The SIMPLE Investment Strategy

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EXECUTIVE SUMMARY

- The SIMPLE investment strategy has provided a higher return, higher risk adjusted return and lower downside risk than conventional investment strategies since 1974.
- The strategy is implemented using low cost exchange traded funds and it has adequate capacity for smaller advisory firms.
- The strategy employs timing algorithms to mitigate downside risk. Market timing has pejorative connotations for some and it is generally not cost-free. However, the mitigation cost of market timing has been less than the cost of mitigation using a static bond allocation.
- The SIMPLE strategy reduces the return risks associated with saving for retirement and with withdrawals during retirement. The potential improvements are so large that planner should consider rethinking guidelines for pre-retirement savings rates and for post-retirement withdrawal rates.
- The strategy should be attractive to risk adverse investors and to advisers who seek to provide improved performance at low incremental cost.
- There are no licensing costs and no third party management fees.

INTRODUCTION

This article introduces the SIMPLE strategy. The SIMPLE strategy promises a higher return, higher risk adjusted return, less downside risk and a longer lived retirement portfolio as compared to traditional investment strategies.

The SIMPLE strategy ranks three funds: US stocks, foreign stocks and real estate. The strategy allocates to the two funds with the highest momentum.

Momentum refers to stocks which are appreciating in price faster than other stocks. Momentum tends to continue to provide outsized returns for a few weeks or a few months after the measurement date.

Momentum is one of the investment "factors" which explain market returns[1]. Other important factors include size (stocks with smaller capitalizations tend to do better than other stocks), value (stocks with lower book-to-price ratios tend to do better than other stocks), volatility and quality (stocks of profitable companies with persistent earnings and low leverage tend to do better than other stocks[2].)

Factor and smart beta funds – the names are essentially interchangeable - are the current rage. Half of the exchange traded funds launched in the first half of 2017 were factor funds[3].

The potential incremental returns from factor investing are huge[4]. Figure 1 illustrates that a dollar invested in large cap stocks in December 1927 would have been worth $3,800 in December 2016 with dividends reinvested, before expenses and taxes. If the same dollar had been invested in small cap stocks with good momentum, the portfolio would have grown to $1.6 million.

The potential returns of the SIMPLE strategy are less than for factor investing. However, we expect the SIMPLE strategy to outperform factor investing in practice because the SIMPLE strategy is less constrained by cyclicality, capacity and tracking issues.

This article begins with a discussion of the constraints which challenge factor investing. We then address downside risk mitigation and argue that tactical changes to the bond allocation (otherwise known as market timing) is cost effective as compared to including a static bond allocation.

We then trace the evolution of the SIMPLE strategy from its origin as Antonacci's Dual Momentum strategy and describe backtested performance

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[1]Eugene F. Fama and Kenneth R, French, "Common risk factors on the returns of stocks and bonds," *Journal of Financial Economics* **33** (1993) 3–56; Mark M. Carhart, "On Persistence in Mutual Fund Performance," *Journal of Finance* **52** 57-82 (March 1997) 57-82.

[2] For a discussion, see "Flight to Quality. Understanding Factor Investing" by Eugene Lim, Raphael Hung, Chin-Ping Chia, Subhajit Barman and Anand Muthukrishnan, MSCI, September 2015.

[3] *ETF Report*, August 2017, p. 21.

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

Global tactical asset allocation (GTAA) strategies across a broad range of asset classes are explored in this article. In contrast to market timing for single asset classes and tactical allocation across similar assets, this topic has received little attention in the existing literature. The main finding documented in this article is that momentum and value strategies applied to GTAA across 12 asset classes deliver statistically and economically significant abnormal returns. For a long top-quartile and short bottom-quartile portfolio based on a combination of momentum and value signals, the authors report a return of 12% per annum over the 1986–2007 period. Performance is stable over time, is also present in an out-of-sample period, and is sufficiently high to overcome transaction costs in practice. The return cannot be explained by potential structural biases toward asset classes with high risk premiums, nor by the Fama–French and Carhart hedge factors. The authors argue that financial markets may be macroinefficient due to insufficient "smart money" being available to arbitrage away mispricing effects.

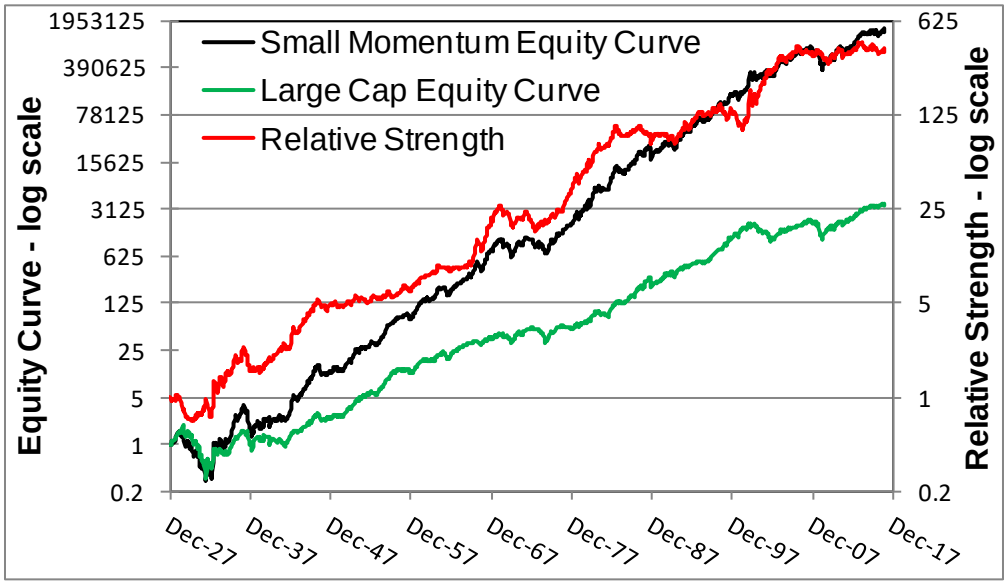
since 1974. We conclude by illustrating the benefits of the SIMPLE strategy for savings accumulation and portfolio longevity.

CONSTRAINTS ON FACTOR INVESTING

Cyclicality

The performance of a factor portfolio tends to vary over time. The industry calls this "cyclicality." The red curve in Figure 1 demonstrates cyclicality in the performance of a small momentum portfolio versus large cap stocks The red curve is the ratio of the equity curve of small momentum stocks divided by the equity curve of large cap stocks. Such ratios are called "relative strength."

Figure 1. Equity Curves (left axis) of Small Momentum and Large Cap Stock Portfolios and the Relative Strength (right axis) of Small Momentum Stocks versus Large Cap Stocks.



A rising relative strength identifies the years when small momentum stocks outperformed large cap stocks. A flat relative strength, after 2005 for example, identifies an interval when small momentum stocks provided about the same return as large cap stocks. Declines in relative strength in 1937-38 and 1969-73 identify intervals when the value of the small momentum portfolio lost 35% of its value relative to the large cap portfolio.

Individual factors tend to be hot at different times and the performance of one factor tends to show low correlations to the performance of other factors. Index providers argue that diversifying across several factors provides a more reliable performance and a partial solution to the cyclicality constraint.

Index providers design multi-factor indices by ranking each stock in terms of a particular factor and combining the ranks in some manner. The final index is composed of stocks with exposure to several factors[5]. The return of multi-

[5] "Factor Exposures of Smart Beta Indexes," FTSE Russell, 2015 and "Focused Factor Indices Methodology Overview," FTSE Russell, © 2017.

Andrew Innes, "The Merits and Methods of Multi-Factor Investing," S&P Dow Jones Indices, 2017.

factor indices is generally less than the potential return of the highest performing factor.

We will show that the SIMPLE strategy exhibits low cyclicality and high returns.

Underperformance Percentage (UPP)

Our goal is an investment strategy which consistently provides more return and less risk than conventional benchmarks. We measure the consistency of a strategy as the percentage of time that the return is less than the return of the benchmark over rolling 36-month intervals.

The small momentum portfolio provided less return than the large cap benchmark in 232 of the 1,033 rolling 36-month intervals between December 1927 and December 2016. The underperformance percentage (UPP) of the small momentum portfolio is 22%, 232 intervals in which the small momentum portfolio provide less return than the large cap benchmark divided by 1033 total intervals.

Gray and Vogel argue that investment managers risk their careers when they adopt strategies which could underperform over an extended period[6].

Index providers minimize underperformance by avoiding concentrated portfolios and sector bets. Factor indices therefore tend to resemble cap weighted funds with small tilts to a factor or factors.

Backtesting shows that the SIMPLE strategy provides a low underperformance percentage. Career risk is low for the adviser who adopts the SIMPLE strategy.

Capacity, Trading Costs and Rebalancing

The third constraint on factor investing is capacity. Large trades move prices and price distortion decreases profitability. Capacity becomes more of a constraint as portfolios become more concentrated, as market capitalizations and trading volumes decrease and as the rebalancing frequency increases. It is no surprise therefore that factor indices tend to avoid stock with low capacity (that is, smaller stocks generally) and to trade quarterly or less frequently.

The SIMPLE strategy is a fund of funds which trades monthly based on the relative momentum of the candidate funds. Although candidate funds have hundreds of millions of dollars of daily volume, capacity won't be adequate if many advisors adopt the SIMPLE strategy and rebalance on the last day of the month. Market arbitrageurs would notice as well. For these reasons, consider rebalancing one fourth of the portfolio at weekly intervals.

Northern Trust Asset Management takes a similar approach. See the July 20, 2017 webinar by Michael R. Hunstad, "Answering the Toughest Questions on Factor Investing."

See also Appendix B.

[6] *Quantitative Momentum,* Wesley R. Gray and Jack R. Vogel, Wiley, 2016. especially Chapters 2 and 8.

The SIMPLE strategy owns at most two funds but it is not a concentrated strategy because the funds are broadly diversified. The return of the SIMPLE strategy is not as high as more concentrated momentum strategies but the return is significantly more than the returns of conventional benchmarks.

Current Momentum Funds

There are no momentum funds with long histories. As shown in Table 1, there is considerable variation in the returns of existing funds.

Table 1. Returns of US Momentum Funds, August 31, 2017, percent. OENO tilts towards momentum within a universe already tilted towards the quality, size and value factors. The loss sustained by the SIMPLE strategy in 2015 was caused by an unfortunate move to cash for the month of October 2015.

		# assets	2014	2015	2016	2017YTD
Large Caps	**VFINX**	**500**	**13.5**	**1.3**	**11.8**	**11.8**
AQR	AMOMX	333±	8.4	3.0	4.7	13.7
Dorsey Wright	PDP	100±	12.2	1.1	2.4	15.6
MSCI	MTUM	125±	14.6	8.9	5.0	23.7
S&P	SPMO	100±			7.4	13.0
Mid&Large Cap	**IWB**	**1000**	**13.1**	**0.8**	**12.0**	**11.6**
Alpha Architects	QMOM	50±			4.9	5.4
AQR	ASMNX	667±	3.0	-3.9	13.2	6.3
FTSE Russell	ONEO	1000±			11.3	9.6
SIMPLE		**2**	**14.2**	**-10.6**	**12.0**	**11.0**

DATA SOURCES

For the small momentum portfolio, we use dividend adjusted total return data from the French data library at the Tuck School of Business, Dartmouth College, based on the 201706 CRSP database. The French small momentum portfolio is a capitalization weighted portfolio of the stocks with eleven month returns in the top 30% of all stocks and capitalizations in the smaller half[7].

