Absolute Momentum: A Simple Rule-Based Strategy and Universal Trend-Following Overlay

Gary Antonacci

Portfolio Management Consultants[1]

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Abstract

There is a considerable body of research on relative strength price momentum but much less on absolute momentum, also known as time series momentum.[2] In this paper, we explore the practical side of absolute momentum. We first explore its sole parameter - the formation, or look back, period. We then examine the reward, risk, and correlation characteristics of absolute momentum applied to stocks, bonds, and real assets. We finally apply absolute momentum to a 60/40 stock/bond portfolio and a simple risk parity portfolio. We show that absolute momentum can effectively identify regime change and add significant value as an easy-to-implement, rule-based approach with many potential uses as both a stand- alone program and trend-following overlay.

[1] http://optimalmomentum.com

[2] We prefer the term absolute momentum because all momentum is based on time series, and practitioners are used to hearing about relative and absolute returns. Relative and absolute momentum follows the same logic.

1. Introduction

The momentum effect is one of the strongest and most pervasive financial phenomena (Jegadeesh and Titman (1993), (2001)). Researchers have verified its value with many different asset classes, as well as across groups of assets (Blitz and Van Vliet (2008), Asness, Moskowitz and Pedersen (2012)). Since its publication, relative strength momentum has held up out-of-sample going forward in time (Grundy and Martin (2001), Asness et al (2012)) and back to the year 1801 (Geczy and Samonov (2012)).

In addition to relative strength momentum, in which an asset's performance relative to its peers predicts its future relative performance, momentum also works well on an absolute or time series basis in which an asset's own past return predicts its future performance. In absolute momentum, we look only at an asset's excess return over a given look back period. In absolute momentum, there is significant positive auto-covariance between an asset's return in the following month and its past one-year excess return (Moskowitz, Ooi and Pedersen (2012)).

Absolute momentum is therefore trend following by nature. Trend-following methods, in general, have slowly achieved recognition and acceptance in the academic community (Brock, Lakonishok and LeBaron (1992), Lo, Mamaysky, and Wang (2000), Zhu and Zhou (2009), Han, Yang, and Zhou (2011)).

Absolute momentum appears to be just as robust and universally applicable as relative momentum. It performs well in extreme market environments, across multiple asset classes (commodities, equity indexes, bond markets, currency pairs), and back in time to the turn of the century (Hurst, Ooi, and Pedersen (2012)).

Despite an abundance of momentum research over the past 20 years, no one is sure why it works. Brown and Jennings (1989) developed a rational equilibrium-based model using historical

prices with technical analysis. More recently, Zhou and Zhu (2014) identified equilibrium returns due to the risk sharing function provided by trend following trading rules, such as absolute momentum.

The most common explanations for both momentum and trend-following profits, however, have to do with behavioral factors, such as anchoring, herding, and the disposition effect (Tversky and Kahneman (1974), Barberis, Shleifer, and Vishny (1998), Daniel, Hirshleifer, and Subrahmanyam (1998), Hong and Stein (1999), Frazzini (2006)).

In anchoring, investors are slow to react to new information, which leads initially to under-reaction. In herding, buying begets more buying and causes prices to over react and move beyond fundamental value after the initial under-reaction. Through the disposition effect, investors sell winners too soon and hold losers too long. This creates a headwind making trends continue longer before reaching true value.

Risk management schemes that sell in down markets and buy in up markets can also cause trends to persist (Garleanu and Pedersen (2007)), as can confirmation bias, which causes investors to look at recent price moves as representative of the future. This then leads them to move money into investments that have recently appreciated, thus causing trends to continue further (Tversky and Kahneman (1974)). Behavioral biases are deeply rooted, which may explain why momentum profits have persisted and may continue to persist.

In this paper, we focus on absolute momentum because of its simplicity and the advantages it holds for long-only investing. We can apply absolute momentum to any asset or portfolio of assets without losing any of the contributory value of other assets. With relative strength momentum, on the other hand, we exclude or reduce the influence of some assets from

the active portfolio. This can diminish the benefits that come from multi-asset diversification and lead to opportunity loss by excluding lagging assets that may suddenly start outperforming.

The second advantage of absolute momentum is its superior ability to reduce downside volatility by identifying regime change. Both relative and absolute momentum can enhance return, but absolute momentum, unlike relative momentum, is also effective in reducing the downside exposure associated with long-only investing (Antonacci (2012)).

The next section of this paper describes our data and the methodology we use to work with absolute momentum. The following section explores the formation period used for determining absolute momentum. After that, we show what effect absolute momentum has on the reward, risk, and correlation characteristics of a number of diverse markets, compared to a buy and hold approach. Finally, we apply absolute momentum to two representative multi-asset portfolios -- a 60/40 balanced stock/bond portfolio and a simple, diversified risk parity portfolio.

2. Data and Methodology

All monthly data begins in January 1973, unless otherwise noted, and includes interest and dividends. For equities, we use the MSCI (Morgan Stanley Capital International) US and MSCI EAFE (Europe, Australia, and Far East) indexes. These are free float adjusted market capitalization weightings of large and midcap stocks. For fixed income, we use the Barclays Capital Long U.S. Treasury, Intermediate U.S. Treasury, U.S. Credit, U.S. High Yield Corporate, U.S. Government & Credit, and U.S. Aggregate Bond indexes. The beginning date of the high yield index is July 1, 1983, and the start date of the aggregate bond index is January 1, 1976. For dates prior to January 1976, we substitute the Government & Credit index for the Aggregate Bond index, since they track one another closely. For Treasury bills, we use the monthly returns on 90-day U.S. Treasury bill holdings. For real assets, we use the FTSE NAREIT U.S. Real

Estate index, the Standard &Poor's GSCI (formally Goldman Sachs Commodity Index), and monthly gold returns based on the month-end closing London PM gold fix.

Although there are more complicated methods for determining absolute momentum (Baltas and Kosowski (2012)), our strategy simply defines absolute momentum as being positive when the excess return (asset return less the Treasury bill return) over the formation (look back) period is positive. We hold a long position in our selected assets during these times. When absolute momentum turns negative (i.e., an asset's excess return turns negative), our baseline strategy is to exit the asset and switch into 90-day U.S. Treasury bills until absolute momentum again becomes positive. Treasury bills are a safe harbor for us during times of market stress.

We reevaluate and adjust positions monthly.[3] The number of transactions per year into or out of Treasury bills ranges from a low of 0.33 for REITs to a high of 1.08 for high-yield bonds. We deduct 20 basis points for transaction costs for each switch into or out of Treasury bills.[4] Maximum drawdown is the greatest peak-to-valley equity erosion on a month-end basis.

3. Formation Period

Table 1 shows the Sharpe ratios for formation periods ranging from 2 to 18 months. Since our data begins in January 1973 (except for high yield bonds, which begin in July 1983) and 18 months is the maximum formation period that we consider, results extend from July 1974 through December 2012. We have highlighted the highest Sharpe ratios for each asset.
Best results cluster at 12 months. As a check on this, we segment our data into subsamples and find the highest Sharpe ratios for each asset in every decade from 1974 through 2012.

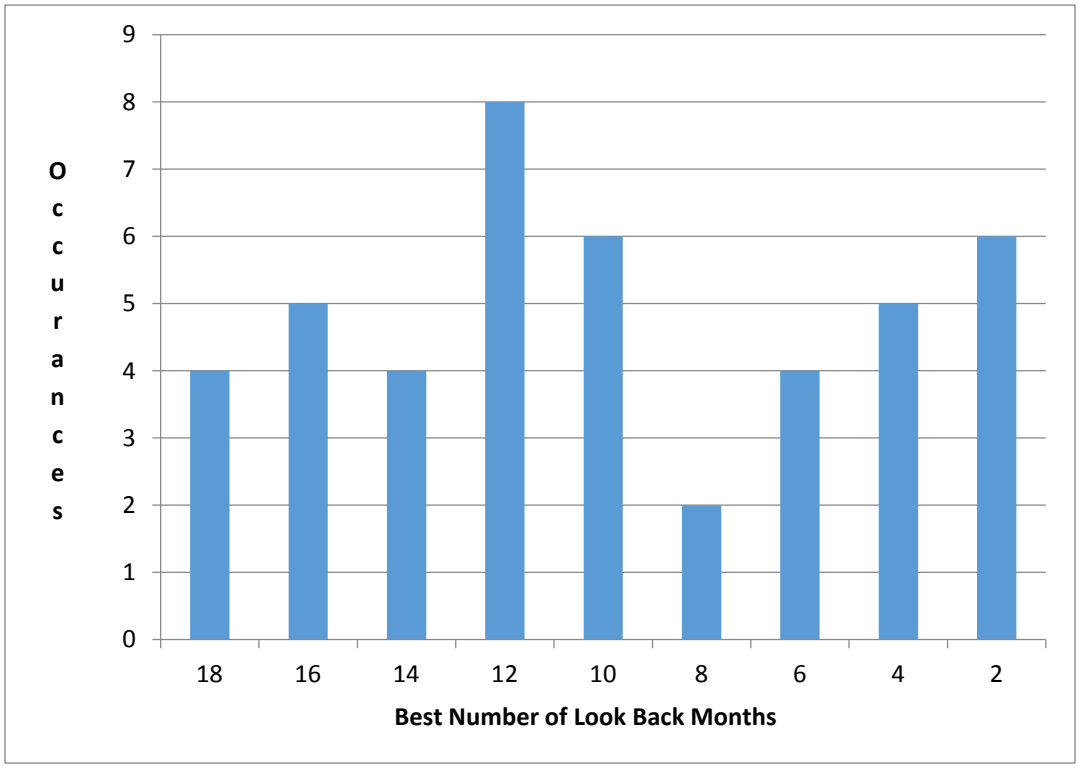
[3] Stock market indices and other assets are less subject to liquidity and microstructure issues than individual stocks, so we do not need to skip a month with our look back periods.
[4] There are no transaction costs deducted for monthly rebalancing of the momentum or any of the benchmark portfolios.

Figure 1 shows the number of times the Sharpe ratio is highest, or within two percentage points of being highest, for each look back period across all the decades.

Table 1 Formation Period Sharpe Ratios

	18	16	14	12	10	8	6	4	2
MSCI US	.41	.43	.45	.56	.46	.44	.41	.38	.23
EAFE	.33	.32	.35	.41	.45	.32	.38	.36	.46
TBOND	.40	.42	.45	.54	.38	.36	.33	.42	.40
CREDIT	.75	.80	.70	.74	.80	.81	.69	.71	.66
HI YLD	.70	.87	.82	.92	.66	.69	.82	.77	.77
REIT	.65	.71	.72	.69	.63	.63	.87	.68	.63
GSCI	.04	.04	.09	.20	.09	-.08	-.11	.13	.06
GOLD	.39	.35	.35	.42	.39	.37	.32	.30	.21

Figure 1 Best Formation Periods 1974-2012



Both our aggregated and segmented results coincide with the best formation periods of relative momentum, which extend from 3 to 12 months and cluster at 12 months (Jegadeesh and

Titman (1993)).[5] Many momentum research papers use a 12-month formation period with a one-month holding period as a benchmark strategy for research purposes. Given its dominance here and throughout the literature, we also use a 12-month formation period as our benchmark strategy. This should minimize transaction costs and the risk of data snooping.

4. Absolute Momentum Characteristics

Table 2 is a performance summary of each asset and the median of all the assets, with and without 12-month absolute momentum, from January 1974 through December 2012.

