A New Metric for Measuring Skill from Investment Performance

Northfield Information Services
Autumn 2008

Northfield
INFORMATION SERVICES, INC.

What We're After

- There are numerous performance metrics used as proxies for manager skill such as alpha, and information ratio
  - Most of these rarely have statistically significant values because you need a long time series of data, over which time conditions are presumed but not guaranteed to be stable
  - We would like a measure that uses more information so we can get statistically meaningful results over a shorter window
- Manager's occasionally experience very bad return outcomes for a period of time
  - We need a means to discriminate the manager being bad from a truly random event

What We Probably Don't Care About

- There is an enormous literature in finance regarding whether asset managers collectively exhibit skill
  - Obvious implications for concepts of market efficiency
  - Most of this work is based on the concept of "performance persistence": those that perform consistently well must be skillful
  - Stewart, Scott D. "Is Consistency Of Performance A Good Measure Of Manager Skill?," Journal of Portfolio Management, 1998, v24(3,Spring), 22-32.
  - Brown, Stephen J. and William N. Goetzmann. "Performance Persistence," Journal of Finance, 1995, v50(2), 679-698.
  - Elton, Edwin J., Martin J. Gruber and Christopher R. Blake. "The Persistence Of Risk-Adjusted Mutual Fund Performance," Journal of Business, 1996, v69(2,Apr), 133-157.
- But we want to evaluate only one manager

Usual Methods

- There is lots of literature on using traditional return performance metrics such as alpha and information ratio as proxies for manager skill:
  - Kritzman, Mark. "How To Detect Skill In Management Performance," Journal of Portfolio Management, 1986, v12(2), 16-20.
  - Lee, Cheng F. and Shafiqur Rahman. "New Evidence On Timing And Security Selection Skill Of Mutual Fund Managers," Journal of Portfolio Management, 1991, v17(2), 80-83.
  - Marcus, Alan J. "The Magellan Fund And Market Efficiency," Journal of Portfolio Management, 1990, v17(1),85-88.
- You need very long time series of return observations to have enough data to get anything statistically significant by which time conditions may change
- Just going to daily data doesn't help
  - diBartolomeo, Dan. "Just Because We Can Doesn't Mean We Should: Why Daily Attribution is Not Better", Journal of Performance Measurement, Spring 2003

More on Skill Detection

- Some research has been done on CUSUM methods
  - Philips, Thomas K., David Stein and Emmanuel Yashchin, “Using Statistical Process Control to Monitor Active Managers”, *Journal of Portfolio Management*, 2003
  - Bolster, Paul, Dan diBartolomeo and Sandy Warrick, “Forecasting Relative Performance of Active Managers”, Northfield Working Paper, 2006
- Tries to isolate what portion of a manager’s history is likely to be relevant to current activities
  - Throw away data from before the most likely date of a regime shift

The Breakdown Problem

- Consider a real manager who maintains a below 3% ex-ante tracking error and has a cumulative return of -6.3% over a one year period
  - Is this a 2.4 standard deviation event? If so the manager was very unlucky
  - Was the risk model wrong? Maybe the risk model was underestimating the risk so it's not such a rare event
  - Expected tracking error averaged 2.74%, realized was 2.80%
- Ex-ante tracking error estimate is the expectation of the standard deviation of the active return, which is measured around the mean
  - Mean active return was -.54% per month
- Huber, Gerard. "Tracking Error and Active Management", Northfield Conference Proceedings, 2001, http://www.northinfo.com/documents/164.pdf

IR as Skill

- Grinold, Richard C. "The Fundamental Law Of Active Management," Journal of Portfolio Management, 1989, v15(3), 30-37.
- IR = IC * Breadth$^{.5}$
  - IR = alpha / tracking error

    IC = correlation of your return forecasts and outcomes

    Breadth = number of independent “bets” taken per unit time
- If we know how good we are at forecasting and how many bets we act on, we know how good our performance should be for any given risk level

The Fundamental Law Makes Big Assumptions

- There are no constraints at all on portfolio construction
  - Positions can be long or short and of any size
- We measure only “independent” bets
  - Buying 20 different stocks for 20 different reasons is 20 different bets
  - Buying 20 stocks because they all have a low PE is one bet, not 20!
- Transaction costs are zero, so bets in one time period are independent of bets in other periods
  - This is the property that casinos depend on. Once we have the odds in our favor, we want to make lots of bets
- Research resources are limitless so our forecasting effectiveness (IC) is constant as we increase the number of eligible assets

Enter the Transfer Coefficient

- Clarke, Roger, Harindra de Silva and Steven Thorley. "Portfolio Constraints And The Fundamental Law Of Active Management," Financial Analyst Journal, 2002, v58(5,Sep/Oct), 48-66.
- IR = IC * TC * Breadth$^{.5}$
  - IR = alpha / tracking error

    IC = correlation of your return forecasts and outcomes

    TC = the efficiency of your portfolio construction (TC < 1)

    Breadth = number of independent “bets” taken per unit time

What Drives the Transfer Coefficient?

