Momentum

Ben McMillan

"The premier market anomaly is momentum."- Fama & French (2008)

There are two types of momentum observed in financial markets:

(I) Relative momentum – those assets that have performed well relative to others will continue to do so
(II) Absolute (Time Series) momentum – those assets that have performed well (on an absolute basis) will continue to do so (also known as trend-following)

This analysis will focus primarily on relative momentum (specifically within the S&P 500 universe of stocks).

The traditional (Relative) momentum strategy, as put forth in the seminal work of Jegadeesh and Titman (1993), ranks stocks based on their total return over a lookback period and then buys the "winners" and shorts the "losers". The lookback period is generally 12 months excluding the most recent month (This done to remove the "short-term" reversal effect as documented by Jegadeesh & Lehman (1990); that said, our results are not dependent on this point.)

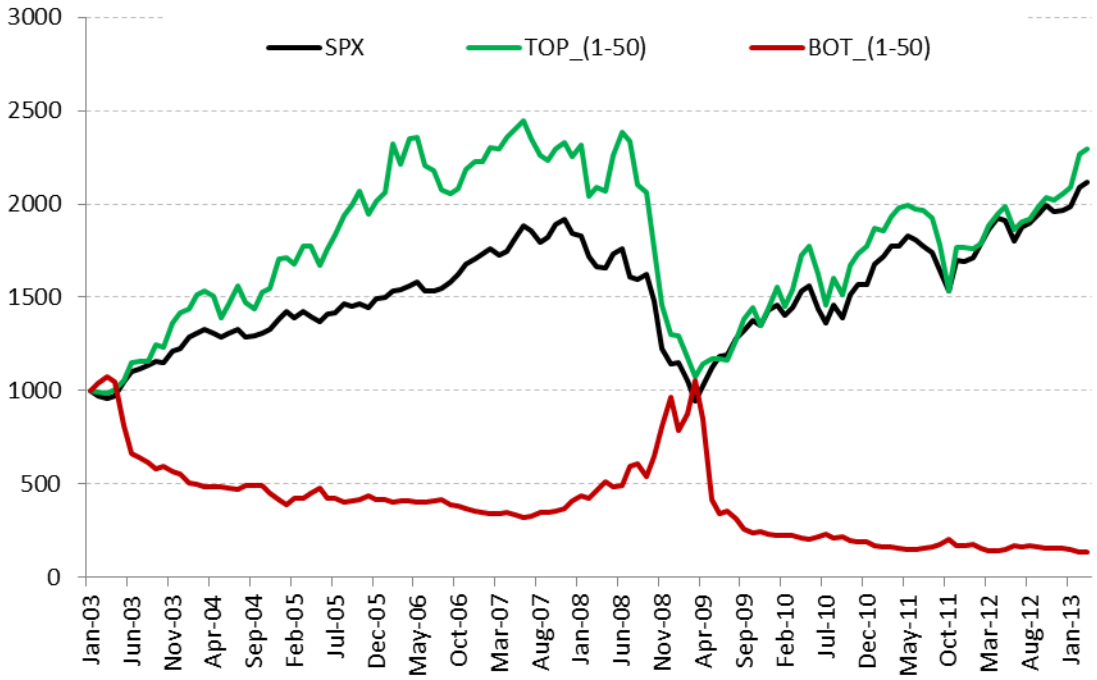
The traditional momentum effect is one of the most robust and pervasive phenomena in the financial markets. Researchers have documented this "alternative beta" in:

- U.S. stocks (Jegadeesh and Titman (1993), Asness (1994))
- Industries (Moskowitz and Grinblatt (1999), Asness, Porter and Stevens (2000))
- Foreign stocks (Rouwenhorst (1998), Chan, Hameed and Tong (2000), Griffen, Ji and Martin (2005))
- Emerging markets (Rouwenhorst (1999))
- Equity indices (Asness, Liew and Stevens (1997), Bhojraj and Swaminathan (2006), Hvidkjaer (2006))
- Commodities (Pirrong (2005), Miffre and Rallis (2007))
- Currencies (Menkoff et al (2011))
- Global government bonds (Asness, Moskowitz and Pedersen (2012))
- Corporate bonds (Jostova, Nikolova and Philipov (2010))

This analysis begins by independently re-creating these results on the S&P 500 universe of stocks over the last decade.

