Risk Premia Harvesting Through Dual Momentum

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Abstract

Momentum is the premier market anomaly. It is nearly universal in its applicability. This paper examines multi-asset momentum with respect to what can make it most effective for momentum investors. We consider price volatility as a value-adding factor. We show that both absolute and relative momentum can enhance returns, but that absolute momentum does far more to lessen volatility and drawdown. We see that combining absolute and relative momentum gives the best results. Finally, we show how asset modules can serve as diversification building blocks that allow us to easily combine relative with absolute momentum and capture risk premia profits.

[1] http://www.optimalmomentum.com An earlier version of this paper with a different title was the first place winner of the 2012 NAAIM Wagner Awards for Advancements in Active Investment Management. The author wishes to thank Tony Cooper, Wesley Gray, and Akindynos-Nikolaos Baltas for their helpful comments.

1. Introduction

Momentum is the tendency of investments to persist in their performance. Assets that perform well over a 6 to 12 month period tend to continue to perform well into the future. The momentum effect of Jegadeesh and Titman (1993) is one of the strongest and most pervasive financial phenomena. Researchers have verified its existence 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)), and residential real estate (Beracha and Skiba (2011)). Since its first publication, momentum has been shown to work out-of-sample going forward in time (Grundy and Martin (2001), Asness, Moskowitz and Pedersen (2012)) and back to the year 1866 (Chabot, Ghysels and Jagannathan (2009)). Momentum works well across asset classes, as well as within them (Blitz and Vliet (2008), Asness, Moskowitz and Pedersen (2012)).

In addition to cross-sectional or relative strength momentum, in which an asset's performance relative to other assets 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 (Moskowitz, Ooi and Pedersen (2012)). Absolute momentum appears to be just as robust and universally applicable as cross-sectional momentum. It holds up well across multiple asset classes and back in time to the turn of the century (Hurst, Ooi, and Pedersen (2012)). Trend following absolute momentum may also benefit relative strength momentum,

since there is evidence that relative strength profits depend on the state of the market (Cooper, Guiterrez, and Hameed (2004)). Fama and French (2008) call momentum "the center stage anomaly of recent years…an anomaly that is above suspicion…the premier market anomaly." They observe that the abnormal returns associated with momentum are pervasive. Schwert (2003) explored all known market anomalies and declared momentum as the only one that has been persistent and has survived since publication.

Yet despite an abundance of momentum research and acceptance, no one is sure why it works. The rational risk-based explanation is that momentum profits represent risk premia because winners are riskier than losers. (Berk, Green and Naik (1999), Johnson (2002), Ahn, Conrad and Dittmar (2003), Sagi and Seashales (2007), Liu and Zhang (2008)). The most common explanations, however, of both relative and absolute momentum, 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)). Such behavioral biases are unlikely to disappear, which may explain why momentum profits have persisted, and may continue to persist, as a strong anomaly.

Zhang (2006) argues that stock price continuation is due to under-reaction to public information by investors, and that investors will under-react even more in the case of greater information uncertainty. One of his proxies for information uncertainty is return volatility. When information uncertainty and price volatility are high, we can expect abnormal returns to be higher.

In addition to extensive study of momentum across countries and asset classes, there has also been considerable study of exogenous factors that influence momentum. Bandarchuk, Pavel

and Hilscher (2011) reexamine some of the factors that have previously been shown to impact momentum in the equities market. These include analyst coverage, illiquidity, price level, age, size, analyst forecast dispersion, credit rating, R^2, market-to-book, and turnover. The authors show that these factors are proxies for extreme past returns and high volatility. Greater momentum profits come from assets that are more volatile or that have extreme past returns.

With respect to fixed income, Jostova, Niklova and Philipov (2010) show that momentum strategies are highly profitable among non-investment grade corporate bonds. High yield, non-investment grade corporate bonds have, by far, the highest volatility among bonds of similar maturity. This may point toward high volatility as also a proxy for credit default risk.

The real estate market and long-term Treasury bonds are subject to high volatility due to their high sensitivity to interest rate risk and economic uncertainty. Gold is also subject to high volatility due to its response to economic and political turmoil.

Before proceeding, we need to distinguish clearly between relative and absolute momentum. When we consider two assets, momentum is positive on a relative basis if one asset has appreciated more than the other has. However, momentum is negative on an absolute basis if both assets have declined in value over time. It is possible for an asset to have positive relative and negative absolute momentum. Positive absolute momentum exists when the excess return of an asset is positive over the look back period, regardless of its performance relative to other assets.

Cross sectional momentum researchers use long and short positions applied to both the long and short side of a market simultaneously. They are therefore only concerned with relative momentum. It makes little difference whether the studied markets go up or down, since short momentum positions hedge long ones, and vice versa.

When looking only at long side momentum, however, it is desirable to be long only when both absolute and relative momentum are positive, since long-only momentum results are highly regime dependent. One way to determine absolute momentum is to see if an asset has had a positive excess return by outperforming Treasury bills over the past year. Since Treasury bill returns should remain positive over time, if our chosen asset has outperformed Treasury bills, then it too is likely to continue showing a positive future return by virtue of the transitive property. In absolute momentum, there is significant positive auto-covariance between an asset's excess return next month and its lagged one-year return (Moskowitz, Ooi, and Pedersen (2012)).

In our momentum match ups, we use a two-stage selection process. First, we choose between our module's non-Treasury bill assets using relative strength momentum. If our selected asset does not also show positive momentum with respect to Treasury bills (meaning it does not have positive absolute momentum), we select Treasury bills as an alternative proxy investment until our selected asset is stronger than Treasury bills. Treasury bill returns thus serve as both a hurdle rate before we can invest in other assets, as well as an alternative investment, until our assets can show both relative and absolute positive momentum.

Besides incorporating a safe alternative investment when market conditions are not favorable, our module approach has another important benefit. It imposes diversification on our momentum portfolio.

With only absolute momentum, this would not be a problem, since one could construct a well-diversified permanent portfolio. With relative strength momentum, however, some assets may drop out of the active portfolio. If one were to toss all assets into one large pot, as is often the case with momentum investing, and then select the top momentum candidates, even with covariance-based position sizing, all or most of the positions could be highly correlated with one

another. Modules help ensure that diversified asset classes receive portfolio representation under a dual momentum framework, without having to use historic covariances, that may be unstable, or historic variances, that may be non-stationary (Tsay (2010)).

2. Data and Methodology

All monthly return data begins in January 1974, unless otherwise noted, and includes interest and dividends. For equities, we use the MSCI US, MSCI EAFE, and MSCI ACWI ex US indices. These are free float adjusted market capitalization weightings of large and midcap stocks. The MSCI EAFE Europe, Australia and Far East Index includes twenty-two major developed market countries, excluding the U.S. and Canada. The MSCI ACWI ex US, i.e., MSCI All Country World Index ex US, includes twenty-three developed market countries and twenty-one emerging market countries. MSCI ACWI ex US data begins in January 1988. We create a composite data series called EAFE+ that is comprised of the MSCI EAFE Index until December 1987 and the MSCI ACWI ex US after its formation in December 1987.[2]

The Bank of America Merrill Lynch U.S. Cash Pay High Yield Index we use begins in November 1984. Data prior to that is from Steele System's mutual find database of the Corporate Bond High Yield Average, adjusted for expenses. For Treasury bills, we use the Bank of America Merrill Lynch 3-Month Treasury bill Index. All other bond indices are from Barclays Capital. The Barclays Capital Aggregate Bond Index begins in January 1976. REIT data is from the FTSE NAREIT U.S. Real Estate Indices of the National Association of Real Estate Investment Trusts (NAREIT). The S&P GSCI (formally Goldman Sachs Commodities Index) is from Standard and Poor's. Gold returns using the London PM gold fix are from the World Gold Council.

[2] Since these indices are based on capitalization, the MSCI ACWI ex US receives only a modest influence from emerging markets. Our results do not change significantly if we use only the MSCI EAFE Index.

There have been no deductions for transaction costs. The average number of switches per year for our modules are 1.4 for foreign/U.S. equities, 1.2 for high yield/credit bonds, 1.6 for equity/mortgage REITs, and 1.6 for gold/Treasuries. Therefore, additional transaction costs from the use of momentum are minor.

Most momentum studies use either a six or a twelve-month formation (look back) period. Since twelve months is more common and has lower transaction costs, we will use that timeframe.[3] With equity returns, one often skips the most recent month during the formation period in order to disentangle the momentum effect from the short-term reversal effect related to liquidity or microstructure issues. Non-equity assets suffer less from liquidity issues. Because we are dealing with gold, fixed income and real estate, as well as equities, for consistency reasons, we adjust all our positions monthly without skipping a month.

We first apply relative and absolute momentum to the MSCI U.S. and EAFE+ stock market indices in order to create our equities momentum module. We then match High Yield Bonds with the Barclays Capital U.S. Intermediate Credit Bond Index, the next most volatile intermediate term fixed income index, to form our credit risk module.

Real estate has the highest volatility over the past five years looking at the eleven U.S. equity market sectors tracked by Morningstar. Real Estate Investment Trusts (REITs) make up most of this sector. The Morningstar real estate sector index has both mortgage and equity based REITs. We similarly use both to create our REIT module.

Our final high volatility risk factor focuses on economic stress and uncertainty. For this, we use the Barclays Capital U.S. Long Treasury Bond Index and physical gold. Investors generally hold these as safe haven alternatives to equities and non-government, fixed income

[3] The four long-only momentum products available to the public also use a twelve-month look back period (three of the four skip the last month, which can be helpful with individual stocks). AQR Funds, QuantShares, State Street Global Advisors, and Summerhaven Index Management are the fund sponsors.

securities. Maximum drawdown here is the greatest peak-to-valley equity erosion on a month end basis.

