Using Momentum to Manage Downside Risk
The Importance of Dynamic Lookback Periods

- Historically, momentum models have shown the ability to protect against large drawdowns.

- The lookback period parameter is a key input to momentum models.

- Over large samples, the ability to deliver downside protection is present over a wide range of lookback periods.

- The selection of the lookback period drives significant performance differentials in individual scenarios.

- More sensitivity does not imply more security. A more accurate statement would be that more sensitivity can create more security in certain types of sell-offs. In other types of markets, slow and steady wins the capital protection race.
The Devil is in the Implementation Details

According to a report by Lloyd’s of London\(^1\), the United States experiences more tornados than any other country in the world. These awe-inducing storms take a devastating toll on communities. Over the last 20 years, tornados have caused more than 80 fatalities and 1,500 injuries annually. Property damage from tornados and severe thunderstorms has approached $8 billion per year over this same time period. According to Property Claim Services, tornados accounted for 37.2% of insured catastrophe losses from 1994 to 2013\(^2\).

Fortunately, tornado-forecasting tools are improving rapidly. The National Weather Service has a new supercomputer, nicknamed “Tide”, that collects data from a myriad of sources and then distills this data at the rate of 213 trillion calculations per second. With the help of Tide and other new and improved systems, researchers believe they will be able to provide one to two hours of lead-time prior to tornado touchdown by 2020.

Better and faster forecasts can only be a good thing, right? Evidence suggests that the situation is not that simple. As usual, the devil is in the details of implementation. It turns out that many people ignore tornado warnings due to high false alarm rates. One data source estimated the false alarm rate at 75% as of 2009. A study conducted by researchers at the National Weather Center in Norman, Oklahoma found that longer lead times actually had the potential to compound the effects of high historical false alarm rates. The participants in the study wanted only a bit more than 30 minutes of lead time, even if up to two hours was technologically feasible. The researchers concluded that lead times should be increased gradually and in parallel with accuracy improvements so that individuals are more likely to act on this potentially life saving information.

While investing is not life or death, the potential for large drawdowns to destroy financial goals has been well documented. In this white paper, we will explore the ability of momentum models to help investors mitigate the impact of large drawdowns. We will then explore the importance of the lookback period assumption in simple momentum models and how the selection of this parameter can positively or negatively impact downside risk management.

\(^2\) Insurance Information Institute
Methodology

To conduct our analysis, we identified the 1000 worst calendar year returns for the current constituents of the S&P 500® (as of February 3, 2015)\(^3\). These returns range from -27.3% (Pentair, 1975) to -98.0% (The Priceline Group, 2000) with an average of -43.9%.

For each year in the sample, we used a simple moving average momentum model to generate trading signals. When a signal is a “buy,” we go long the security. When a signal is a “sell,” we move to cash\(^4\). We assume a monthly rebalance implemented with portfolio tranching to eliminate calendar risk\(^5\).

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\(^3\) If this was a strictly academic paper, we would have considered not only current S&P 500 constituents, but also historical constituents. This approach would eliminate any potential hindsight bias in our analysis.

\(^4\) For simplicity, we assume a 0% interest rate on our cash position, no transaction costs and no taxes. Non-zero interest rates will improve the returns of the momentum strategies while transaction costs and taxes will decrease the returns of the momentum strategies.

\(^5\) For more information, see our “Mitigating Calendar Risk through Portfolio Tranching” white paper.
Other than the time series of stock prices, the only necessary input to our model is the lookback period. The lookback periods determine how sensitive the moving average will be to changes in the asset’s price. Shorter lookback periods create more sensitivity and longer lookback periods create less sensitivity.

Using Momentum For Downside Risk Management

To measure how effective a momentum strategy can be in avoiding large drawdowns, we utilize the concept of downside capture. Downside capture is calculated by taking a strategy’s return during the period and dividing it by the raw return of the stock over that same period. As an example, a downside capture of 0.50 indicates that the strategy lost half of what the associated stock lost in that year. Typically, the downside capture in our analysis will be between 0 and 1. However, there are some cases where it is less than 0 or greater than 1. A downside capture less than 0 indicates that the strategy delivered a positive return in a down year for the stock. A downside capture greater than 1 indicates that the strategy lost more than the underlying stock.

Using a 12-month lookback period, the average downside capture was 0.37 over the 1000 years of largest losses. This means that on average a 50% loss would have been limited to only 19%. The consistency of the results is
striking. Using a 12-month moving average as an entry/exit model reduced the loss realized in 96% of cases. The loss was reduced by at least one quarter in 89% of cases, at least one half in 70% of cases and at least three quarters in 38% of cases.

Over the full sample, the results are consistent regardless of what lookback period we select. In the chart below, we graph the average downside capture, as well as the range around the average, for lookback periods ranging from one month to twelve months.
While longer lookback periods generally perform better than shorter lookback periods, performance is solid across the board. The worst performing lookback period (1 Month) still reduces losses by more than half.

**Averages Can Be Misleading**

In the previous section, we showed that on average the use of a simple moving average, regardless of lookback period, would have allowed investors to materially reduce downside risk in our sample. The “on average” in the prior sentence is italicized for a reason: averages can be misleading. A 2013 article in the New York Times provided a fitting example to highlight the issue with relying solely on averages to make an argument:

“In 2011, for example, the average income of the 7,878 households in Steubenville, Ohio, was $46,341. But if just two people, Warren Buffett and Oprah Winfrey, relocated to that city, the average household income in Steubenville would rise 62 percent overnight, to $75,263 per household.”