Funds have an advantage over indices in that they reflect actual performance net of fees. Unfortunately, there are only about thirty years of fund history and it is therefore necessary to use spliced data sets.

A spliced dataset is a composite or index prior to the availability of fund data and fund data thereafter[8].

Bonds	Spliced VBMFX: Intermediate Term Government Bonds (SBBI) before September 1988 and the mutual fund VBMFX thereafter. The VBMFX benchmark is the Barclays US Aggregate Bond Index.
T-bills	Spliced BIL: 13-week T-bills (^IRX) to June 2007 and BIL thereafter. BIL is an exchange traded fund which uses the Barclays 1-3 Month U.S. Treasury Bill Index as its benchmark.
Large Cap US Stocks	Spliced VFINX: S&P Composite (SBBI) before September 1988 and the mutual fund VFINX thereafter. VFINX uses the S&P Composite with dividends as its benchmark.

[7] The French data library measures momentum as the total return over eleven months, the past year omitting the most recent month. Relative Momentum measures momentum as the total return over twelve months. The Relative Momentum algorithm provides a slightly better return, Sharpe ratio and maximum drawdown performance with the SIMPLE strategy.

[8] SBBI refers to Ibbotson's "Stocks, Bonds, Bills and Inflation Yearbook" published by Morningstar, Inc.

SBBI attributes the large company stock total returns from 1977 - August 1997 to the American National Bank and Trust Company of Chicago and to Standard and Poor's thereafter. Prior to March 1957, the S&P Composite consisted of ninety stocks.

Daily data for the S&P 500 Composite without dividends are from Yahoo.com (^GSPX) and FastTrack.net (SP-CP).
Monthly data for the MSCI-EAFE index are from msci.com. This index excludes the US, Canada and emerging markets.

Monthly data for the FTSE NAREIT All REITs Index are from reit.com. This is a market capitalization-weighted index that includes all tax-qualified real estate investment trusts (REITs) that are listed on the New York Stock Exchange, the American Stock Exchange or the NASDAQ National Market List.

^IRX is the bank discount rate of 91-day Treasury bills. The market day return of a T-bill maturing in n days is $[1 + \{ R_{bd} * n / 36{,}000 / (1- R_{bd} * n / 36{,}000)\}] ^ (365 / (252 * n) – 1$. See Bodie, Kane and Marcus, 4th Edition, pp. 27-29. The market day return was approximated as (1+^IRX/100)^(1/252).

Daily ^IRX data are from Yahoo.com.

Daily data for stocks, mutual funds, ETFs and indices after August 1988 are from FastTrack.net.

Foreign Stocks	Spliced HAINX: MSCI-EAFE (net of foreign tax) before September 1988 and the mutual fund HAINX thereafter. HAINX is an actively managed fund. The mutual fund VGTSX is more representative of foreign stocks because it uses the FTSE World exUS Index as its benchmark. Unfortunately, VGTSX has no data history before May 1996.
Real Estate	Spliced FRESX: FTSE NAREIT US Real Estate "ALL REITS" Index before September 1988 and the mutual fund FRESX thereafter. FRESX is an actively managed fund which uses the MSCI US REIT Index as its benchmark.
Long Bonds	Spliced VUSTX: Long Term Government bonds (SBBI) before September 1988 and the mutual fund VUSTX thereafter. As of July 2017, the average maturity and duration of VUSTX are about 25 and 17 years respectively. The fund's benchmark is the BloomBarc US Long Treasury Index.

Sidebar

"CAGR" is the compounded annual growth rate or annualized return. It is computed as the nth root of the ratio of the current value to the value n years ago, minus 1.

"Sharpe ratio" measures the annualized return per unit of return variation. It is computed as the square root of 12 times the average Adjusted Monthly Return divided by the standard deviation of the Adjusted Monthly Returns. Adjusted Monthly Return is the portfolio return less the return of Treasury Bills.

"Drawdown" is the decline in portfolio value from the previous high (measured at month's end) to the current value of the portfolio (again measured at month's end.) minus one. "Maximum drawdown" is the largest drawdown over an interval. "Drawdown date" is the month-end at which the maximum drawdown is observed.

MITIGATING DOWNSIDE RISK

Drawdown is defined as the current value of a portfolio divided by the highest prior value of the portfolio minus one. It is probably impossible to eliminate drawdowns entirely but it is possible to mitigate downside risk. For example, one could

- Include a permanent allocation to defensive securities. The traditional 60:40 portfolio is an example of this approach.

- Hedge the portfolio[9].
- Tactically vary the allocation to defensive securities in response to market conditions in a rules based manner. This is "market timing."

The challenge is not in mitigating downside risk. The challenge is to mitigate risk *cost effectively*.

The standard by which a risk mitigation strategy should be evaluated is whether it preserves more of the return than other mitigation strategies.

We have tested many risk mitigation timing algorithms. Two of our favorites are Antonacci's Absolute Momentum[10] and the Nicholas timer[11]. Absolute Momentum invests in stocks when the return of US large cap stocks, including dividends, exceeds the total return of T-bills, both returns being measured over the trailing twelve months. When T-bills have the higher return, the portfolio is invested in intermediate term bonds.

The Nicholas timer recommends stocks when the total return of US large cap stocks, averaged over the prior 1-, 3-, 6- and 12-months is positive. The Nicholas timer recommends intermediate term bonds when the average total return of large cap stocks is negative.

The Nicholas *timing* algorithm is similar to the *allocation* algorithm that has been used by the FundX Investment Group since the 1970s.

These algorithms trade infrequently. The Absolute Momentum timer adjusted the bond allocation about every 13 months over the past eighty-nine years. The Nicholas timer adjusted the bond allocation about every eight months.

We show the long term performance of these algorithms in Figure 2 relative to the performance of the unmanaged small momentum portfolio. The relative strengths of the Absolute Momentum and Nicholas timers rise sharply at times, indicating protection in a falling market, and fall equally sharply at other times, indicating that the timer has been fooled by a moderate market decline or has stayed too long in bonds as the market recovered.

The relative strength of the Absolute Momentum timer shows a pronounced downward trend, meaning that Absolute Momentum timing has a tendency to destroy value relative to the untimed portfolio. The annualized decline rate is

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[9] Hedging using protective puts is described in the Swan blog at swanglobalinvestments.com. Over the past twenty years, the Swan Defined Risk Strategy has slightly exceeded the total return of US stocks net of fees with half of the volatility. The largest annual losses were 5% (2008 and 2011).

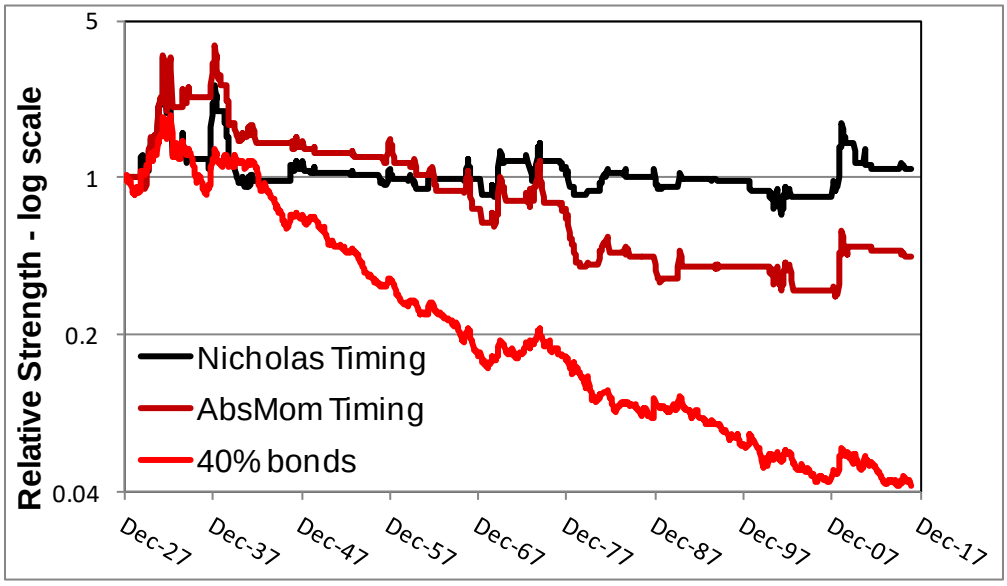
See also "Understanding the S&P Managed Risk 2.0 Indices," 2017.

[10] Gary Antonacci, *Dual Momentum Investing*, McGraw Hill, 2015, p. 98. Antonacci did not use the method described in Figure 8-4 and in the section entitled "How to Use It" when preparing his results.

[11] John B. Nicholas, "Market Timers Yet Again," AAII Silicon Valley CIMI Group, August 10, 2015.

about 1%[12]. The decline rate should be thought of as the cost of insuring against severe drawdowns.

Figure 2. Relative Strengths of Timed Small Momentum Portfolios and of the French Small Momentum Portfolio plus 40% Bonds. The relative strengths are being compared to the value of the unmanaged small momentum portfolio.



Source: Monthly Allocations July2017.xlsb

Nicholas timing also exhibits a decline in some intervals. Because the relative strength is variable, the insurance cost of Nicholas timing depends on the interval being tested. From 1977 through 2007, the annualized decline rate was 1.2% per year. For the entire interval, the relative strength increased slightly and the cost was zero.

We have yet to find a timing strategy which does not incur an insurance cost with some portfolios under some market conditions.

The usual mitigation strategy is a static bond allocation. As shown in Figure 2, adding 40% bonds to the small momentum portfolio would have destroyed 96% of the value since 1927 relative to the value of the portfolio without bonds. This is a 4% annualized decline rate. The insurance cost of adding a static 40% bond allocation to the small momentum portfolio is 4% a year.

Absolute Momentum and Nicholas timing mitigate severe drawdowns at a lower cost than a static bond allocation. Market timing is imperfect but it is a better mitigation strategy than a static allocation to bonds.

[12] The value of the relative strength at December 2016 raised to the power (1/89) minus one. Decline rates are different with different interval and different portfolios.

EVOLUTION OF THE SIMPLE STRATEGY

We sought a strategy

- which was easy to implement without extensive computations;
- which provided higher returns and lower drawdowns than traditional benchmarks;
- which underperformed conventional benchmarks infrequently;
- which had adequate capacity for implementation by individual investors and smaller RIAs; and
- which did employ explicit market timing.

This section describes the degree to which the SIMPLE strategy met these goals.

Dual Momentum

We are attracted by the simplicity and effectiveness of Dual Momentum. Antonacci's strategy employs three assets and two algorithms. The portfolio is invested in an intermediate-term bond fund when the total return of T-bills over the trailing twelve months exceeds the total return of US large cap stocks. This is the Absolute Momentum timing algorithm that we discussed previously.

Antonacci uses the Relative Momentum algorithm to choose between US and foreign stocks. The algorithm compares the total return of US stocks over the trailing twelve months to the total return of foreign stocks and invests in a US stock fund when US stocks have the higher return or in a foreign stock fund when foreign stocks have the higher return.

