CUSUM Analysis for Manager Evaluation and Monitoring

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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
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

- 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 Shewhart, whose key insight was to focus on results.
  - The product is what counts
    - If it is good, the process is good
    - If it is bad, 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 it's 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 way 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.