To fully explore the implications of a data set, we must look beyond the average. The box and whisker plot of the previous page clearly shows that downside capture varies around its mean quite a bit for all lookback periods. However, even this does not paint an entirely clear picture. If the different
lookback periods vary around their mean in the same way (i.e. are highly correlated), then the choice of lookback period would matter very little.

On the next page, we summarize the distribution of downside capture spread. We define downside capture spread as the difference between the downside capture of the best performing lookback period and the downside capture of the worst performing lookback period. A downside capture spread of 0.00 implies that all lookback periods delivered the exact same amount of downside protection. A downside capture spread greater than or equal to 1.00 implies that the performance differential between the best and worst lookback periods equaled or exceeded the magnitude of the stock’s drawdown.

We find that the average downside capture spread across the 1000 years in our sample is 0.49. This translates into an average return differential of 20% between the best and worst performing lookback periods. Put simply, lookback period selection matters quite a bit. For the football fans out there, it can mean the difference between looking like Tom Brady or Scott Norwood⁶ (sorry Bills fans).

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⁶ Scott Norwood was a kicker for the Buffalo Bills from 1985 to 1991. He is best known for missing a potential game winning field goal in Super Bowl XXV. This loss started a streak of four consecutive Super Bowl losses for the Bills.
An extreme example of the importance of the lookback period is Broadcom Corp. (ticker: BRCM) in 2000. BRCM was down 38.3% in 2001. A lucky trend follower that happened to use a two-month moving average would have hit a home run, generating a positive 36.0% return! Another trend follower that happened to use a six-month moving average would have lost 38.1%. In this example, the downside capture spread is a remarkable 1.94.

Below we present two more examples of the large performance spreads created by different lookback period assumptions. The first example is AutoNation Inc. (ticker: AN), which declined 36.9% in 2008. While the trend for AN was decidedly downward for the full year, there were a number of intra-year ups and downs. AN was modestly up in the first part of the year, gaining 6.4% from 12/31/07 to 5/12/08. From this point on, volatility skyrocketed. The stock lost 54.6% from 5/12/08 to 7/15/08, gained 76.1% from 7/15/08 to 9/8/08, lost 66.8% from 9/8/08 to 10/24/08 and then gained 123.0% through the end of the year.

The heightened sensitivity of a shorter lookback period combined with the choppiness of the stock led to a number of whipsaw trades (“buy high, sell low”) when a 3-month moving average was applied. On the other hand, a longer, 12-month lookback period was able to capture the downward trend while filtering out the intra-year volatility. As a result, the 12-month lookback
period was able to avoid the entire drawdown (return of 0.0%) while the 3-month lookback period actually lost 47.0%, 10.1% more than the stock itself.

The second example is Altera Corp. (ticker: ALTR), which lost 54.3% in 1992. ALTR’s sell-off was of a very different nature than AN’s in 2008. The sell-off began suddenly after a large up move and then continued almost uninterrupted into the fourth quarter of that year.
As a result, the more sensitive 3-month lookback period was able to get out earlier than the 12-month lookback period while also avoiding the whipsaws that plagued the shorter lookback period in our AN example. For the year, the 3-month lookback limited the decline to 7.6% compared to a 27.1% loss when the 12-month lookback was used.

While these are just a few examples of the 1000 sell-offs that we studied, they illustrate a key observation. Namely, sell-offs come in all shapes in sizes. As a result, no single lookback period will be ideal for avoiding all drawdowns.

As we interact with peers and advisors, we often hear blanket statements that are taken to be fact regarding the best ways to utilize momentum in a risk management construct. One that we hear regularly is that more sensitive models - think shorter lookback periods - will do better in times of market crisis because they are able to get out of and back into the market more quickly. However, getting in and out faster is only a good thing when your signals are right. The AutoNation example illustrates that more sensitivity can be very bad when there is short-term mean reversion in the midst of a large sell-off.

More sensitivity does not imply more security. A more accurate statement would be that more sensitivity can create more security in certain types of sell-offs. In other types of markets, slow and steady wins the capital protection race.

**Implications for Tactical Asset Management**

In this paper we have made two main observations regarding the importance of lookback period selection when using momentum models to manage downside risk:

1. Lookback period selection mattered very little over the entire sample.
2. Lookback period selection was crucial in individual scenarios.

These two observations seem somewhat paradoxical. The first suggests that we can pick a random lookback period and sleep well at night knowing that all will work out in the long run. The second suggests that we should agonize over lookback period selection knowing that it can make the difference between success or failure in risk management.
The key difference lies in the phrase “on average.” When we have the luxury of diversifying across thousands of scenarios due to a large number of unique positions, we can worry less about the exact lookback period.

At Newfound, however, we typically make tactical decisions to manage the downside risk in portfolios of broad asset classes. While broad asset class crashes do not necessarily occur year in and year out, they can wreak havoc on even the best financial plans due to the finite nature of many investors’ investment horizons. In this case, where we cannot necessarily diversify the parameter risk across hundred of positions, we have to be more precise.

Newfound’s models are built to adapt to each asset individually. Specifically, our momentum models incorporate a mechanism to dynamically adjust – in real time – the lookback period that is used to estimate the momentum strength for a given security at a given point in time. While we seek to incorporate diversification into portfolio design wherever possible – which can help reduce the accuracy required by our model parameterization – we believe that dynamically adjusting the lookback period can help our models navigate changing market scenarios with greater success.
Past performance is no guarantee of future returns.

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