alpha and transaction costs parameters for that stock accordingly, whether it will be a long position or a short-sale position. If uptick costs are important for a short sale, you can adjust the transaction cost for selling. If the loan fee rates are material, these can be included as part of the stock return expectation. As loan fees reduce the expected profit from a short position, the loan fee rate is actually a positive increment to the stock's expected alpha. It is also possible to model loan fees as an additional increment to transaction costs by forming an expectation of the cumulative loan fee over the expected holding period of the position. This procedure is not recommended to the uncertainty of a holding period arising from recall risk. If you want to adjust for the additional risk that you may perceive in a short-sale, this can be accomplished by an upward adjustment to the asset-specific risk value (column 5 of the data file) for that stock. Special tax treatment of short-sales is automatic within the Optimizer's tax functions.

There are some cases where sign-constraining the problem may be undesirable. For example, if we are allowed to take short positions in a portfolio with a traditional equity index benchmark, there may be securities that we would choose to hold for diversification reasons even in the face of a negative return expectation. Such cases by forming a second "version" of each stock where there is the possibility of both long or short positions. For example, we could have both IBM stock in our portfolio that would only allowed to have positive weights and second version called IBM.SS that would only be allowed to have negative weights. We could then set the return and transaction cost expectations for these two versions of IBM separately.

It is imperative that the second version of a stock be created as a composite asset wherein the underlying portfolio consists of the regular version of the stock. Creating a second version of a stock by adding a new record to the Optimizer data file will result in incorrect risk analyses in the optimizations as the asset-specific risk of these two securities would be presumed to have correlation zero, when in fact they have correlation equal to one.

Use of the composite asset facility also provides an even more realistic mechanism for representing the additional risk of a short sale. If we so desire, we could create our second, short-sale versions such as IBM.SS, where the underlying portfolio contains more than 100% of the underlying stock and an offsetting negative amount of a synthetic asset that has no risk properties. We would first create a new record in the Optimizer data file for a synthetic security called SLACK that would have zero exposure to all risk factors (like cash). If we believe that IBM.SS was 5% riskier than regular IBM, we could now create the underlying portfolio for IBM.SS as 105% weight in IBM, and -5% weight in SLACK.

Very realistic representation of short-sales in the Northfield Optimizer is easily accomplished. However, users should be judicious in expending effort in this regard, as the economic materiality of the fine points of short-selling is frequently small.

Northfield Exhibiting at the MMI Show

Northfield will be exhibiting the Managed Accounts Rebalancing System (MARS), at the upcoming MMI Managed Accounts Solutions Conference in New York, October 19-20, 2005. Visit **http://www.moneyinstitute.com** for more information.

Northfield Staff Speaking Engagements

Northfield President, Dan diBartolomeo, presented "Empirical Tests of CUSUM Procedures for Asset Manager Evaluation and Monitoring," three times in the past few months, The first was at the Boston QWAFAFEW meeting, on August 16th , then at the R-Squared UBS Conference on September 12, and lastly at the IMCA conference in St Louis on September 19th.

Dan will be speaking at the FactSet Investment Process Symposium in Phoenix on November 10th. The topic will be "Estimation Error in Portfolio Optimization." Visit **http://www.factset.com/www_419.aspx** for more details.

Dan will also be speaking at the November 14th QWAFAFEW meeting San Francisco as part of a three speaker program. The topic will be "Combining Traditional and Non-Traditional Asset Classes: Various Approaches to Modeling."

Northfield's Russ Hovanec spoke on a roundtable discussion on new front office technologies for risk management and portfolio construction at the Informa Investment Solutions 2nd Annual Conference on Investment Solutions for Tomorrow's Needs on Sept 12-13, in New York City.

Technical Support Tip: How to Use Penalties

By Jennifer Gerber and Howard Hoffman

Penalties allow users to "push" their optimal portfolio towards a target value of a user specified variable. The Penalties file (.PNS), which can be found under "Input Tables" in the optimizer, has one row for each penalty. Each row references a .PEN file which is created outside of the optimizer. The .PEN files are two-column files that consist of security ID in the first column and variable value in the second column.