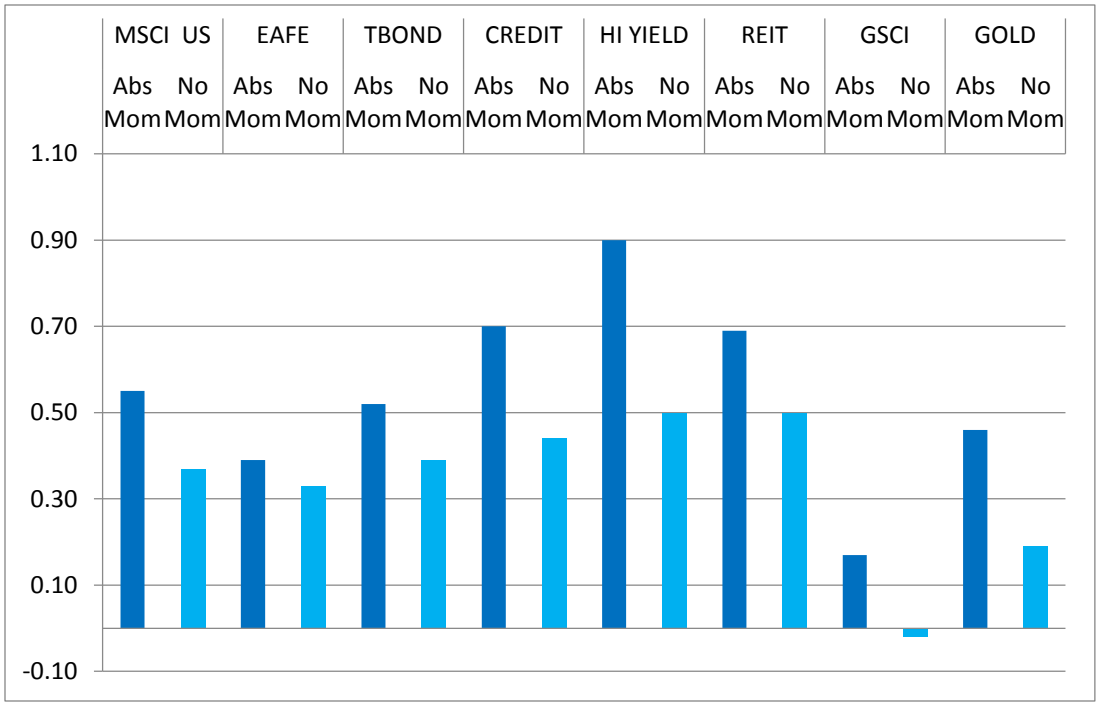
Table 2 Absolute Momentum Results 1974-2012

	Annual Return	Annual Std Dev	Annual Sharpe	Maximum Drawdown	% Profit Months
MSCI US Abs Mom	12.26	11.57	.55	-22.90	75
MSCI US No Mom	11.62	15.74	.37	-50.65	61
EAFE Abs Mom	10.39	11.82	.39	-25.14	78
EAFE No Mom	11.56	17.53	.33	-56.40	60
TBOND Abs Mom	10.08	8.43	.52	-12.92	77
TBOND No Mom	9.74	10.54	.39	-20.08	61
CREDIT Abs Mom	8.91	4.72	.70	-8.70	82
CREDIT No Mom	8.77	7.18	.44	-19.26	67
HI YLD Abs Mom	9.97	4.76	.90	-7.14	88
HI YLD No Mom	10.05	8.70	.50	-33.31	75
REIT Abs Mom	14.16	11.74	.69	-19.97	75
REIT No Mom	14.74	17.25	.50	-68.30	62
GSCI Abs Mom	8.24	15.46	.17	-48.93	81
GSCI No Mom	4.93	19.96	-.02	-61.03	54
GOLD Abs Mom	13.68	16.62	.46	-24.78	81
GOLD No Mom	9.44	19.97	.19	-61.78	53
MEDIAN Abs Mom	10.25	11.66	.53	-21.43	79
MEDIAN No Mom	9.90	16.48	.38	-53.53	61

[5] Cowles and Jones (1937) were the first to point out the profitable look back period of 12 months using U.S. stock market data from 1920 through 1935. Moskowitz et al (2012) also found a 12-month look back period best when applying absolute momentum to 58 liquid futures markets from 1965 through 2009.

Figure 2 shows the Sharpe ratios and percentage of profitable months for these assets, with and without 12-month absolute momentum. Figure 3 presents the percentage of profitable months, and Figure 4 shows maximum monthly drawdown. Every asset has a higher Sharpe ratio, lower maximum drawdown, and higher percentage of profitable months with 12-absolute momentum over this 38-year period.[6]

Figure 2 Asset Sharpe Ratios 1974-2012



[6] The percentage of months each asset has positive absolute momentum: MSCI US 72%, MSCI EAFE 65%, TBOND 66%, CREDIT 56%, HI YIELD 68%, REIT 78%, GSCI 50%, and GOLD 53%.

Figure 3 Percentage of Profitable Months 1974-2012

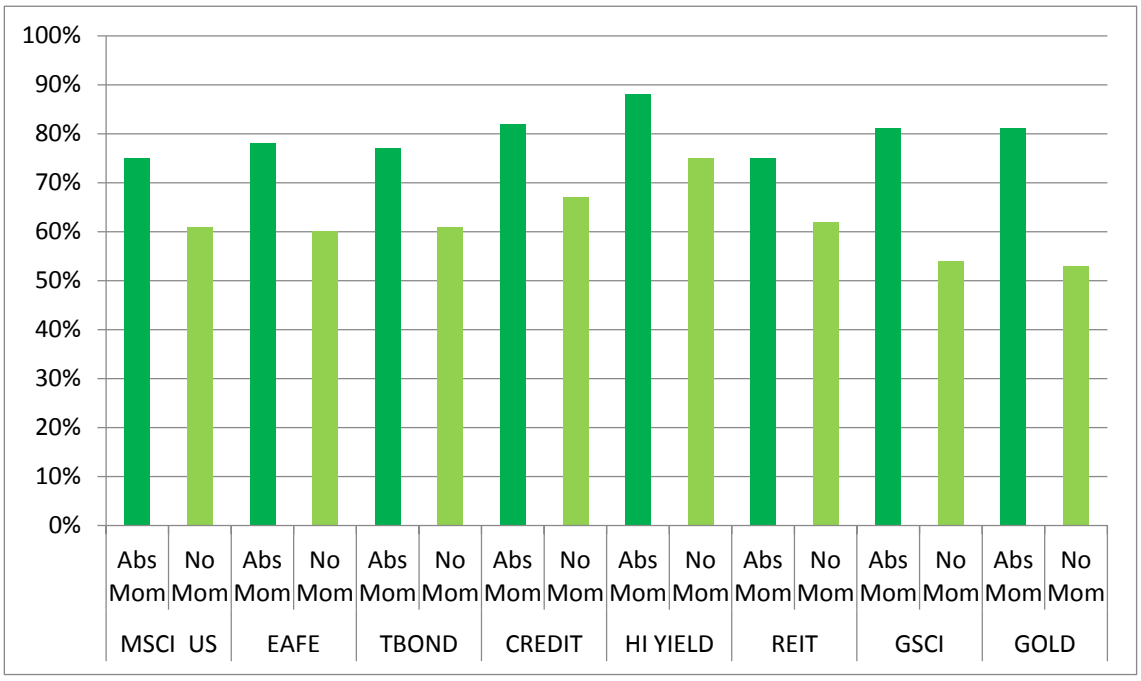


Figure 4 Maximum Monthly Drawdown 1974-2012

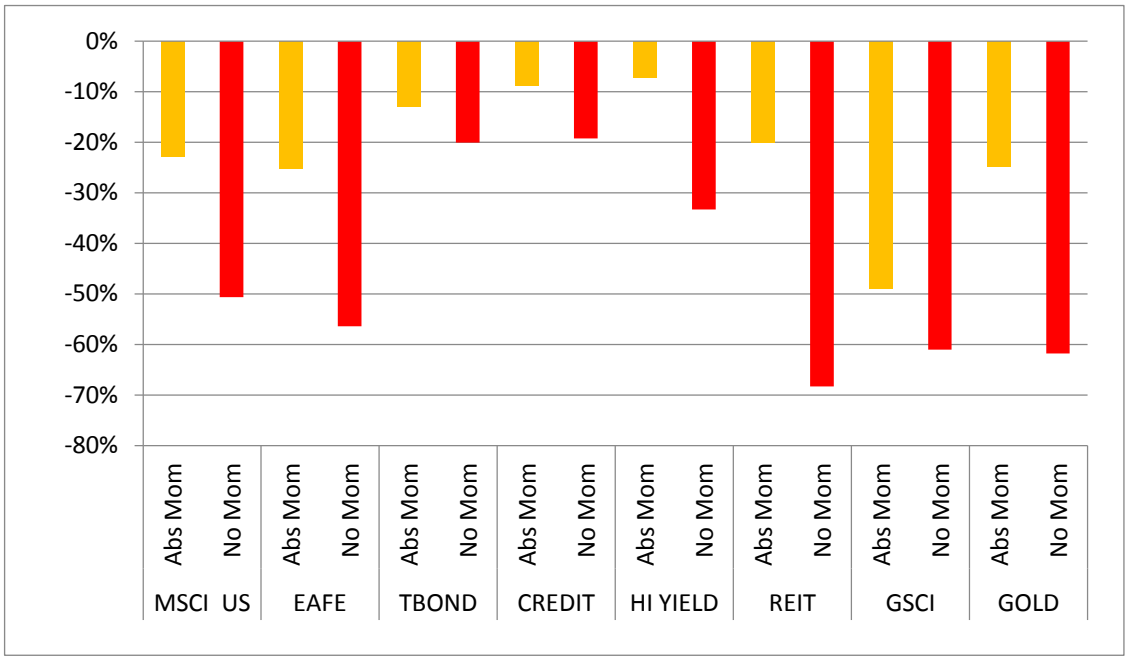


Table 3 shows the monthly correlations between our assets, with and without the application of absolute momentum. The average correlation of the eight assets without absolute momentum is 0.22, and with absolute momentum, it is 0.21. There is no indication from our data that absolute momentum, in general, increases correlation. This has positive implications for applying absolute momentum to multi-asset portfolios, which we look at next.

Table 3 Monthly Correlations 1974-2012

No Momentum							
	EAFE	TBOND	CREDIT	HI YLD	REIT	GSCI	GOLD
MSCI US	.63	.11	.26	.43	.58	.10	.01
EAFE		.03	.12	.37	.48	.18	.19
TBOND			.67	.12	.05	-.10	.01
CREDIT				.40	.15	.04	-.02
HI YLD					.32	.07	-.04
REIT						.11	.07
GSCI							.27
w/ 12-Month Absolute Momentum							
	EAFE	TBOND	CREDIT	HI YLD	REIT	GSCI	GOLD
MSCI US	.49	.05	.35	.45	.45	.14	.04
EAFE		.03	.26	.31	.29	.13	.11
TBOND			.81	.04	-.03	-.04	-.02
CREDIT				.38	.28	-.01	.05
HI YLD					.41	.09	.02
REIT						.13	.12
GSCI							.30

Figures 5 through 12 are log-scale growth charts of each asset with a starting value of 100.

