Morgan Stanley

INVESTMENT MANAGEMENT

When Good Managers Stumble: How to Know When to Let Go (or Not)

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- When investors see signs of "alpha decay" in a manager's performance, they need to determine if it is permanent or likely to be reversed.
- Terminating a manager whose performance later recovers costs the investor permanent capital losses due to short-term noise while keeping a manager whose "alpha decay" is permanent leads to long term losses.
- New research by the Portfolio Solutions Group ("PSG") provides a rigorous, statistically sound, quantitative approach that offers guidance for deciding whether to keep or drop managers.[1]
- This paper outlines our approach through a framework that involves a statistical process control scheme known as CUSUM, or a Cumulative Sum Control Chart.[2] CUSUM is a statistical method that has its roots in industrial quality control, which PSG has adapted for monitoring manager performance.
- The PSG CUSUM framework enhances the CUSUM test process proposed in the original literature, from Philips, Yashchin, Stein (2003), by refining alpha estimation, adding peer group analysis, and including additional tests to evaluate the manager's stock-picking abilities. It allows investors to focus on potential problems before they have any serious impact on the performance of the overall portfolio.

AUTHOR

PORTFOLIO SOLUTIONS GROUP

[1] The statements above reflect the views and opinions of only PSG as of the date hereof and not as of any future date. The specific approach mentioned herein has not been evaluated or tested by an independent third party.

[2] Philips, Thomas K. and Yashchin, Emmanuel and Stein, David M., Using Statistical Process Control to Monitor Active Managers (January 17, 2003).

Investors who hire active managers do so with the expectation that they will outperform their passive counterparts. However, even the best managers do not outperform all the time, and many good ones can suffer a string of negative periods.

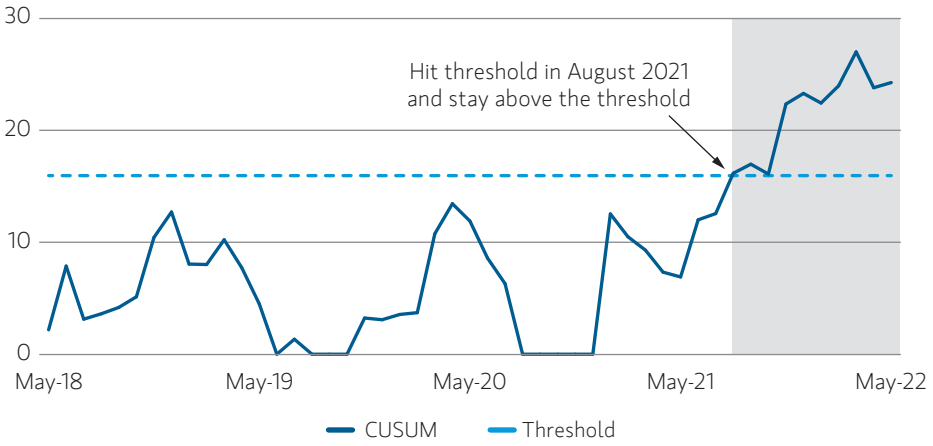
Given this reality, when investors see signs of performance deterioration, they need to determine if it is permanent or likely to be reversed. Often, the issue is addressed during the manager monitoring process. Based on our interviews with prominent asset owners, there is consistent use of excess return, information ratio (IR), style analysis, guideline monitoring through holdings, and qualitative aspects (changes to business, team, process, regulatory events) in this monitoring process. However, the industry standard for quantitative monitoring is fairly undeveloped and very judgement based.

We believe that qualitative evaluations must be supported by a rigorous, statistically sound, quantitative approach that can systematically identify managers in trouble. This is especially true for institutions with investments in a large number of managers, as it increases oversight efficiency and helps promote a more uniform review process.

To achieve this goal, the Portfolio Solutions Group at Morgan Stanley Investment Management explores a statistical process control scheme known as CUSUM—a statistical method that has its roots in industrial quality control and was first proposed as a method to rapidly detect changes to the mean of a noisy random process. Our team has conducted research to improve CUSUM's performance and has extended the model to a framework that offers a consistent rationale for subsequent decision-making.

DISPLAY 1

CUSUM of a hypothetical active fund manager



Source: Bloomberg, Morningstar, Morgan Stanley Investment Management Portfolio Solutions Group Analysis, as of May 31, 2022.

The index performance is provided for illustrative purposes only and is not meant to depict the performance of a specific investment. **Past performance is no guarantee of future results.** Forecasts/estimates are based on current market conditions, subject to change, and may not necessarily come to pass.