There are two main types of penalties that one can set up: normal and membership. In a normal penalty, we want the optimizer to target a specific goal or be within a specific range for the weighted average of the variable. For example, suppose you had a list of manager rankings with 1 being strong sell and 10 being strong buy. You would create a file called "rankings.PEN" with all security IDs in the first column and the corresponding ranking in the second column. Now if you wanted to target an average ranking of 7, you can use a soft constraint or a hard constraint. To use a hard constraint, you just set a minimum and maximum value, perhaps 6.9 and 7.1. You could also set hard constraints relative to the initial portfolio value or relative to the benchmark value. A soft constraint would influence the optimizer by adding an additional negative term to the utility function.

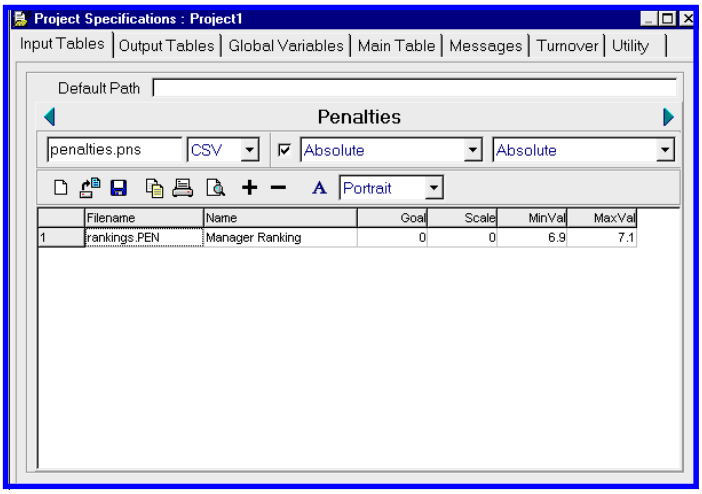
The term for each penalty is:

Penalty = $S*(W-G)^2$

S = Scale
W = Weighted Average of Variable
G = Goal

Since we use quadratic penalties, the utility is penalized by the square of the difference from the target. The scale determines how important this penalty is relative to other penalties and risk, return and costs. The larger the scale, the more influential the penalty. In this case, your goal would be 7. There is no rule of thumb to setting the scale. You can consider the maximum deviation from the goal that you are willing to allow, square it and then calculate a scale that would put the penalty on the same order of magnitude as your alpha or risk.

A membership penalty would be used to control how much of the portfolio is in a certain group. Again, consider the example of having a list of manager rankings. This time you want the optimizer to consist of 50% securities with ranking 8 or higher. You would create a .PEN file with just the securities with ranking 8 or higher in the first column. The second column would be all 100's. This is to signify that these stocks are a member of this group. Now in the .PNS file, you can set the minimum to 50, which means that at least 50% of the portfolio must consist of stocks from this group.



Open Optimizer Penalties Window

There are two reports that contain penalty data. The Penalties Summary report can be found under Output Tables tabà Reports tab. Select the tab labeled "Quadratics" near the bottom of the window. The Penalties Summary will display the Penalty, Goal, Initial Value, Initial difference (Initial Value– Goal), Optimal Value, and Optimal Difference (Optimal Value – Goal). By single-right clicking on the report page the user can select to have a seventh column added which shows the change in value. If a hard constraint is violated, it will be reported on the Constraint Summary, "Factors" tab.

The Northfield Technical Support Staff is always available to answer any questions. To contact Technical Support in Boston send your e-mails to **support@northinfo.com** or call 617-208-2080 between the hours of 8am and 6:30pm EST Monday through Friday.

European clients can contact Christine Milne in the London office by sending e-mail to **christine@northinfo-europe.com** or call +44-(0)-20-7801-6250.