3. Equity/Sovereign Risk

Our first momentum module of the MSCI U.S. and EAFE+ indices gives us broad exposure to the U.S. equity market, as well as international diversification. Table 1 presents the summary statistics from January 1974 through December 2011 for these two equity indices, of our momentum strategy using both relative and absolute momentum, and relative strength momentum on its own, without the use of Treasury bills as a hurdle rate and alternative asset.

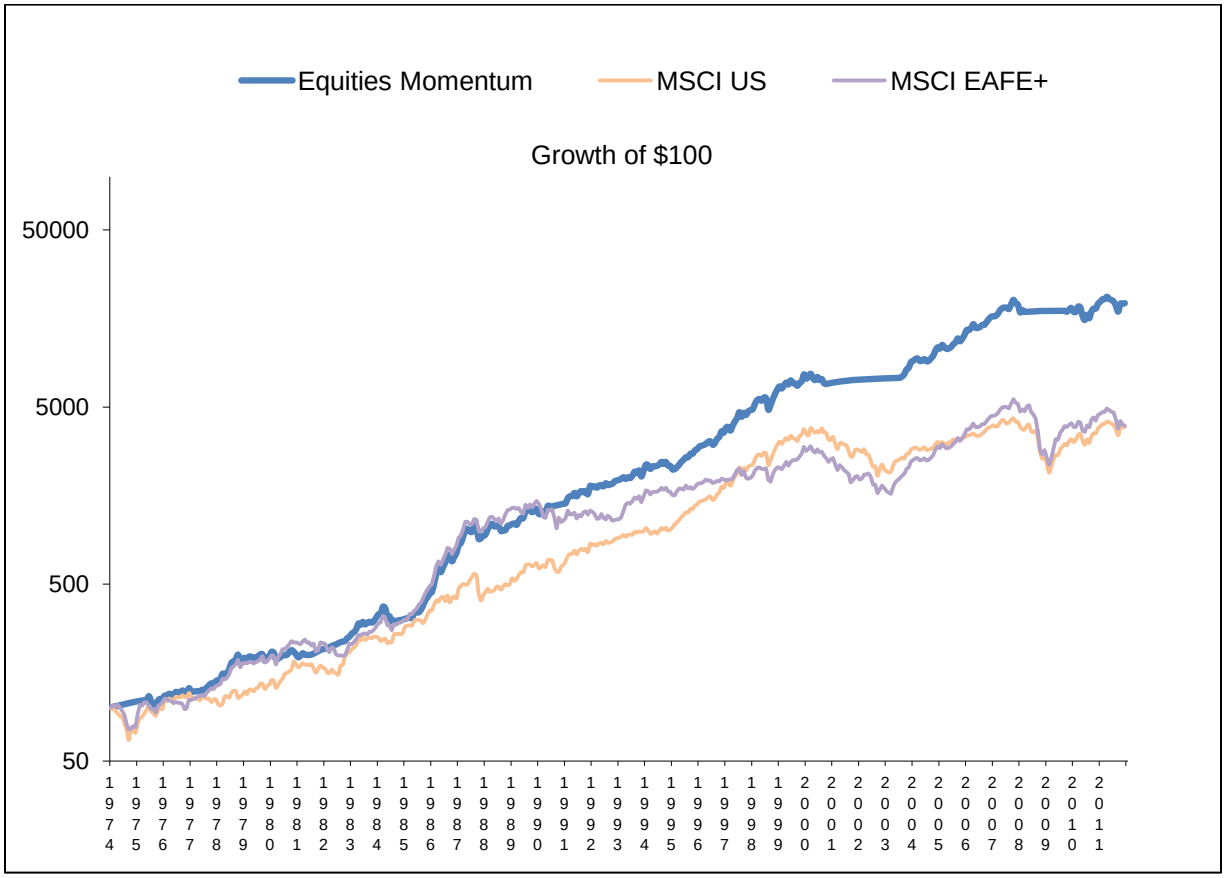
Table 1 Equities Momentum 1974-2011

	Dual Momentum	Relative Momentum	US	EAFE+
Annual Return	15.79	13.46	11.49	11.86
Annual Std Dev	12.77	16.17	15.86	17.67
Annual Sharpe	.73	.45	.35	.33
Max Drawdown	-23.01	-54.56	-50.65	-57.37
% Profit Months	73	62	60	60
Trades/Year	1.4	1.2	-	-

Our dual momentum strategy shows an impressive 400 basis point increase in return and a corresponding reduction in volatility from the equity indices themselves. Dual momentum doubles the Sharpe ratio and cuts the drawdown in half.

In Figure 1, we see that our dual momentum approach sidestepped most of the downside volatility that occurred in 2001-2002, as well as 2008.

Figure 1 Equities Dual Momentum 1974-2011



Most momentum research on equities looks at individual securities sorted by momentum. All three of the fully disclosed, publically available stock market momentum programs use momentum applied to individual stocks. It might therefore be interesting to see how our dual momentum equity module approach stacks up against individual stock momentum.

The AQR large cap momentum index is composed of the top one-third of the Russell 1000 stocks based on twelve-month momentum with a one-month lag.[4] AQR adjusts positions quarterly. The AQR small cap momentum index follows the same procedure but with the Russell 2000 index. Table 2 shows the results of the AQR indices, our equities dual momentum module, and the MSCI US benchmark from when the AQR U.S. indices began in January 1980.

[4] Data is from AQR Capital Management, LLC: http://www.aqrindex.com

Table 2 AQR Stock Momentum versus Equities Dual Momentum 1980-2011

	AQR Large Cap	AQR Small Cap	US MSCI	Equities Module
Annual Return	14.75	16.92	12.42	16.43
Annual Std Dev	18.68	22.44	15.60	13.13
Annual Sharpe	.45	.46	.41	.75
Max Drawdown	-51.02	-53.12	-50.65	-23.01
% Profit Months	65	63	63	75

The AQR indices show an advantage over the broad US market index in terms of return but not volatility.[5] This is characteristic of single asset, cross-sectional momentum. Our dual momentum module shows higher than market returns with considerably lower volatility and drawdown.

4. Credit Risk

Table 3 lists the average credit rating, average bond duration, and annualized standard deviations over the past five years of the most common intermediate term fixed income indices maintained by Barclays Capital.

The U.S. High Yield Bond Index has the highest volatility. Since average bond durations are about the same, the main cause of the index volatility differences between these intermediate bond indices is the credit default risk of their respective holdings, as reflected in their average credit ratings.

[5] The AQR momentum indices have significant portfolio turnover and estimated transaction costs of .7% per year that are not included in the above figures.

Table 3 Intermediate Fixed Income

Index	Rating	Duration	Volatility
Treasury	AA	4.0	3.7
Government	A	5.3	3.3
Government/Credit	A	3.9	3.4
Aggregate Bond	A	4.4	3.6
Credit	A	4.4	5.4
High Yield	B	4.1	14.0

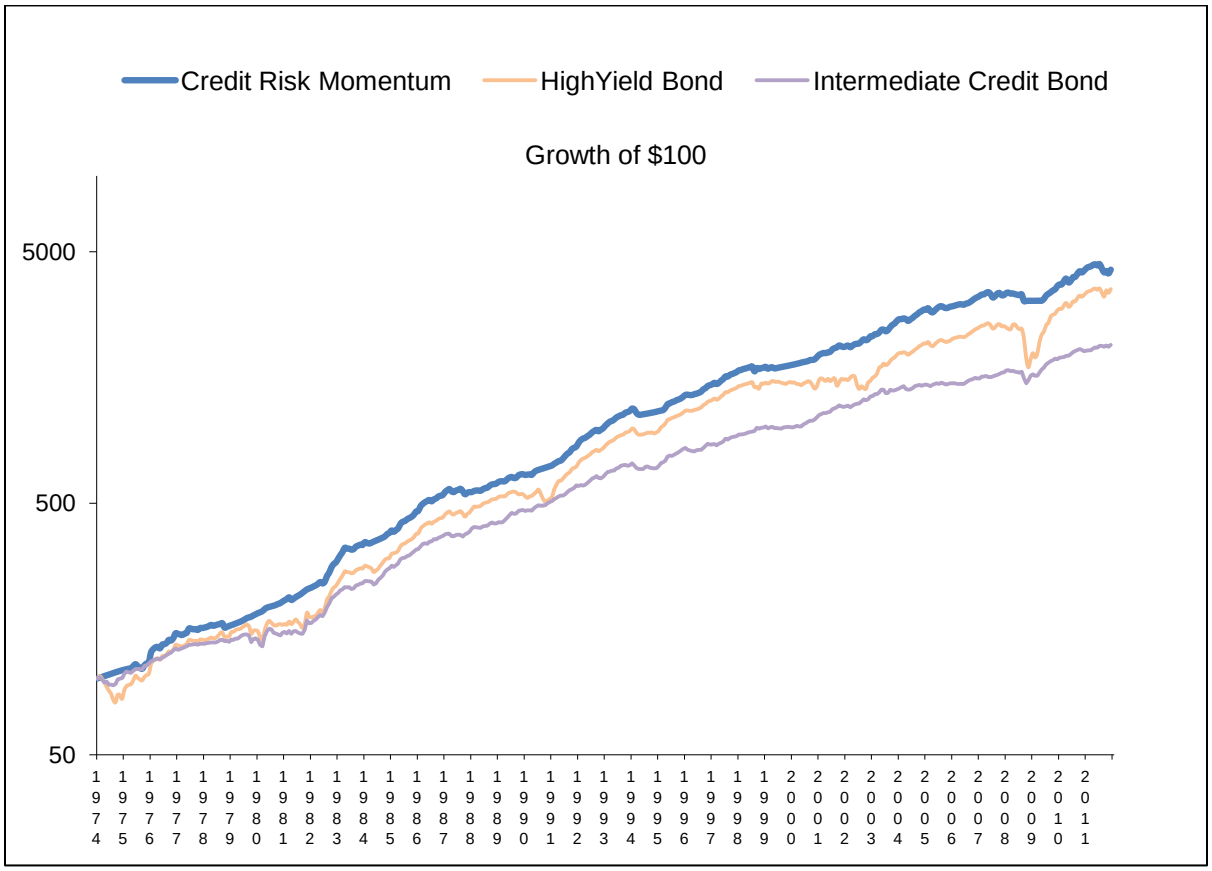
In Table 4, we see that applying dual momentum to high yield and credit bond indices produces almost a doubling of their individual Sharpe ratios. Dual momentum gives about the same profit as high yield bonds alone, but with less than half the volatility and one-quarter the drawdown.