Understanding CUSUM for Portfolio Management

From a portfolio management perspective, after identifying a high-conviction manager, we monitor the manager's performance in the next period. The performance pattern is detected over time when new performance data comes in. A very natural question is: When is the performance bad enough that it may shift our expectation for the manager's ability to outperform and hence require action? Institutional investors tend to be more patient, evaluating performance over a pre-defined period such as the last 1, 3 or 5 years to avoid overreaction to market noise. Quantitatively, it is like a traditional hypothesis testing, which requires a fixed number of data points to reduce the probability that we might get it wrong. This approach is static and does not utilize all of the information that is collected. Intuitively, the time needed to make a decision should be based on distribution of the performance data that investors experience.

Our approach starts with the adaptation of CUSUM.[3] The main advantage of CUSUM relative to traditional hypothesis testing (T-stat)[4] is that it detects the changes over time and raises the alarm when there is enough evidence collected, rather than waiting for a pre-determined time period, which is generally faster. CUSUM is also insensitive to the underlying return distributions.

CUSUM estimates the ratio of the likelihood that a set of observed returns comes from a bad manager's distribution vs a good manager's distribution. Graphically, the CUSUM estimator looks like a drawdown chart based on cumulative risk-adjusted returns, which will raise alarms when this ratio is above a certain threshold. One can claim that the observed returns are from a bad manager and the asset owner should consider re-underwriting the manager. *Display 1* visualizes how CUSUM is used. In this example, CUSUM of the manager has

[3] Details included in *Appendix I*

[4] A T-Stat is a statistical tool used to compare the means of two groups or group's mean to a standard value.

been monitored since 2018 and stayed below the threshold until August 2021, when the alarm was raised for a closer check of the manager's performance.

While the CUSUM framework provides a good model that can be adapted for manager monitoring and can rapidly detect the decay of manager IRs, we have made some further enhancements when building the PSG framework, to better fit our purpose.

Further Enhancement

1. HOW TO MEASURE A MANAGER'S ALPHA

At its core, CUSUM is designed to detect alpha decay. Therefore, accurate measurement of alpha is essential for the model's effectiveness. In the original model proposed in the literature, the manager information ratio is calculated based on excess return over appropriate benchmarks. Excess return against "naïve" market benchmarks has exposure to hidden risk factors, or betas, that help drive performance and are distinct from the manager's stock-picking ability. A good example is within the value manager universe, in which cyclical value funds and defensive value funds can show different exposure to the "quality" factor. Thus, if we merely use the market benchmark, the contribution from the bias to the quality factor would be missed, and the outperformance of one set of value funds over the other would be mistakenly attributed to alpha.

In addition, the fundamental assumption of using excess return is that exposure to markets/factors remains constant at 1. This method is unable to capture the changes in a manager's exposure to different markets or trading styles. To address the issues mentioned above, we use dynamic[5] style factor attribution models with a selected set of factors. This approach can help us better evaluate the skill of active managers by explicitly accounting for time varying factor exposures.

2. ONE STEP FURTHER: FINDING A RELEVANT PEER GROUP

If manager performance deteriorates to a certain threshold in our CUSUM model, it is a signal that future performance is likely to be sub-par as well. However, this could still be driven by hidden biases that are not captured by the factor model. To further improve the model and eliminate hidden biases, we do not treat this flag as the final word, but rather, as a trigger for closer analysis of the manager and the peer group.

To better understand the underlying biases that drive the manager's performance, we believe it is important to understand the performance of peer managers with similar biases. We refine the broad universe to construct a small peer group of such managers, and we evaluate the performance of the peer groups during the same period. To identify the peer group with similar biases and compare the performance within the peer group, we use the following three steps:[6]

1. Select a group of peers that shows the highest level of similarity based on those with the closest style betas.
2. Identify common hidden biases that exist in the small group of peers and estimate the managers' exposure to the hidden factors.
3. Take out the impact of the hidden common factors and estimate the "true alpha."

3. TESTS TO EVALUATE MANAGER'S STOCK PICKING ABILITY

After finding the relevant peer group, we try to answer the following questions:

A. Does the manager perform better than the relevant peer group, i.e., those with a similar style?

If the manager has positive true alpha after the steps highlighted above, it means the manager has generated more alpha than most of the closest peers. In other words, the manager has demonstrated good stock picking ability after considering the hidden trend. If the answer is no, then the model offers a recommendation for dropping the manager.