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(a) the average professional investment manager outperforms passive index funds because individual investors have below index performance

(b) manager active returns persist. We can predict with reasonable reliability which managers are going to outperform in the future, even if the average manager is just average

(c) We are doing a societal good because if all investors were passive, there would be no functional mechanism to ration capital in the economy. Our economy would break down over time

We believe there are some serious analytical problems in the typical evaluation process today. The first problem is that much manager evaluation occurs relative to benchmarks that are often not suitable for the manager's investment approach. The second problem is that evaluation of past performance is based on standardized periods (i.e. 5 years) rather than periods that are relevant to the manager in question. Third, many commonly used evaluation measures such as Sharpe ratio or information ratio correspond to meaningful investor utility for only a small fraction of investors. Finally, the statistical significance of ex-post performance is measured in a simple time series fashion. The analysis does not include the context of whether the manager exists among a tightly bunched set of peers or a widely dispersed set, which is a critical issue in examining the "luck versus skill" issue.

It is our view that there are three key elements for a successful manager evaluation process. The first is to ensure that each fund is being measured against the right benchmark and the right group of peer funds. In this regard, we use an augmented method of returns-based style analysis. The second element is to evaluate each manager over the length of history that is optimal for that particular manager. Our CUSUM analysis is used to accomplish this. Finally, we evaluate each fund using a direct measure of value-added to investors. This measure is constructed in a Bayesian framework that adjusts for the dispersion of contemporaneous return dispersion across managers within a fund's peer group.

There is a large amount of academic literature as to whether persistence is demonstrated in active manager returns. If markets are very efficient, there should be no persistence patterns in active management returns. While there are there are innumerable studies showing markets are relatively efficient, many fund studies show that some persistence does exist. Most of these studies such as Hendricks, Patel and Zeckahuaser (1993), Elton, Gruber, and Blake (1996), Goetzmann and Ibbotson (1994) suggest that persistence exists over relatively short time frames, generally strongest around a one-year horizon. Carhart (1997), Stewart (1998), Brown and Goetzmann (1995) and Detzel and Weigand (1998) all have varying degrees of short-term persistence but find that most of the persistence can be explained by style effects and fund cash flows rather than investment management skill.

One possible explanation for the observed persistence in active manager returns is that funds are being misclassified and hence, measured against the wrong benchmarks. As it was put in diBartolomeo and Witkowski (1997), "The best way to win a contest for the largest tomato is to paint a cantaloupe red and hope the judges don't notice". For example, imagine you operate two funds, one that is aggressive and other conservative; to persistently outperform your peer groups you actually have to be more skillful than competitors (which is not easy). You might choose the easy way out. You could mischaracterize both funds: market the aggressive fund as conservative, market the conservative one as aggressive. Depending on market conditions, *one of the two will always compare well* to the intentionally wrong peer group.

There have been several studies on the issue of fund misclassification. The first was diBartolomeo and Witkowski (1997). It studied 748 mutual funds from 1990 through 1995, about 40% of which appeared to be misclassified in terms of objective. This study also finds that misclassifications did not occur at random and appear to be intentional to a meaningful degree. The resulting confusion diminished investors' ability to diversify fund types, with an annual associated cost in the billions of dollars. Very similar results on different data sets using different methods were obtained in Brown and Goetzmann (1997) and Kim, Shukla and Thomas (2000). Comparable problems with institutional money managers are less severe but still present to a material degree.

The most rigorous approach to classification would come through the formation of "normal portfolios" by comparing actual portfolio holdings to benchmarks across time as the best method, described in Kritzman (1987). Unfortunately, the required data is not available to large universes of managers, and even if the data is available the process is too labor intensive to be applied to large fund universes.

As an alternative, we use an augmented form of returns-based style analysis to match funds to a broad range of benchmarks as proposed in Sharpe (1992). This procedure forms a portfolio of market indices that mimics fund be-

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havior over time. Inferences about fund composition can then be drawn from the index representation. Our key improvement to Sharpe's method is to utilize a calculation of confidence intervals on the style weights as derived in diBartolomeo and Lobosco (1997). We want to avoid drawing meaningless conclusions from information like "a fund is 10% small cap value" if it turns out to be "10% plus or minus 30%."