Table 4 Credit Risk Momentum 1974-2011

	Dual Momentum	Relative Momentum	High Yield	Credit Bond
Annual Return	10.49	10.39	10.29	8.53
Annual Std Dev	4.74	6.13	8.67	5.19
Annual Sharpe	.97	.74	.51	.54
Max Drawdown	-8.20	-12.08	-33.17	-11.35
% Profit Months	83	75	71	73
Trades/Year	1.2	0.9	-	-

Although investors often apply momentum to equity investments, fixed income investors should take note of the potential here for extraordinary risk adjusted returns from a combination of relative and absolute momentum. Dual momentum gives us an additional 196 basis points per year return over intermediate term credit bonds with less volatility and drawdown.

Figure 2 Credit Risk Dual Momentum 1974-2011



5. Real Estate Risk

We can look for additional asset classes with high volatility. Table 5 is a list of the most volatile Morningstar equity sectors over the five years ending December 31, 2011.

Table 5 Morningstar Sectors

Sector	Annual Volatility
Real Estate	33.9
Basic Materials	29.7
Financial Services	29.4
Energy	27.2
Consumer Cyclical	24.4
Industrials	24.1
Technology	22.6

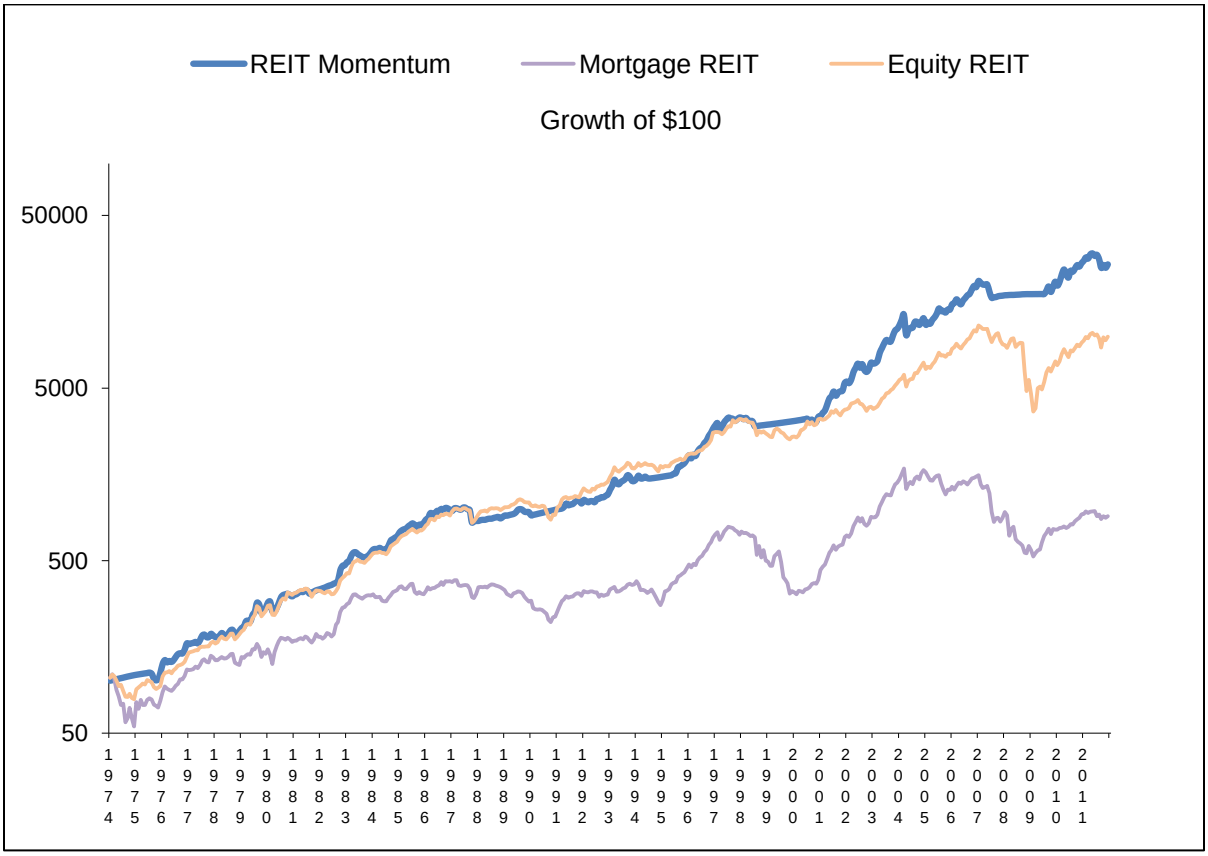
At the top of the list is real estate, with a standard deviation of 33.9%. The Morningstar Real Estate sector includes both equity and mortgage REITS. We will use equity and mortgage REITs separately to give us some differentiation for momentum selection purposes.

Table 6 shows an annual rate of return of 16.78% from our dual momentum strategy applied to these real estate REITs. This is higher than the returns of the individual equity and mortgage REIT indices. Our dual momentum Sharpe ratio is also higher than the Sharpe ratios of the REIT indices.

Table 6 REIT Momentum 1974-2011

	Dual Momentum	Relative Momentum	Equity REIT	Mortgage REIT
Annual Return	16.78	16.80	14.60	8.28
Annual Std Dev	13.24	16.56	17.39	20.71
Annual Sharpe	.77	.62	.48	.13
Max Drawdown	-23.74	-48.52	-68.30	-42.98
% Profit Months	73	62	62	59
Trades/Year	1.6	1.3	-	-

Figure 3 REIT Dual Momentum 1974-2011



6. Economic Stress

Economic stress is another volatility-based factor. Gold and long-term Treasury bonds can both react positively to weakness in the economy. Economic weakness tends to produce falling nominal interest rates, which raises bond prices. Gold is often strong when long-term Treasury yields fall and bond prices rise. Gold represents a flight from uncertainty, while Treasuries represent a flight toward quality.

Long-term Treasuries often have a negative correlation with equities, which makes them particularly useful from a portfolio point of view.[6] Gold can also be a hedge and diversifier during times of economic turmoil (Baur and McDermott (2012), Ciner, Gurdgiev, and Lucey (2012)).

Table 7 shows the economic stress module results. Gold's average annual standard deviation of 20.00 is almost the same as the 20.71 volatility of mortgage REITs, which is the highest of all our assets. Treasury bond's annual volatility of 10.54 is higher than the 8.67 volatility of the High Yield Bond Index.

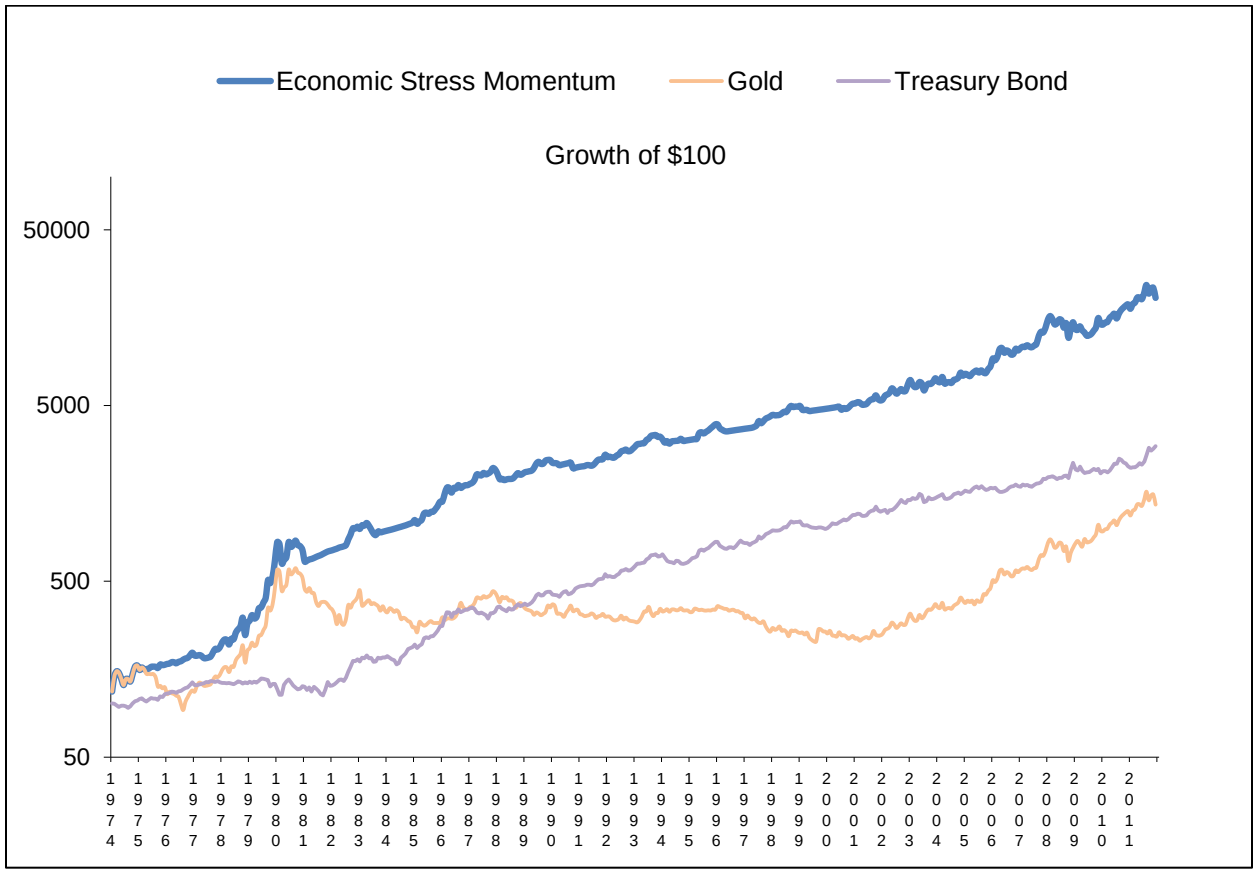
Table 7 Economic Stress Momentum 1974-2011