At any given time, the Dual Momentum strategy is exclusively invested in a US stock fund, in a foreign stock fund or in an intermediate bond fund.

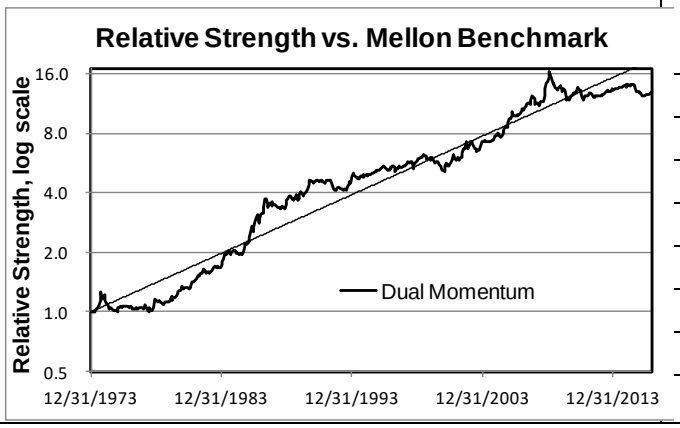
Figure 3 shows the relative strength of the Dual Momentum strategy over time. We are plotting the value of the portfolio managed by the Dual Momentum algorithms divided by the value of the BNY Mellon benchmark[13]. We choose the BNY Mellon benchmark because it is more globally diversified than the usual benchmark of 40% US bonds and 60% US stocks.

Dual Momentum is outperforming when the relative strength is rising.

The time interval is limited by the availability of foreign stock data.

[13] BNY Mellon compares hundreds of corporate and public pension, foundation, endowment, Taft-Hartley and health care plans (their US Master Trust Universe) to a portfolio of 50% Russell 3000, 10% MSCI ex-US and 40% Lehman Aggregate Bond Index. As implemented here, the benchmark is 50% spliced VFINX, 10% spliced HAINX and 40% spliced VBMFX rebalanced monthly.

Figure 3. Relative Strength and Statistics for Dual Momentum, 1974 – 2016. Dual Momentum uses the Relative Momentum ranking algorithm and the Absolute Momentum timing algorithm to choose among US stocks, foreign stocks and bonds.



1974-2016	Dual Momentum	BNYMellon Benchmark
CAGR	16.8%	10.0%
StdDev	13%	10%
Sharpe	0.92	0.56
maxDD	0.21	0.33
DD Date	Sep-11	Feb-09
UPP	13%	reference
k-ratio	3.9	3.5
Std Error	0.38	0.25

Performance statistics for the Dual Momentum strategy and for the BNY Mellon benchmark are shown to the right of the chart and defined in the sidebar. The Dual Momentum strategy would have provided more return than the benchmark, the maximum drawdown would have been less than the benchmark drawdown and the Sharpe ratio would have been higher.

The "standard error" entry requires some explanation. We had initially used the Kestner-ratio[14] to characterize the linearity of the relative strength plot. (Since the ordinate is logarithmic, it would be more correct to refer to the "exponentiality of the relative strength plot.")

The k-ratio is analogous to the Sharpe ratio in that it is the return (the slope of the least squares lined fitted through the equity curve) divided by a risk statistic (the standard error of the slope which measures the vertical variations of the equity curve from the least squares line.) The k-ratio is ambiguous as a goodness of fit indicator because high values of the ratio are associated with both good fits and with high returns.

The statistic shown here is the standard error of the slope of the least squares line. Smaller is better.

The underperformance percentage is 13%; that is, the return of the Dual Momentum strategy underperformed the BNY Mellon benchmark in 13% of the

[14] Lars N. Kestner, "(Re)Introducing the K-Ratio, papers.ssrn.com/sol3/papers.cfm?abstract_id=2230949, March 2013, defines the ratio as the slope of the linear least squares line of the equity curve divided by the standard error of the slope times a factor equal to the SQRT of the number of observations per year divided by the number of observations,.

The EXCEL formula for month-end observations , after Fred Penny of the Systematic Trader, is

k-ratio = (SQRT(12) / N) * Slope(EC, Dates) * SQRT(DEVSQ(Dates)) / STEYX(EC, Dates)..

where EC is the array of the log values of the equity curve and Dates is the array of the associated month-end dates.

rolling 36-month intervals. We will show that the SIMPLE strategy reduces the underperformance percentage.

Relative strength has been declining since March 2009. While the benchmark has appreciated 10.9% annually since then, Dual Momentum has appreciated only 8.3%. The 10.6% appreciation rate of the SIMPLE strategy nearly matches that of the benchmark.

The SIMPLE Strategy Defined

The SIMPLE strategy adds a third equity component, real estate, to the Dual Momentum strategy and invests in the two funds with the highest momentum. The investment options are generally large cap US stocks and foreign stocks, large cap US stocks and real estate or foreign stocks and real estate. The portfolio is invested in intermediate term bonds in times of market stress.

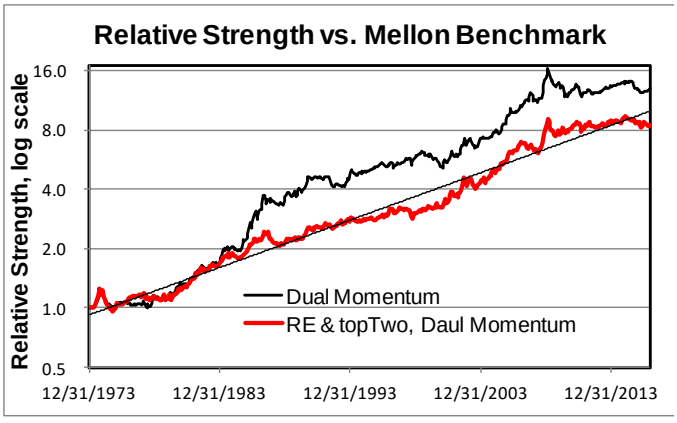
Adding real estate makes strategic sense since the value of investable real estate is comparable to the values of the US and foreign stock markets.

Adding a third equity fund allows simultaneous investment in two equity funds. Allocating to more than one fund provides a psychological benefit in that it generally means smaller changes when rebalancing.

Investing in more than one equity fund tends to decrease returns. The 15.6% return of the SIMPLE strategy is less than the 16.8% return of Dual Momentum.

Figure 4. Relative Strength and Statistics for the SIMPLE Strategy, 1974 – 2016.

The SIMPLE strategy uses Relative Momentum ranking to choose the best two from among US stocks, foreign stocks and real estate. The SIMPLE strategy uses Absolute Momentum timing to choose between stocks and bonds.



1974-2016	SIMPLE	Dual Momentum
CAGR	15.6%	16.8%
StdDev	12%	13%
Sharpe	0.91	0.92
maxDD	0.22	0.21
DD Date	Nov-87	Sep-11
UPP	5%	13%
k-ratio	5.9	3.9
Std Error	0.23	0.38

On the other hand, investing in more than one equity fund reduces the risk of have the entire portfolio in the wrong fund and should increase Sharpe ratios and reduce drawdowns. *Casinos make money by providing odds that are only a few percent better than random. Momentum investing makes money even though the prediction accuracy is less than perfect.*

The standard deviation is less with the SIMPLE strategy but there is no difference between the Sharpe ratios and drawdowns of the SIMPLE and Dual Momentum strategies.

The primary advantages of the SIMPLE strategy are that the relative strength of the SIMPLE strategy is more consistent over time and that the underperformance percentage is reduced to 5%. This means fewer calls from anxious customers and less career risk for the adviser.

The greater consistency is evidenced qualitatively in Figure 4 by the better alignment between the red curve and the least squares line and by the flat relative strength post 2009.

A Variation of the SIMPLE Strategy

A concern with backtesting is that the results may be sensitive to the specific algorithms employed. A concern with using a single ranking and a single timing algorithm is that the recommendations may prove to be unreliable in certain markets since the predictive strengths of almost any algorithm varies with market conditions.

Figure 5 shows the performance with another set of algorithms. Since the long term statistics are essentially the same as for the SIMPLE strategy, performance is not sensitive to the specific algorithms. We show, later in this article, that a variety of algorithms provide more return, better Sharpe ratios and lower drawdowns than the benchmark. Figures 4 and 5 are simply two of the better choices.

The algorithms used in Figure 5 are combinations of algorithms and might be expected to provide more reliable performance. The bond allocation is the equally weighted recommendations of the Absolute Momentum, Nicholas and StormGuard® standard[15] timing algorithms. If two of the algorithms recommend stocks and the third recommends bonds, two thirds of the portfolio is invested in stocks and one third in bonds.

Funds are ranked by two algorithms, Relative Momentum and annualized FundX[16]. If one algorithm recommends US stocks and foreign stocks at the end of a month while the other recommends US stocks and real estate, the equity portion of the portfolio during the following month would be 50% US stocks, 25% foreign stocks and 25% real estate.

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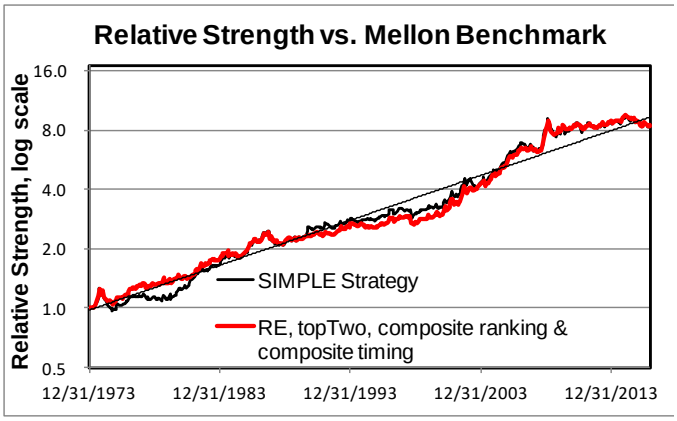
[15]The algorithm is bullish when 22 * DEMA50 + 0.006 is greater than zero. DEMA50 is the double exponential moving average of the daily returns of the S&P Composite without dividends. The factor used in the DEMA calculations is the reciprocal of fifty days. See www.sumgrowth.com.

[16] Momentum is measured as twelve times the 1-month total return for the fund plus four times the 3-month total return plus two times the 6-month total return plus the 12-month total return. This ranking algorithm is described at seekingalpha.com as “vigilant asset allocation.”

Figure 5. Relative Strength and Statistics for the SIMPLE Strategy with Composite Algorithms, 1974 – 2016.



1974-2016	Composite Algorithms	SIMPLE
CAGR	15.6%	15.6%
StdDev	11%	12%
Sharpe	0.94	0.91
maxDD	0.20	0.22
DD Date	Nov-87	Nov-87
UPP	4%	5%

The chart illustrates that the variation outperforms the SIMPLE strategy in the first part of this interval and underperforms in the middle of the interval. The long term statistics are similar for the SIMPLE strategy and the variation.