Figure 5 MSCI US 1974-2012

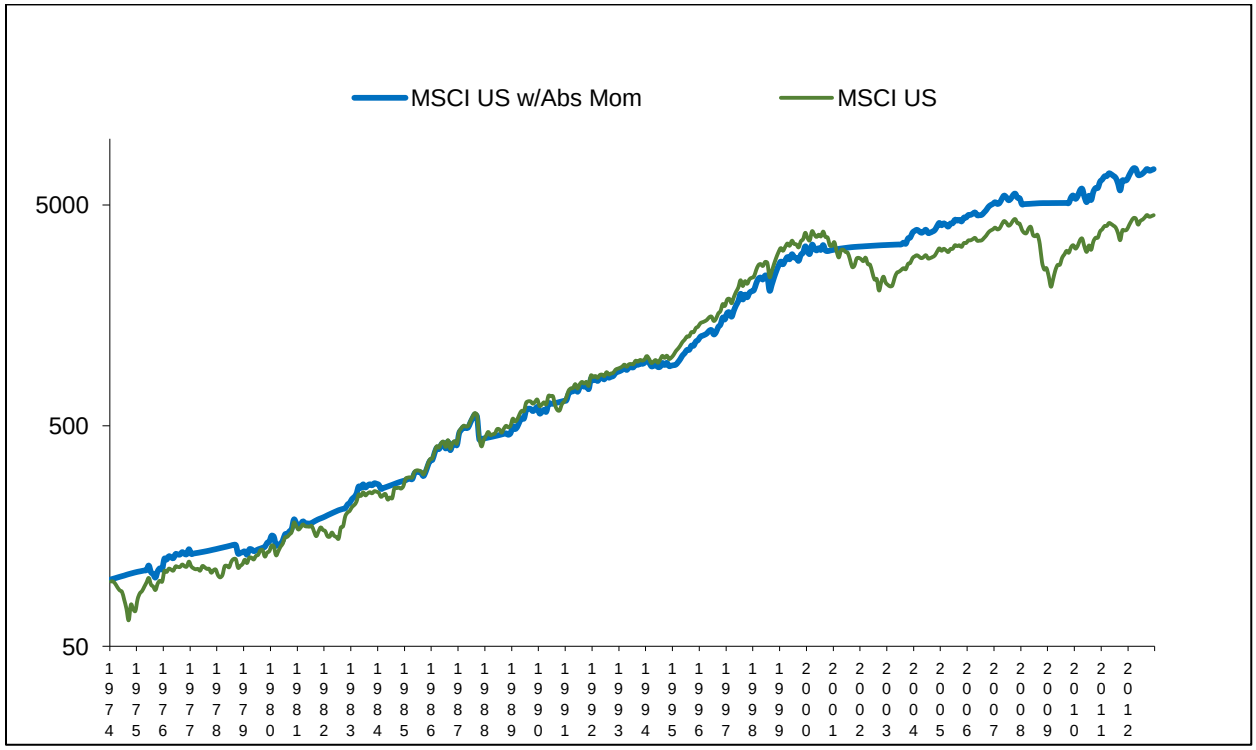


Figure 6 MSCI EAFE 1974-2012

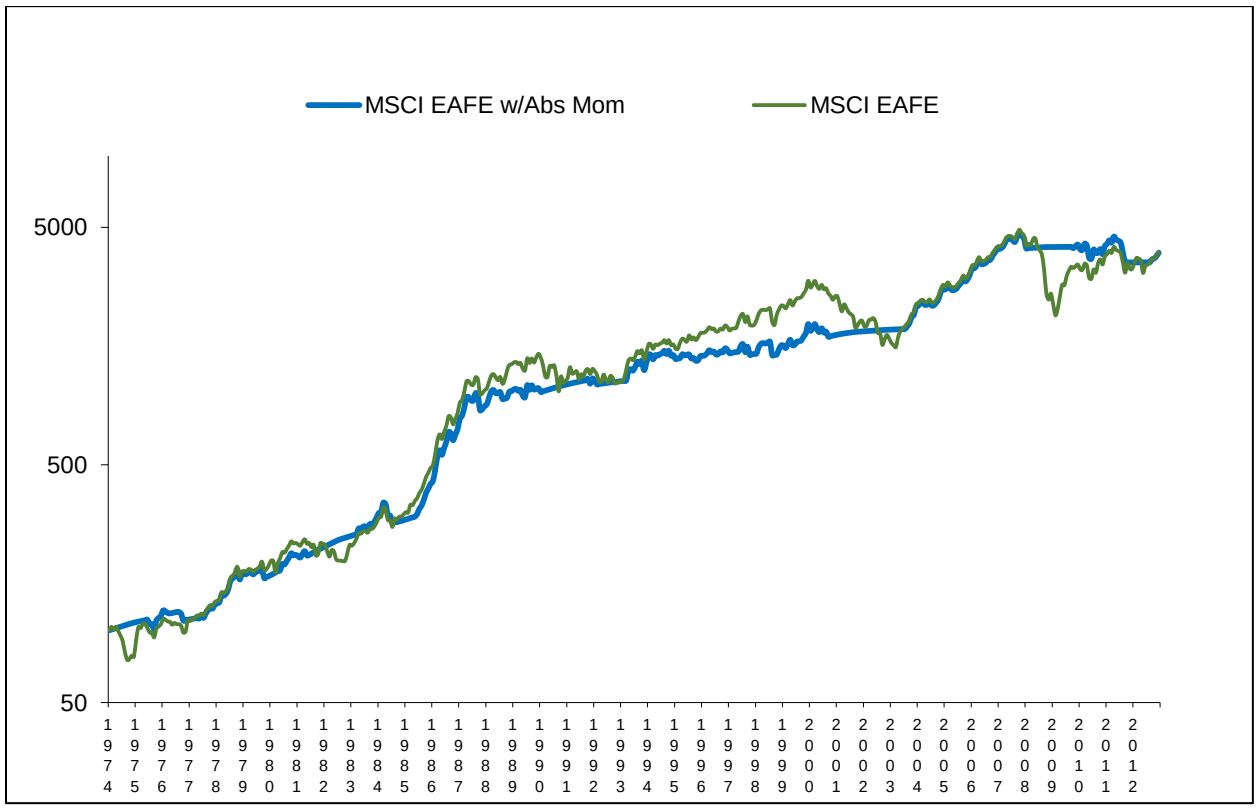


Figure 7 U.S. Treasury Bonds 1974-2012

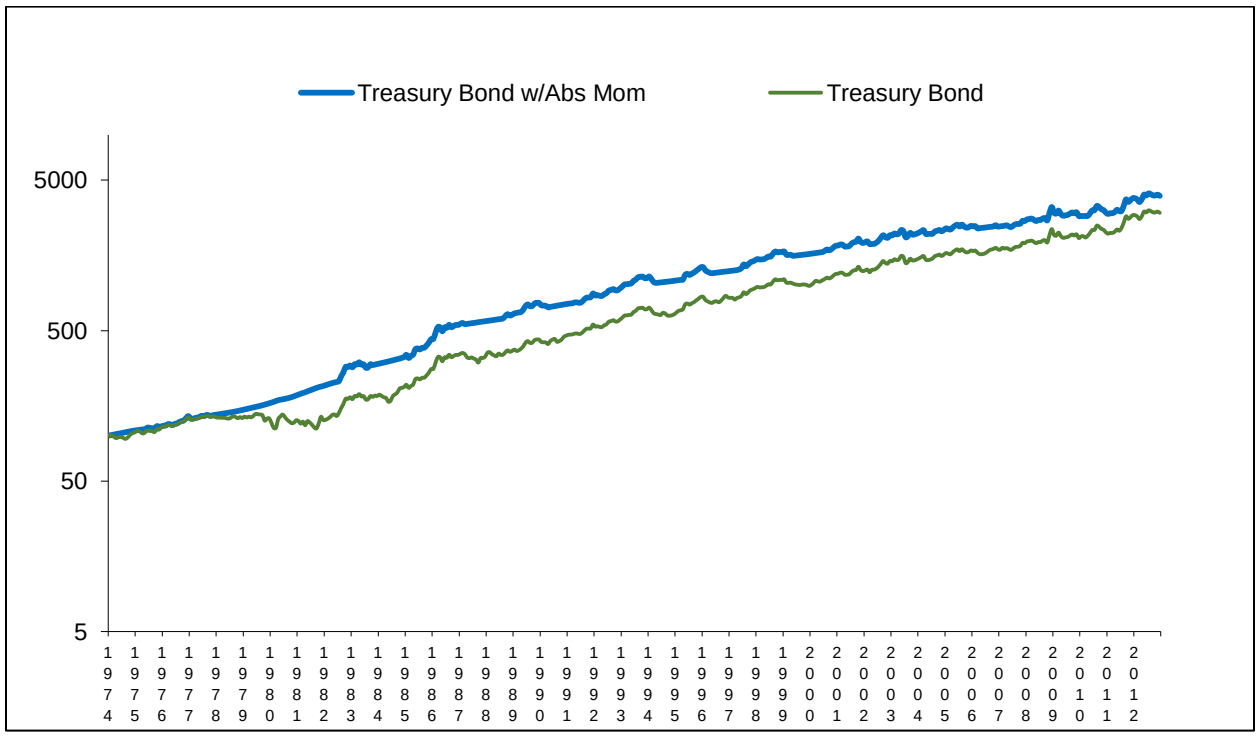


Figure 8 U.S. Credit Bonds 1974-2012

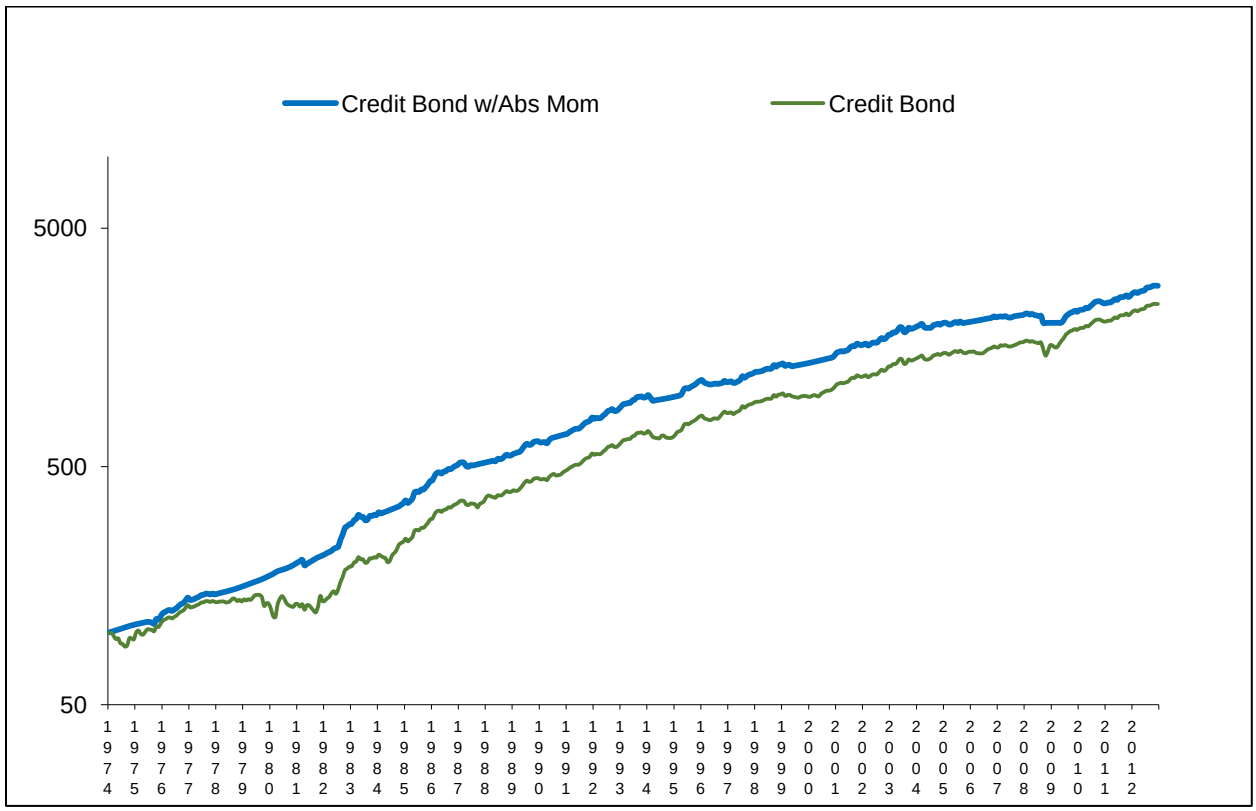


Figure 9 U.S. High Yield Bonds 1984-2012

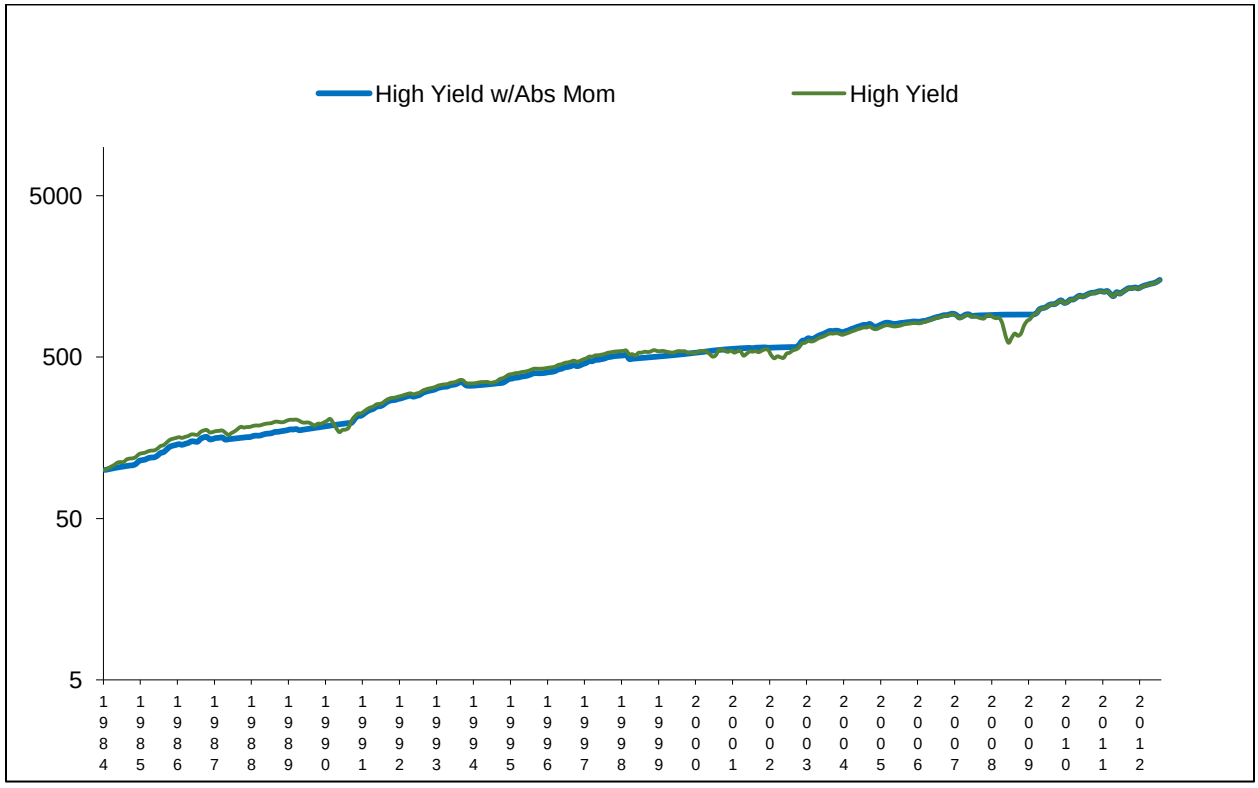


Figure 10 U.S. REITs 1974-2012

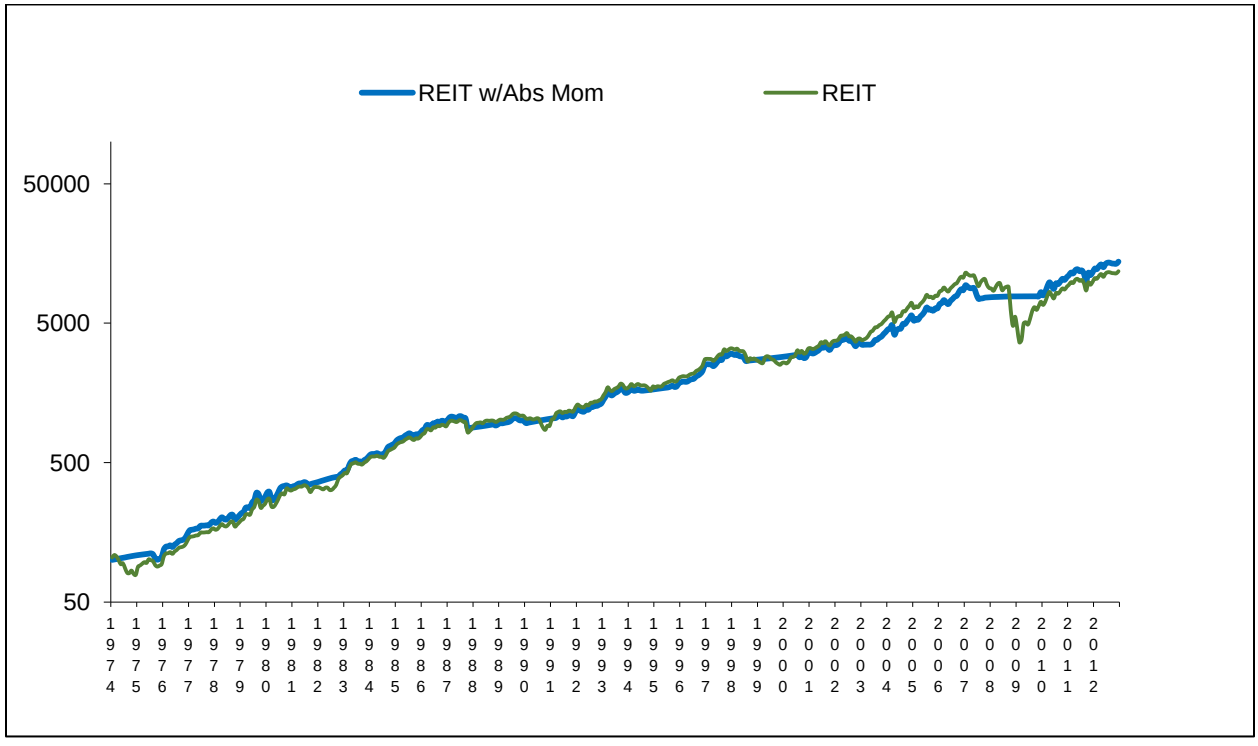


Figure 11 S&P GSCI 1974-2012

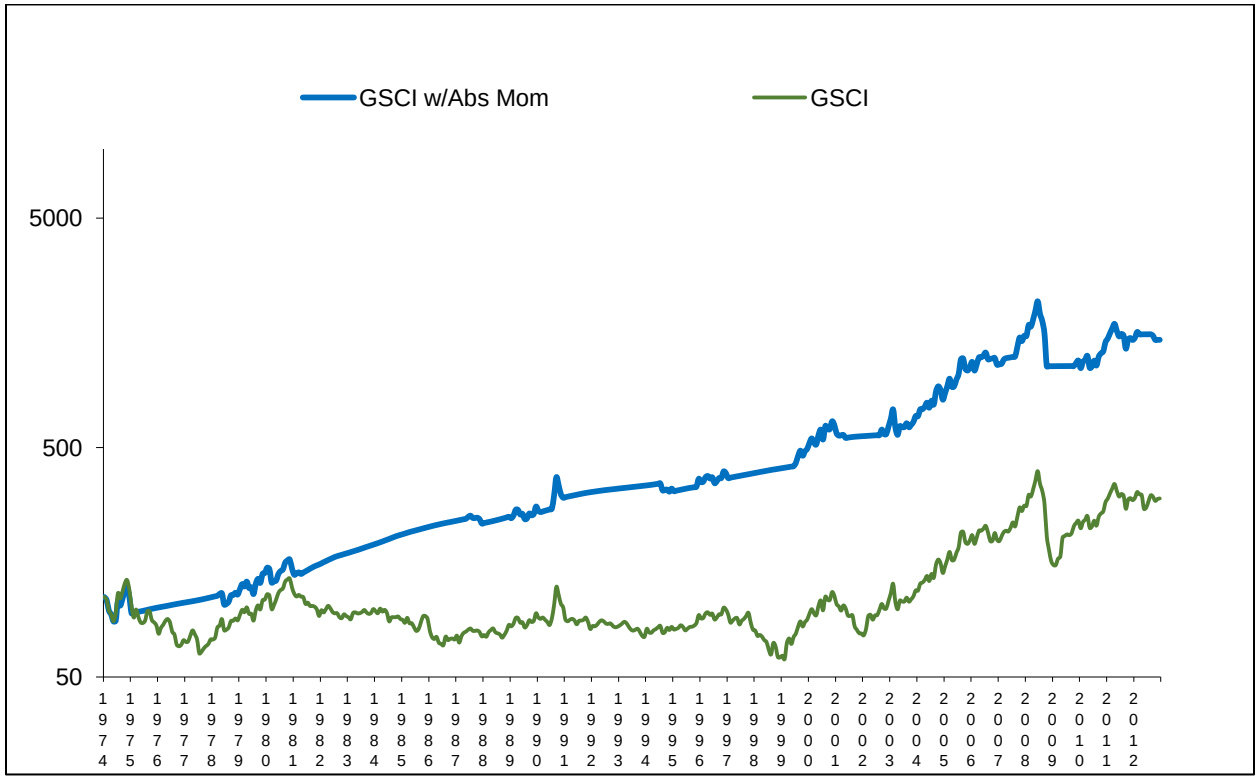
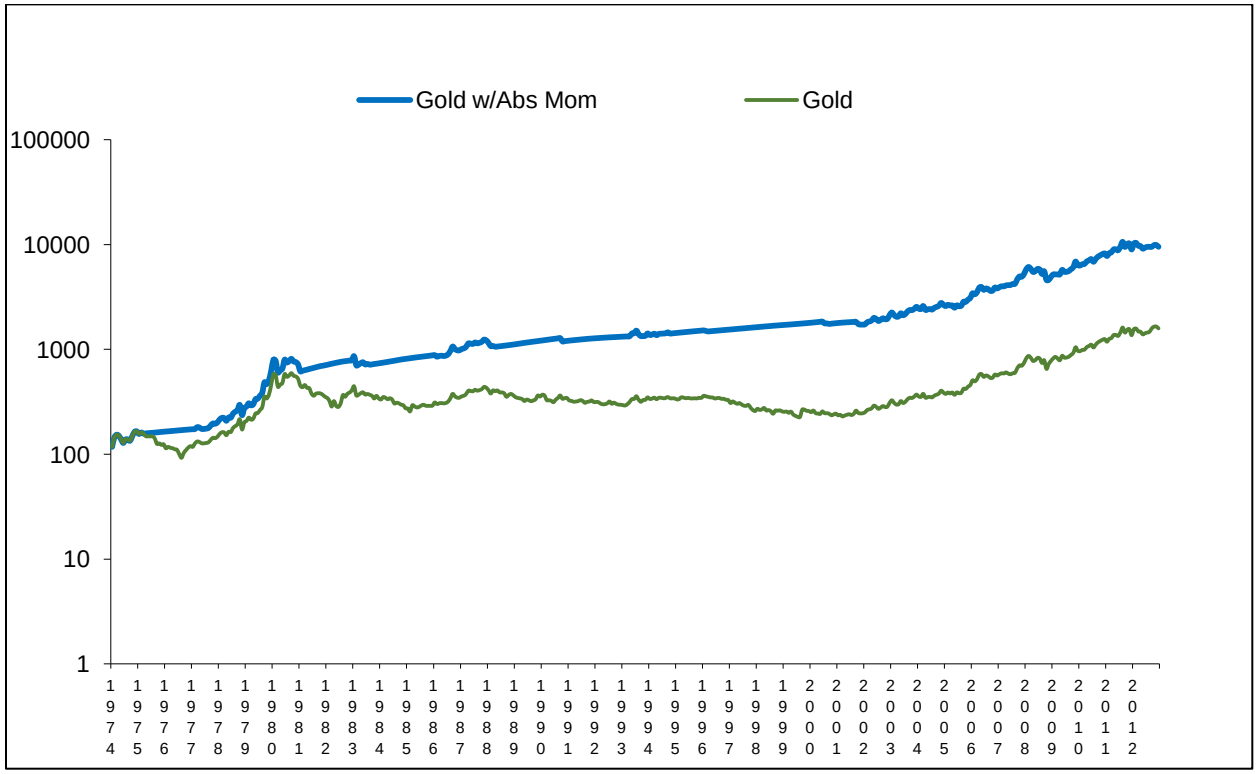


Figure 12 London Gold 1974-2012



5. 60/40 Balanced Portfolio

Given the ability of 12-month absolute momentum to improve risk-adjusted performance over a broad range of individual assets, it is natural to wonder how absolute momentum might affect our multi-asset portfolios. One of the simplest multi-asset portfolios is the 60% stocks and 40% bonds mix (60/40) that institutional investors adopted in the mid-1960s, based on their observation of stock and bond returns from 1926 through 1965. Table 4 shows how a 60/40 portfolio of the US MSCI and US Treasury indexes, as well as the US MSCI index, have performed since 1974, with and without the addition of 12-month absolute momentum.