	Dual Momentum	Relative Momentum	Gold	Treasury Bond
Annual Return	16.65	16.31	9.22	9.90
Annual Std Dev	17.04	17.65	20.00	10.54
Annual Sharpe	.59	.56	.17	.39
Max Drawdown	-24.78	-36.82	-61.78	-20.08
% Profit Months	70	63	53	62
Trades/Year	1.6	1.2	-	-

[6] An alternative to 20 year Treasuries are zero coupon bonds. These match up well with gold's volatility and provide a quasi-leverage effect due to the high convexity of zero coupon bonds.

Dual momentum substantially raises the annual return and Sharpe ratio when compared to those of the individual assets. The economic stress module not only offers the potential for high returns, but it can add value as a safe haven during times of market stress and economic turmoil when normal correlations often rise. In Table 10, we see that the stress module contributes positive skew to our portfolio, which, along with trend-following absolute momentum, can help reduce the overall left tail risk of our portfolio.

Figure 4 Economic Stress Dual Momentum 1974-2011



7. Robustness Checks

Table 8 divides our 38 years of data into four decade-based sub periods. Sharpe ratios generally remain strong throughout the sub periods.

Table 8 Dual Momentum Performance by Decade

	Annual Return	Annual Std Deviation	Annual Sharpe	Maximum DD	% Profit Months
1/74-12/79					
Equities	12.43	10.72	.59	-11.84	69
Credit	10.56	5.63	.83	-4.15	81
REIT	18.69	13.31	.89	-12.70	75
Stress	40.69	24.83	1.18	-20.28	68
1/80-12/89					
Equities	22.38	14.43	1.04	-17.31	73
Credit	13.80	4.56	1.67	-4.94	84
REIT	14.34	11.20	.72	-17.91	69
Stress	15.83	17.72	.53	-24.27	73
1/90-12/99					
Equities	20.21	13.54	.97	-14.74	71
Credit	10.57	3.82	1.23	-5.41	88
REIT	13.42	9.85	.74	-11.20	77
Stress	7.23	7.48	.21	-10.79	76
1/00-12/09					
Equities	9.49	9.41	.39	-14.98	81
Credit	7.62	4.39	.45	-7.82	79
REIT	22.14	16.45	.90	-23.74	77
Stress	13.27	16.49	.43	-24.78	63

Table 9 shows dual momentum module performance using 3, 6, 9, and 12 month formation periods. All formation periods have average Sharpe ratios greater than the average Sharpe ratios of the individual assets shown in Table 10.

Table 9 Dual Momentum Formation Periods – 1974-2011

	Annual Return	Annual Std Deviation	Annual Sharpe	Maximum DD	% Profit Months
12 Months					
Equities	15.79	12.77	.73	-23.01	73
Credit	10.49	4.74	.97	-8.20	83
REIT	16.78	13.24	.77	-23.74	73
Stress	16.65	17.04	.59	-24.78	70
9 Months					
Equities	14.61	12.87	.65	-27.70	78
Credit	10.09	4.83	.88	-8.02	82
REIT	15.86	13.19	.71	-23.74	72
Stress	14.35	17.13	.47	-31.13	69
6 months					
Equities	14.67	12.33	.68	-22.54	74
Credit	10.95	4.98	1.01	-7.65	83
REIT	16.67	13.61	.74	-34.59	74
Stress	11.79	16.35	.35	-24.27	68
3 Months					
Equities	14.04	12.78	.61	-24.96	73
Credit	10.89	5.60	.89	-9.73	82
REIT	11.64	15.21	.37	-61.09	73
Stress	12.42	15.84	.40	-28.56	69

8. Dual Momentum Summary

Table 10 is a results summary of each asset and risk module, as well as of a composite of all four dual momentum modules that has been equally weighted.[7]

[7] 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.

Table 10 Momentum Summary 1974-2011

	Annual Return	Annual Std Dev	Annual Sharpe	Maximum Drawdown	Skew	Kurtosis
Equities						
• US	11.49	15.86	.35	-50.65	-.38	4.83
• EAFE+	11.86	17.67	.33	-57.37	-.32	4.21
Credit Risk						
• High Yield	10.29	8.67	.51	-33.17	-.49	10.01
• Credit Bond	8.53	5.19	.54	-11.35	.45	9.53
REITs						
• Equity REIT	14.60	17.39	.48	-68.30	-.72	11.57
• Mortgage REIT	8.28	20.71	.13	-42.98	-.22	8.29
Economic Stress						
• Gold	9.22	20.00	.17	-61.78	.60	6.72
• Treasuries	9.90	10.54	.39	-20.08	.38	4.81
Momentum Modules						
• Equities	15.79	12.77	.73	-23.01	-.24	4.83
• Credit Risk	10.49	4.74	.97	-8.20	-.10	8.96
• REITs	16.78	13.24	.77	-23.74	-.75	8.33
• Economic Stress	16.65	17.04	.59	-24.78	.68	11.86
• Composite	14.93	7.99	1.07	-10.92	-.45	6.56

Table 11 shows the percentage asset utilization within each momentum module. We will use this information to construct weighted average return benchmarks without momentum.

Table 11 Weighted Average Return Benchmarks 1974-2011

	Asset	Return	% of Time Utilized[8]	Weighted Average Return Benchmark
Equities	U.S.	11.49	37.7	
	EAFE+	11.86	39.7	
	T Bill	5.89	22.6	10.35
Credit Risk	Credit	8.53	19.5	
	Hi Yield	10.29	55.3	
	T Bill	5.89	25.2	8.82
REITs	Equity	14.60	46.9	
	Mortgage	8.28	26.8	
	T Bill	5.89	26.3	10.56
Stress	Gold	9.02	39.0	
	Treasuries	9.90	43.2	
	T Bill	5.89	17.8	8.91

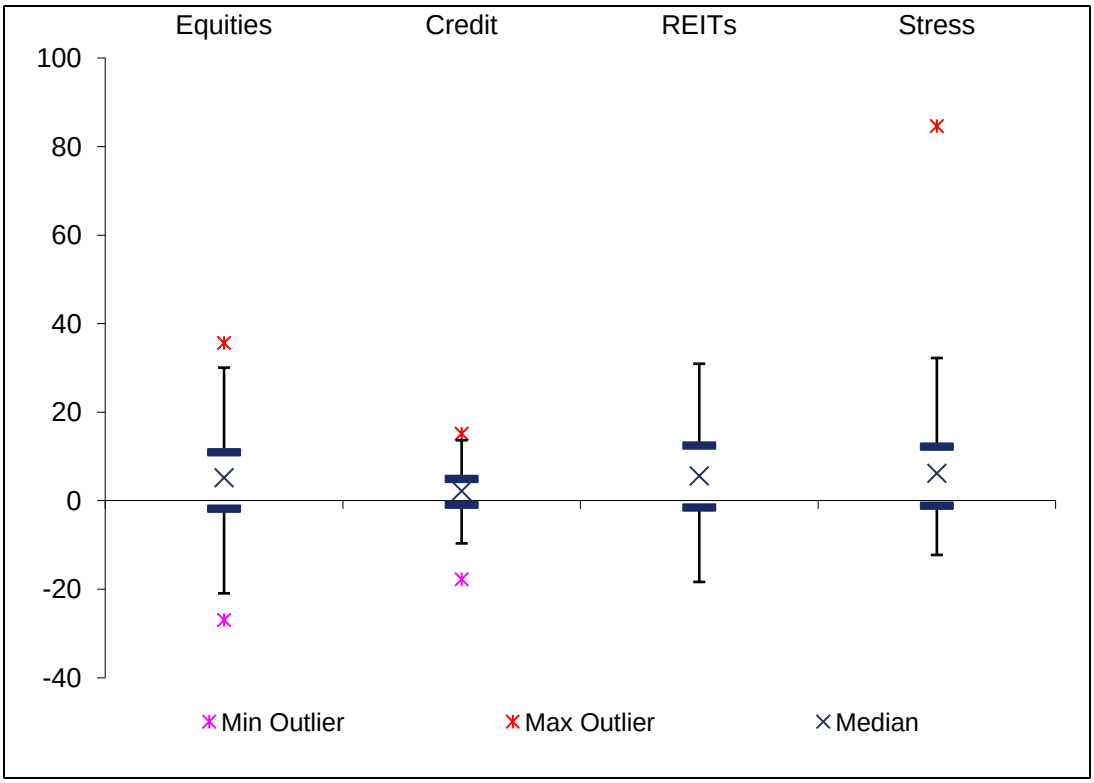
Table 12 compares dual momentum module performance with the weighted average return benchmarks from Table 11. Figure 5 is an inter quartile box plot of the differences in annual return between the weighted average benchmarks and the dual momentum modules covering our 38 years of data.