An Alternative to Market Timing

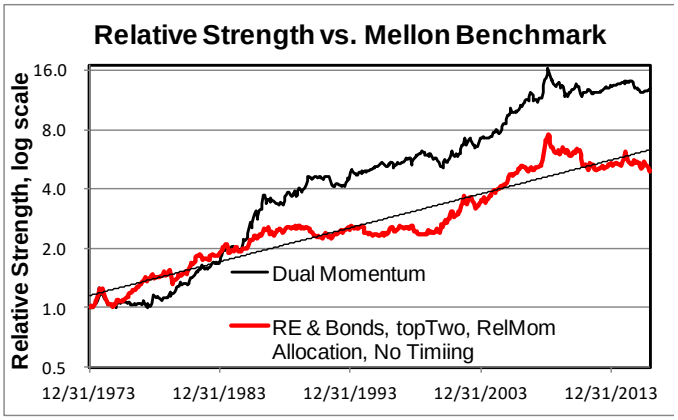
One of our goals was to eliminate market timing both because of its pejorative connotation and because timers sometimes take the portfolio to bonds even though one of the equity components is appreciating more rapidly than bonds.

It is possible to mitigate drawdowns without market timing by asking the ranking algorithms to choose among US and foreign stocks, real estate and bonds. The ranking algorithms will choose the funds with the highest momentum or the least negative momentum. In times of market stress, the ranking algorithms will generally choose bonds.

Since we are using top2 allocation, two bond funds are needed so that the portfolio can fully transition to bonds.

An advantage of this approach is that the portfolio transitions more gradually into and out of bonds as compared to explicit timing.

Figure 6. Relative Strength and Statistics for the SIMPLE Strategy plus Bonds, 1974 – 2016. The SIMPLE strategy plus bonds uses Relative Momentum to choose the best two from among US stocks, foreign stocks, real estate, an intermediate bond fund and a long bond fund. There is no timing algorithm.

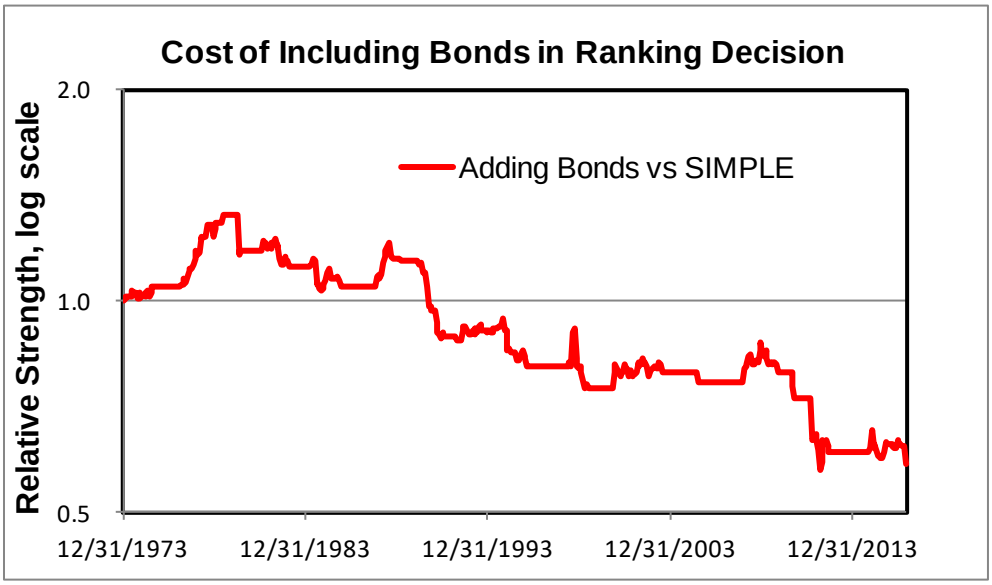


1974-2016	Add Bonds	SIMPLE
CAGR	14.2%	15.6%
StdDev	11%	12%
Sharpe	0.82	0.91
maxDD	0.21	0.22
DD Date	Nov-11	Nov-87
Track Error	24%	5%
k-ratio	5.1	5.9
Std Error	0.25	0.23
US, xUS, RE, bonds	RelMom	No timing

The bond approach significantly increases the return and improves the Sharpe ratio and drawdown as compared to the BNY Mellon benchmark but the improvements are less than achieved with the SIMPLE strategy. This approach might nonetheless be attractive to a customer who is convinced the "market timing does not work."

The bond approach involves some career risk since the 36-month returns are less than the returns of the BNY Mellon benchmark nearly a quarter of the time. UPP is 24%.

Including bonds in the ranking decision is a form of downside risk mitigation. The mitigation cost is about 2% a year more than the cost of market timing. This estimate was derived from the slope of the relative strength of the strategy including bonds versus the SIMPLE strategy.



Source: SIMPLE_August2017.xlsb

Effect of Timing Algorithm

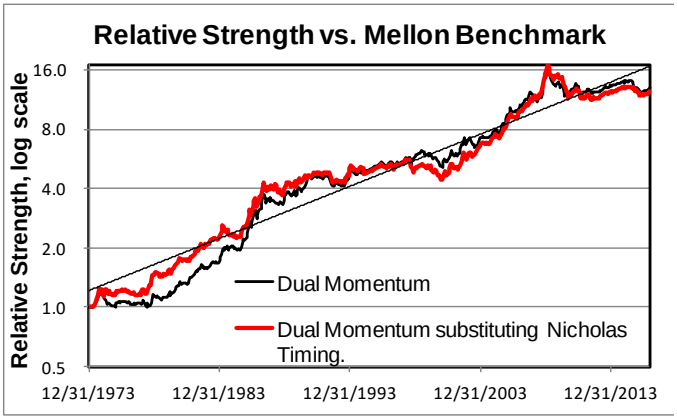
Since the relative performance of any algorithm can vary over the short term, more consistent results over time should be obtained by basing tactical signals on the recommendations of several algorithms. We can compute several timing algorithms the 1974 – 2016 interval. We will look at their performance individually and then in combination.

The red curve is the next chart is the relative strength of the Dual Momentum strategy with the Nicholas timer substituting for the Absolute Momentum timer. The straight line is the exponential least squares fit to the red curve.

The statistics to the right of the chart are in the same order as previously. The identifiers have been removed to allow room to show the statistics for the 1974 – 1993 and 1994 – 2016 intervals. The 1994 – 2016 interval is the interval over which we have results for the AAII Shadow Stock portfolio.

The final row is also new. It contains information about the assets in the strategy and identifies the ranking and timing algorithms.

Substituting Nicholas Timing



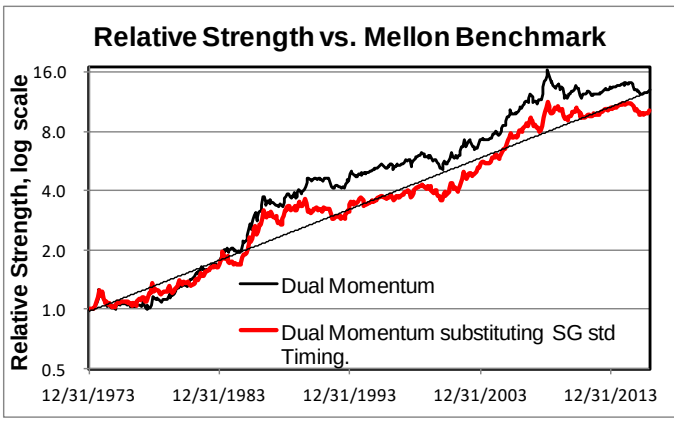
1974-2016	1974-1993	1994-2016
16.7%	22.1%	12.1%
13%	14%	12%
0.90	0.96	0.83
0.20	0.15	0.20
Sep-10	Oct-87	Sep-10
17%	6%	27%
4.1	7.3	5.2
0.35	0.18	0.15
US, xUS	RelMom	Nicholas

The red curve is the next chart is the relative strength of the Dual Momentum strategy with the StormGuard® standard timer[17] substituting for the Absolute Momentum timer. The returns and Sharpe ratios in the first half of the interval are reduced.

[17] We use the original definition of StormGuard® standard which was 22 * DEMA50 + 0.006. The 22 factor adjusts the daily DEMA to a monthly DEMA assuming 22 market days per month. The definition has been revised to 21 * DEMA50 plus 0.0055 but the revision is not material..

DEMA50 is the double exponential moving average of the daily returns of the S&P Composite without dividends assuming a trend constant of fifty days. The factor used in the StormGuard DEMA calculations is the reciprocal of fifty days which is an unusual definition.

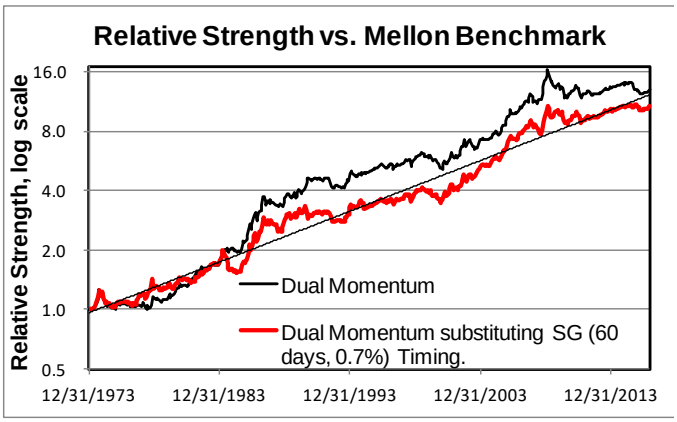
Substituting StormGuard® Timing



1974-2016	1974-1993	1994-2016
16.1%	19.8%	13.0%
14%	15%	13%
0.83	0.81	0.85
0.24	0.21	0.24
Oct-08	Sep-90	Oct-08
15%	13%	19%
4.8	5.8	6.0
0.30	0.21	0.14
US, xUS	RelMom	SG std

Lengthening the StormGuard® trend constant from 50 to 60 days improves the consistency of the relative strength plot and reduces the tracking error.

Substituting StormGuard® Timing with 60 day Trend Constant

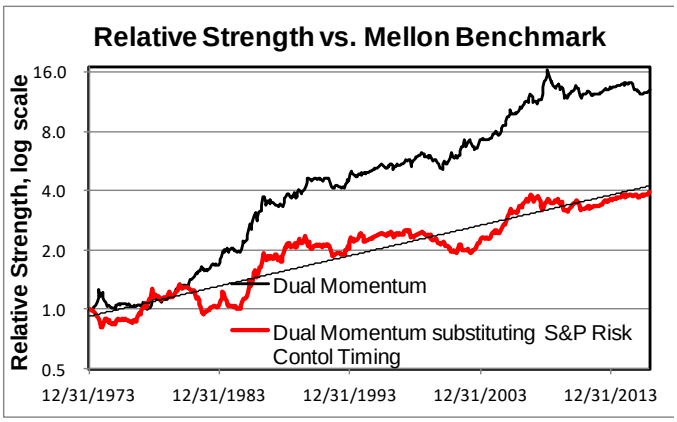


1974-2016	1974-1993	1994-2016
16.2%	19.5%	13.5%
14%	15%	13%
0.82	0.79	0.86
0.26	0.21	0.26
Oct-08	Sep-90	Oct-08
10%	10%	10%
5.2	6.3	6.4
0.27	0.19	0.13
US, xUS	RelMom	SG 60d & 0.7%

The performance of the S&P volatility based risk control timer[18] is illustrated in the next chart. The timer assumes an 18% target volatility and does not use leverage. Performance statistics are disappointing over the entire interval.