Our next step is to establish time samples over which different managers may be evaluated. Practitioner tradition in the investment industry is to evaluate active manager track records over a long period of at least 3 to 5 years. Some will argue a full "market cycle" is needed (although there is no apparent agreement over what constitutes such as a cycle. As we've seen previously, all the academic studies refute this. Those studies find no evidence that long-term past performance is predictive of future performance. The academic research argues strongly that if there is any meaning to past performance at all, its short-lived, probably only the last year.

The key question we must ask ourselves is "What time portion of a track record do we really need to evaluate as part of our monitoring of manager quality control?" We need a procedure to draw the line between getting enough meaningful data within a manager's record and older, stale data that should be ignored. Our choice for this analytical task is a statistical process control technique called CUSUM. This technique was described in detail in our February, 2005 newsletter. With it, we are able to define the best observation period over which to review fund performance for each fund. The CUSUM article is posted at **http://www.northinfo.com/documents/72.pdf**.

Now that we know the period over which we want to evaluate performance for a manager, we can move on to defining a performance metric. deGroot and Plantinga (2001) studied many popular performance measures and concluded that many measures are congruent to value-added for investors for only a small fraction of investors. One such widely used measure is the information ratio (alpha/tracking error). Consider a manager that adds exactly one basis point of return in every time period. The information ratio is infinite, but very little investor wealth is added.

For our empirical study, we chose to measure excess return above a carefully chosen benchmark that should reflect both risk and investing style. This directly measures added value for investors. To the extent that an efficiency measure such as the information ratio is also desirable, our version of CUSUM analysis already incorporates the trend in the information ratio over time.

The most obvious reason why persistence may occur among fund active returns is that some managers are more skillful than others. Therefore, our metric of performance must consider the statistical significance of a manager's active return record, so as to identify those who are skillful from those who have been merely lucky. To do this we must incorporate information about the dispersion of performance of peer funds into the evaluation of each individual fund. If manager returns are widely dispersed within a peer group, its easier to have a high excess return or a high information ratio. If the dispersion of returns is low, its harder.

We adopted a Bayesian framework of a "precision weighted" excess return estimate that incorporates information about the dispersion of peer fund returns during the evaluation period for each fund. This is similar to the method in Shanken and Jones (2004), but without the elaborate Monte-Carlo simulations. Here's a simple example of the math:

- Lets assume Manager X has an excess return (A) of 4% per year with a standard deviation (S) of 4%
- Over the same time period, the average peer manager had an annual excess return of .25% (Mean), and the dispersion (CSD) of the excess returns across the peer group is 1.5%

$$E = (A/S^2 + Mean/CSD^2) / (1/S^2 + 1/CSD^2)$$
$$A = 4,\ S = 4,\ MEAN = 0.25,\ CSD = 1.5$$
$$E\ (precision\ weighted) = (0.361) / (0.5069) = 0.712$$

So in this case, we would believe that our best estimate of the active return derived from manager skill rather than luck is 71 basis points, rather than the 4% active return that the manager actually achieved during the sample period studied.

Empirical Tests

In order to test the predictive efficacy of our method, we undertook to study a large body of US equity mutual funds from the early 1990s through 2005. Further tests were then conducted on international mutual funds and on a large selection of hedge funds. The method showed predictive power that was both statistically and economically significant in all cases.

For the study of domestic funds, our initial universe was all equity mutual funds in existence as of April, 2005. We then removed a variety of funds including multiple classes of shares in the same fund, index funds, tax efficient funds, and other highly specialized strategies. Our data consisted

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of monthly returns (as reported by Standard and Poor's Micropal) on the remaining funds.

