

CUSUM Analysis for Manager Evaluation and Monitoring

Dan diBartolomeo
Northfield Asset Allocation Seminar
September 2004

Evaluating Investment Track Records

- ◆ Tradition in the investment industry is to evaluate active manager track records over a long period
 - At least 3 to 5 years
 - Some will argue over a market cycle is needed
- ◆ Typical measures such as information ratios may not be statistically significant for many decades for low risk strategies such as enhanced index funds

Academic Evidence is the Reverse

- ◆ Academic studies refute the importance of evaluating long term track records
- ◆ Most studies show that if there is any persistence at all in manager performance, it has a short life of a year or less
 - What happened on average over the last five or ten years means nothing to the future
- ◆ Hendricks, Darryll, Jayendu Patel and Richard Zeckhauser. "Hot Hands In Mutual Funds: Short-Run Persistence Of Relative Performance, 1974-1988," Journal of Finance, 1993, v48(1), 93-130.

The Key Question

- ◆ What time portion of a track record do we really need to evaluate?
- ◆ What we need is a procedure to draw the line between getting enough meaningful data within a manager's record and older, stale data that should be ignored
- ◆ Enter CUSUM

A Robust Method Monitoring Manager

Returns: CUSUM

- ◆ CUSUM is a technique developed in industrial operations theory to detect quality control problems
 - Philips, Thomas, Emmanuel Yashchin and David M Stein. "Using Statistical Process Control to Monitor Active Managers, Forthcoming in Journal of Portfolio Management, 2003
 - Blondell, David, Philip Hoang, John G. Powell and Jing Shi. "Detection Of Financial Time Series Turning Points: A New CUSUM Approach Applied To IPO Cycles," Review of Quantitative Finance and Accounting, 2002, v18(3,May), 293-315.
- ◆ CUSUM defines key turning points in the active return time series, and defines statistical significance of results subsequent to the key turning point

Traditional Process Control

- ◆ Traditional process control focuses on process
 - Concentrate on the machines on production line
 - If they operate well, products should be good
 - Similar in spirit to performance measurement