Table 4 60/40 Balanced Portfolio Performance 1974-2012

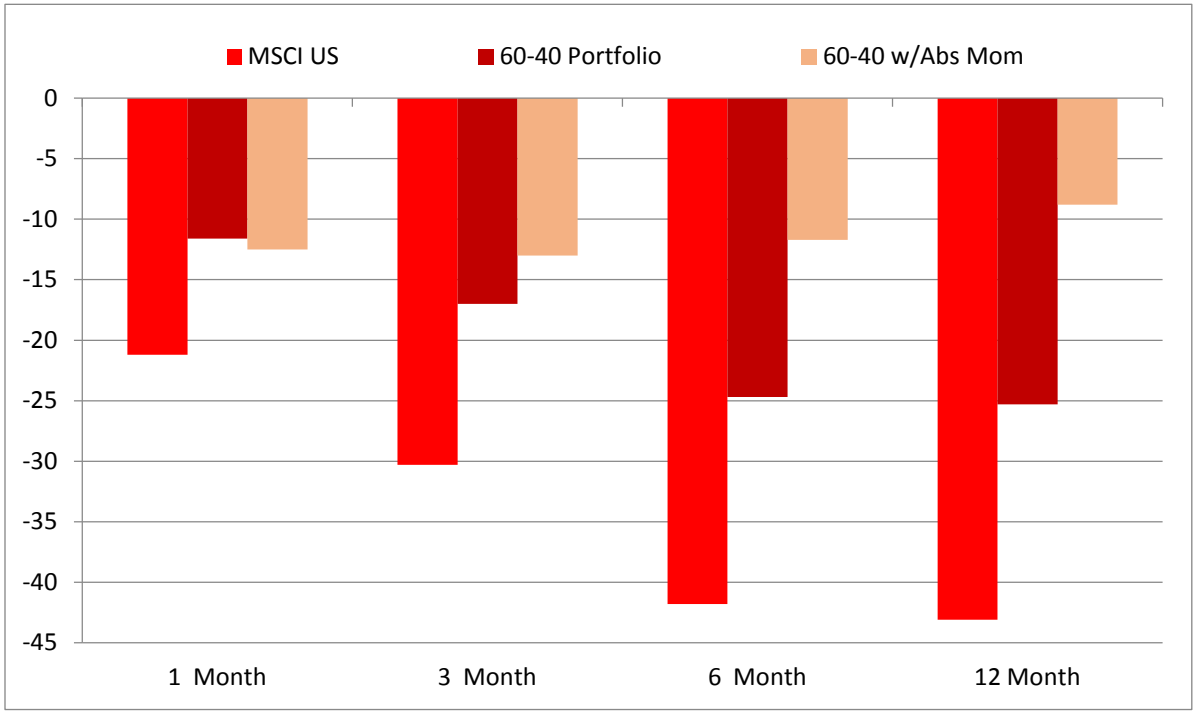
	Annual Return	Annual Std Dev	Annual Sharpe	Maximum Drawdown	% Profit Months	Correlation to S&P500	Correlation to 10 Yr Bond
60/40 w/Abs Mom	11.52	7.88	.72	-13.45	74	.67	.37
60/40 No Mom	10.86	10.77	.47	-29.32	63	.92	.46
MSCI US w/Abs Mom	12.26	11.57	.55	-22.90	75	.74	.13
MSCI US No Mom	11.62	15.74	.37	-50.65	61	1.00	.10

The 60/40 portfolio without momentum shows some reduction in volatility and drawdown compared to an investment solely in US stocks. However, the strong 0.92 monthly correlation of the 60/40 portfolio with the S&P 500 shows that the 60/40 portfolio has retained most of the market risk of stocks. Because stocks are much more volatile than bonds, stock market movement dominates the risk in a 60/40 portfolio. From a risk perspective, the regular 60/40 portfolio is, in fact, mostly an equity portfolio, since stock market variation explains most of the variation in performance of the 60/40 portfolio.

