A Primer on Momentum

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1. What is Momentum?

Momentum refers to the tendency of assets that have outperformed the market in the recent past to continue outperforming in the future. In fact, momentum has been the subject of much research and discussion in the financial industry and in some cases has been shown to have the potential to generate excess returns:

1. in individual equity markets (Jegadeesh and Titman 1993),[1]
2. in foreign equity markets (Rouwenhorst 1998 and others), [2]
3. in country equity indices (Asness, Liew, and Stevens 1997), [3]
4. in global interest rate markets (Asness, Moskowitz, and Pedersen 2009),[4]
5. and in commodities (Gorton, Hayashi, and Rouwenhorst 2008).[5]

Unlike other well-documented sources of excess returns like value and size that are specific to equities, momentum can often be applied across asset classes in a uniform manner. A small allocation to momentum offers several other potential benefits as well. In addition to generating excess returns relative to a long-only benchmark, momentum strategies typically offer:

1. a low correlation to long-only sleeves of the portfolio,
2. an increasingly negative correlation to long-only sleeves during periods of market stress,
3. and positive expected returns during prolonged drawdowns in any particular asset.

2. Is Momentum an "alpha" Strategy?

Momentum is *not* an alpha strategy. The terms "alpha" and "beta" come from the Capital Asset Pricing Model (CAPM), which relates the expected return on an asset to the market return using the following equation:

$$E(r_i) - r_f = \beta\big(E(r_m) - r_f\big).$$

In words, this equation says that the expected return on asset *i* in excess of the risk-free rate r_f, $(E(r_i) - r_f)$, is proportional to the expected market excess return, $\big(E(r_m) - r_f\big)$. The relative size of the expected returns is given by the coefficient β, which is the Greek letter beta.

[1] Jegadeesh, Narasimhan and Sheridan Titman, (1993). Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency.
[2] Rouwenhorst, K. Geert, *et. al.*, (1998). International Momentum Strategies.
[3] Asness, Clifford S., John M. Liew, and Ross L. Stevens, (1997). Parallels Between the Cross-Sectional Predictability of Stock and Country Returns.
[4] Asness, Clifford S., Tobias J. Moskowitz, and Lasse H. Pedersen, (2009). Value and Momentum Everywhere.
[5] Gorton, Gary B., Fumio Hayashi, and K. Geert Rouwenhorst, (2007). The Fundamentals of Commodity Futures Returns.

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When considering an active investment strategy, the value of active management is often put into similar terms by modifying the CAPM to include a constant coefficient:

$$E(r_i) - r_f = \alpha + \beta\big(E(r_m) - r_f\big).$$

In this second version, the new constant term α is the Greek letter alpha. What this modification of the CAPM ignores is that there are myriad systematic sources of compensated risk other than "the market" to which knowledgeable managers can potentially expose a portfolio. In our view, returns in excess of the market that are generated by systematic exposure to a persistent risk factor *are not alpha*. Instead, they are "alternative betas" because they are merely returns accruing to a risk factor other than "the market."

Arbitrage Pricing Theory (APT) was developed in the 1970s to capture this phenomenon. An APT model would explain returns as a function of several factors instead of the single "market" factor included in CAPM. For example, an APT model that considers three factors would take the form:

$$E(r_i) - r_f = \alpha + \beta_1 \cdot Factor_1 + \beta_2 \cdot Factor_2 + \beta_3 \cdot Factor_3.$$

Fama and French (1992) used exactly this sort of model to demonstrate that alternative sources of risk—in this case market capitalization and value—have historically also been important drivers of potential portfolio return.[6] Fama and French use excess returns on the market portfolio as their first factor and, if they had stopped there, would have been using CAPM. Instead they also include the excess returns of small firms over large firms and inexpensive firms over expensive firms as their second and third factors.

Momentum is an alternative risk factor. One way it can be implemented is in a purely passive manner, taking equally risk-weighted positions across assets in the momentum basket with signs in accordance with the sign of the assets' momentum. Such a strategy would include no discretionary views and subjective return forecasts would never enter into the resulting portfolio weight calculations. An additional implementation strategy would be to explicitly allocate to momentum through a dedicated risk budget. In a framework where momentum receives its own risk allocation, investors may find it preferable to allow portfolio-level net short positions when the mix of long-only and momentum positions calls for it. We view removal of the long-only constraint as a key differentiator that may provide investors with portfolio stability during prolonged periods of market stress.

[6] Fama, Eugene F. and Kenneth R. French, (1992). The Cross-Section of Expected Stock Returns.

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3. Does Momentum Belong in a Traditional "beta" Product?