[8] The entire portfolio is simultaneously in Treasury bills 3.5% of the time. Three of the four modules are simultaneously in Treasury bills 6.8% of the time, while two of the four modules are simultaneously in Treasury bills 8.3% of the time.

Table 12 Benchmark versus Momentum Performance 1974-2011

	Annual Return	Annual Std Deviation	Annual Sharpe	Maximum DD	% Profit Months
Equities Momentum	15.79	12.77	.73	-23.01	73
Equities Benchmark	10.35	11.79	.38	-44.56	63
Credit Momentum	10.49	4.74	.97	-8.20	83
Credit Benchmark	8.82	5.55	.56	-20.06	75
REIT Momentum	16.78	13.24	.77	-23.74	73
REIT Benchmark	10.56	12.08	.39	-52.90	64
Stress Momentum	11.65	17.04	.59	-24.78	70
Stress Benchmark	8.91	9.10	.35	-21.33	60

Figure 5 Benchmark/Momentum Annual Return Differences 1974-2011



9. Module Characteristics

We might find additional high volatility assets by further segmenting a market or asset class. For example, we could split equities into individual countries or regions. However, greater segmentation would reduce the diversification benefits we get from using broader asset classes.

Our module approach imposes a framework of portfolio diversification, which reduces portfolio volatility. Our trend following, absolute momentum Treasury bill overlay further reduces potential downside volatility. These two elements of our dual momentum approach are desirable from a portfolio risk point of view.

Figure 6 Composite Dual Momentum versus Components 1974-2011

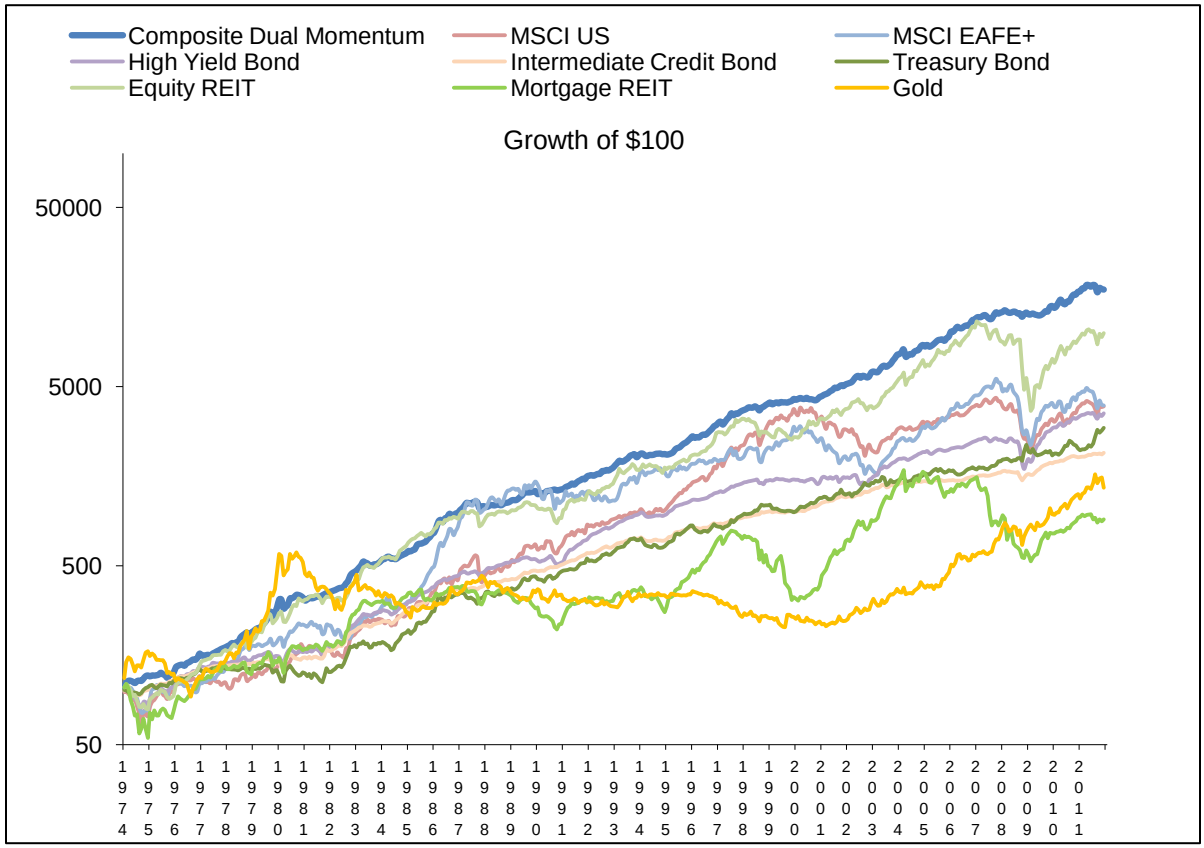


Figure 7 Composite Dual Momentum versus Benchmarks 1974-2011

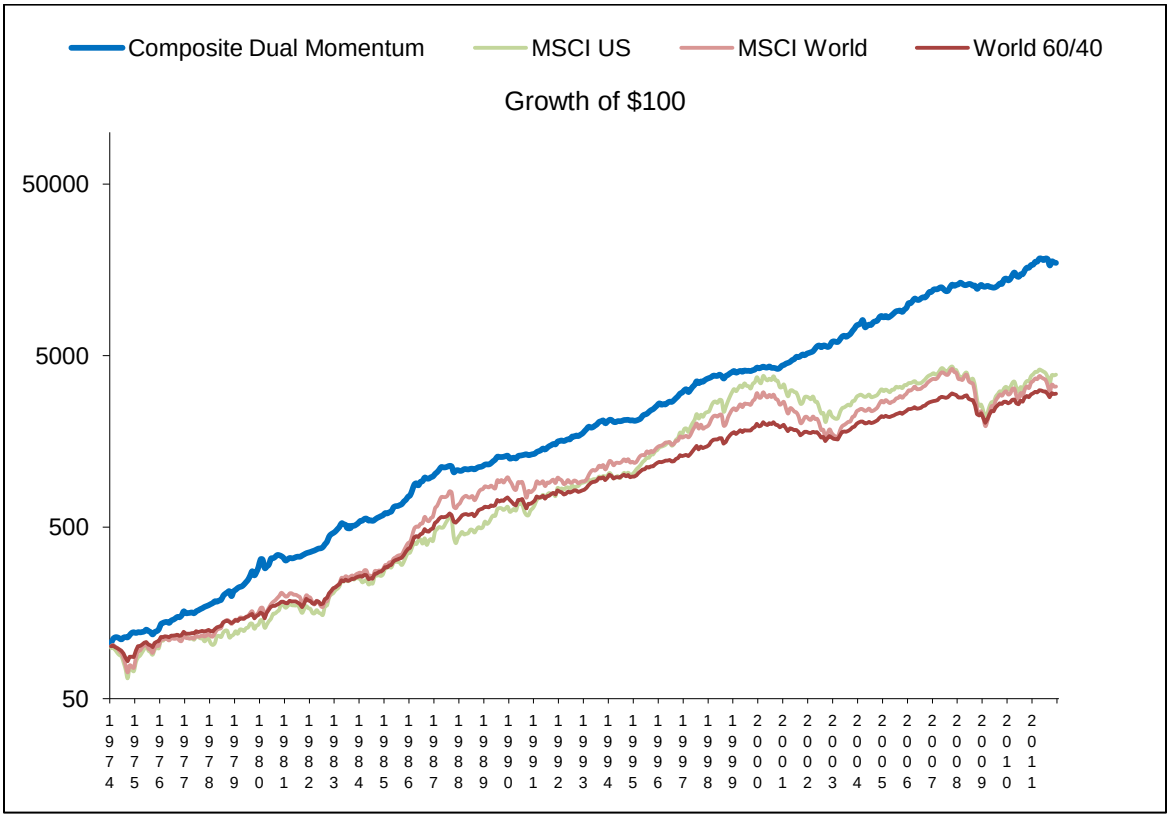


Figure 8 shows the Sharpe ratios of all our assets and momentum modules, as well as of an equally- weighted composite dual momentum portfolio. The highest Sharpe ratio belongs to the composite dual momentum portfolio, showing how momentum results benefit from cross-asset diversification.