The MSCI US index with the addition of absolute momentum has a 0.74 correlation to the S&P 500, which is lower than the 0.92 correlation of the 60/40 index to the S&P 500. MSCI US with absolute momentum does a better job than the 60/40 portfolio in reducing portfolio drawdown, while also providing higher returns. The correlation to the S&P 500 of the 60/40 portfolio using 12-month absolute momentum drops to 0.67 from 0.92.[7] The 60/40 portfolio with absolute momentum retains the same return as the normal MSCI US Index, but with only half the volatility. The maximum drawdown drops by more than 70%.

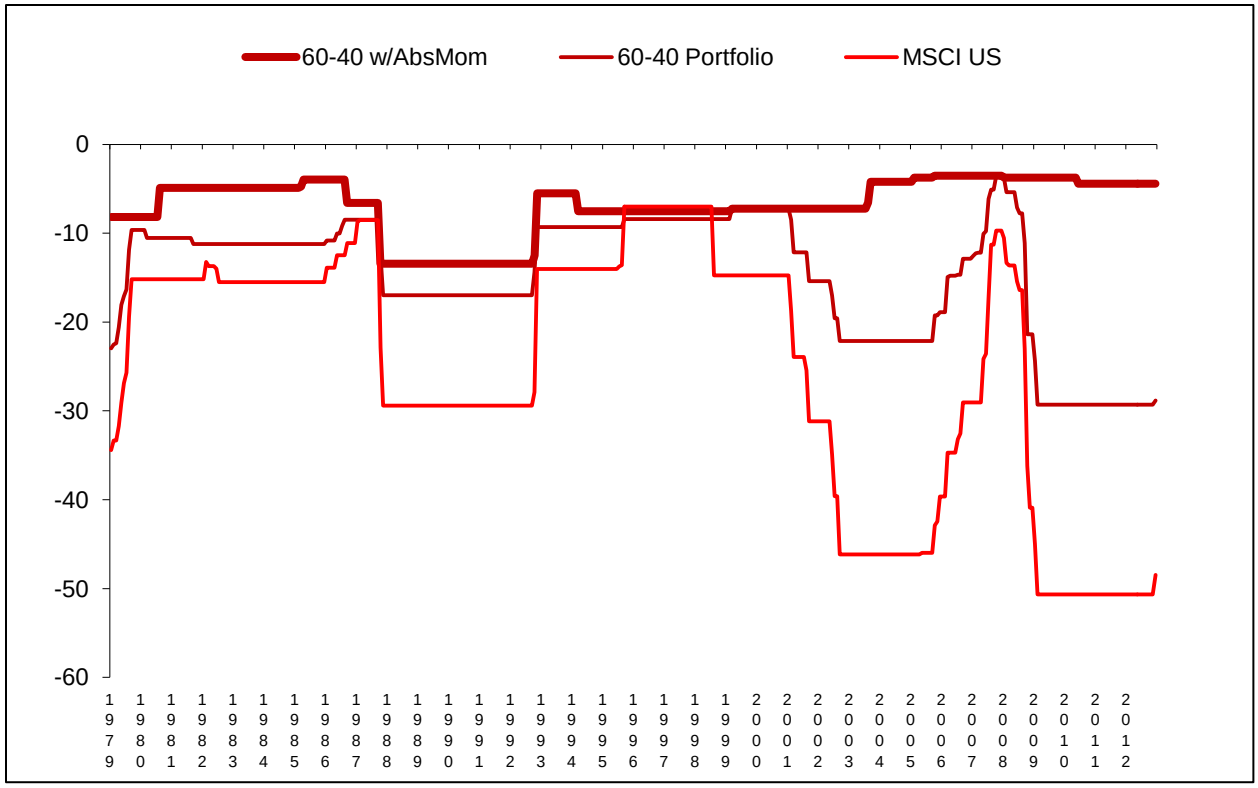
Figure 13 shows the maximum 3, 6, and 12-month drawdown of the MSCI US Index and the 60/40 portfolios, with and without 12-month absolute momentum. Figure 14 is a rolling five-year window of the maximum drawdown of the same portfolios.

Figure 13 1 to 12-Month Maximum Drawdown 1974-2012



[7] For the 10 years ending December 2012, the monthly correlation of the absolute momentum 60/40 portfolio to the S&P 500 index was .53, compared to a correlation of .87 for the normal 60/40 portfolio to the S&P 500 index.

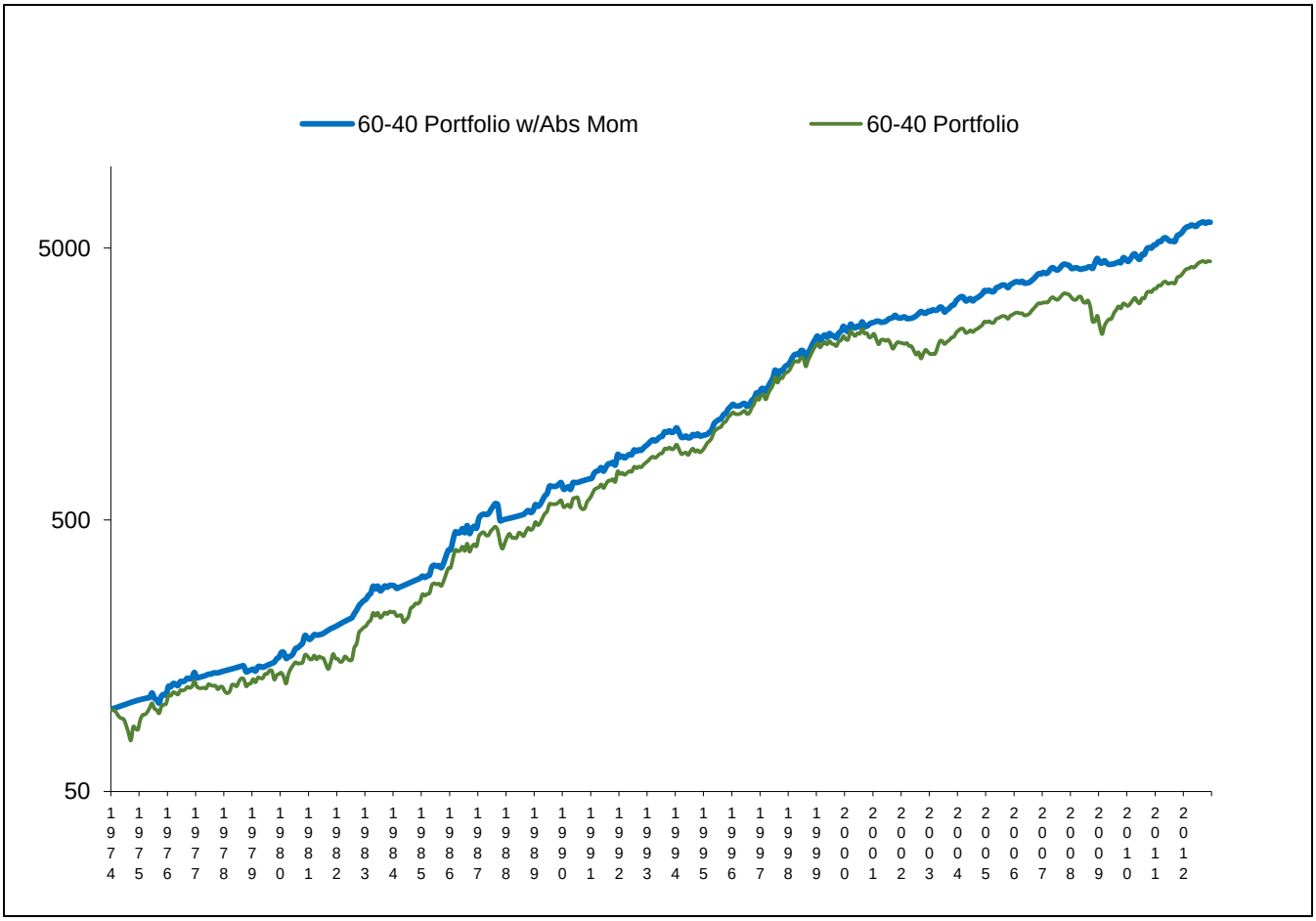
Figure 14 Rolling 5-Year Maximum Drawdown 1979-2012



The traditional 60/40 portfolio offers little in the way of risk-reducing diversification, even though it looks balanced from the perspective of dollars invested in each asset class. From 1900 through 2012, the probability of the 60/40 portfolio having a negative real return has been 35% in any one year, 20% over any five years, and 10% over any 10 years[8]. Its real maximum drawdown was 66%. Adding a simple 12-month absolute momentum overlay to the 60/40 portfolio achieves market-level returns with a more reasonable amount of downside risk. Figure 15 shows the consistency of the 12-month absolute momentum 60/40 portfolio compared to the traditional 60/40 portfolio. The trend following, market-timing feature of absolute momentum may be more valuable now than in the past, when the world was less inter-connected, asset correlations were lower, and diversification alone was better able to reduce downside exposure.

[8] Data is from the Robert Shiller website: http://www.econ.yale.edu/~shiller/data.htm

Figure 15 60/40 Balanced Portfolios 1974-2012



6. Parity Portfolios

The usual way of dealing with the strong equities tilt of the 60/40 portfolio is to diversify more broadly and/or dedicate a larger allocation to fixed income investments. Endowment funds, for example, often diversify into a number of specialized areas, such as private equity, hedge funds, and other higher risk alternative investments. Some risk parity programs also diversify broadly. In addition, risk parity portfolios attempt to equalize the risk across different asset classes by allocating more capital to relatively lower volatility assets, like fixed income. A stock-bond portfolio, for example, would require at least a 70% allocation to bonds in order to have equal risk exposure from bonds and equities.

A common way to construct risk parity portfolios is to weight each asset's position size by the inverse of its volatility.[9] This normalizes risk exposure across all asset classes. But there are several problems with that approach. First, one somehow has to determine the best look back interval and frequency for measuring volatility. This introduces data snooping bias. Second, volatility and correlation are inherently unstable and non-stationary. Their use therefore introduces additional estimation risk and potential portfolio instability. We take a simpler approach that accomplishes much the same thing as traditional risk parity. Starting with the MSCI US and long Treasury bond indexes used in our 60/40 portfolio, we add REITs, credit bonds, and gold, with an equal weighting given to each asset class.[10] We use credit bonds to increase the fixed income exposure of the portfolio. Credit bonds diversify our fixed income allocation by providing some credit risk premium with less duration risk than long Treasuries. REITs give us exposure to real assets with some additional risk exposure to equities. Gold gives us real asset exposure that is different from real estate.[11] Gold has the highest volatility, and so it represents only 20% of our parity portfolio, whereas bonds receive the largest allocation of 40% from being represented twice in the portfolio. Exposure to equities is somewhere between gold and bonds.

By structuring our portfolio purposefully to begin with, we are able to balance our risk exposure between fixed income, equities, and real assets non-parametrically without incurring any added estimation risk. We will see that the addition of absolute momentum to our parity portfolio reduces and equalizes risk exposure across all asset classes.

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[9] Some use covariance instead of volatility in order to take into account asset correlations.

[10] DeMiguel, Garlappi, and Uppal (2009) test 14 out-of-sample allocation models on 7 datasets and find that none have higher Sharpe ratios or certainty equivalent returns than equal weighting. Gains from optimal diversification with more complicated models are more than offset by estimation errors.

[11] We use gold instead of commodities because of the possible lack of risk premia and substantial front-running rollover costs associated with commodity index futures (Daskalaki and Skiadopoulus (2011), Mou (2011)).

Table 5 shows the correlations of the S&P 500, U.S.10 Year Treasury, and GSCI Commodity indexes to the 60/40 and parity portfolios, both with and without 12-month absolute momentum. Our parity portfolio with 12-month absolute momentum shows a modest and nearly equal correlation to both stocks and bonds. Because of the downside risk attenuation through absolute momentum, we have achieved risk parity while limiting fixed income assets to no more than 40% of our portfolio.

Table 5 Monthly Correlations 1974-2012

	60/40 Portfolio	60/40 w/Abs Momentum	Parity Portfolio	Parity w/Abs Momentum
S&P 500	.92	.67	.67	.40
10 Year Bond	.58	.35	.37	.36
GSCI	.05	.06	.25	.19

Having a well-balanced portfolio means that in low growth and low inflation environments, bonds may outperform and sustain the portfolio, whereas equities and REITs may perform better and sustain the portfolio under high inflation and high growth scenarios. Table 6 shows the comparative performance of the 60/40 and parity portfolios, with and without 12-month absolute momentum, overall and by decade. The parity portfolio with absolute momentum maintains the highest Sharpe ratio and the lowest drawdown throughout the data. Figure 16 is a chart of the parity portfolio versus the 60/40 Balanced Portfolio, and Figure 17 shows the parity portfolio versus its components.