18 Standard & Poors' Dynamic Rebalancing Risk Control Timing Indicator allocates between stocks and cash based upon the current volatility of the S&P Composite without dividends. Target volatility is 18% annually; no leverage. Source: Limiting Risk Exposure with S&P Risk Control Indices, February 2012; S&P Indices: Index Mathematics Methodology, January 2012; and S&P Risk Control Indices: Parameters, 5 January 2012. S&P has released a new timer based on synthetic puts.

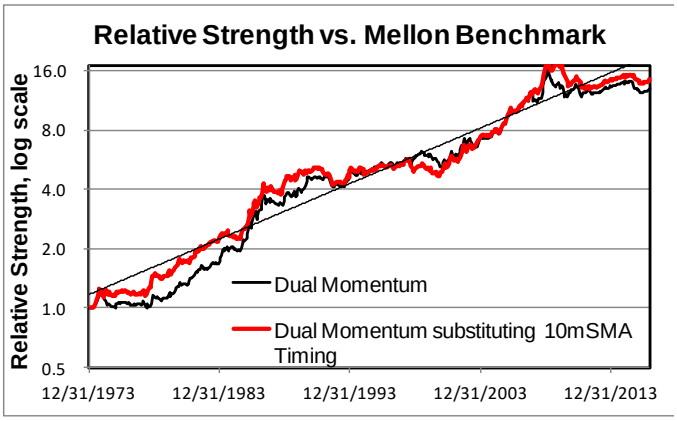
Substituting S&P Risk Control



1974-2016	1974-1993	1994-2016
13.6%	17.2%	10.5%
15%	16%	14%
0.62	0.62	0.62
0.37	0.30	0.37
Feb-09	Dec-74	Feb-09
33%	35%	36%
3.5	5.1	3.8
0.34	0.22	0.16
US, xUS	RelMom	SPVOL

The performance of the 10-month simple moving average[19] is illustrated in the next chart. The performance statistics are comparable to those of Dual Momentum over the first half of the interval and are better in the second half but the underperformance percentage is larger.

Substituting the 10mSMA Timer



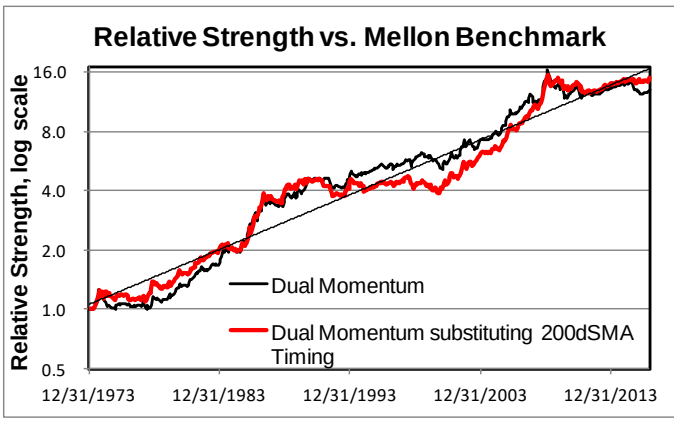
1974-2016	1974-1993	1994-2016
17.0%	22.1%	12.8%
13%	14%	12%
0.94	1.00	0.90
0.20	0.15	0.20
Sep-10	Oct-87	Sep-10
18%	11%	23%
4.3	6.8	6.0
0.34	0.20	0.14
US, xUS	RelMom	10mSMA

The performance of the 200 day SMA timer[20] is illustrated in the next chart. The long term statistics improve, especially in the second half of the interval but the underperformance percentage increases.

[19] Move to cash when the price of the S&P Composite with dividends reinvested is less than the 10-month simple moving average (10mSMA). Source: Mebane T. Faber "A Quantitative Approach to Tactical Asset Allocation." Working Paper 2014 and *The Journal of Wealth Management*, Spring 2007.

[20] Simple moving average over 200 days of the daily price of the S&P Composite without dividends. The signal is bullish if the price of the Composite without dividends is higher than the 200dSMA.

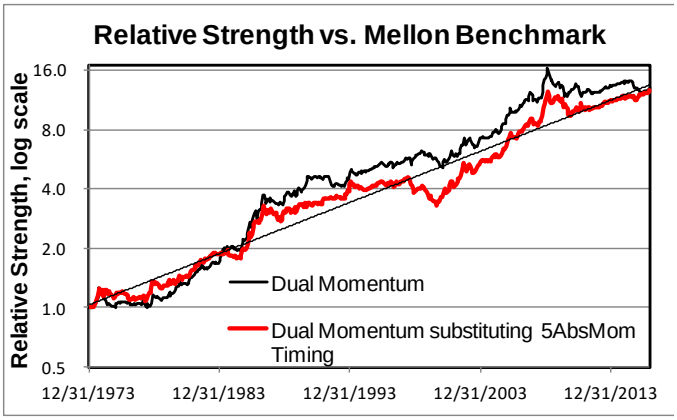
Substituting the 200dSMA Timer



1974-2016	1974-1993	1994-2016
17.1%	21.3%	13.6%
12%	14%	11%
0.97	0.97	0.98
0.15	0.15	0.15
Aug-98	Oct-87	Aug-98
21%	16%	23%
4.7	6.0	7.3
0.31	0.22	0.12
US, xUS	RelMom	200dSMA

The 5AbsMom timer reduces the lookback interval of the Absolute Momentum timer from 12 to 5 months[21]. The performance during the first half of the interval is degraded and performance improves during the second half. Even though the Sharpe ratio increases during the second half, the underperformance percentage increases.

Substituting the 5AbsMom Timer



1974-2016	1974-1993	1994-2016
16.7%	21.0%	13.0%
12%	13%	11%
0.95	0.95	0.95
0.18	0.18	0.15
Aug-88	Aug-88	Aug-98
14%	5%	23%
4.9	6.8	7.3
0.29	0.18	0.11
US, xUS	RelMom	5AbsMom

The relative strength of the timer based on initial unemployment claims (IUC)[22] is illustrated in the next chart. This is a weekly signal. The second half statistics are very good but the first half statistics are disappointing.

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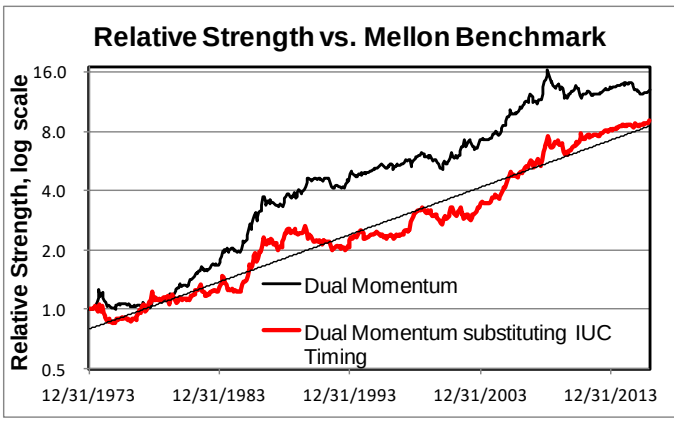
[21] Don Maurer, "An Approach to Testing Price Based Timers," Silicon Valley CIMI Group, March 3, 2016.

Zakamulin identified the best lookback interval for Absolute Momentum timing by examining performance over rolling ten year intervals. The general pattern is that a 4-month lookback was best during 1952-1995, 24 months during 1996-2003, 10 months during 2004-2009 and 6 months during 2010 – 2014. Valeriy Zakamulin, "A Comprehensive Look at the Empirical Performance of Moving Average Trading Strategies," SSRN-id2677212, revision December 11, 2015.

[22] Al Zmyslowski, March 2015, stimulated by articles on the Doug Short blog. Buy stocks if the most recent seasonally adjusted initial unemployment claims are less than 97% of the 22 week SMA, buy

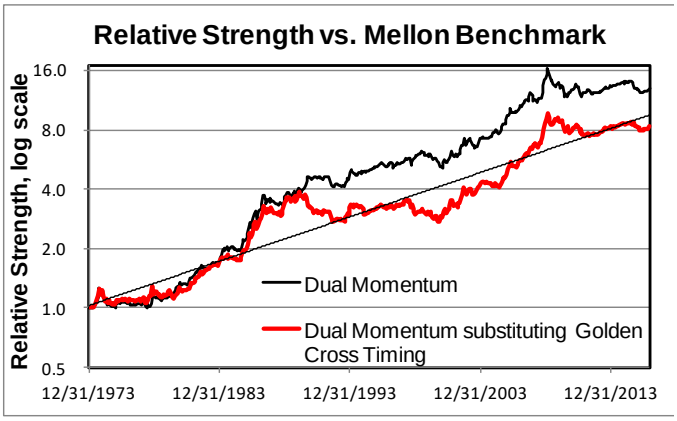
Substituting Timer based on Initial Unemployment Claims



1974-2016	1974-1993	1994-2016
15.8%	17.3%	14.5%
14%	15%	13%
0.80	0.67	0.92
0.26	0.21	0.26
Sep-02	Sep-90	Sep-02
14%	22%	10%
5.7	5.5	6.5
0.24	0.21	0.13
US, xUS	RelMom	IUC

The relative strength of the Golden Cross timer[23] is illustrated in the next chart. The returns, Sharpe ratios and tracking errors are disappointing.

Substituting the Golden Cross Timer



1974-2016	1974-1993	1994-2016
15.6%	19.5%	12.3%
13%	14%	11%
0.84	0.83	0.87
0.21	0.21	0.17
Sep-90	Sep-90	Jun-10
22%	17%	27%
4.3	5.2	6.9
0.31	0.24	0.11
US, xUS	RelMom	GoldenX

The relative strength of the DR*VOL timer, which weights the double exponential moving average of the daily return of the S&P Composite without dividends by the daily volume of the Composite[24], is illustrated in the next

---

bonds if the claims are more than 112% of the 22 week SMA and adopt the prior week's signal where the number of claims are within these limits.

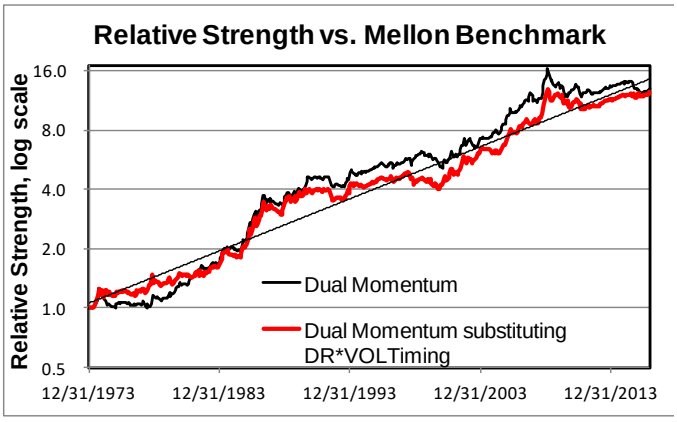
[23] 50-day SMA of the daily price crossing the 200-day SMA of the daily price. Prices are for the S&P Composite without dividends. The signal is bearish if 50SMA is declining at the crossover and bullish if 50SMA is rising at the crossover.