Over the last 10 years, buying the top decile of stocks in the S&P 500 based on their previous 12 months' performance (excluding the last month), and rebalancing monthly, would've resulted in the pro-forma returns shown in green ("TOP_(1-50)"). Shorting the bottom decile of stocks would've resulted in the pro-forma results shown in red ("BOT_(1-50)").

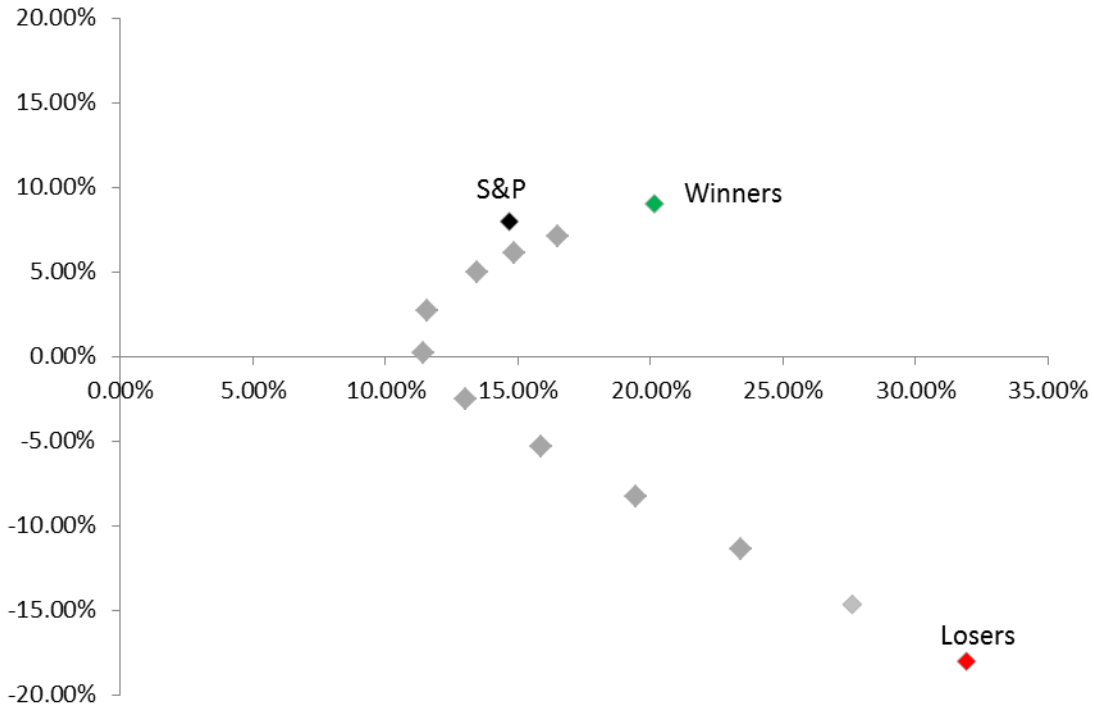
(no transaction costs or borrowing costs are taken into account in simulations)



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
SPX	28.67%	10.87%	4.91%	15.78%	5.49%	-36.99%	26.47%	15.08%	2.09%	15.99%
TOP_(1-50)	43.60%	19.21%	20.37%	8.12%	4.02%	-44.07%	19.73%	20.41%	-5.64%	18.54%
BOT_(1-50)	-49.58%	-22.52%	6.65%	-16.37%	26.22%	78.70%	-71.57%	-24.30%	2.93%	-16.02%

The traditional momentum strategy does relatively well in producing a portfolio of "winners" over this period despite suffering a larger drawdown (than the S&P) in 2008. Shorting the "losers", however, despite producing a positive return in 2008, would've lost money over time, most notably in when the market rebounded in 2003 and 2009.

The efficient frontier of the "winners" and "losers" portfolios is shown below:



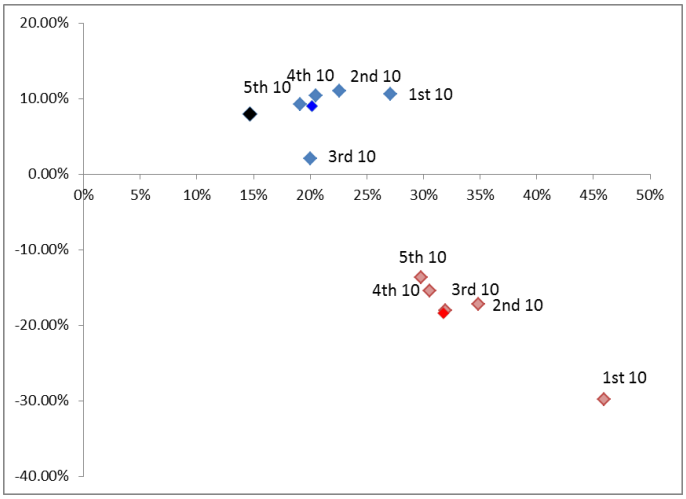
Any allocation from the "winners" portfolio to short the "losers" does dramatically reduce the volatility of a combined portfolio but at the expense of the total return. In fact, over this decade, the short "losers" portfolio performed so poorly (particularly during the market rebounds) that the cost of this "hedge" was more than it ended up being worth (up 78% in 2008).

Refining the "Losers"portfolio

Shorting a portfolio of lowest ranked momentum stocks does predictably well during periods like 2008 but suffer significantly during market rebounds as shown above. Specifically, the short portfolio of S&P "losers" shown above lost 51% in April of 2009 when the most beaten-down stocks rebounded the most sharply (for this reason, April'09 is generally known as the "momentum crash" just like August 2007 is the "quant crash").

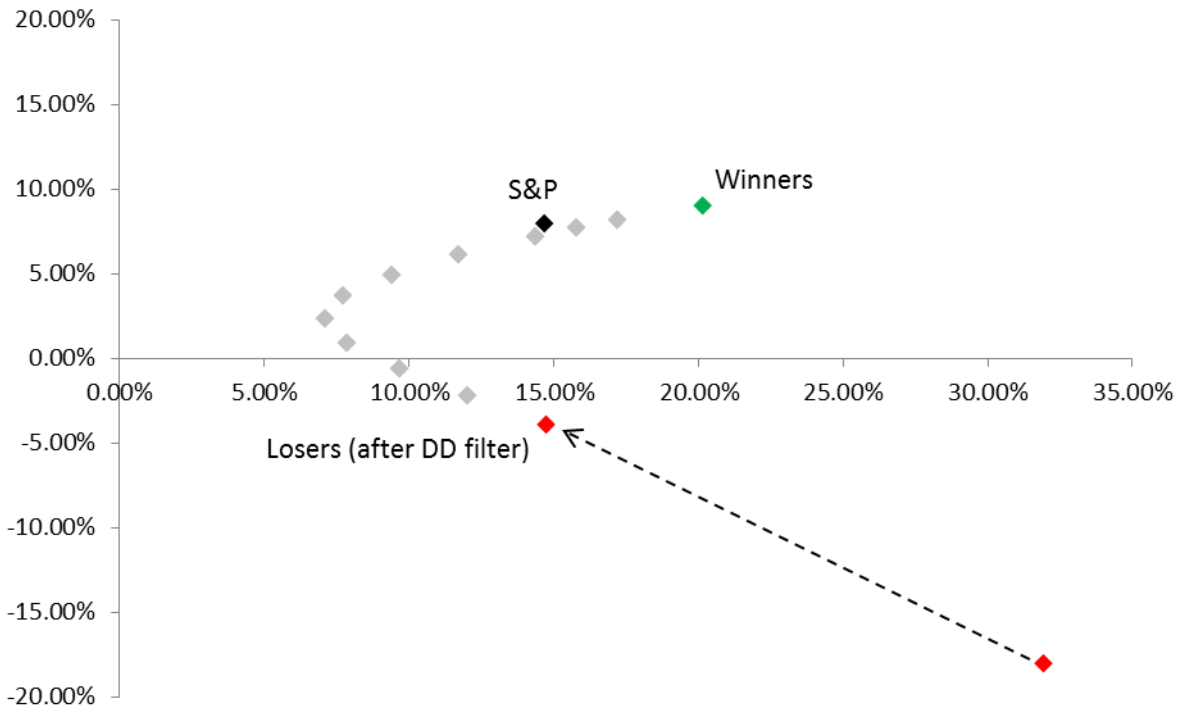
In April'09, many of the 50 stocks in the "loser" portfolio were financials (Principal Financial Group), highly levered names (such as International Paper) or stocks facing bankruptcy (Harley Davidson). As of March '09 these 50 stocks in the "losers" portfolio where trading down, on average, 87% from their highs and had an average β to the S&P 500 of 1.99.