In general, we think that investors are best served by products that are offered in sleeves granular enough to maximize a clients' ability to customize his or her portfolio. In this case, however, a blend of risk parity and momentum may be more fruitful. This is because the vast majority of trend-following momentum strategies available today are risk-weighted in one way or another. Because of this, an investor who hires separate momentum and risk parity managers may typically face an unintended concentration risk when assets have positive momentum. This is because the momentum manager will typically have its largest positions in exactly the same assets—those with low recent volatility—as the risk parity manager. At market inflection points, such portfolios may have much sharper drawdowns than those with long-only sleeves allocated conditional on the contents of the momentum basket, as the latter strategy may significantly reduce a risk-weighted portfolio's concentration in low volatility assets.

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4. What Happens to the Portfolio when we include a Momentum Sleeve?

We simulate two risk parity strategies targeting 10% volatility: one plain vanilla and another where we allocate 20% of our risk budget to a momentum strategy. Table 1 below shows some common metrics of portfolio performance.

You can see that the standard risk parity strategy compounded at 11.7% per year with a Sharpe ratio of 0.77. It had a maximum drawdown of 29.8%, less than the 37% drawdown seen by investors in 60/40 portfolios of stocks and bonds, but still large. Contrast these results with the risk parity strategy that includes a sleeve dedicated to the momentum alternative beta, which suffered a 22% drawdown.

Adding Momentum to Risk Parity: 1990-2011[7]		
	Risk Parity	Risk Parity w/ Mom.
Excess Return	**9.0%**	**14.5%**
Annualized Volatility	**11.7%**	**11.3%**
Sharpe Ratio	**0.767**	**1.280**
Annualized Return	**11.7%**	**17.4%**
Max Drawdown	**-29.8%**	**-22.1%**

Table 1. Calculated by Salient Capital Advisors, LLC, July 2012. Notes: **Excess Returns** are the annualized geometric mean of excess returns over cash since 1990 for each strategy. **Annualized Volatility** is the annualized standard deviation of excess returns. **RoR** is the annualized geometric mean of returns including cash since 1990. Past performance is not necessarily indicative of future results. **Sharpe Ratio** represents a measure of risk-adjusted performance. **Max. Drawdown** measures the largest peak-to-trough decline of an investment over a certain time period. The **Risk Parity Portfolio** above is comprised of a blend of Equities, Credit, Interest Rates and Commodities, where the **Risk Parity w/ Mom.** portfolio also incorporates a Momentum sleeve, comprised of 51 futures contracts.

In part because of the smaller drawdowns, the risk parity strategy with momentum compounded returns at a 5.7% higher annual rate, generating a Sharpe ratio of 1.29. But the advantages provided by the allocation to momentum go beyond reduction of drawdowns. Figure 1 on the next page compares total return and drawdowns since 1990. The figure shows that the strategy with momentum outperformed in periods of relative tranquility as well as those that were difficult for the long-only strategy.[8]

[7] The data has been retrospectively calculated and did not exist prior to June 2012. Accordingly, the index performance shown for periods prior to June 2012 has been developed with the benefit of hindsight. Certain futures contracts and credit default swap instruments comprising the underlying asset classes were not available at inception of the retrospective Index performance calculation beginning in January 1990. Futures contracts unavailable at Index inception were included in the underlying asset classes as available. Credit default swaps comprising the Global Credit asset class were included beginning February 2009.

[8] Past performance is no guarantee of future results.