Figure 8 Sharpe Ratios 1974-2011

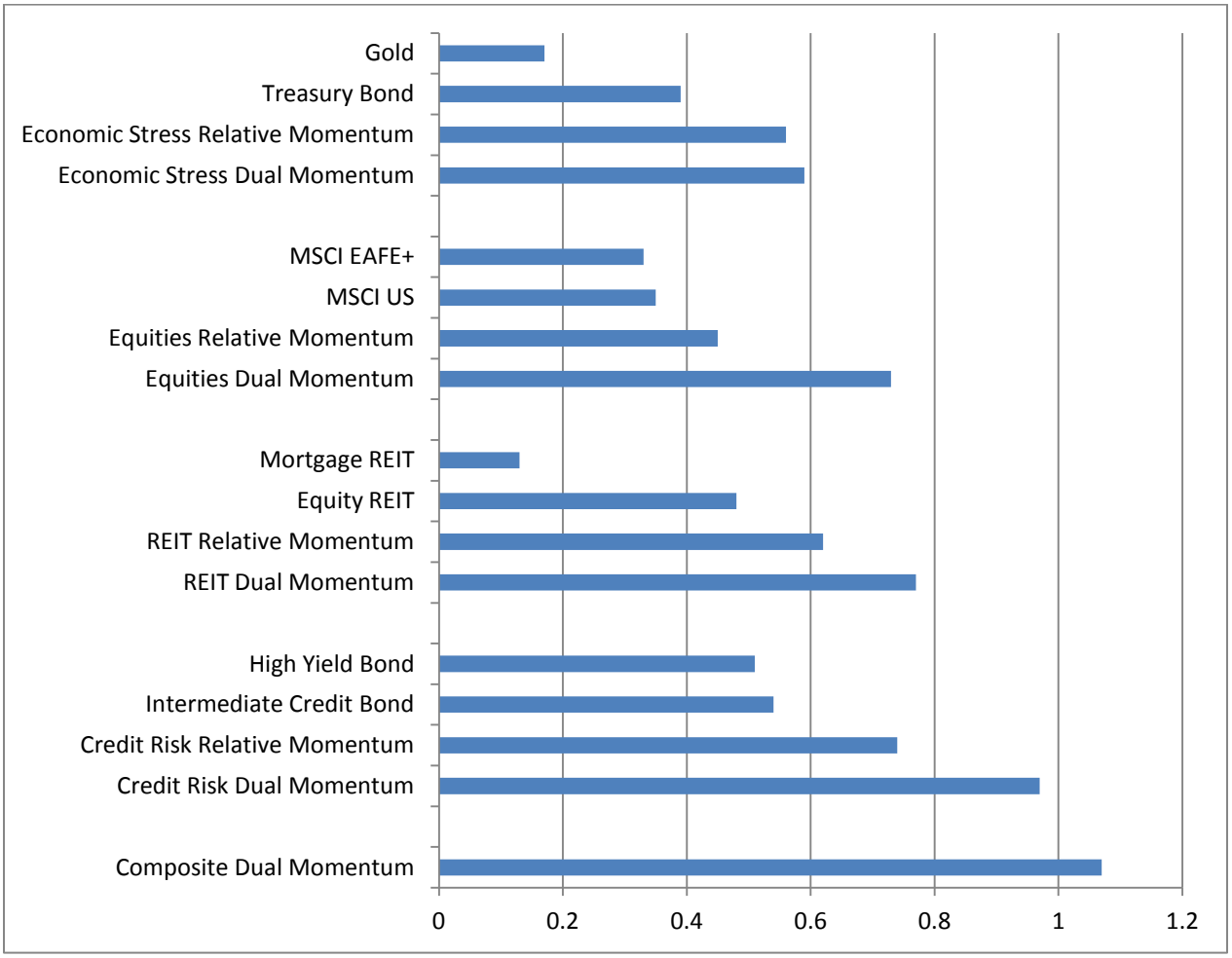


Table 13 shows performance versus several benchmarks during the three worst periods of monthly equity erosion over the 38 years covered by our data. We see that our composite dual momentum portfolio, through its trend following characteristics, has been a safe haven from most market adversity during this 38-year period. Figures 9 and 10 show maximum drawdowns that occur over rolling numbers of months and years.

Table 13 Largest Bear Market Drawdowns 1974-2011

Date	MSCI US	MSCI World	World 60/40	Composite Momentum
3/74 - 9/74	-33.3	-30.8	-19.0	+2.1
9/00 – 9/01	-30.9	-31.7	-15.9	+17.1
4/02 - 9/02	-29.1	-25.6	-11.9	+7.5
11/07 - 2/09	-50.6	-53.6	-32.8	-2.8
World 60/40 is composed of 60% MSCI World Index and 40% Barclays Intermediate Treasury Index.				

Figure 9 Rolling 1-12 Month Maximum Drawdowns 1974-2011

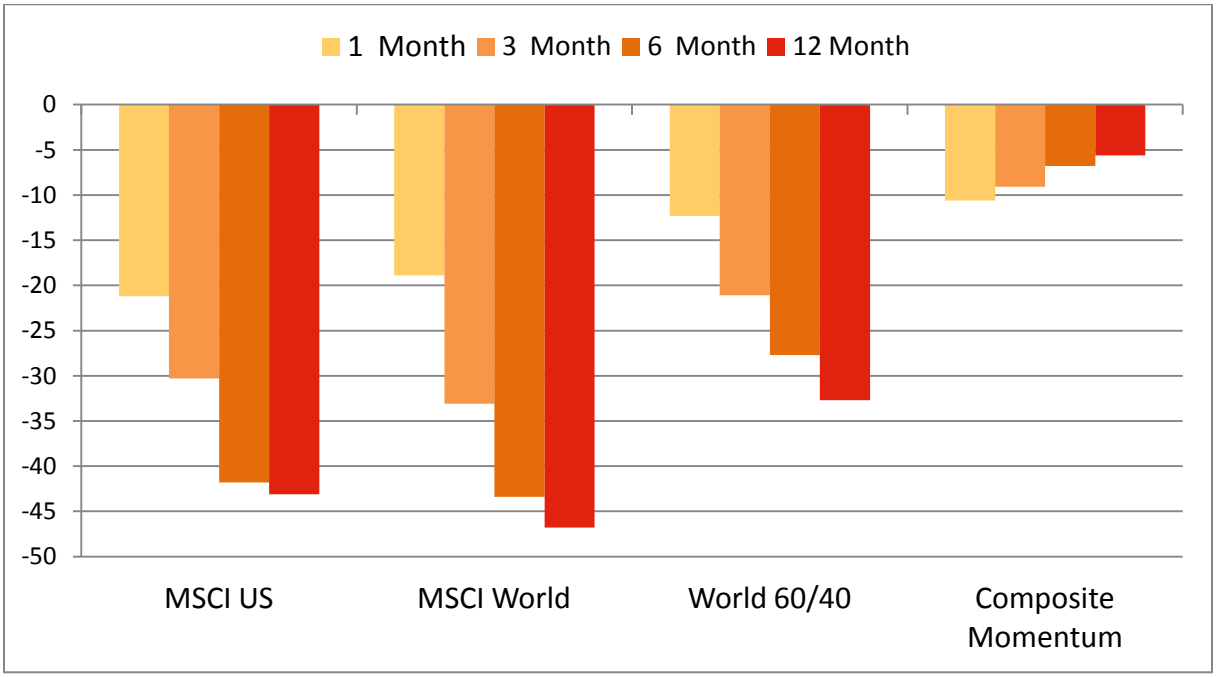
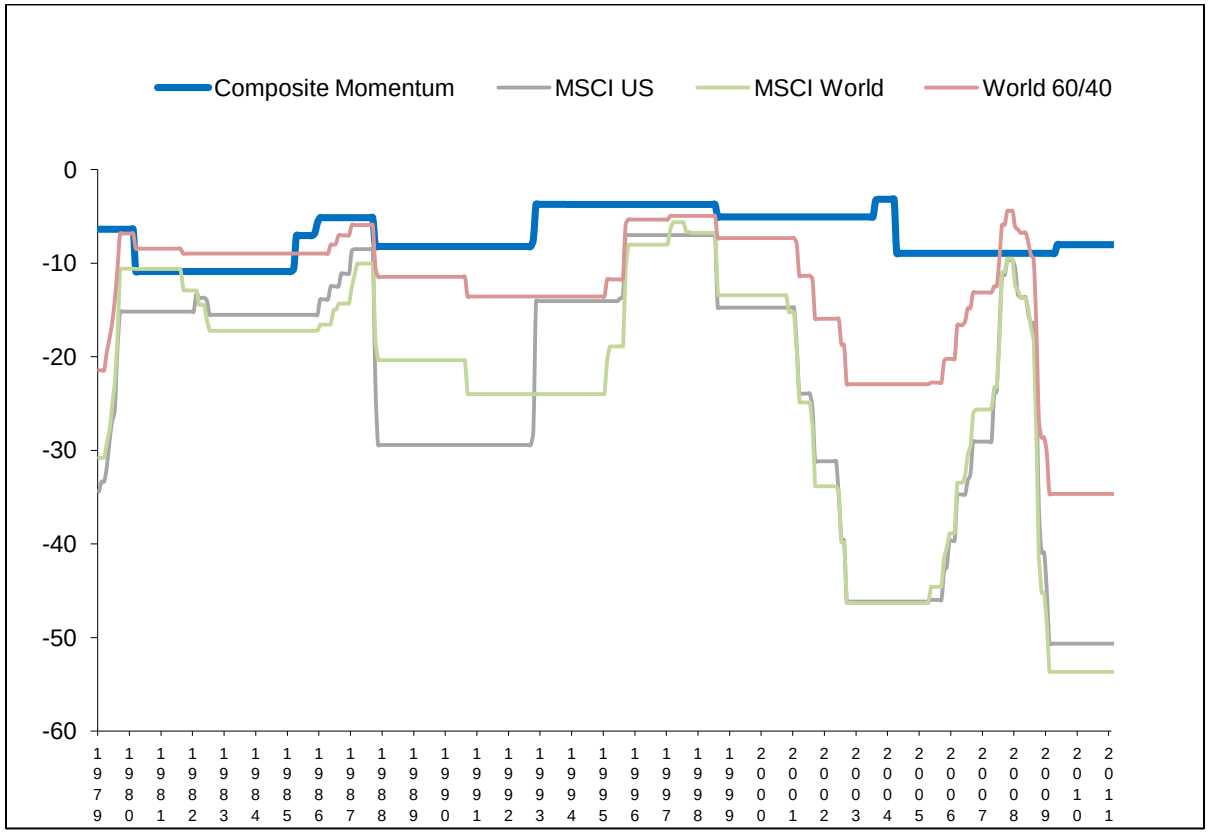


Figure 10 Rolling 5 Year Maximum Drawdowns 1979-2011



10. Absolute Momentum

Table 14 shows equal-weighted composite portfolios with and without absolute momentum. The first column is all nine assets without any momentum. The second column shows the same assets with an absolute momentum overlay applied to each asset. The third column shows our four modules with relative momentum, but not absolute momentum. The final column is our dual momentum module-based portfolio. We see that absolute momentum enhances performance considerably, both with and without relative momentum.