[24] DEMA50 of the product of the daily return of the S&P Composite without dividends times the daily volume, normalized by DEMA50 of the daily volume. Alpha = 1/50. The signal is bullish if the indicator is positive.

Gregory Morris, *The Complete Guide to Market Breadth Indicators: How to Analyze and Evaluate Market Direction and Strength* describes algorithms of this type. The specific form of this algorithm was suggested by John Nicholas and Don Maurer in April 2016.

chart. The long term statistics are comparable to Dual Momentum; somewhat lower performance in the first half of the interval and somewhat better performance in the second half. Underperformance percentage remains high.

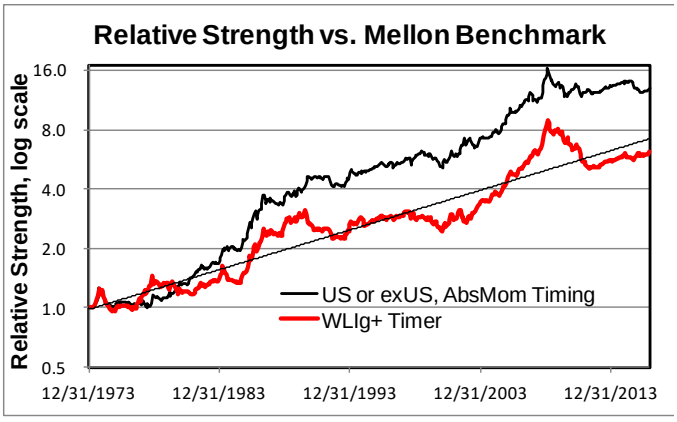
Substituting the DR*VOL Timer



1974-2016	1974-1993	1994-2016
16.6%	21.0%	13.0%
13%	15%	11%
0.91	0.89	0.95
0.16	0.16	0.15
Aug-88	Aug-88	Aug-98
86%	91%	79%
4.5	5.8	7.8
0.32	0.21	0.10
US, xUS	RelMom	DR*VOL

The WLIg+ timer is based on economics, specifically on the weekly leading indicators[25]. The performance is disappointing in this application.

Substituting the WLIg+ Timer



1974-2016	1974-1993	1994-2016
14.8%	18.2%	11.8%
14%	15%	13%
0.74	0.72	0.76
0.26	0.21	0.25
May-12	Sep-90	May-12
27%	28%	30%
4.2	5.2	4.2
0.31	0.22	0.17
US, xUS	RelMom	WLIg+

The performance of GOOD, the "get out of Dodge" timer[26], is disappointing in this application.

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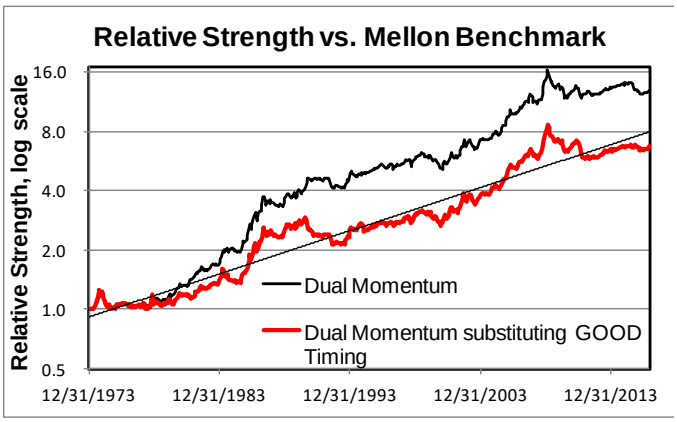
[25] Weekly indicator developed by van Vuuren and Vrba from the Weekly Leading Indicator Growth index. A positive value is bullish. The WLIg+ indicator can be calculated from 1968. Source *Further Improving the Use of the ECRI WLI*, Dwaine van Vuuren and Georg Vrba, January 17, 2012.

[26] Don Gimbel, Note 115: An Absolute Take-Out Signal, October 2013. Enter the market when the 50-day EMA of the daily price of the S&P Composite without dividends rises above the 200EMA and exit the market when the 75EMA of the daily returns falls below the 300EMA. Alpha = 2 / (1 + x). No tolerance.

Gimbel based the indicator on the S&P Composite with dividends; the change was necessary to allow the use of this indicator over the full interval..

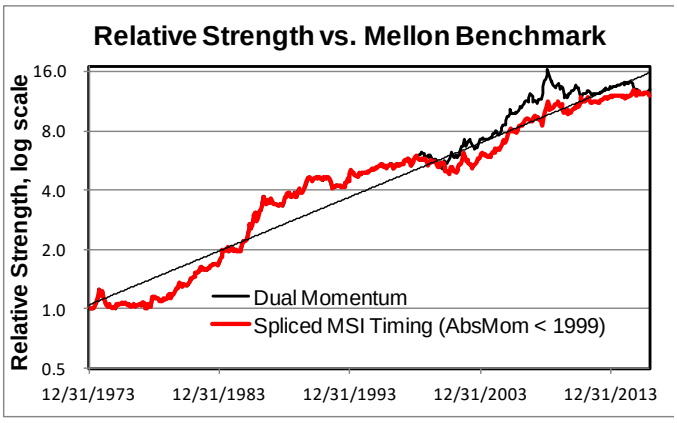
Substituting the GOOD Timer



1974-2016	1974-1993	1994-2016
15.0%	18.0%	12.5%
13%	14%	12%
0.77	0.72	0.82
0.21	0.21	0.21
Sep-90	Sep-90	Nov-11
18%	22%	17%
4.6	4.9	5.3
0.29	0.23	0.14
US, xUS	RelMom	GOOD

The Delta MSI timer has not been evaluated before February 1999[27]. The next chart illustrates the performance of the spliced MSI timer, Absolute Momentum before 1999 and MSI thereafter.

Substituting the Spliced MSI Timer



1974-2016	1974-1993	1994-2016
16.6%	21.9%	12.1%
12%	13%	12%
0.93	1.03	0.83
0.23	0.15	0.23
Oct-08	Oct-87	Oct-08
10%	9%	12%
3.6	5.8	5.5
0.40	0.23	0.13
US, xUS	RelMom	Spliced MSI

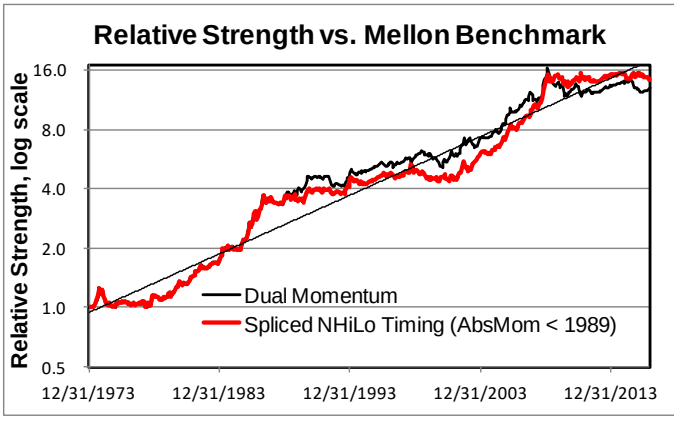
The MSI timer underperformed during the dot.com bust but has provided consistent performance since then with improved underperformance percentage. We are hopeful as to the future performance.

The NASDAQ HiLo timer has not been evaluated before 1989[28]. The next chart illustrates the performance of a spliced NHiLo timer, Absolute Momentum

[27] Delta Investment Management's MSI indicator is published each Thursday in Barron's. Historical values are available from June 2013. The index was approximated back to January 1999 by determining the daily fraction of stocks in the Russell 3000 universe with prices above their respective 75-day simple moving averages. Indicator values are the 10-day exponential moving average of the daily fractions; alpha is 0.1. Values above 50% are considered bullish.

before 1989 and NHiLo thereafter. The performance in the second half is good but the underperformance percentage remains high.

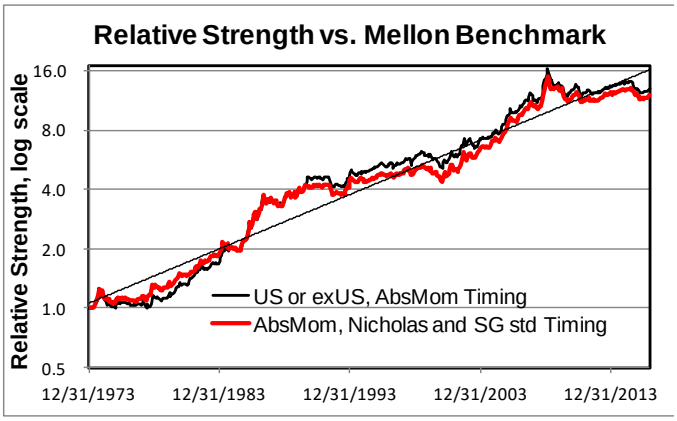
Substituting the Spliced NASDAQ HiLo Timer



1974-2016	1974-1993	1994-2016
17.0%	21.3%	13.4%
12%	13%	10%
1.02	1.01	1.03
0.15	0.15	0.13
Oct-87	Oct-87	May-10
15%	8%	22%
4.7	5.9	6.5
0.32	0.22	0.14
US, xUS	RelMom	NHiLo

The final plot in this sequence illustrates the performance of the timer constructed of the equally weighted recommendations of the Absolute Momentum, Nicholas and StormGuard® standard timers. The performance is not much different from that of Absolute Momentum alone but diversification does promise greater reliability in future markets.

Substituting the Absolute Momentum, Nicholas and StormGuard® standard Composite Timer



1974-2016	1974-1993	1994-2016
16.6%	21.3%	12.6%
13%	14%	12%
0.91	0.96	0.86
0.17	0.15	0.17
Jun-10	Oct-87	Jun-10
13%	9%	19%
4.3	6.4	5.8
0.34	0.20	0.14
US, xUS	RelMom	Three Timers

The conclusion is that substituting the Absolute Momentum timer with another timer does not significantly improve the Dual Momentum strategy.

We look at the effect of the ranking algorithm in the next section.

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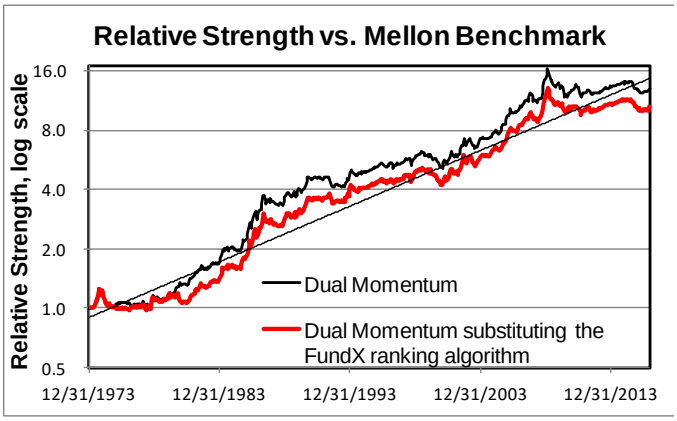
[28] The NASDAQ HiLo indicator is determined as the cumulative sum of new daily highs less new daily lows crossing the exponential moving average of the cumulative sum with alpha = 0.125. The signal is bullish if the indicator is positive.