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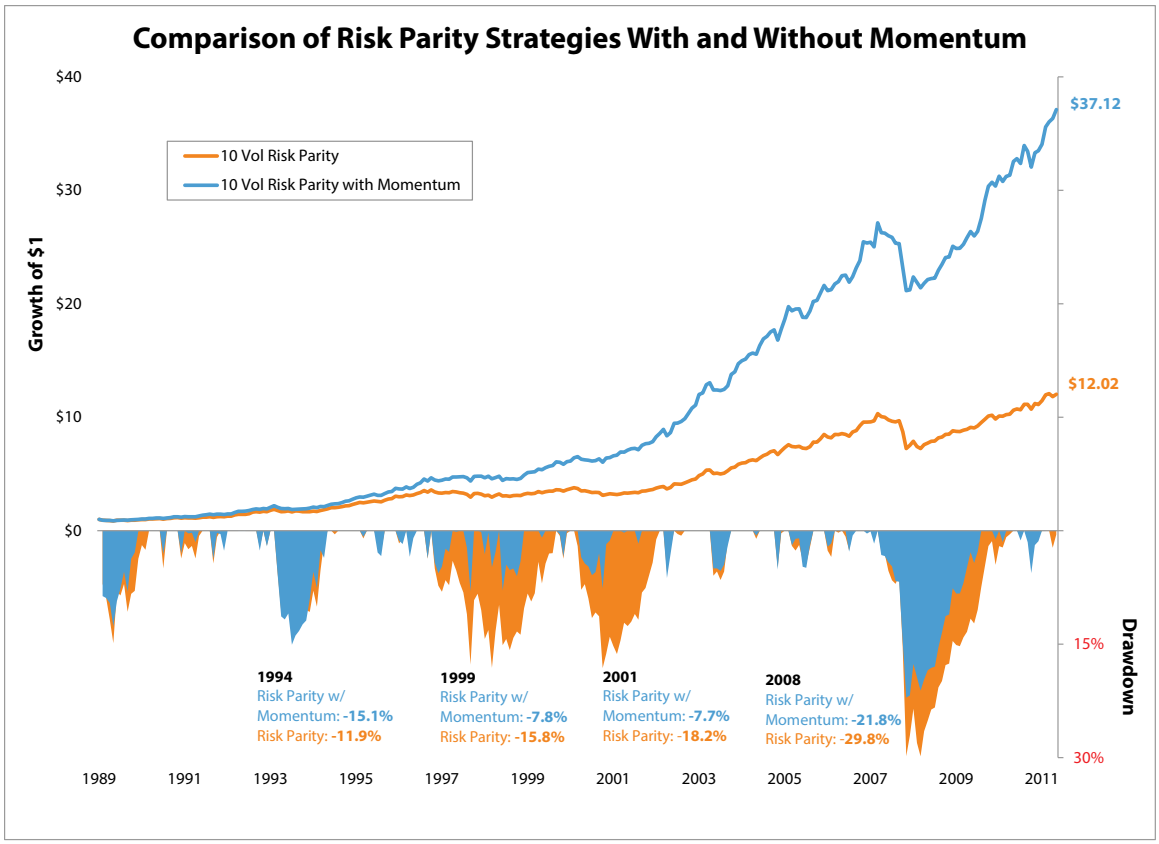

Figure 1. Notes: The figure compares the performance of risk parity strategies implemented across 51 futures and credit default swap index contracts with and without an allocation to momentum. The portfolio without momentum targets a 10% volatility and distributes expected variance equally across each of the following baskets: Equities, Commodities, Interest Rates, and Credit. The risk parity strategy that includes momentum also targets 10% volatility but spreads expected variance evenly across the same five baskets, with the fifth basket being the allocation to momentum. For illustrative purposes only. Past performance is not indicative of future results. There are special risks associated with an investment in commodities and futures, including market price fluctuations, regulatory changes, interest rate changes, credit risk, economic changes and the impact of adverse political or financial factors. Transactions in futures are speculative and carry a high degree of risk.

One final potential benefit of including an allocation to momentum accrues because of the assets typically used to implement risk parity strategies. In particular, risk parity strategies generally access commodity markets through futures markets. These markets can, at times, impose a significant carry cost on commodity investors. The inclusion of a momentum basket systematically tilts commodity allocations away from assets with large carry costs and toward commodities with smaller carry costs and/or large positive price momentum. Investors may benefit from this as it allows them to position their portfolio exposures in the most liquid portion of the futures markets while seeking to keep cost of carry in their commodity allocations at potentially reasonable levels.

Please note that the returns presented in Figure 1 and Table 2 on the next page are the result of a hypothetical investment framework. Backtested performance is NOT an indicator of future actual results and do the results above do NOT represent returns that any investor actually attained. Backtested results are calculated by the retroactive application of a model constructed on the basis of historical data and based on assumptions integral to the model which may or may not be testable and are subject to losses. Certain assumptions have been made for modeling purposes and are unlikely to be realized. No representations and warranties are made as to the reasonableness of the assumptions. Changes in these assumptions may have a material impact on the backtested returns presented. This information is provided for illustrative purposes only. Backtested performance is developed with the benefit of hindsight and has inherent limitations. Specifically, backtested results do not reflect actual trading or the effect of material economic and market factors on the decision-making process. Since trades have not actually been executed, results may have under- or over-compensated for the impact, if any, of certain market factors, such as lack of liquidity, and may not reflect the impact that certain economic or market factors may have had on the decision-making process. Further, backtesting allows the security selection methodology to be adjusted until past returns are maximized. Actual performance may differ significantly from backtested performance. Backtested results are adjusted to reflect the reinvestment of dividends and other income. The above backtested results are do not include the effect of backtested transaction costs, management fees, performance fees or expenses, if applicable. No cash balance or cash flow is included in the calculation.

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5. Risk Parity through the Style Analysis Lens

Style analysis is a convenient way to compare strategies across managers. Using linear regression, it tries to identify the primary drivers of a strategy's returns by putting a manager's returns in terms of the benchmarks they most resemble. Here we will use style analysis to compare our risk parity strategies with and without momentum.