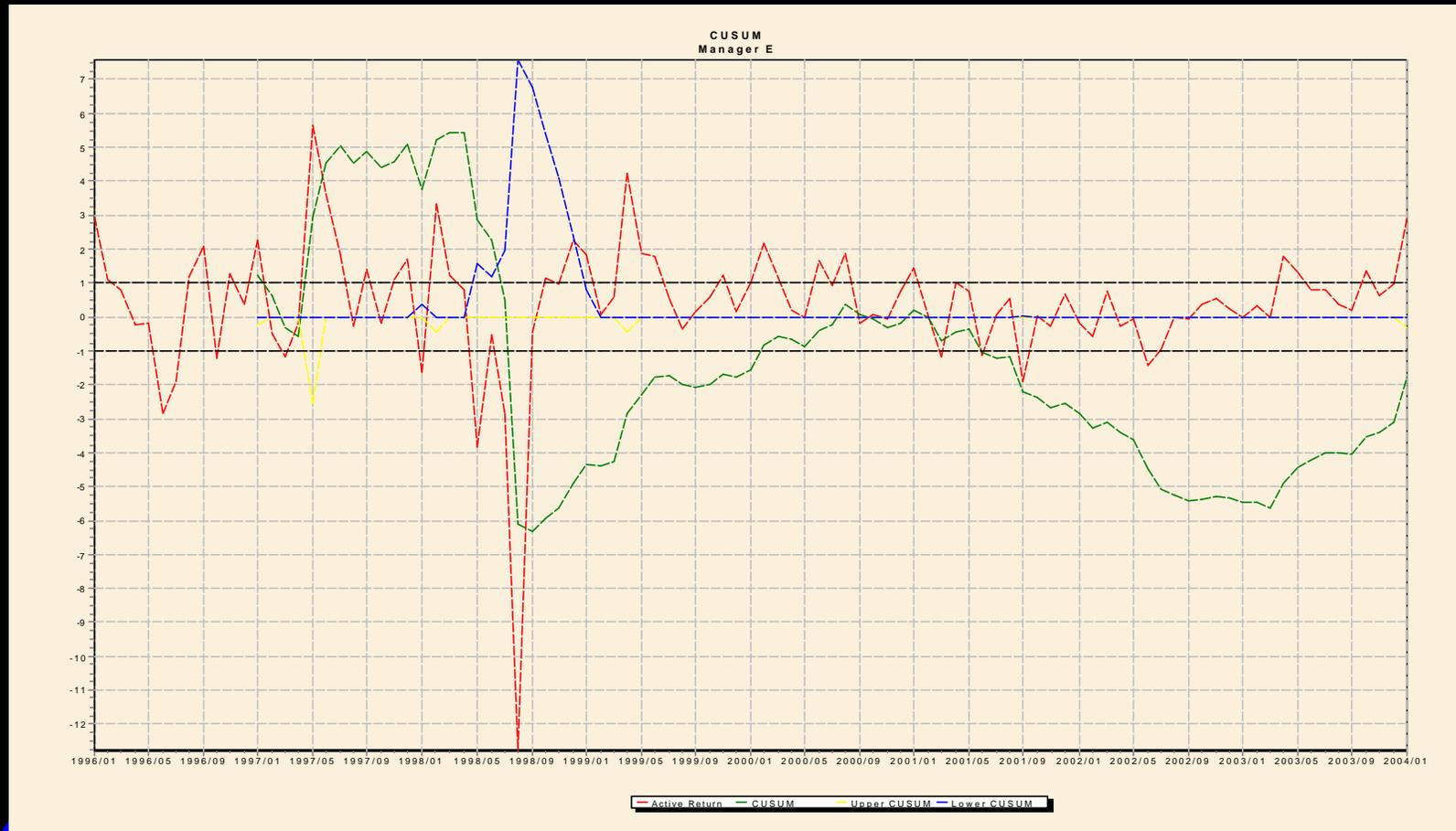
Statistical Process Control

- ◆ Developed at Bell Labs in the 1930's by Walter Shewart, whose key insight was to focus on results.
 - The product is what counts
 - ❖ If it is good, the the process is good
 - ❖ If it us bad, then the process is bad
- ◆ Similar in spirit to performance monitoring
- ◆ Originally used to monitor Western Electric's telephone production lines
- ◆ Separate "signal" from noise

The CUSUM Technique

- ◆ Created by E.S. Page in 1954
 - Reliably detects small process shifts
 - Insensitive to probability distribution
 - Provably optimal: detects process shifts faster than any other method.
 - Extremely robust, good under almost any definition of optimality
 - Much better than exponentially weighted moving average.
- ◆ Mathematically its very simple and tractable
- ◆ Easily analyzed algebraically or graphically

CUSUM (Green) Plot Shows Regimes of Over and Under Performance



Our Implementation of CUSUM

- ◆ Calculate excess returns for a manager, either over a known benchmark, or a benchmark inferred from returns-based style analysis
- ◆ Hold out a short sample period at the beginning to get an initial estimate of the mean and standard deviation of excess return
- ◆ Standardize each excess return by subtracting prior mean and dividing by prior standard deviation
- ◆ Calculate the cumulative sum of the standardized excess returns
- ◆ Apply backward looking likelihood test to find where CUSUM value is most significant
- ◆ Throw away prior return data, and concentrate your analysis on the period from the critical point until now

Conclusions

- ◆ CUSUM has a wide variety of applications in operations research, and economic forecasting
- ◆ It is not a timing tool for hiring and firing managers
- ◆ It is a robust, and under certain assumptions, mathematically optimal way to detect shifts in the quality of a process
- ◆ Provides an excellent tool for deciding how much of a manager's track record is relevant to current operations and conditions