This effect was most pronounced in the bottom 10 stocks (see below):



Two enhancements have emerged in the academic literature to address this phenomenon. The first, simply incorporates a filter when selecting the "losers" portfolio that avoids shorting any stock that is trading in a drawdown more than X%. For this analysis we simply chose 75% as a reasonable drawdown (DD) threshold with no attempt made to optimize this parameter.

Incorporating a DD filter when constructing a short "losers" portfolio substantially improves the performance of short momentum strategy yet still not enough to justify combining it with a long momentum strategy – even in small amounts:

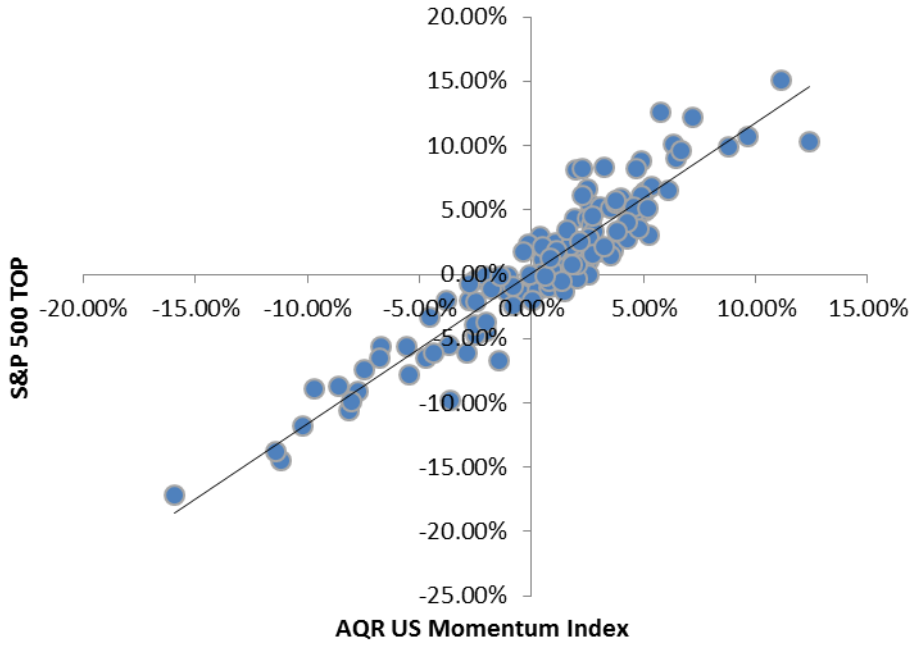


For this reason, most practitioners focus only on positive momentum.

AQR

AQR began managing long-only momentum funds based on their small-cap (AQRMOMSC), large/mid-cap (AQRMOMLC) and international (AQRMOMIL) momentum indices in 2009. In each index, AQR selects the top 33% of the stocks with the largest positive momentum over the last 12 months (excluding the most recent) and rebalances quarterly. In the case of the AQR US Momentum Index, the fund buys the top 333 stocks of the universe of 1000 large/mid-cap stocks and weights them by market capitalization.

A simple comparison of our "winners" portfolio above vs. the AQR US Momentum Index (AQRMOMLC) shows a **94%** correlation over the last decade:



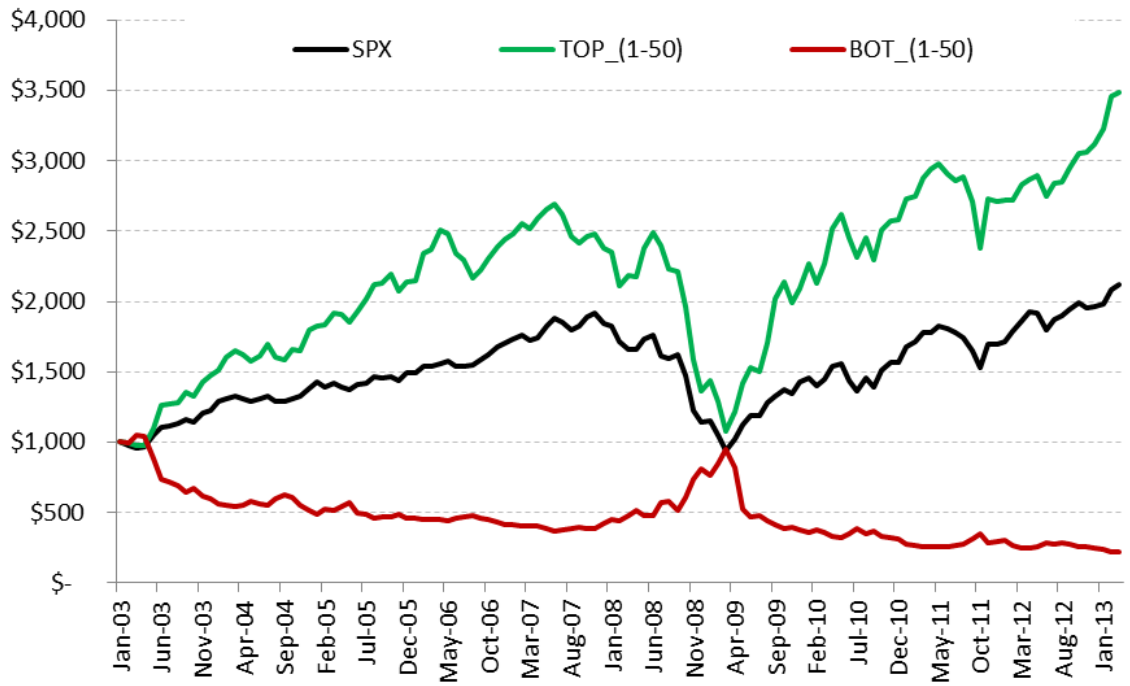
	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003
SPX	15.99%	2.09%	15.08%	26.47%	-36.99%	5.49%	15.78%	4.91%	10.87%	28.67%
AQR	15.27%	-5.00%	18.22%	14.79%	-37.01%	13.98%	9.88%	12.74%	10.06%	29.89%
TRAD_TOP_(1-50)	18.54%	-5.64%	20.41%	19.73%	-44.07%	4.02%	8.12%	20.37%	19.21%	43.60%

**since inception (July'09), the AQR Momentum fund (AMOMX) (Expense ratio of 50bps) has had a correlation of 99.3% to the AQR Momentum Index (which assumes no fees or transaction costs).*

Residual Momentum:

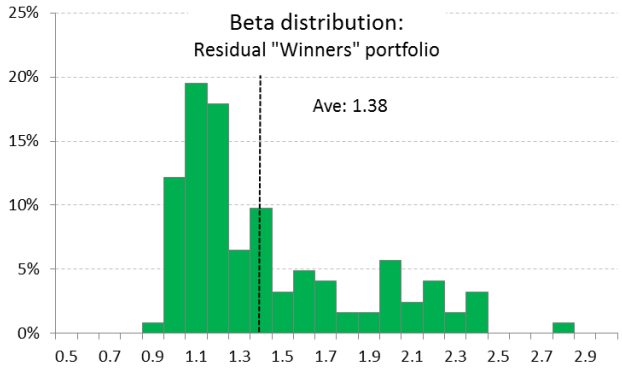
Conventional momentum strategies work well but tend to be heavily influenced by overall market moves (β). Recent research (Blitz, D., J. Huij, and M. Martens, (2011). ‚*Residual Momentum*', Journal of Empirical Finance, 18, 506-521.) has put forth a method to focus more on stock-specific momentum that is less affected by beta. Specifically, regression analysis is used to strip out the effects of the S&P 500 from each stock's returns. The stock's momentum is then calculated using only the portion of its returns that cannot be explained by a regression against the market (the residuals). These researchers find that a residual momentum strategy generates not only higher Sharpe ratios (than traditional momentum) but is also more consistent in its profitability while less affected by swings in the overall market. We have applied this methodology to the both the S&P 500 and ASX 100 and obtain similar results.

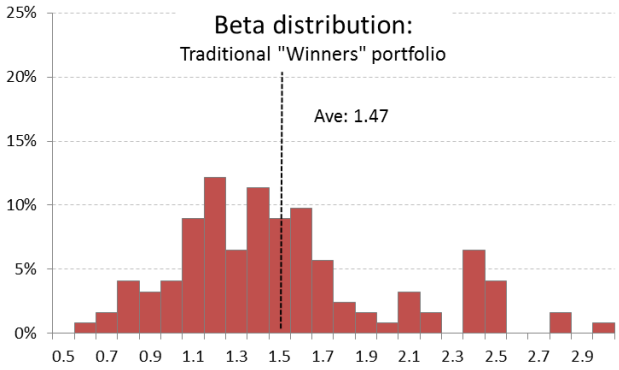
The long "winners" portfolio using "residual" momentum outperforms the conventional momentum approach in every year but 2007. The short "losers" portfolio using residual momentum still underperforms over time (except, notably in 2008) but by a smaller margin than the conventional momentum approach:



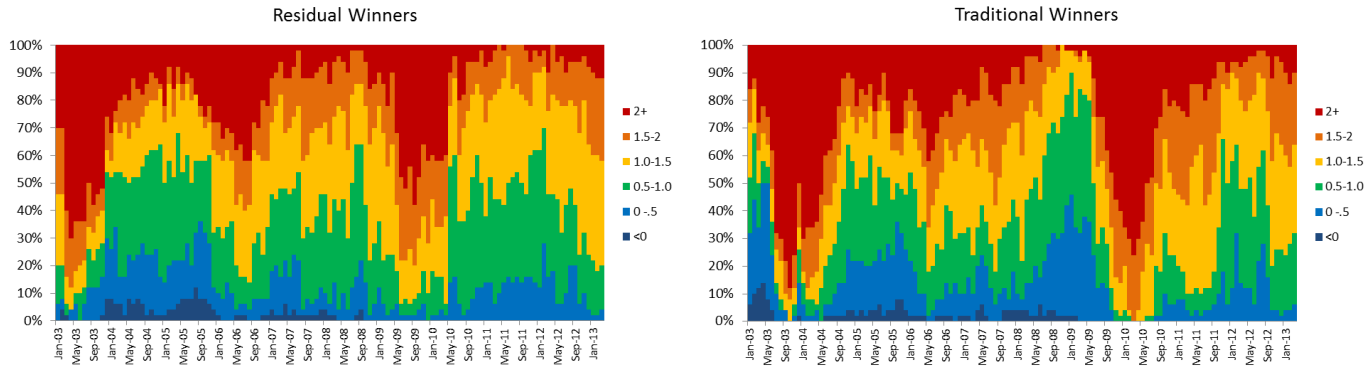
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
SPX	28.67%	10.87%	4.91%	15.78%	5.49%	-36.99%	26.47%	15.08%	2.09%	15.99%
Resid_TOP_(1-50)	51.41%	20.80%	17.36%	15.65%	-5.44%	-38.90%	57.87%	20.36%	-0.27%	18.65%
TOP_(1-50)	43.60%	19.21%	20.37%	8.12%	4.02%	-44.07%	19.73%	20.41%	-5.64%	18.54%
Resid_BOT_(1-50)	-44.26%	-12.63%	-5.81%	-9.38%	9.00%	69.19%	-53.12%	-22.29%	8.52%	-21.35%
BOT_(1-50)	-49.58%	-22.52%	6.65%	-16.37%	26.22%	78.70%	-71.57%	-24.30%	2.93%	-16.02%

As designed, the "winners" portfolio created using residual momentum not only demonstrates less beta to the S&P 500 over time but is also much less prone to having an extreme beta to the S&P 500. The large majority of the time, the beta of the residual "winners" portfolio is fairly concentrated around 1.0 (between 0.8 and 1.5) with a median beta of 1.19 vs. 1.39 for the traditional portfolio:

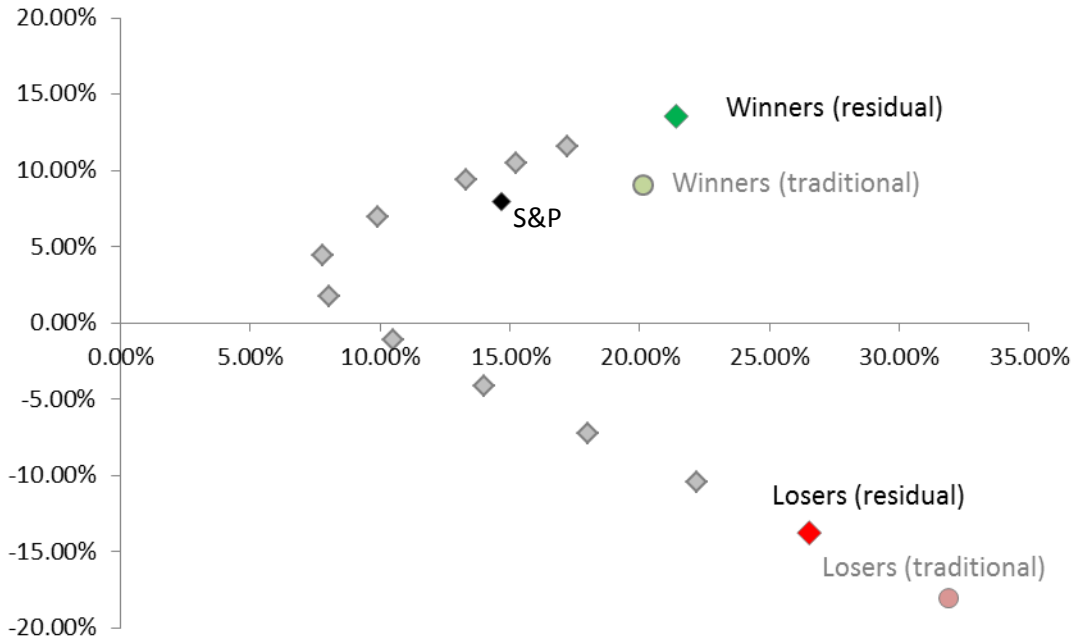




Furthermore, the beta profile of the residual "winners" is less affected by market-extremes. In both 2003 & 2008,the traditional winner's portfolio becomes overwhelmingly concentrated in very low-beta stocks (as the market's declining). Consequently, when the market rebounds (late 2003 and 2009/10), the traditional "winners" portfolio is disproportionately made up of very high-beta stocks:

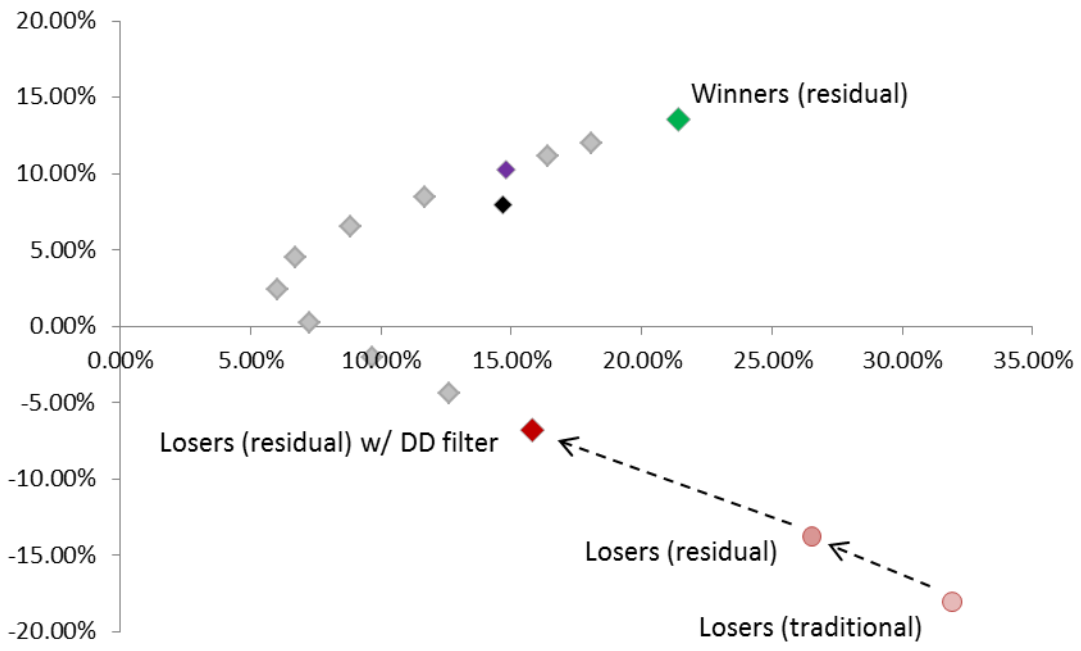


The efficient frontier of the two residual momentum portfolios is shown below (with the two traditional momentum portfolios as a reference):