A set of fifteen benchmark indices were chosen for the domestic funds. These included the Russell 1000, 2000 and 3000 (plus their Value and Growth subsets for a total of nine indices), the S&P 500 and the S&P Midcap (plus their Value and Growth subsets for a total of six indices). We tested two approaches to benchmark assignments. The first approach was to use style analysis (with confidence intervals) to assign funds to benchmarks based on a set of rules. The second approach was to simply assign each fund to whichever benchmark index it was most correlated over the past sixty months. Both approaches provided similar results, so the latter was chosen as more tractable in operation. **Table 1** summarizes the benchmark assignments for the overall period of 1995 through 2004.

Table 1: Assignment of Benchmarks

Style\Size	S&P 500	Russell 1000	S&P Mid	Russell 2000	Russell 3000	Total
Value	8.3%	7.7%	2.5%	3.9%	9.2%	31.6%
Blend	11.1%	4.9%	2.8%	2.8%	14.3%	35.8%
Growth	1.3%	2.8%	3.5%	10.7%	14.3%	32.5%
Total	20.7%	15.4%	8.9%	17.4%	37.7%	100.0%

If mutual fund managers behaved like institutional managers, then the choice of a single benchmark for each fund would be simple – the appropriate benchmark would be highly correlated with the fund's returns and the appropriate benchmark would not change over time. In retail funds, the ambiguity of benchmarks allow for wide latitude by fund managers. There was a high degree of benchmark switching based on the rolling 60 month correlation values, as shown in **Figure 1**. It should be noted that this analysis may overstate the seriousness of the problem in that many of the benchmark indices are highly correlated with one another (e.g. the Russell 1000 and the Russell 3000 typically have correlation over 99%), so many of the switches may arise from statistical noise in the data.

Method of Analysis

The goal is to determine if mutual fund (or other funds, such as institutional or hedge funds) returns demonstrate a persistence that can be anticipated by the CUSUM statistic.

Currently, we believe that a reasonable approach to this is to do a set of non-overlapping cross sectional regressions. If we do an 8 year estimation period, we will have 16 independent cross sectional regressions of the sort:

$$r = \alpha + \beta \times \text{Average Annual Returns}$$

where:

r = return over following 12 months

α = regression intercept

β = regression coefficient, presumably positive and statistically significant, that represents persistence of returns from the inflection point forward.

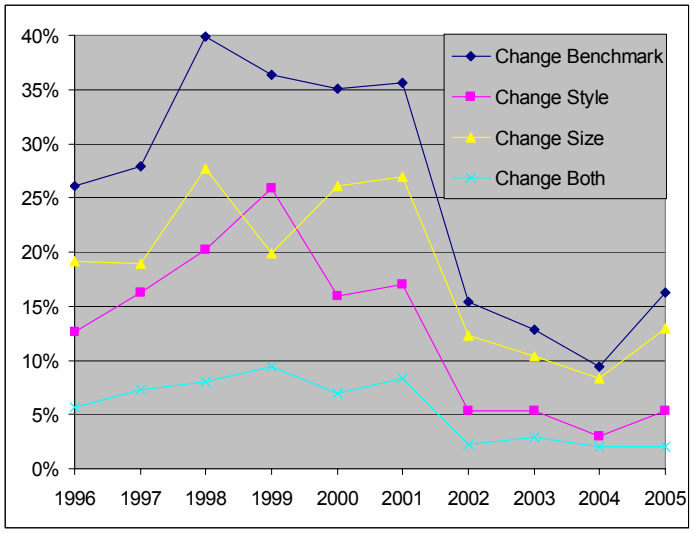

Figure1: Portion of Mutual Funds that Change Maximum Correlation 60 Month Rolling Correlations

The initial regression used pooled results on 9550 fund-years from 1993 through the third quarter of 2005. The dependent variable was the annual active returns and the independent variable as the active returns from the CUSUM inflection point to the month preceding the prediction period.