B. Is there alpha generation in this close peer group over the long term?

In this step we want to make sure this close peer group, with similar investing styles, has shown the ability to generate alpha over the long term. If not, then this would mean a negative recommendation from the model. The manager may have fared better than its close peers, but this close peer group has not been able to consistently produce excess return. Of course, this evaluation should be performed prior to initial manager selection, but it is also advisable to do so routinely.

C. Does the peer group perform worse than the broader universe during the manager's deterioration period?

Finally, we look at how the close peers have performed relative to the broad universe during the same period of the manager's performance deterioration. If a manager has outperformed its peers and the peer group has demonstrated strong alpha generation over the long term,

[5] The dynamic factor models are implemented using a Kalman filtering approach, which generates estimates of a manager's beta(s) at each point in time. See Kalman, R.E., "A New Approach to Linear Filtering and Prediction Problems" in Journal of Basic Engineering, No. 82, 1960.

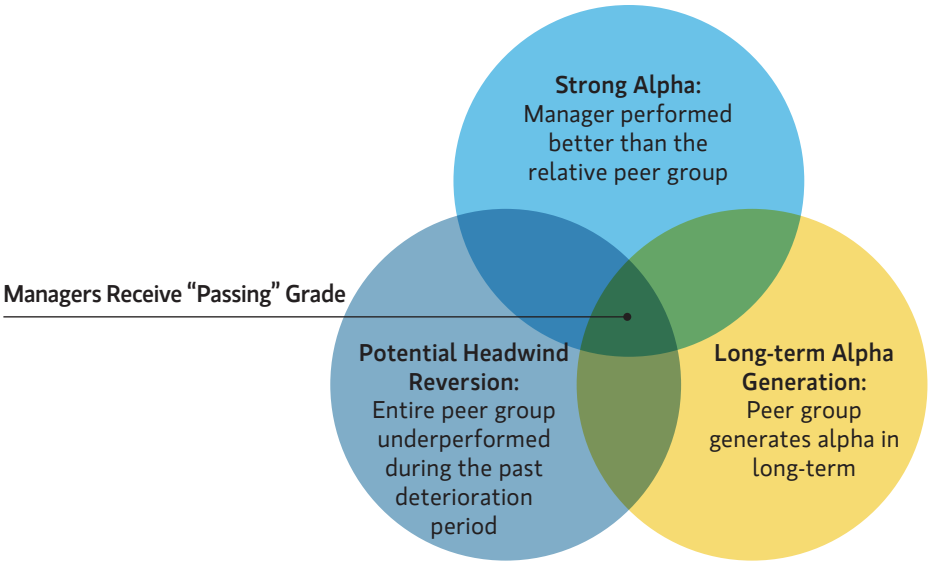
[6] Details included in the *Appendix II*.

it is possible that the triggering of CUSUM may be due to the peer group's underperformance relative to the broad universe over this period. This could suggest that the underperformance of the manager—and the small group—stems from some trend caused by uncaptured bias. Thus, the manager's performance could recover as style trends revert in the future. Conversely, if the peer group has been outperforming the broader universe, this results in a negative recommendation since they are likely to be adversely affected by any forthcoming trend reversal.

These three questions are summarized in *Display 2* that can guide investors in choosing whether to keep or part ways with an underperforming manager.