Table 14 Composite Portfolios 1974-2011

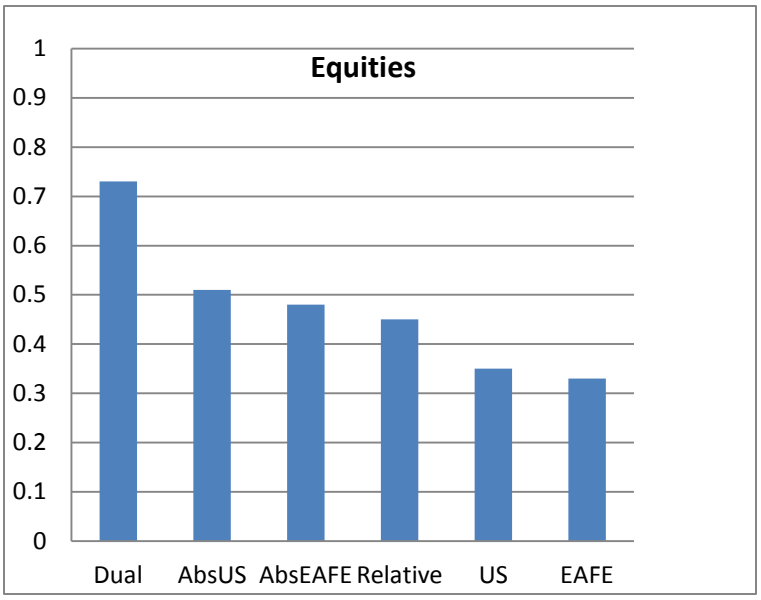
	No Momentum	Absolute Momentum	Relative Momentum	Dual Momentum
Annual Return	9.93	11.76	14.21	14.90
Annual Std Dev	8.15	5.50	9.94	7.99
Annual Sharpe	.50	1.05	.80	1.07
Max Drawdown	-27.00	-7.52	-27.29	-10.92
% Profit Months	68	76	69	73

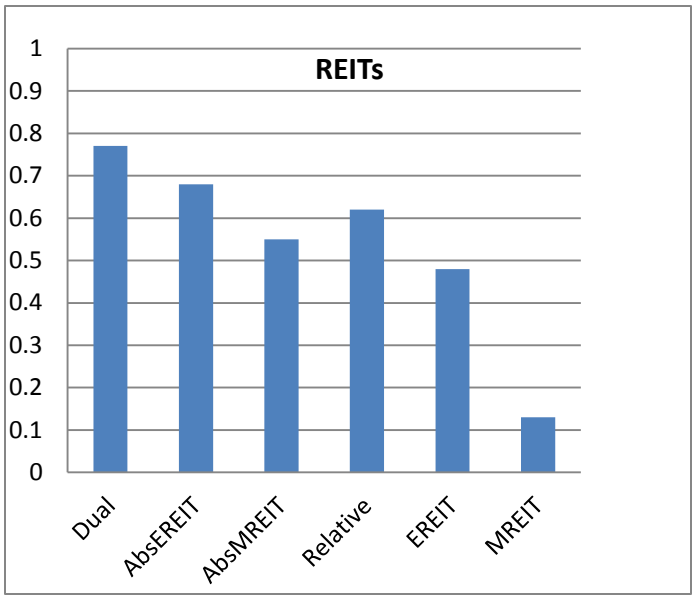
Table 15 shows absolute and relative momentum further broken out in various ways. The column called Dual Momentum is the combination of relative and absolute momentum as per the methodology of this paper. Absolute Momentum results for each asset are determined by looking at momentum for that asset alone with respect to the Treasury bill hurdle rate. Relative Momentum looks at the momentum match up within each module asset without the inclusion of Treasury bills. Figure 11 displays the Sharpe ratios, and Figure 12 shows the maximum drawdown of each of these relative and absolute momentum strategies.

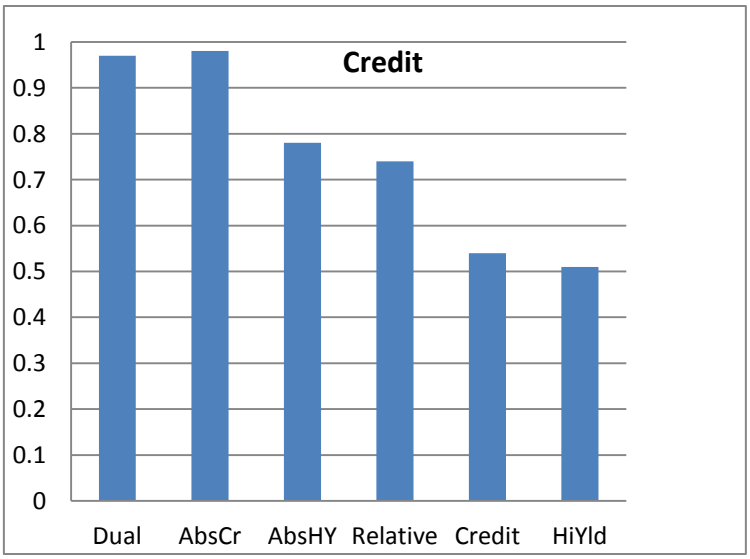
Table 15 Absolute and Relative Momentum 1974-2011

Equities	Dual Mom	US Abs Mom	EAFE Abs Mom	Relative Mom
Annual Return	15.79	12.03	11.67	13.46
Annual SD	12.77	11.78	11.85	16.17
Sharpe	0.73	0.51	0.48	0.45
Max DD	-23.01	-29.42	-23.11	-54.56
Credit	Dual Mom	Hi Yield Abs Mom	Credit Abs Mom	Relative Mom
Annual Return	10.49	10.44	8.48	10.39
Annual SD	4.74	4.66	3.56	6.13
Sharpe	0.97	0.98	0.78	0.74
Max DD	-8.2	-7.28	-7.47	-12.08
REITs	Dual Mom	Eq REIT Abs Mom	Mort REIT Abs Mom	Relative Mom
Annual Return	16.78	14.23	12.62	16.8
Annual SD	13.24	11.75	11.84	18.56
Sharpe	0.77	0.68	0.55	0.62
Max DD	-23.74	-19.95	-23.74	-48.52
Stress	Dual Mom	T Bond Abs Mom	Gold Abs Mom	Relative Mom
Annual Return	16.65	10.44	14.27	16.31
Annual SD	17.04	8.38	16.6	17.65
Sharpe	0.59	0.55	0.48	0.56
Max DD	-24.78	-12.92	-24.78	-36.82