Note that we express our factor set a little bit differently from the norm. We view our factors as falling into three baskets: primary, secondary, and alternative. Our primary factors (Treasuries, US Large Cap Equities, Commodities, and Foreign Currency) are included as they are. Our secondary factors (High Yield, US Small Cap, Developed Ex US, and EM Equity) are then stripped of their exposure to the primary factors and included in the factor set; for example, our high yield factor is the residual from a regression of HY on the first four factors. Our alternative factors are then stripped of exposure to the primary and secondary factors and included in the factor set. This process reduces the multicollinearity among our factors, which we believe improves the precision of our coefficient estimates without diminishing the information content of the data.

Table 2 below shows the results of a style analysis performed on the two risk parity strategies discussed above. Comparing the first and second rows of the table, inclusion of momentum does not fundamentally change the factor loadings of our risk parity strategy. On average, the loadings on the long-only factors fall moderately, just as we would expect given we are reallocating a portion of our risk budget to momentum. This reduction is then offset by a large positive loading on the momentum alternative beta factor. We are unable to identify a statistically significant loading on high yield bonds, likely because credit entered our risk parity simulations in 2009 due to limitations in the availability of data.

Style Analysis: Adding Momentum to Risk Parity													
FUND	R^2	α	BXIIUS10	SP	CCI	DXY	HY	Dev Ex US	EM	HFRI Macro	HFRI Relative Value	HFRI Event-Driven	Barcap CTA
Generic Risk Parity	0.79	0.06%	0.85	0.34	0.35	0.00	0.00	0.34	0.21	0.00	0.00	0.00	0.00
Risk Parity + Momentum	0.66	0.66%	0.66	0.25	0.28	0.00	0.00	0.31	0.28	0.00	0.00	0.00	0.31

Table 2. Notes: For illustrative purposes only. Past performance is not necessarily indicative of future results. The column headings in blue are for government issued bonds called US Treasuries (BXIIUS10), equities with a market capitalization value of more than $10 billion called US Large Cap Equity (SP), raw materials that can be bought and sold called Commodities (CCI), the measure of the value of the U.S. dollar relative to the other major currencies called the US Dollar Index (DXY), high paying bonds with lower credit ratings than investment-grade corporate bonds, Treasury bonds or municipal bonds called High Yield Bonds (HY), a mirror of the investable universe of companies in developed countries outside the US called Developed non-US Equity (Dev Ex US), an index designed to measure the equity market performance of emerging markets called Emerging Market Equity (EM), an index designed to measure hedge fund strategies that base their investment process on the movements in underlying economic variables and their impacts on other investment vehicles called HFRI Macro Hedge Fund Index (HFRI Macro), an index designed to measure strategies with an investment thesis predicated on realization of a valuation discrepancy in the relationship between multiple securities called HFRI Relative Value Hedge Fund Index (HFRI Relative Value), an index designed to measure the strategies of investment managers who maintain positions in companies currently or prospectively involved in corporate transactions called HFRI Event-Driven Hedge Fund Index (HFRI Event-Driven), and an an unweighted index that measures the composite performance of established programs. For purposes of this index, an established trading program is a trading program that has four years or more documented performance history called the Barclay Capital CTA Index (Barcap CTA). The first four columns—treasuries, US Large Cap, Commodities, and DXY—are included as monthly returns. The remaining factors are included after accounting for and removing their exposure to the first four factors, thus their loadings are on the factor's spread to the first four factors. Index performance does not reflect the deduction of fees or expenses. Note that an investor cannot invest directly in an index.

6. Conclusion

It is our experience that loadings on alternative beta factors are fairly common among risk parity providers. The methodology described in this white paper, wherein alternative sources of return are allocated a dedicated risk budget brings the use of these approaches out into the open, rather than obscuring them behind a generic label like "tactical overlay." We believe momentum is a form of alternative beta that can be successfully incorporated into a global asset allocation like risk parity because it can be applied uniformly across asset classes. This analysis attempts to explain why a unified portfolio construction methodology that allows for interaction between the long-only and momentum allocations offers the potential to reduce the likelihood of duplicative exposure when volatility spikes.

Using simulated risk parity strategies, this analysis shows momentum has a low correlation to long-only risk parity strategies and that a 20% risk allocation to momentum offers the potential to improve portfolio performance and increase the Sharpe ratio from 0.77 to 1.28.

Lastly, we use style analysis to illustrate that an allocation to momentum, according to our methodology, does not fundamentally change the risk-balanced nature of our risk parity strategy; instead it increases the number of compensated risk factors driving portfolio returns. This is demonstrated in slightly lower loadings on traditional market factors and a moderate loading on the momentum (CTA) risk factor.

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