DISPLAY 2

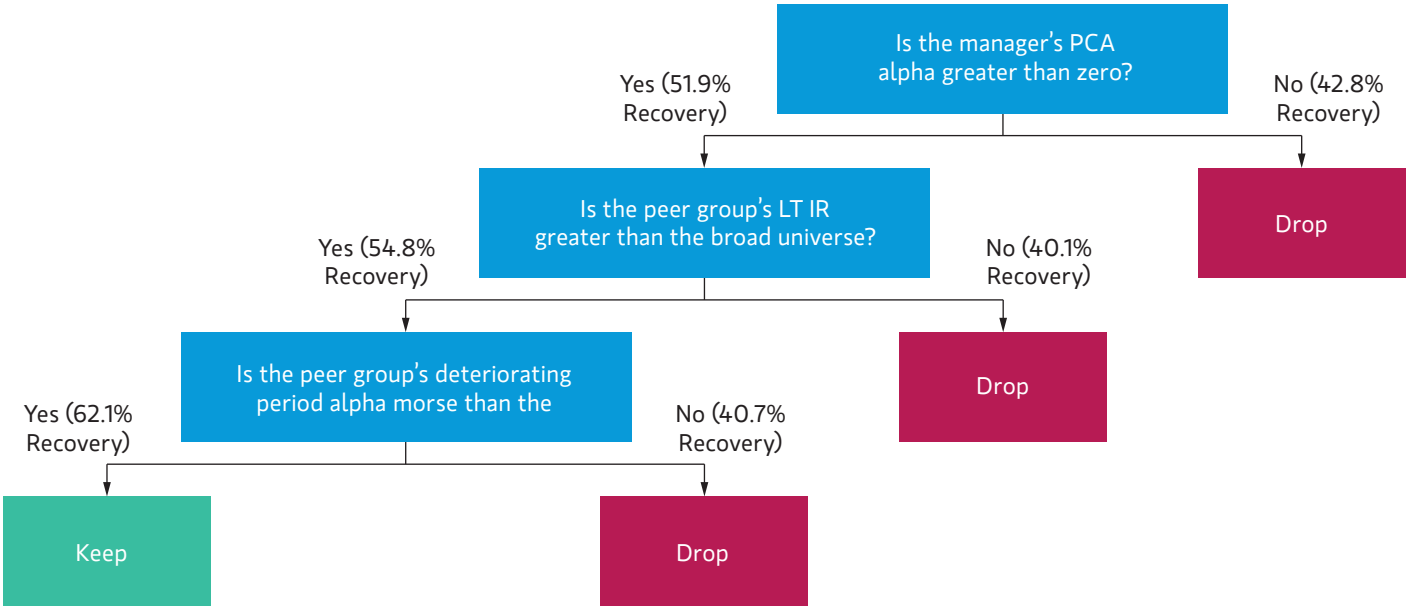
Illustration of how the framework helps to determine keeping or dropping managers when CUSUM is triggered



For illustrative purposes only. Source: Morgan Stanley Investment Management Portfolio Solutions Group.

DISPLAY 3

The model's predictions were validated: while less than 50% managers can recover from the underperformance, the group tagged with "passing grades" has 62.1% of managers recovered.



For illustrative purposes only and is not meant to depict the performance of a specific investment. **Past performance is no guarantee of future results.** Forecasts/estimates are based on current market conditions, subject to change, and may not necessarily come to pass. Source: Bloomberg, Morningstar, Morgan Stanley Investment Management Portfolio Solutions Group Analysis, as of May 2020.

Validating the model's methodology

To validate our CUSUM framework, we evaluated managers in the Morningstar U.S. Large Cap universe, U.S. Small Cap universe and Global Large Cap universe, from December 1993 through May 2020, (determined by data availability) on a rolling one-year basis.[7] *Display 3* shows the historical recovery outcomes of the universes included, mapped to model predictions, and correlated with questions A, B and C above.

In the test, question A splits the universe into two parts—managers who have true alpha greater than zero or not. The managers who showed positive true alpha have a 51.9% recovery rate while the managers who had negative true alpha only have 42.8% recovery rate. In the next test (question B), only managers generating positive true alpha were included and we found those who had peer groups that have outperformed the benchmark over the long term had a recovery rate of 54.8%, outperforming the others who did not. In the final qualification test, those managers whose peer group also underperformed the broad universe during the manager's "deterioration period" had a superior recovery rate of 62.1% vs. 40.7% for the managers on the other side.

DISPLAY 4

The MSIM / CUSUM framework significantly improved predictive accuracy over CUSUM alone

Accuracy based on MSIM/CUSUM Framework	**59.5%**
Accuracy based on Naive CUSUM Framework	**52.8%**

The refined group of managers who passed all three tests showed a stronger recovery rate historically compared to the rest of the universe. We believe these results offer strong validation of the model.

But a final question remains: Does the model's guidance improve on the simple CUSUM trigger that kicks off the framework? In other words, what if we simply parted ways with managers that hit the CUSUM poor-performance threshold? The table in *Display 4* summarizes relative accuracy.[8]

The table shows that the MSIM / CUSUM framework improves accuracy to around 60%. However, it is worth stressing that the "Naïve CUSUM Model" is not a generic analytical tool. As we discuss in previous sections, we undertake significant analytical and preparatory work to ensure we have valid IRs to populate the CUSUM database, as the foundation for our enhanced manager selection approach.

Conclusion

Consistent alpha production is a rare skill, even among highly talented investment professionals. When managers hit a rough patch, sophisticated investors must weigh the potential opportunity costs of premature dismissal against the possible portfolio damage of hanging on too long. We invite you to consider how the MSIM / CUSUM framework can help add clarity and rigor to that important decision-making process.