Figure 11 Momentum Sharpe Ratios 1974-2011







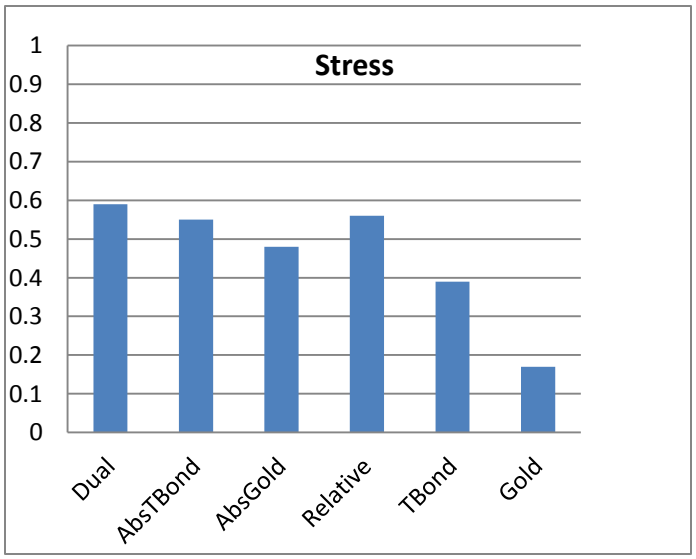
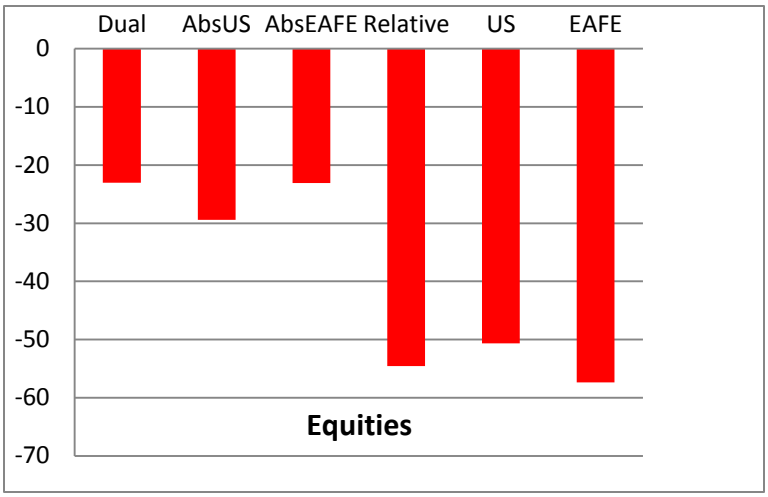
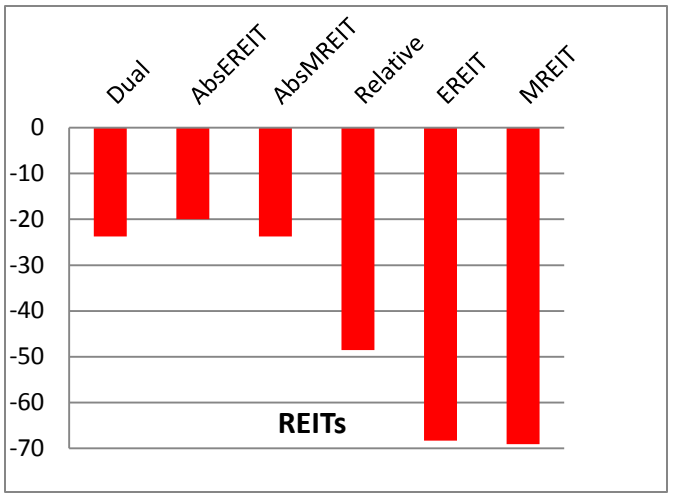
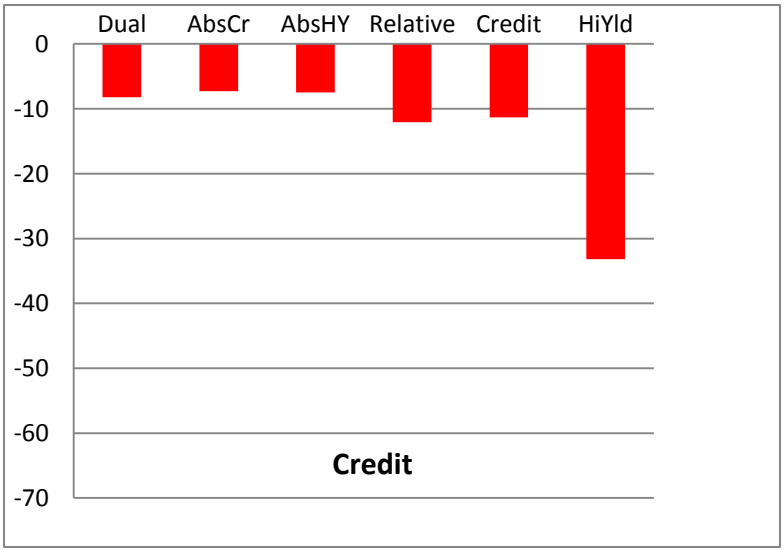
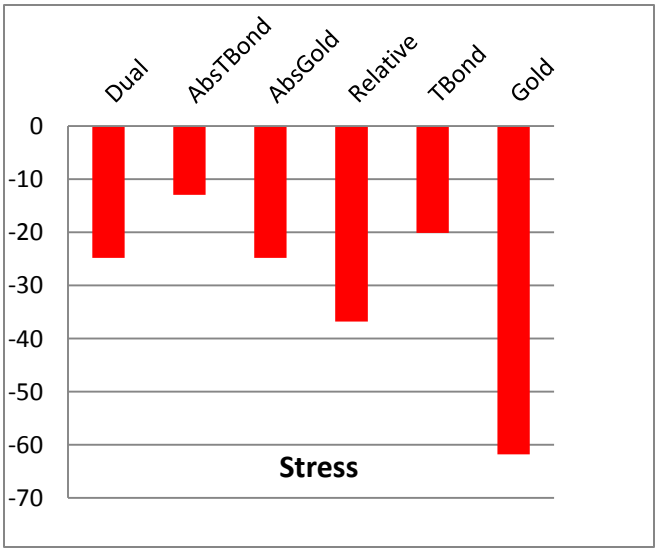


Figure 12 Momentum Maximum Drawdowns 1974-2011









In every case, relative momentum performance is superior to the individual assets' performance without the use of momentum, as seen in the Sharpe ratios. Absolute momentum, on average, gives some improvement in Sharpe ratio with respect to relative momentum. In addition, absolute momentum gives substantially lower maximum drawdowns than relative momentum. While both relative and absolute momentum can enhance returns, only absolute

momentum substantially reduces volatility and drawdown. The best results, however, come from dual momentum, our combination of absolute and relative momentum.

11. Correlations

Table 16 shows the monthly correlations of the dual momentum modules, as well as the correlations of the modules using only relative momentum. We have already seen that absolute momentum is beneficial in raising return and lowering the volatility and drawdown of individual portfolio assets. We now see that absolute momentum is also worthwhile from a portfolio point of view, since it lowers cross-module correlations.

Table 16 Correlation Coefficients 1974-2011

With Dual Momentum			
	Credit Risk	REITs	Stress
Equities	.35	.29	.22
Credit Risk		.40	.12
REITs			.14
With Relative Momentum			
	Credit Risk	REITs	Stress
Equities	.40	.45	.23
Credit Risk		.46	.22
REITs			.18

Table 17 shows the monthly correlation of each module's dual and relative momentum to the major asset classes of the S&P 500 index and 10 Year US Treasury bonds. Most of the

dual momentum correlations are also lower than the relative momentum major asset correlations.

Table 17 Module Correlations to Major Asset Classes 1974-2011

	Equities	Credit	REITs	Stress
S&P500 w/Dual Momentum	.56	.42	.36	.11
S&P500 w/Relative Momentum	.78	.49	.53	.13
10 Yr Bonds w/Dual Momentum	.08	.34	.10	.28
10 Yr Bonds w/Relative Momentum	.07	.57	.14	.36

12. Factor Model

Table 18 shows a six-factor model of our momentum modules and composite dual momentum portfolio regressed against the excess returns of the MSCI World Equity (MSCI), Barclays Capital U.S. Aggregate Bond (BOND), and S&P GSCI (GSCI) indices, along with the Fama-French-Carhart size (SML), value (HML), and cross-sectional momentum (UMD) risk factors, as per the Kenneth French website.

Table 18 Six-Factor Model Coefficients 1976-2011

	Alpha[9]	MSCI	BOND	GSCI	SMB	HML	UMD	R^2
Equities	5.20**	.62***	-.05	.02	-.04	-.03	.20***	.54
	(2.54)	(9.12)	(-0.44)	(,52)	(-.70)	(-.43)	(4.78)	
Credit	2.00**	.13***	.30***	-.01	.08***	.09***	.07***	.21
	(2.55)	(6.29)	(4.07)	(-.39)	(3.06)	(2.69)	(3.29)	
REITs	3.28	.34***	.27**	-.04	.41***	.34***	.27***	.26
	(1.49)	(6.13)	(2.05)	(-1.39)	(6.63)	(5.10)	(5.41)	
Stress	4.61*	.20***	.64***	.15***	-.01	.16*	.22**	.10
	(1.65)	(2.47)	(2.64)	(4.30)	(-0.12)	(1.68)	(2.07)	
Composite	3.76***	.32***	.29***	.03	.11***	.14***	.19**	.44
	(3.36)	(9.06)	(3.08)	(1.53)	(3.01)	(3.69)	(5.31)	

[9] Alphas are annualized. Newey-West (1987) adjusted t-statistics are in parentheses. Significance levels are *** 1%, ** 5%, and * 10%.

We see significant positive alphas in our equities and credit, and stress modules, as well as our dual momentum composite. As expected, cross-sectional momentum loadings are positive and significant across all modules and the composite.

13. Conclusions

Our results have important implications for momentum investors. Using thirty-eight years of past performance data, dual momentum modules show significant performance improvements in all four areas we have examined - equities, credit risk, real estate, and economic stress, as well as with an equally-weighted composite portfolio of all the modules. The ancillary conclusions we reach are as follows:

1) Long side momentum works best when one uses a combination of absolute momentum and relative strength momentum. Trend determination with absolute momentum can help mitigate downside risk and take advantage of regime persistence, while both relative strength and absolute momentum can enhance expected returns. Portfolios also benefit from the low correlations that accompany dual momentum, making multi-asset momentum portfolios desirable.

2) Investors generally wish to avoid high volatility. There is now, in fact, a propensity toward low volatility investment portfolios. However, what is undesirable is downside variability, rather than total volatility. Absolute momentum can help investors harness volatility and convert it into extraordinary returns while reducing the potential drawdowns that are usually associated with high volatility.

3) Focused modules can isolate and target specific risk factors. They facilitate the effective use of a hurdle rate/safe harbor alternative asset. Modules provide flexibility and diversification

on a non-parametric basis, making it simple and easy to implement dual momentum-based portfolios.

The combination of relative and absolute momentum makes diversification more efficient by selectively utilizing assets only when both their relative and absolute momentum are positive, and these assets are more likely to appreciate. A dual momentum approach bears market risk when it makes the most sense, i.e., when there is positive absolute, as well as relative, momentum. Module-based dual momentum, serving as a strong alpha overlay, can help capture risk premia from volatile assets, while at the same time, defensively adapting to regime change.

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