Table 6 Parity Portfolios versus 60/40 Balanced Portfolios 1974-2012

	Parity w/Abs Mom	Parity Portfolio	60/40 w/Abs Mom	60/40 Portfolio
All Data				
Annual Return	11.98	11.28	11.52	10.86
Annual Std Dev	5.75	8.88	7.88	10.77
Annual Sharpe	1.06	0.62	0.72	0.47
Max Drawdown	-9.60	-30.40	-13.45	-29.32
% Profit Months	75	69	74	63
1974-83				
Annual Return	15.78	13.10	11.37	9.41
Annual Std Dev	7.20	10.05	6.88	12.35
Annual Sharpe	0.86	0.38	0.33	0.04
Max Drawdown	-6.31	-16.89	-8.19	-22.95
% Profit Months	80	64	81	52
1984-93				
Annual Return	12.34	10.19	14.48	15.63
Annual Std Dev	4.98	5.62	9.78	11.40
Annual Sharpe	1.09	0.62	0.75	0.73
Max Drawdown	-4.28	-6.53	-13.45	-16.99
% Profit Months	78	71	79	68
1994-03				
Annual Return	9.06	9.45	12.10	10.86
Annual Std Dev	4.65	6.66	8.23	10.05
Annual Sharpe	0.99	0.74	0.90	0.62
Max Drawdown	-4.87	-7.56	-8.16	-22.14
% Profit Months	72	73	69	64
2004-12				
Annual Return	10.69	12.55	7.84	7.34
Annual Std Dev	5.78	12.12	5.92	8.80
Annual Sharpe	1.47	0.84	0.99	0.61
Max Drawdown	-9.60	-30.40	-5.03	-29.32
% Profit Months	69	70	67	69

Figure 16 Parity Portfolios versus 60/40 Balanced Portfolios 1974-2012

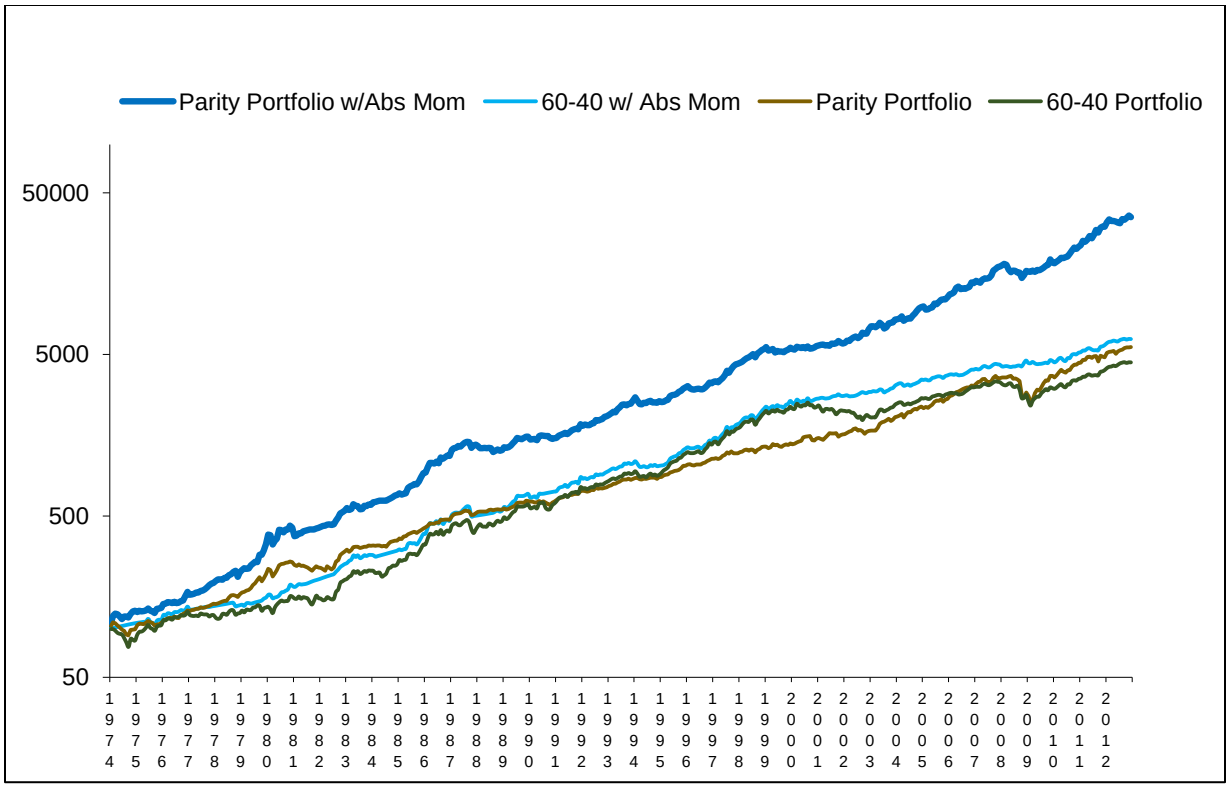


Figure 17 Parity Portfolio versus Components 1974-2012

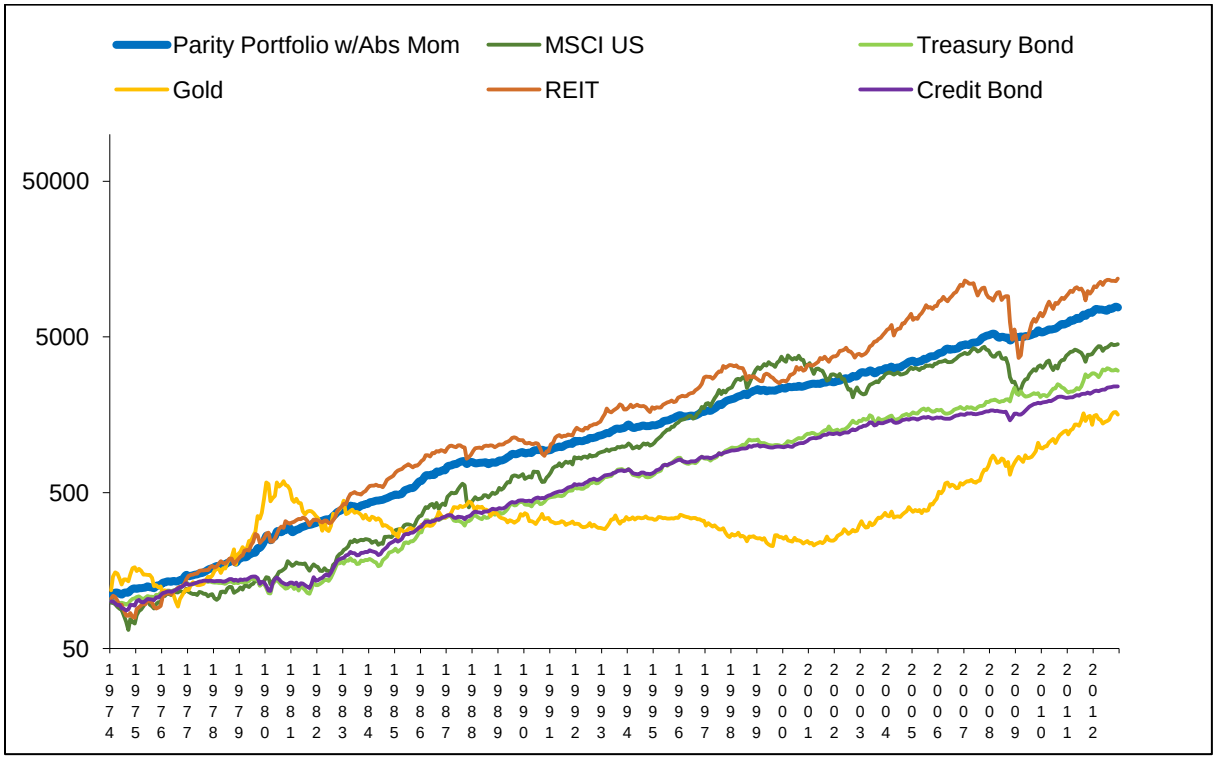


Figure 18 Rolling 12-Month Returns 1975-2012

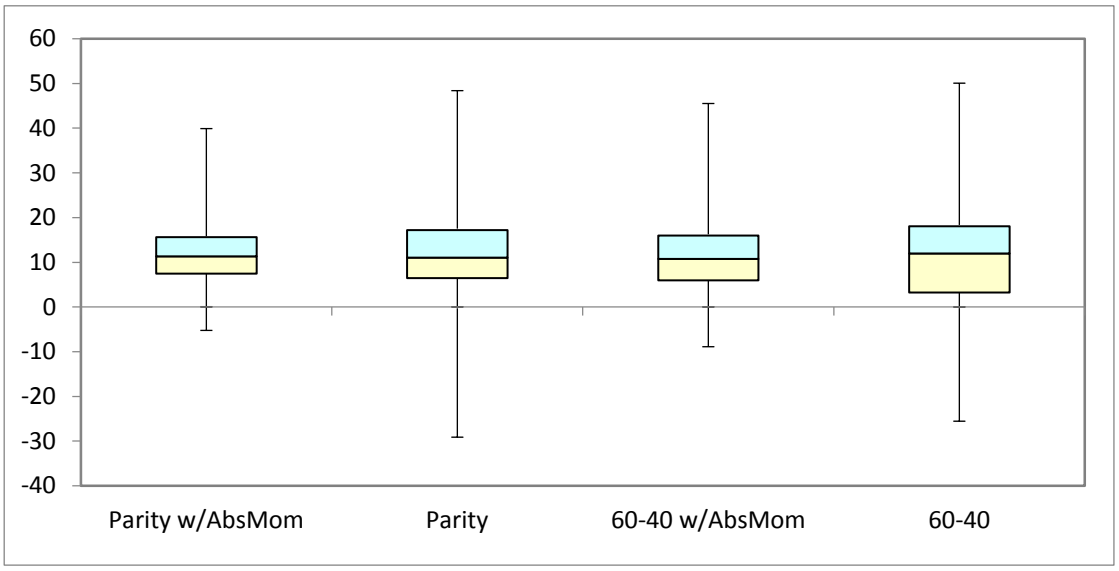
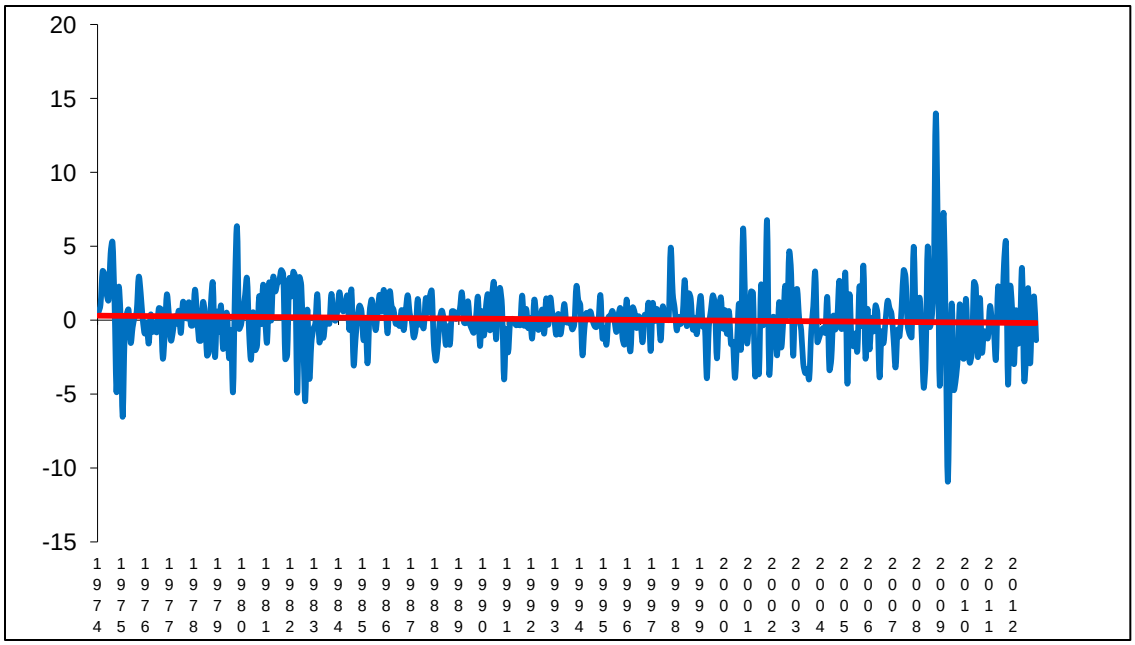


Figure 18 is a box plot showing quartile ranges of rolling 12-month portfolio returns. Figure 19 shows the difference in monthly returns between the parity portfolios with and without 12-month absolute momentum. There was some increased volatility in 2008--2009. However, the plotted trend line shows the average return differences remained constant over time.

Figure 19 Monthly Differences in Parity Portfolio Performance 1974-2012



7. Parity Portfolio Drawdown

As was the case with individual assets and the 60/40 portfolio, 12-month absolute momentum excels in reducing the parity portfolio drawdown, as per Figures 20-21.