These results show that the previous returns are related to the future returns at a statistically and economically significant level, with about 20% of the years' returns being predicted by the returns during the preceding period. These regressions were done using both pooled and annual regressions, and are shown in **Table 2** (next page), which shows that two years (2000 and 2003) had negative persistence, and the negative persistence was statistically significant only in 2003, the year that reversed the three-year decline in most market cap and sector benchmarks.

It is interesting to note that in using the CUSUM technique to evaluate the appropriate time period to evaluate for funds, the average "best evaluation period" was around two years for the bulk of the time sample. Since 2001, this figure as trended upward illustrating the pervasive effect of the collapse of the tech bubble on the performance of domestic mutual funds.

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Table 2: Annual Regressions of Active Return vs. Previous Return, Domestic Funds			
	Intercept	Previous	t-stat
1993	0.237	0.288	6.5
1994	0.364	0.110	2.2
1995	-1.398	0.063	0.7
1996	-0.041	0.002	0.0
1997	-2.691	0.327	4.2
1998	-1.528	0.409	3.0
1999	1.204	0.758	5.9
2000	4.067	-0.028	-0.4
2001	-1.027	0.151	2.5
2002	-0.410	0.254	5.0
2003	-2.388	-0.382	-7.0
2004	-1.896	0.352	10.2
2005	-0.381	0.268	3.6
Average	-0.453	0.198	2.8
Pooled	-0.604	0.192	9.6

(Continued from page 9)

Given that our data sample contained only surviving funds, there were concerns about the potential bias that this could induce in the results. This issue has been extensively researched in academia in papers such as Elton, Gruber and Blake (1996) and Hallahan and Faff (2001). It was our initial judgment that the rate of extinction among domestic funds was not sufficient to have meaningfully biased our result. Typically, funds with poor performance are the ones which become extinct by being merged with more successful funds. As such, one simple test for potential survivorship bias is to determine whether our results change when looking at subsets of funds with only positive or negative returns.

To do this, we create a new independent variable in our regressions that is the product of a dummy variable, which is equal to zero if the active returns are positive and one if the returns are negative, and the average annual return in the prediction period.

If this variable has a positive coefficient, then one might conclude that, among surviving funds, that persistence was stronger for funds with negative returns. This would reduce the value of the technique in identifying managers with superior returns if only unskilled (negative active returns) managers showed persistent performance. A pooled regression that includes a variable for negative active returns shows that this effect was negligible over our data sample, and not economically nor statistically significant.

Table 3 shows the regression results when using precision returns for the independent variable and actual returns for the dependent variables. Because the mean active return varies between the independent and dependent periods, a pooled regression will not be useful for this analysis.

Table 3: Annual Regressions of Active Return vs. Previous Return, with Precision Adjustment			
	Intercept	Previous	t-stat
1993	2.364	1.675	4.3
1994	2.907	2.935	2.0
1995	-1.388	2.292	0.9
1996	2.907	2.935	2.0
1997	-0.428	4.259	2.2
1998	5.943	6.539	2.2
1999	3.798	6.007	2.4
2000	4.430	-0.408	-0.4
2001	-1.929	0.698	0.6
2002	-1.328	3.373	2.1
2003	-3.670	-4.267	-1.6
2004	1.439	10.101	5.7
2005	7.005	16.659	2.6
Average	1.696	4.061	1.9
Pooled	-0.513	0.918	8.0

We repeated this same analysis on a database of international funds managed, for the most part, by US based mutual fund companies. We assigned one of two different benchmarks, either the MSCI EAFE index (assigned to 79% of funds) or the IFCI Emerging Markets Investible index (assigned to 21% of funds).

In **Table 4,** we see that the average coefficient is similar (0.118 vs. 0.198) to the result for the domestic fund, but the t-statistics are somewhat lower, but still highly significant. On the other hand, **Table 5** shows that the average persistence coefficient is 1.341 when using precision returns.