[7] At each year end between 1996 and 2018, we picked the manager whose past three-year rolling style factor information ratio was above universe median. This provided a universe of managers that had, for at least one period, delivered top-half performance. When members of this group experienced performance deterioration, and hit the CUSUM threshold, we performed the analysis described in this paper. *Display 3* summarizes the accuracy of the "keep or drop" recommendations of the MSIM / CUSUM model.

[8] Accuracy is determined by the percentage of correct calls made by the model. For the simple CUSUM trigger, it represents the number of managers whose performance did not improve in the three years after triggering the threshold. For the MSIM / CUSUM model framework, we reviewed the outcomes in the subsequent three years of managers who qualified for keeping in *Display 3* (ones with the "hold" recommendation) versus all others, who received "drop" recommendations.

Appendix I

CUSUM

- The CUSUM model seeks to find out, given experienced returns, if a manager is more likely to be a good one (defined as having an IR greater than or equal to the top 25th percentile IR among peers) or a bad one (defined as having an IR smaller than or equal to the bottom 75th percentile IR among peers)
- This is done through a statistical test that checks how likely it is that a manager's performance is in line with a good manager distribution or a bad manager distribution. Using coin tossing as an example, a person is asked to evaluate whether the coin is a fair one. One can toss the coin and based on the outcome determine how likely it is that this coin is a fair one. In the first few tosses, it will be difficult to make the decision. However, as more tosses are made, we will have more and more information to make the decision. Suppose there are 1000 tosses made. 500 are heads and the other 500 are tails, so one can then reasonably conclude that the coin is fair. As the number of times the coin lands on heads goes up, one could guess it is less and less likely that the coin is a fair one. Very similar to the coin toss example, the CUSUM model defines key turning points in the manager's alpha time series and helps to capture any deterioration in the manager's alpha-generating ability. When CUSUM hits a threshold, the model tells whether the manager is more likely to be a bad manager than a good one and a re-evaluation of the manager's ability should be conducted.
- The model defines key turning points in the active return time series and helps to capture if the manager's alpha generating ability deteriorates. It is calculated as the log-likelihood ratio based on the k most recent observations as shown below:

$$L_N(k) = \log\left[\frac{(Probability\ [k\ most\ recent\ observations \mid manager\ is\ bad])}{(Probability\ [k\ most\ recent\ observations \mid manager\ is\ good])}\right]$$

- When new observations come in, CUSUM is recalculated. When the log-likelihood ratio (CUSUM) at time N passes the threshold, an alert is triggered. L_N can be rewritten in recursive format after rescale by $1/|bad\ IR - good\ IR|$:

$$L_0 = 0,\ L_N = \max\left[0,\ L_{N-1} - IR_N + \frac{\text{good IR+bad IR}}{2}\right]$$

- The information ratio is used to measure the manager's performance and calculate CUSUM. Information ratios and CUSUMs calculated based on different measurements, including excess return and alpha from different attribution models, are used for the test.
- The threshold is calculated based on Wald Constant Threshold, which is determined such that the risk to detect an alarm at time N is controlled by tolerance level α:

$$P\ (L \geq Threshold) \leq \alpha$$

$$Threshold = -ln\ (\alpha) / |bad\ IR - good\ IR|$$

Appendix II

STEPS TO REFINE PEER GROUP

1. First, we look at the style betas of peers in the large universe and select a group of peers that shows highest similarity based on those with the closest style betas. In this step we seek to extract managers that have similar exposures to observable factors such as value or size. Through this step we reduce the numbers of managers in the peer group from a larger universe size to 20% of the larger universe size or 40 managers, whichever is smaller.
2. In the second step we focus on the premise that the manager likely belongs to a smaller peer group with as-yet-unidentified common biases. We use an advanced statistic model[9] to estimate managers' exposures to hidden common factors, and, like the first step, we select managers that show the highest similarities to the manager in question. In this step we further reduce the size of the group to half of the size in step one.
3. Finally, we take out the commonality of the close peers from their return time series and the residual is the "true alpha" for the CUSUM analysis. The goal is to have the alpha estimation as pure as possible.

References

Philips, Thomas K. and Yashchin, Emmanuel and Stein, David M., Using Statistical Process Control to Monitor Active Managers (January 17, 2003)

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[9] This is done by Principal Component Analysis

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Dubai: MSIM Ltd (Representative Office, Unit Precinct 3-7th Floor-Unit 701 and 702, Level 7, Gate Precinct Building 3, Dubai International Financial Centre, Dubai, 506501, United Arab Emirates. Telephone: +97 (0)14 709 7158).

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