UNDERSTANDING DYNAMIC, VOLATILITY-ADJUSTED MOMENTUM

A INTRODUCTION TO NEWFOUND’S FLAGSHIP TACTICAL INVESTMENT MODEL
WHAT IS MOMENTUM?

Momentum, also known as trend-following or relative-strength, is one of the oldest investment strategies and most well-researched phenomena in the marketplace. The strategy is the core of two of Wall Street’s oldest adages: “cut your losses [short] and let your profits run” (a quote frequently attributed to British economist David Richard) and Marty Zweig’s “the trend is your friend.”

Momentum indicators are reactive – security price behavior is translated into strength / weakness signals that are agnostic to fundamental valuation and economic circumstance. Momentum strategies are therefore opportunistic, seeking to invest in securities that have exhibited recent outperformance and avoid those that have exhibited recent underperformance.

The existence of momentum is a market anomaly, which financial theory struggles to explain. An increase in asset prices, in and of itself, should not warrant a further increase according to the efficient market hypothesis. Such an increase is warranted only by a change in demand and supply or by new information. Even Eugene Fama and Kenneth French (1996) have found the momentum anomaly to be the largest discrepancy to their own Fama-French model, remaining unexplained by standard market, size and value risk factors.

WHAT IS MOMENTUM?

For nearly two decades, momentum has generally been accepted in academia as a distinct driver of return premiums, although the root cause of the anomaly is still highly debated. The inefficiency is most commonly explained by investor’s behavioral biases, such as:

- Herding (also known as the “bandwagon” effect)
- The over- or under-reaction to new information
- Confirmation bias (ignoring information contradictory to your beliefs)
- The asymmetric response of investors to gains and losses

Unfortunately, investments do not exhibit momentum over all time horizons. Evidence shows that momentum is a driving factor in a variety of asset classes over 3 to 12 month measurement periods, after which the advantage begins to fade. Berger, Ronen, and Moskowitz (2009) explain that securities which out-perform over longer periods of time actually become relatively expensive and subsequently tend to under-perform their peers.

When no trend exists, momentum strategies can suffer from whipsaw (the consistent mistiming in the purchase and sale of securities) and excessive costs from high turnover. In the worst case scenario, a portfolio might suffer a “death by a thousand paper cuts” before a trend re-emerges. It is critical, therefore, to employ a process that is as robust as possible to these risks.


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## BREAKING IT DOWN

### DYNAMIC

A dynamic window governs what information the model utilizes. As significant information flows into the market more frequently, the dynamic window will shrink, becoming more adaptive to short-term changes. As more time elapses between significant information, the dynamic window expands, becoming more robust to short-term fluctuations.

### VOLATILITY-ADJUSTED

Volatility provides context for returns. Our thesis is that when significant information moves into the market, a security’s price should react beyond what can be explained as day-to-day market noise.

### MOMENTUM

1. **Absolute:** Securities that go (up / down) in value tend to keep going (up / down) in value.

2. **Relative:** Securities which (out / under)-perform their peers tend to continue to (out / under)-perform.

Our model is designed to harvest momentum in an efficient way, seeking to avoid whipsaw risks and limit transaction costs.
UNDERSTANDING THE DYNAMIC WINDOW

Consider decomposing a price series into trend and noise:

\[ y_t = mt + a \sin(t) \]

\[ y_t = mt \]

\[ y_t = a \sin(t) \]

The variable \( m \) determines how strongly the price series trends; the variable \( a \) determines how volatile the price series is.

Momentum systems seek to filter out noise and identify trends. One such example is a simple moving average (SMA). The length of the SMA, \( n \), that successfully filters all noise can be represented by:

\[ y_t > y_{t-n} \]

\[ mt + a \sin(t) > m(t-n) + a \sin(t-n) \]

We can solve this to obtain a lower bound for \( n \):

\[ n > 2 \frac{a}{m} \]

\[ n > 2 \frac{\text{noise}}{\text{trend}} \]

The Takeaway

**Low Noise-to-Trend Ratio**
- Dynamic window shrinks to track trend more closely

**High Noise-to-Trend Ratio**
- Dynamic window expands to filter out noise
UNDERSTANDING THE DYNAMIC WINDOW

Expanding Window
High Noise-to-Trend Ratio

Over the 2005, 2006 and 2007 time period, the overall trend in the S&P 500 was moderate and volatility was high enough that a longer-term moving average was necessary to filter market noise and capture the underlying trend.

Contracting Window
Low Noise-to-Trend Ratio
2008 & 2009

In 2008 and 2009, while market volatility was strong, the overall market trend was stronger, causing a long-term moving average to lag significantly. In an environment where noise-to-trend is low, a shorter moving average can be utilized to track trend more efficiently.
QUANTITATIVE INTEGRITY: WHEN THE MODEL WILL UNDERPERFORM

No Momentum

Just like joints are the weakest point of a structure, a model's assumptions are where it is most vulnerable to failure. Our model assumes that momentum exists in a given security. We avoid utilizing the model on securities that exhibit mean reversionary tendencies over long time periods.

Real World Examples
- VIX
- Coca-Cola vs. Pepsi

Difficulties Calibrating

Transitions from low volatility, high trend markets to high volatility, low trend markets can make it difficult to correctly distinguish between signal and noise.

Real World Examples
- August-October 2011
- Equities post-merger announcement
At Newfound, we do not assume that our model is infallible. Instead, we treat model output as a key input to a thoughtful portfolio construction process.

By using this approach, we reduce the model accuracy needed for a product to add value over a full market cycle.

**Example:** Global Defensive Equity Strategy

<table>
<thead>
<tr>
<th># of Signals used in Product</th>
<th>Portfolio Rules</th>
<th>Model Accuracy to Outperform</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (ACWI ETF)</td>
<td>De-risk if signal turns off</td>
<td>84%</td>
</tr>
</tbody>
</table>

| Newfound Quantitative Integrity | 11 (Global Sector ETFs) | De-risk if 8 or more sector signals are off | 53% |

1 Assumes simple binomial model calibrated to S&P 500 performance since 1980. Assumes 81% probability of an up market and 19% probability of a down market. In up markets, we assume an annual return of 17.6% and in down markets we assume an annual return of -15.2%.

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