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Table 4: Annual Regressions of Active Returns vs. Previous Return, International Funds								
	1998	1999	2000	2001	2002	2003	2004	Average
Intercept	-4.629	6.806	4.364	-0.159	-0.055	-0.639	0.894	0.940
Previous	0.046	-0.127	-0.218	0.154	0.394	0.241	0.332	0.118
t-stat	0.806	-1.106	-6.822	4.433	10.699	4.494	9.149	3.093

Table 5: Annual Regressions of Active Returns vs. Previous Return, with Precision Adjustment, International Funds								
	1998	1999	2000	2001	2002	2003	2004	Average
Intercept	-5.131	2.264	7.435	-3.216	-2.297	0.014	3.540	1.290
Previous	0.153	-0.741	-0.682	1.071	3.094	2.250	3.055	1.341
t-stat	0.542	-0.897	-7.068	6.224	9.396	3.376	6.688	2.953

(Continued from page 10)

Using the Hedge Fund.net database, we identified about 500 funds with a sufficiently long history to repeat this analysis on hedge funds. Following the technique used for domestic and international mutual funds, we estimated the correlation between hedge fund returns and several different indices, represented by the columns in **Table 1**. We then determined which index had the highest correlation with the fund returns over the study period and then compared this to alternate indices that would allow a more parsimonious choice of benchmark. This established that three indices (cash, MSCI World Index and the Russell 3000 index) would be reasonable benchmarks for the various hedge funds.

Table 1: Assignment of Benchmarks

Row	Bonds	Cash	EAFE	IFCI	MSCIW	R3000	SP500	Total
Cash	18.8%	15.7%						34.6%
MSCIW			11.7%	3.7%	5.2%			20.6%
R3000						39.8%	5.0%	44.9%

Because hedge funds normally employ a long-short strategy, we also need to adjust each hedge fund by its appropriate beta for the appropriate period when estimating active returns. This is particularly important because of the serial correlation of index returns (1995-1999 were positive while 2000-2002 were negative for domestic equities).

$$\alpha = r_{fund} - r_f - \beta \times (r_{index} - r_f)$$

Table 6 shows the range of betas for the different indices:

Table 6: Average and Standard Deviation of β for Highest Correlation Equity Indices

Benchmark	$\beta_{average}$	$\beta_{standard\ Deviation}$
EAFE	0.37	0.36
IFCI	0.14	0.12
MSCIW	0.60	0.35
R3000	0.54	0.39
SP500	0.42	0.43

Comparing **Table 7** and **Table 8** show that, in the case of hedge funds, use of Precision-Weighted Returns increases both the average regression coefficient and its statistical significance.

Table 7 : Annual Regressions of Active Return vs. Previous Return, Hedge Funds

	1998	1999	2000	2001	2002	2003	2004	Average
Intercept	-0.941	10.043	10.151	8.417	5.806	9.674	3.491	6.663
Previous	0.198	-0.132	0.166	-0.013	0.069	0.059	0.114	0.066
t-stat	2.224	-2.856	5.314	-0.378	2.257	1.601	3.625	1.684

Table 8 : Annual Regressions of Active Return vs. Previous Return with Precision Adjustment, Hedge Funds

	1998	1999	2000	2001	2002	2003	2004	Average
Intercept	-7.512	10.244	6.114	-0.409	-0.207	4.458	-4.406	1.183
Previous	0.630	-0.059	0.629	0.692	0.730	0.654	0.907	0.598
t-stat	1.624	-0.264	4.484	4.055	3.988	2.947	4.850	3.098

Conclusions

We have demonstrated a methodology for the monitoring and evaluation of active managers. This methodology incorporates three stages. We begin by using augmented returns based style analysis to help us select the most appropriate benchmark index. We then use CUSUM analysis to determine the most meaningful period of past performance to evaluate. Finally, we use a precision-weighted estimate of excess returns as the metric of performance that incorporates contemporaneous information about returns achieved across the peer group of managers.

The results of large scale empirical tests of US domestic mutual funds, international mutual funds and hedge funds all support this methodology as being able to provide predictive rankings of managers that are both statistically and economically significant over a one calendar year time horizon.

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