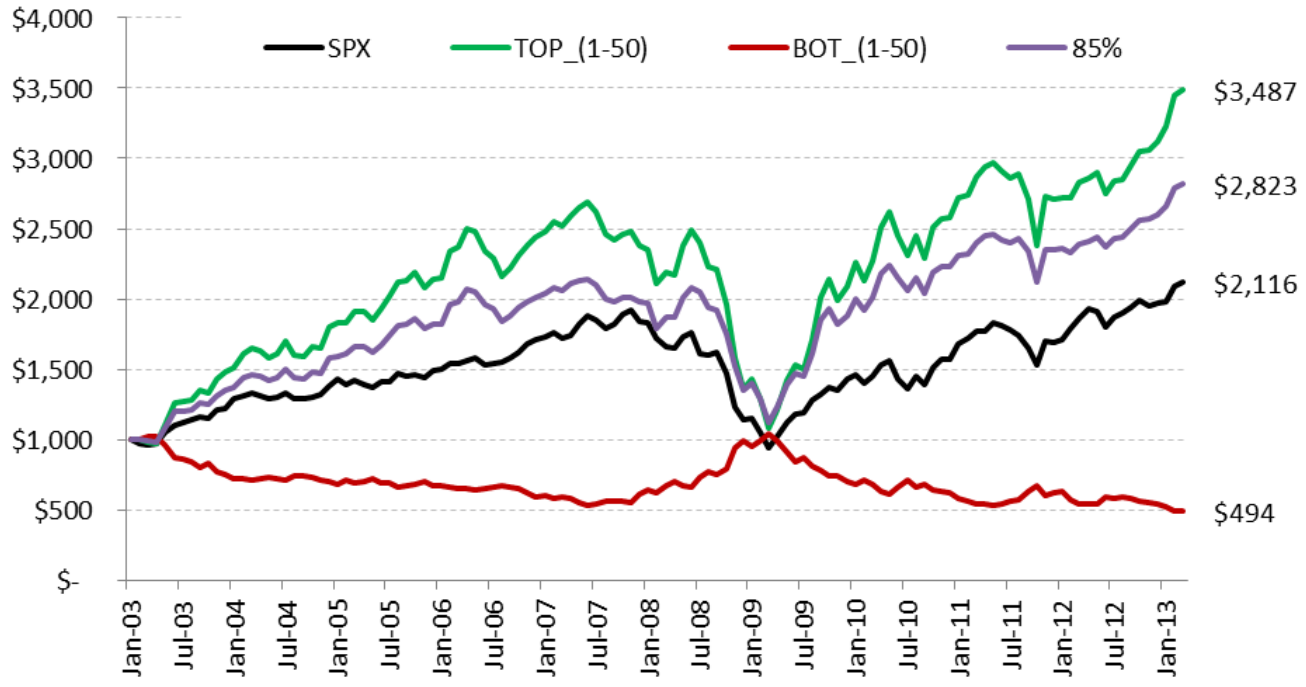


The improvement in the risk/return profiles of both the "winners" and "losers" portfolios now generates an efficient frontier that eclipses the S&P 500. Regardless, while the "losers" portfolio is less of a bad hedge, it is still very costly to implement for the significant, but, relatively short benefit in 2008. A simple long portfolio of the residual "winners" would likely be preferred over any combination with the residual "losers".

Using a drawdown filter (as shown above) when selecting the stocks for the "losers" portfolio significantly improves the risk/return profile over and above using residual momentum:



As a result, the cost of investing in the "losers" portfolio is now potentially low enough that when combined with the robust performance of the "winners" portfolio, could reduce volatility and drawdowns without sacrificing long-term performance. Specifically, an 85%/15% "winners"/"losers" portfolio has approximately the same long-term volatility of the S&P 500 Index yet outperforms it in most years (by a healthy margin) while demonstrating lower drawdowns:



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
SPX	28.67%	10.87%	4.91%	15.78%	5.49%	-36.99%	26.47%	15.08%	2.09%	15.99%
Resid_TOP_(1-50)	51.41%	20.80%	17.36%	15.65%	-5.44%	-38.90%	57.87%	20.36%	-0.27%	18.65%
Resid_BOT_(1-50)	-27.57%	-6.11%	-1.77%	-9.92%	6.63%	48.15%	-28.77%	-14.63%	8.51%	-16.26%
85%/15%	36.68%	16.63%	14.53%	11.70%	-3.42%	-28.84%	42.88%	15.49%	1.88%	13.00%

Conclusions

Momentum is a robust phenomenon and is most significant when used to create positive momentum portfolios ("winners")

Using a residual momentum measure significantly improves performance in a robust fashion

Given the broad success of traditional momentum across markets & asset-classes, a residual momentum approach would likely yield similar improvements when applied to other markets/asset classes (or at least worth exploring)