Figure 20 One to 12-Month Maximum Drawdown 1974-2012

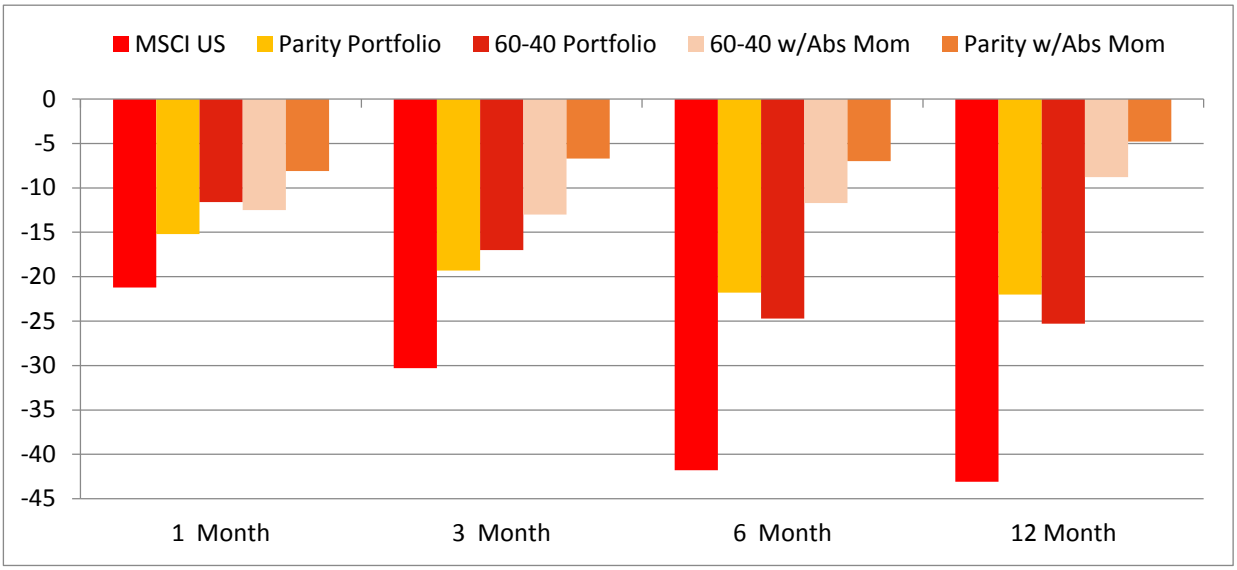


Figure 21 Rolling 5-Year Maximum Drawdown 1974-2012

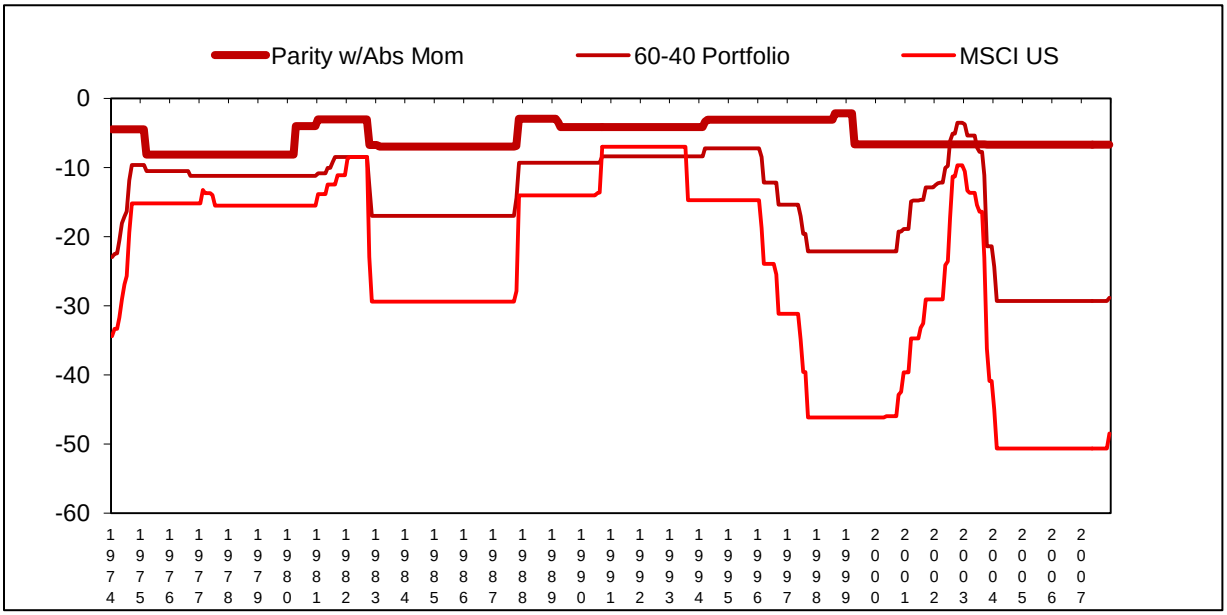


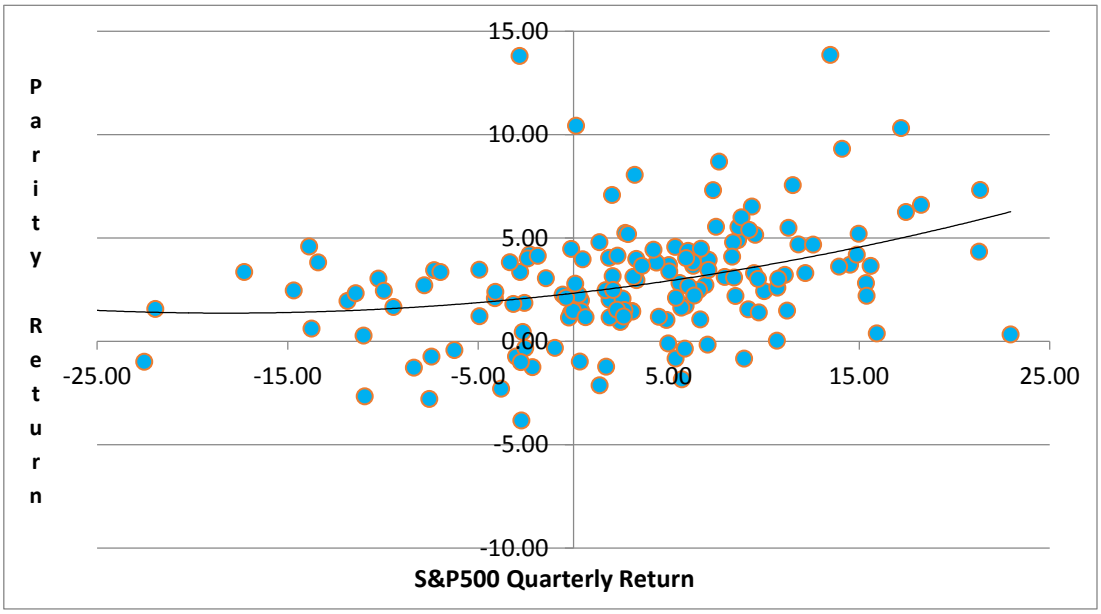
Table 7 shows how our parity portfolio with absolute momentum, by adapting to regime change, bypassed the major equity erosions of the stock market since our data began in 1974.

Table 7 Maximum Stock Market Drawdown 1974-2012

Date	MSCI US	60/40 Portfolio	Parity w/Abs Mom
3/74 -- 9/74	-33.3	-22.4	+2.2
9/87--11/87	-29.4	-17.0	-1.7
9/00 –- 9/01	-30.9	-15.4	+5.4
4/02 -- 9/02	-29.1	-12.2	+7.3
11/07 -- 2/09	-50.6	-29.3	-0.4

Figure 22 is a plot of our parity portfolio quarterly returns on the y-axis plotted against the corresponding quarterly returns of the S&P 500 index plotted on the x-axis. We can see clearly how the parity portfolio with absolute momentum has truncated stock market losses.

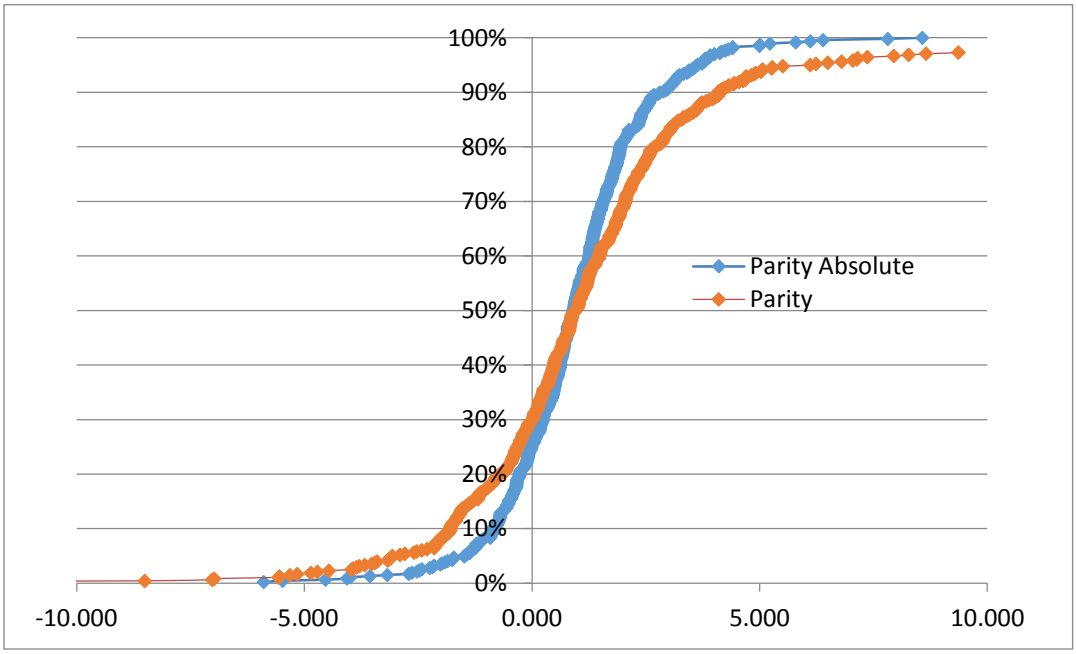
Figure 22 Quarterly Returns - Parity Portfolio versus S&P 500 1974-2012



8. Stochastic Dominance

Because financial markets can have non-stationary variance and autocorrelated, interdependent return distributions, it is best to analyze and compare them using robust or non-parametric methods. One such method is second-order stochastic dominance, where one set of outcomes is preferred over another if it is more predictable (less risky) and has at least as high a mean return (Hader and Russell (1969)). Figure 23 is a plot of the cumulative distribution function of the monthly returns of the parity portfolios, with and without absolute momentum.

Figure 23 Cumulative Distribution Functions 1974-2012



The parity portfolio with 12-month absolute momentum shows a lower probability of loss and a greater probability of gain than the parity portfolio without momentum. Because the mean of the parity portfolio with 12-month absolute momentum is also higher than the mean of the parity portfolio without absolute momentum, a risk- averse investor would always prefer the parity portfolio with 12-month absolute momentum, due to second order stochastic dominance.

9. Leverage

Risk parity programs often have so much fixed income in their portfolios that their managers have to leverage the portfolios in order to strive for an acceptable level of expected return. Since absolute momentum reduces the volatility of our parity portfolio while, at the same, preserving equity level returns, there is not the same need for leverage.