- Imagine a manager with a diverse team of analysts that are great at forecasting monthly stock returns on a large universe of stocks, but whose portfolio is allowed to have only 1% per year turnover
  - Good monthly forecasts, diverse reasons and a large universe imply high IC and high breadth
  - But if we can never act on the forecasts because of the turnover constraint TC can be zero or even negative
- If we can't short a stock that we correctly believe is going down, or take a big position in a stock that we correctly believe is going up, TC declines
  - The more binding constraints we have on our portfolio construction, the more return we fail to capture when our forecasts are good
  - For bad forecasters, a low TC is good. You hurt yourself less when you constrain your level of activity

Limitations of IR

- Managers often talk about IR, but it really doesn't correspond to investor utility except in extreme cases
  - Consider a manager with an alpha of 1 basis point and a tracking error of zero
  - IR is infinite but value added for the investor is very, very small
  - deGroot, Sebastien and Auke Plantinga, "Risk Adjusted Performance Measures and Implied Risk Attitudes", *Journal of Performance Measurement*, Winter 2001/2002
- The statistical significance of a ratio is hard to calculate
  - Jobson, J. D. and Bob M. Korkie. "Performance Hypothesis Testing With The Sharpe And Treynor Measures," Journal of Finance, 1981, v36(4), 889-908.

Redefine Active Risk

- Qian, Edward and Ronald Hua. “Active Risk and the Information Ratio”, Journal of Investment Management, Third Quarter 2004.

- They define “strategy risk” as variation in returns due to time series changes in the manager skill level (i.e. IC is not constant over time)

  Active Risk = std(IC) * $N^{1/2}$ * Tracking Error

- If the “breadth” of a strategy is constant then:

  IR = avg (IC) / std (IC)

Our Solution is to Incorporate Cross-Sectional Information

- Successful active management involves forecasting what returns different assets will earn in the future, and forming portfolios that will efficiently use the valid information contained in the forecast
  - We usually have a large universe of assets to work with, so we get statistical significance quickly
  - In mathematical terms, this means that the position sizes within our portfolios balance the marginal returns, risks and costs
  - If we know how good we are at forecasting future asset returns, we can forecast how well our portfolios should perform if they are efficiently constructed. If we do less well than we should, our portfolio construction is at fault

A Quant Way to Think About It

- Every portfolio manager must believe that the portfolio they hold is optimal for their investors
  - If they didn't they would hold a different portfolio
- If we describe investor goals as maximizing risk adjusted returns, we know that the marginal risks associated with every active position must be exactly offset by the expected active returns
  - Guaranteed by the Kuhn Tucker conditions for finding the maximum of a polynomial function
  - For every portfolio, there exists a set of alpha (active return) expectations that would make the portfolio optimal. We call these the implied alphas
  - Sharpe, William F. "Imputing Expected Security Returns From Portfolio Composition," Journal of Financial and Quantitative Analysis, 1974, v9(3), 462-472.

The Effective Information Coefficient

- We define the EIC as the skill measure
- EIC is the pooled average rank correlation of the implied alphas and the realized returns at the security level
  - If our forecasting skill is good (high IC) and our portfolio construction skill is good (high TC) then EIC will be high
  - If either IC or TC is low, EIC will be low
- As this measurement involves every active position during each time period, the sample is large and statistical significance is obtained quickly

Using EIC to Dissect Performance

- If we have EIC values for a given period (e.g. month), we can estimate the expected magnitude of alpha
- The expected alpha is just the EIC times the cross-sectional dispersion of the asset returns
- So we can look at returns as:

$$P_t - B_t = EIC_t * D_t + \varepsilon_t$$

P_t = portfolio return during period t
B_t = benchmark return during period t
EIC_t = skill for period t
D_t = cross sectional dispersion of asset returns
ε_t = residual returns due to luck

- You can now look at the time series standard deviation of the ε_t to see if the risk model is predicting risk accurately

An Alternative View

- Active managers can add value in two ways:
  - Being right more often than they are wrong about which securities will outperform the market. Sort of like a batting average in baseball
  - Getting bigger magnitude returns on gainers than on losers. You can have a batting average below 50% and still make money if you hit a decent number of “home runs”
- Peter Lynch used to refer to “ten baggers”
  - Stocks that go up ten fold in value while you hold them
  - Just a couple can have a huge effect on portfolio returns
- Batting average concept first formalized in:
  - Sorensen, Eric H., Keith L. Miller and Vele Samak. "Allocating Between Active And Passive Management," Financial Analyst Journal, 1998, v54(5,Sep/Oct), 18-31.

Attribution to Batting Average and Active Return Skew

- A formalization was proposed by hedge fund manager Andrei Pokrovsky (formerly Northfield staff) in 2006
- We can easily measure batting average
  - It is the percentage of cases in which active returns and active weights are of the same sign
  - High numbers are good
- Take the vector product of active weights and active returns. Measure the skew statistic of the distribution
  - Positive skew in active returns is a measure of portfolio construction efficiency

Style Dependency of Batting Average and Active Skew

- Value managers will tend to have high batting average and low skew
- Growth/momentum managers will tend to have lower batting average but higher skew
- Trend following behavior creates the skew
  - Wilcox, Jarrod W. "Better Risk Management," Journal of Portfolio Management, 2000, v26(4,Summer), 53-64.
  - diBartolomeo (2003) http://www.northinfo.com/documents/132.pdf
  - Bondarenko, Oleg. “The Market Price of Variance Risk and the Performance of Hedge Funds”, University of Illinois-Chicago Working Paper, 2004.

Conclusions

- Its often difficult to assess whether a period of extraordinary performance (good or bad) is the result of luck or skill
- We propose the Effective Information Coefficient as a measure of skill
  - It is estimated both over time and across assets so sample sizes get large quickly
  - It incorporates both key aspects of investment skill, forecasting returns and forming efficient portfolios
- We present an alternative representation of skill as “batting average” and “payoff skew”