Effect of the Ranking Algorithm

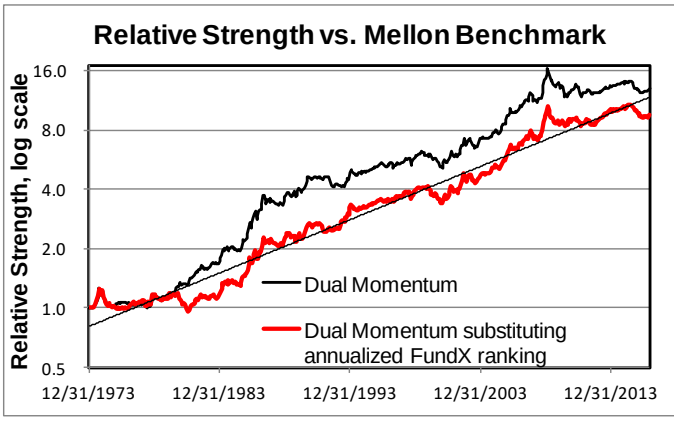
In this section, we use the Absolute Momentum timing algorithm and substitute for the Relative Momentum ranking algorithm.

Substituting the FundX Ranking Algorithm[29]



1974-2016	1974-1993	1994-2016
16.2%	20.8%	12.3%
12%	13%	12%
0.90	0.98	0.83
0.18	0.15	0.18
Sep-11	Oct-87	Sep-11
14%	9%	20%
4.1	5.2	5.7
0.36	0.24	0.13
US, xUS	FundX	AbsMom

Substituting the Annualized FundX Ranking Algorithm[30]



1974-2016	1974-1993	1994-2016
15.9%	19.4%	13.0%
12%	13%	12%
0.88	0.90	0.86
0.19	0.19	0.19
Nov-00	Aug-81	Nov-00
15%	18%	15%
5.0	4.9	6.5
0.29	0.23	0.12
US, xUS	AnFundX	AbsMom

We conclude that changing the ranking algorithm is unlikely to substantially improve the Dual Momentum strategy.

Real Estate and topTwo Allocation

Adding real estate makes strategic sense since the value of investable real estate is comparable to the values of the US and foreign stock markets.

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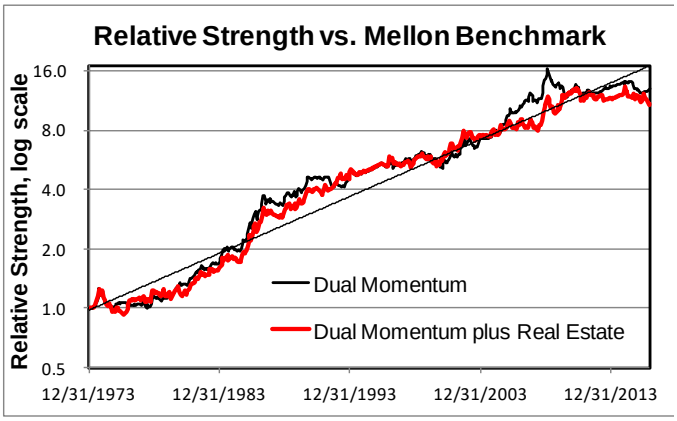
[29] The FundX ranking algorithm determines the momentum of a security as the sum or average of the 1-, 3-, 6- and 12-month total returns for that security.

[30] Momentum is measured as twelve times the 1-month total return for the fund plus four times the 3-month total return plus two times the 6-month total return plus the 12-month total return. This ranking algorithm is described at seekingalpha.com as "vigilant asset allocation."

The performance of Dual Momentum can be improved by adding a third equity component, real estate. As shown in the next chart and table, the relative strength against the BNY Mellon benchmark visually more consistent and the underperformance percentage is reduced. However, the return and Sharpe ratio are also reduced.

Adding Real Estate to the Dual Momentum Strategy

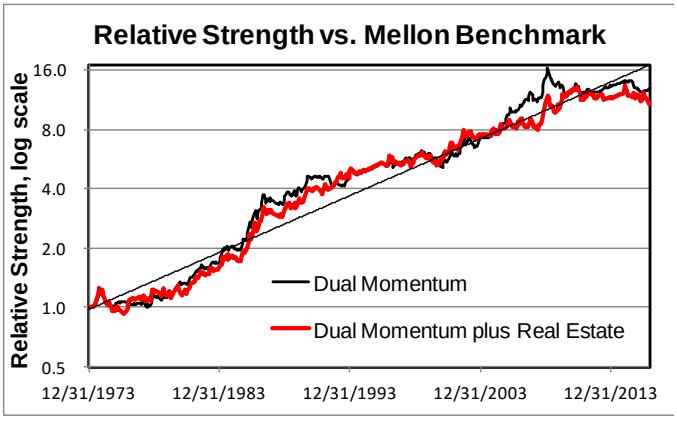


1974-2016	1974-1993	1994-2016
16.3%	21.9%	11.5%
13%	14%	13%
0.87	1.00	0.74
0.22	0.16	0.22
Sep-11	Mar-80	Sep-11
8%	3%	13%
3.8	5.9	6.7
0.39	0.22	0.11
US, xUS, RE	RelMom	AbsMom

Substituting the FundX or the annualized FundX algorithm degrades performance.

Substituting the timer constructed of the equally weighted recommendations of the Absolute Momentum, Nicholas and StormGuard® standard timers for Absolute Momentum is inferior to the portfolio containing just US and foreign stocks in all respects except for underperformance percentage.

Adding Real Estate to the Dual Momentum Strategy with Composite Timing



1974-2016	1974-1993	1994-2016
16.2%	21.4%	12.0%
13%	14%	12%
0.87	0.93	0.80
0.16	0.16	0.16
Mar-80	Mar-80	Oct-08
10%	2%	17%
4.4	6.6	8.0
0.33	0.19	0.10
US, xUS, RE	RelMom	Three Timers

topTwo Ranking

Adding a third equity fund allows simultaneous investment in two equity funds. Investing in more than one equity fund tends to decrease returns because the additional funds tend to have lower momentum. On the other hand, investing in more than one equity funds reduces the risk of investing the entire portfolio in the wrong fund and thereby tends to increases Sharpe ratios and to reduce drawdowns.

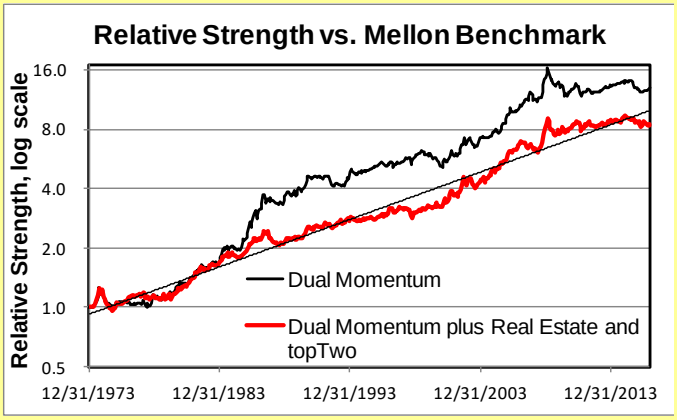
Allocating to more than one fund provides a psychological benefit in that it generally produces smaller changes to the equity allocation.

The SIMPLE strategy achieves a higher Sharpe ratio, a lower drawdown and a reduced underperformance percentage than the Dual Momentum strategy but at the expense of some reduction in the long term return.

Perhaps most importantly, the relative strength of the SIMPLE strategy is more consistent over time. This is demonstrated by a reduction in the post 2009 decline and by a reduction in the underperformance percentage.

Comment. The shading identifies this as the SIMPLE strategy.

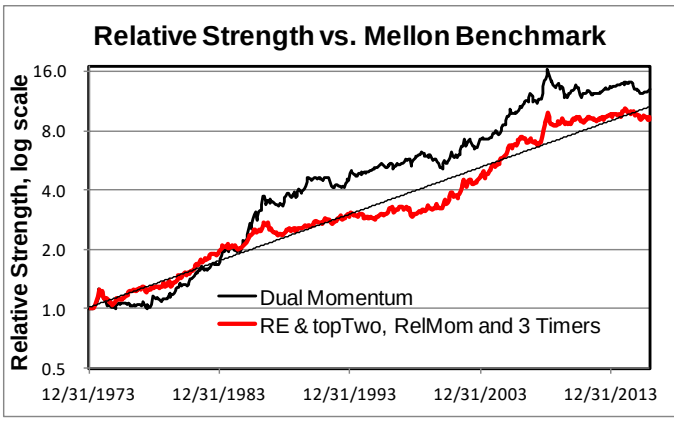
Adding Real Estate and topTwo Allocation to the Dual Momentum Strategy.



1974-2016	1974-1993	1994-2016
15.6%	18.7%	13.0%
12%	12%	12%
0.91	0.91	0.91
0.22	0.22	0.19
Nov-87	Nov-87	Sep-11
5%	7%	4%
5.9	7.5	7.4
0.23	0.15	0.11
US, xUS & RE, top2	RelMom	AbsMom

Using the composite recommendations of several timers is likely more reliable in future markets than using Absolute Momentum alone. The next chart illustrates the SIMPLE strategy with composite timing. There are slight increases in the return and Sharpe ratios and small changes in the underperformance percentage. Some investors may prefer the SIMPLE strategy with composite timing because of the promise of greater reliability.

The SIMPLE Strategy with Composite Timing.

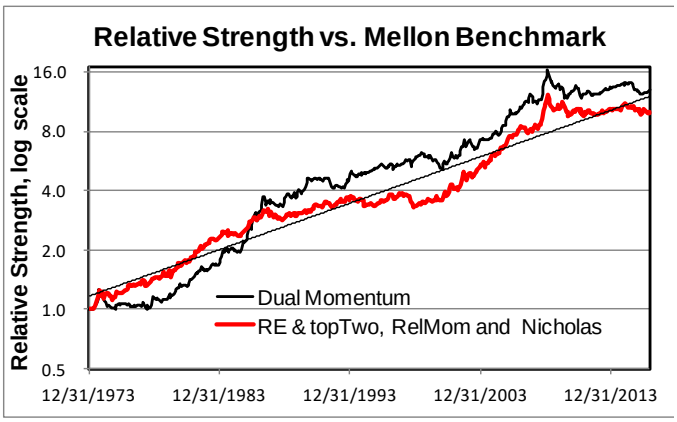


1974-2016	1974-1993	1994-2016
15.9%	19.1%	13.1%
12%	12%	11%
0.94	0.92	0.97
0.21	0.21	0.15
Nov-87	Nov-87	Oct-08
5%	3%	7%
6.3	8.6	7.6
0.22	0.13	0.11
US, xUS & RE, top2	RelMom	Three timers

The next charts illustrate the effect of other single timers on the SIMPLE strategy.

Substituting the Nicholas timer for Absolute Momentum enhances the return in the first half of the interval and the drawdown in the second half but otherwise degrades performance.