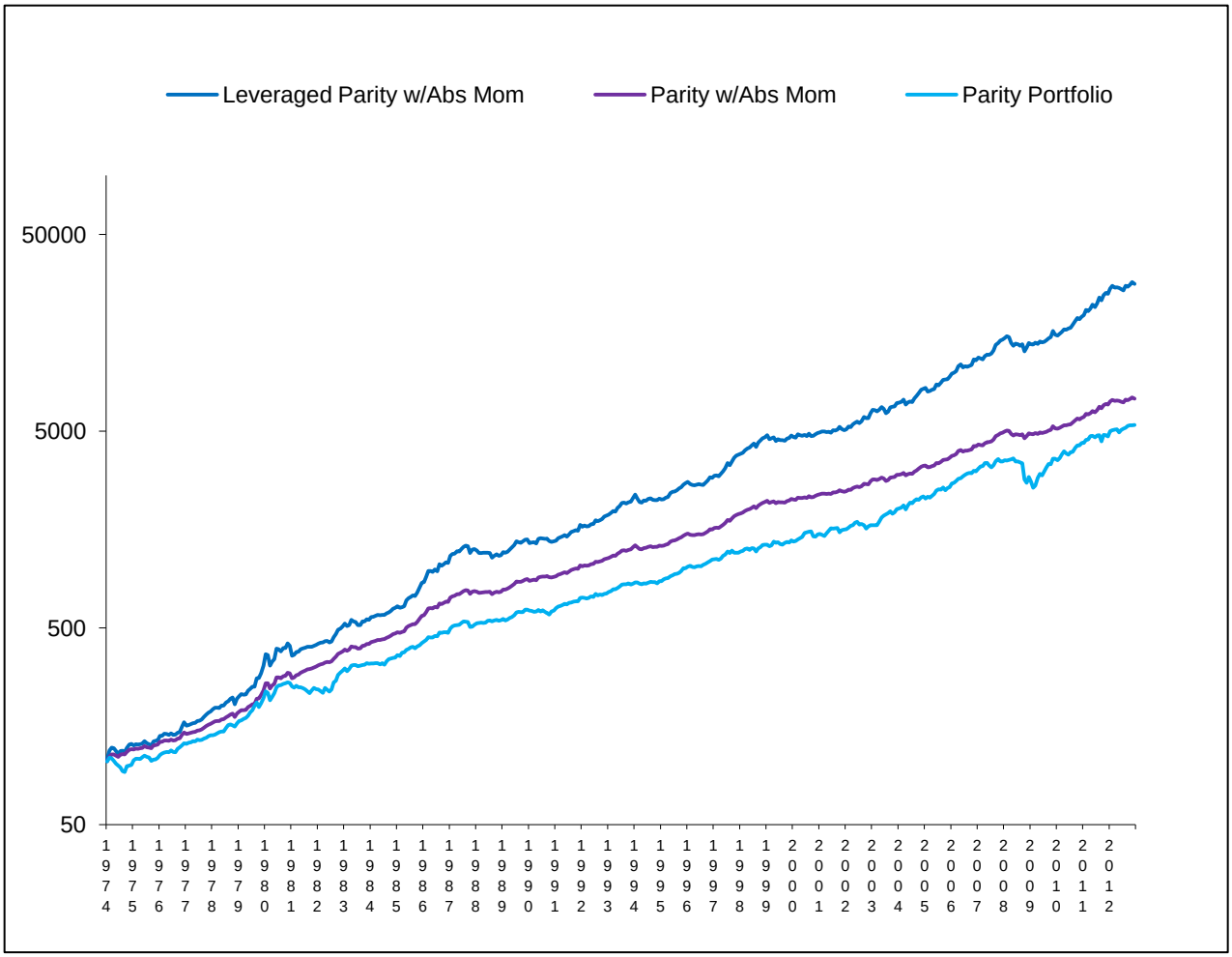
However, given the low expected drawdown of an absolute momentum parity portfolio, one may still wish to use leverage in order to boost expected returns, as is done with other risk parity programs.[12] Table 8 shows the pro-forma results of our 12-month absolute momentum parity portfolio leveraged to an annual volatility level just below the long-term volatility of a normal 60/40 portfolio. We use a borrowing cost of the fed funds rate plus 25 basis points[13] and a leverage ratio of 1.85 to 1.

Table 8 Parity Portfolios 1974-2012

	Leveraged Parity w/Abs Mom	Parity Portfolio w/Abs Mom	Parity Portfolio No Momentum
Annual Return	16.87	11.98	11.28
Annual Std Dev	10.61	5.75	8.88
Annual Sharpe	.98	1.06	.62
Max Drawdown	-18.44	-9.60	-30.40
Skew	.07	.16	-.82
Excess Kurtosis	2.77	2.70	7.04

[12] Trend following methods can also reduce negative skew and associated left tail risk (Rulle (2004)). Negative skew can be especially problematic when there is leverage. Absolute momentum may reduce or eliminate negative skew.
[13] Elimination of Treasury bill holdings in lieu of borrowing would reduce borrowing costs. We have not accounted for this cost saving.

Figure 24 Parity Portfolios 1974-2012



Risk in a levered portfolio has many facets, such as fat tail, illiquidity, counter-party, basis, and converging correlation risk. Since most risk parity programs have well over 50% of their assets in fixed income securities, their greatest future risk may be that of rising interest rates. An increase in nominal interest rates back to a historically normal level of 6% could lead to a 50% drop in the price of long bonds. Parity with 12-month absolute momentum, as presented here, is more adaptive than normal risk parity and has the ability to exit fixed income investments during periods of rising interest rates due to its trend following nature. Absolute momentum is, in general, a valuable adjunct to the use of leverage.

10. Factor Pricing Models

Table 9 shows our 12-month absolute momentum parity portfolio regressed against the U.S. stock market using the single-factor capital asset pricing model (CAPM), as well as the three-factor Fama-French model incorporating market, size, and value risk factors, as per the Kenneth French website[14]. We also show a four-factor Fama-French/Carhart model that adds relative momentum, as well as a six-factor model that additionally adds the excess return of the Barclays Capital U.S. Aggregate Bond and S&P GSCI commodity indexes.

Table 9 Factor Model Coefficients 1974-2012

	Annual Alpha	Market Beta	Small Beta	Value Beta	Momentum Beta	Bond Beta	GSCI Beta	R^2
6 Factor Model	3.82** (4.10)	.159** (6.90)	-.044 (1.51)	.039 (1.41)	.078** (2.75)	.259** (3.28)	.045** (4.56)	.23
4 Factor-Fama French/Carhart	4.07** (4.28)	.167** (7.84)	-.061* (2.00)	.054* (2.01)	.092** (3.39)	-	-	.21
3 Factor-Fama-French	5.24** (5.99)	.149** (6.54)	-.071* (2.38)	-.017 (0.86)	-	-	-	.17
Single Factor-CAPM	4.97** (5.62)	.139** (6.29)	-	-	-	-	-	.15

Newey-West (1987) robust t-statistics in parentheses adjust for serial correlation and possible heteroskedasticity. Statistical significance at the 1% and 5% level is denoted by ** and * respectively.

Since our parity portfolio is long only, we naturally see highly significant loadings on the stock, bond, and GSCI market factors. Absolute momentum captures some significant cross-sectional momentum beta. Our parity portfolio with 12-month absolute momentum provides substantial and significant alphas according to all four models.

[14] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

11. Conclusions

Cowles and Jones first presented 12-month momentum to the public in 1937. It has held up remarkably well ever since then. Relative strength momentum, looking at performance against one's peers, has attracted the most attention from researchers and investors. Yet relative strength is a secondary way of looking at price strength. Absolute momentum, measuring an asset's performance with respect to its own past, is a more direct way of looking at and utilizing market trends to determine price continuation.

Trend determination through absolute momentum can help one navigate downside risk, take advantage of regime persistence, and achieve higher risk-adjusted returns. Absolute momentum, as used here, is a simple rule-based approach that is easy to implement. One needs only see if returns relative to Treasury bills have been up or down for the preceding year.

We have seen on 39 years of past data how 12-month absolute momentum can help improve the reward-to-risk characteristics of a broad range of investments. Absolute momentum has considerable value as a tactical overlay to multi-asset portfolios, where it has many potential uses. A risk parity portfolio using absolute momentum, due to its modest correlation to traditional investments, such as stocks and bonds, could function either as a core holding or as an alternative asset holding.

Absolute momentum can enhance the expected return and reduce the expected drawdown of core portfolios, as we have shown in this paper. It can help investors with basic stock/bond allocations, such as a 60/40 balanced mix, meet their investment objectives without resorting to excessively large allocations to fixed income that could subject them to substantial interest rate risk. We have seen, in fact, that applying absolute momentum to a stock only portfolio may reduce or eliminate the need for fixed income as a portfolio diversifier. Investors

using absolute momentum can also reduce or eliminate leverage, the selection of riskier assets like hedge funds and private placements, and data-snooping based portfolio constructs that rely on non-stationary and estimation risk-prone correlations and covariances.

There are other potential uses as well for absolute momentum. Simple absolute momentum can be a more cost-effective alternative to managed futures (Hurst, Ooi, and Pedersen (2013)). It can also be an attractive alternative to option overwriting by retaining more of the potential for upside appreciation, while at the same time providing greater downside protection. Absolute momentum can likewise be an attractive alternative to costly tail risk hedging. It can reduce the need for aggressive diversification with marginal assets having lower expected returns. If one wishes to achieve higher returns by using riskier assets or by leveraging a portfolio, then 12- month absolute momentum can make that more viable by truncating expected drawdown.

Despite its many possible uses, absolute momentum has yet to attract the attention it deserves as an investment strategy and risk management tool. We have developed variations of and enhancements to 12- month absolute momentum that go beyond the scope of this introductory paper. Yet all investors would do well to become familiar with absolute momentum, since, even in its simplest form as presented here, absolute momentum can be an attractive stand-alone strategy, or a powerful tactical overlay for improving the risk-adjusted performance of any asset or portfolio.

References

Antonacci, Gary, 2012, "Risk Premia Harvesting Through Dual Momentum," working paper, Portfolio Management Associates, LLC, working paper

Asness, Clifford S., Tobias J. Moskowitz, and Lasse J. Pedersen, 2012, "Value and Momentum Everywhere," *Journal of Finance*, forthcoming

Baltas, Akindynos-Nikolaos and Robert Kosowski, 2012, "Improving Time Series Momentum Strategies: The Role of Trading Signals and Volatility Estimators," working paper

Barberis, Nicholas, Andrei Shleifer, and Robert Vishny, 1998, "A Model of Investor Sentiment," *Journal of Financial Economics* 49, 307–343

Blitz, David C and Pim Van Vliet, 2008, "Global Tactical Cross-Asset Allocation: Applying Value and Momentum Across Asset Classes," *Journal of Portfolio Management* 35(1), 23-38

Brock, William, Josef Lakonishok, and Blake LeBaron, 1992, "Simple Technical Trading Rules and the Stochastic Properties of Stock Returns," *Journal of Finance* 47, 1731–1764

Brown, David P and Robert H Jennings, 1989, "On Technical Analysis," *Review of Financial Studies* 2(4), 527-551

Cowles, Alfred III and Herbert E. Jones, 1937, "Some A Priori Probabilities in Stock Market Action," *Econometrica* 5(3), 280-294

Daniel, Kent, David Hirshleifer, and Avanidhar Subrahmanyam, 1998, "Investor Psychology and Security Market Under-and Over-Reactions." *Journal of Finance* 53, 1839–1886

Daskalaki, Charoula and George S Skiadopoulus, 2011, "Should Investors Include Commodities in Their Portfolios After All? New Evidence," *Journal of Banking and Finance* 35 (10), 2606-2626

DeMiguel, Victor, Lorenzo Garlappi and Raman Uppal, 2009, "Optimal Versus Naïve Diversification: How Inefficient is the 1/N Portfolio Strategy*?" Review of Financial Studies* 22 (5), 1915-1953

Frazzini, Andrea, 2006, "The Disposition Effect and Underreaction to News," *Journal of Finance* 61, 2017-2046

Garleanu, Nicolae and Lasse H Pedersen, 2007, "Liquidity and Risk Management," *The American Economic Review* 97, 193-197

Geczy, Christopher and Mikhail Samonov, 2012, "212 Years of Price Momentum (The World's Longest Backtest 1801-2012)," working paper

Grundy, Bruce D and J Spencer Martin, 2001, "Understanding the Nature of the Risks and the Sources of the Rewards to Momentum Investing," *Review of Financial Studies* 14, 29-78

Hader, Josef and William R Russell, 1969, "Rules for Ordering Uncertain Prospects," *The American Economic Review* 59(1), 25-34.

Han, Yufeng, Ke Yang, and Guofo Zhou, 2011, "A New Anomaly: The Cross-Sectional Profitability of Technical Analysis," working paper

Hong, Harrison and Jeremy Stein, 1999, "A Unified Theory of Underreaction, Momentum Trading, and Overreaction in Asset Markets," *Journal of Finance* 54, 2143-2184

Hurst, Brian, Yao Hua Ooi, and Lasse H Pedersen, 2012, "A Century of Evidence on Trend-Following Investing," AQR Capital Management, LLC

Hurst, Brian, Yao Hua Ooi, and Lasse H Pedersen, 2013, "Demystifying Managed Futures," working paper

Jegadeesh, Narasimhan and Sheridan Titman, 1993, "Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency," *Journal of Finance* 48, 65-91

Jegadeesh, Narasimhan and Sheridan Titman, 2001, "Profitability of Momentum Strategies: An Evaluation of Alternative Explanations," *Journal of Finance* 56(2), 699–720

Mou, Ziqun, 2011, "Limits to Arbitrage and Commodity Index Investment: Front-Running the Goldman Yield," working paper

Moskowitz, Tobias J., Yao Hua Ooi, and Lasse Heje Pedersen, 2012, "Time Series Momentum," *Journal of Financial Economics* 104, 228-250

Newey, Whitney K. and Kenneth D. West, 1987, "A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix," *Econometrica* 55(3), 703–708

Tversky, Amos and Daniel Kahneman, 1974, "Judgment under Uncertainty: Heuristics and Biases," *Science* 185, 1124-1131

Zhou, Guofu and Yingzi Zhu, 2014, "A Theory of Technical Trading Using Moving Averages," working paper

Zhu, Yingzi and Guofu Zhou, 2009, "Technical Analysis: An Asset Allocation Perspective on the Use of Moving Averages," *Journal of Financial Economics* 92, 519-544