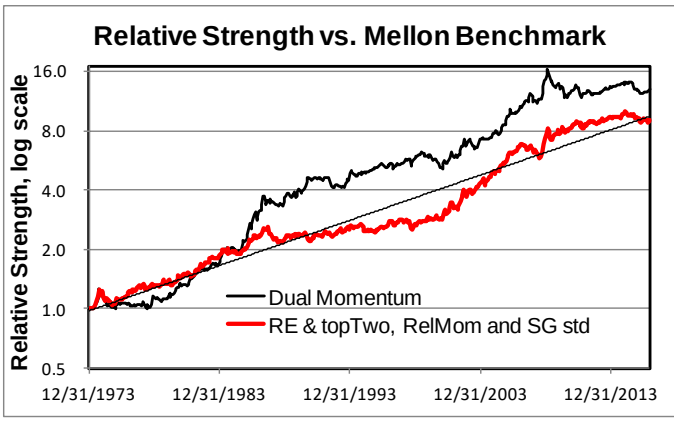
The SIMPLE Strategy with Nicholas Timing.



1974-2016	1974-1993	1994-2016
16.1%	20.3%	12.5%
12%	13%	11%
0.94	0.97	0.92
0.19	0.19	0.15
Oct-87	Oct-87	Sep-10
16%	2%	76%
5.5	9.8	6.7
0.25	0.12	0.12
US, xUS & RE, top2	RelMom	Nicholas

Substituting the standard StormGuard® timer for Absolute Momentum enhances the return in the second half of the interval but reduces return and Sharpe in the first half. The maximum drawdown is not attractive. The Relative strength looses 15% relative to the Mellon benchmark during 2008.

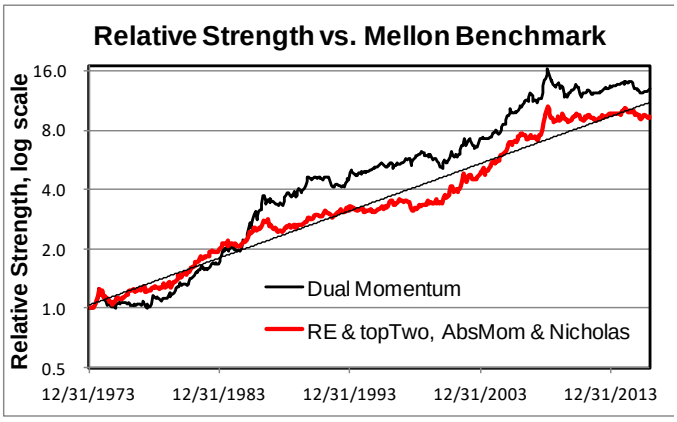
The SIMPLE Strategy with StormGuard® Standard Timing.



1974-2016	1974-1993	1994-2016
15.8%	18.2%	13.7%
12%	13%	12%
0.89	0.82	0.96
0.23	0.22	0.23
Oct-08	Nov-87	Oct-08
5%	7%	2%
7.4	8.2	7.8
0.18	0.13	0.11
US, xUS & RE, top2	RelMom	SG std

Substituting Absolute Momentum timing for a composite of the equally weighted recommendations of the Absolute Momentum and StormGuard® Standard timing algorithms provides good statistics except for the Sharpe ratio in the second half of the interval.

SIMPLE Strategy with Absolute Momentum and StormGuard® Standard Timing.

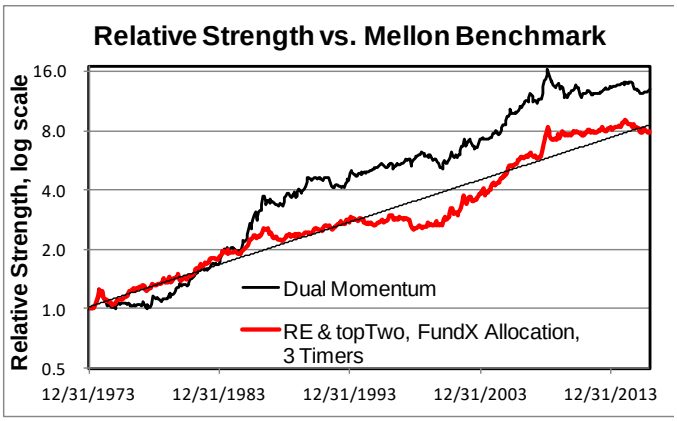


1974-2016	1974-1993	1994-2016
15.7%	18.4%	13.4%
12%	12%	11%
0.92	0.88	0.96
0.22	0.22	0.19
Nov-87	Nov-87	Oct-08
3%	4%	3%
6.7	8.0	7.8
0.20	0.14	0.11
US, xUS & RE, top2	RelMom	AbsMom, SG std

The next examples test alternate ranking algorithms. Composite timing of the Absolute Momentum, Nicholas and StormGuard® standard algorithms applies in all cases.

Substituting the FundX ranking algorithm degrades performance, especially the underperformance percentage, in the second half of the interval.

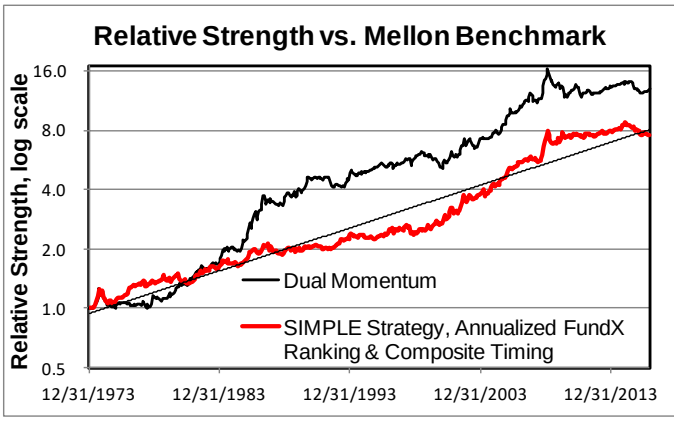
SIMPLE Strategy with FundX Ranking and Composite Timing.



1974-2016	1974-1993	1994-2016
15.4%	18.7%	12.7%
11%	12%	11%
0.92	0.90	0.94
0.21	0.21	0.15
Nov-87	Nov-87	Oct-08
11%	4%	18%
6.5	8.8	8.3
0.20	0.13	0.10
US, xUS & RE, top2	FundX	Three timers

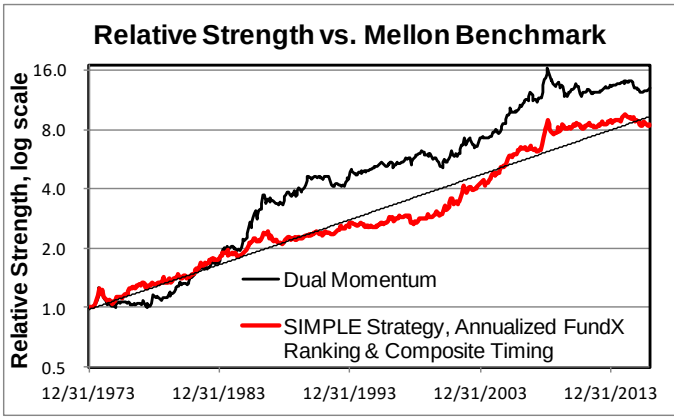
Substituting the annualized FundX ranking algorithm degrades performance, especially the underperformance percentage, in the second half of the interval.

SIMPLE Strategy with Annualized FundX Ranking and Composite Timing.



1974-2016	1974-1993	1994-2016
15.3%	17.5%	13.4%
11%	12%	11%
0.92	0.83	1.01
0.19	0.19	0.15
Oct-87	Oct-87	Oct-08
5%	7%	4%
8.6	8.9	8.5
0.15	0.11	0.10
US, xUS & RE, top2	AnFundX	Three timers

SIMPLE Strategy with Composite Ranking (Relative Momentum and Annualized FundX) and Composite Timing.



1974-2016	1974-1993	1994-2016
15.6%	18.3%	13.3%
11%	12%	11%
0.94	0.89	1.00
0.20	0.20	0.15
Nov-87	Nov-87	Oct-08
4%	3%	4%
7.4	8.9	8.1
0.18	0.12	0.11
US, xUS & RE, top2	RelMom AnFundX	Three timers

Effect of Adding Bonds

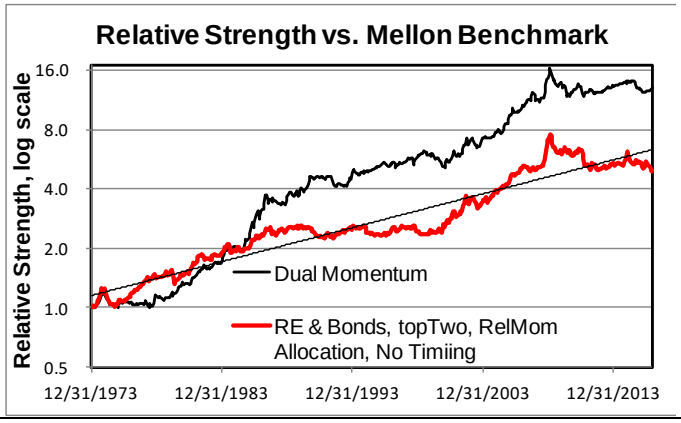
One of our goals was to eliminate market timing both because of its pejorative connotation and because timers sometimes take the portfolio to bonds even though one of the equity components is appreciating more rapidly than bonds.

It is possible to mitigate drawdowns without market timing by asking the ranking algorithms to choose among US and foreign stocks, real estate and bonds. The ranking algorithms will choose the funds with the highest momentum or the least negative momentum. In times of market stress, the ranking algorithms will generally choose bonds.

Since we are using top2 allocation, two bond funds are needed so that the portfolio can fully transition to bonds.

An advantage of this approach is that the portfolio transitions more gradually into and out of bonds as compared to explicit timing.

The SIMPLE Strategy Without Timing plus Bonds.



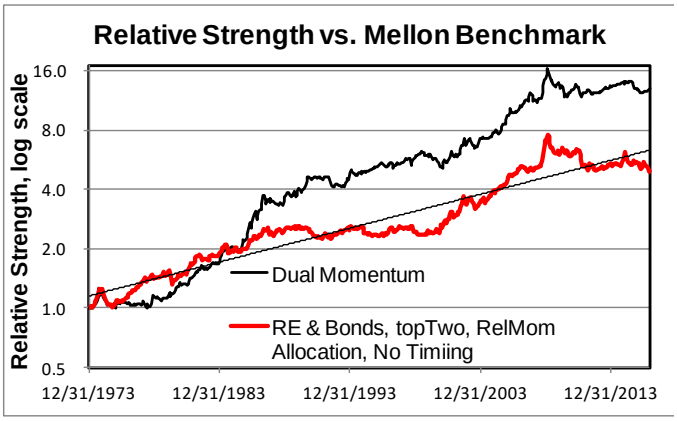
1974-2016	Add Bonds	SIMPLE
CAGR	14.2%	15.6%
StdDev	11%	12%
Sharpe	0.82	0.91
maxDD	0.21	0.22
DD Date	Nov-11	Nov-87
Track Error	24%	5%
US, xUS, RE, bonds	RelMom	No timing

The bond approach significantly increases the return and improves the Sharpe ratio and drawdown as compared to the BNY Mellon benchmark. A lower Sharpe ratio means that the portfolio with bonds is more volatile per unit of return that the SIMPLE portfolio.

The improvements are less than achieved with the SIMPLE strategy. This approach might nonetheless be attractive to a customer who is convinced that "market timing does not work."

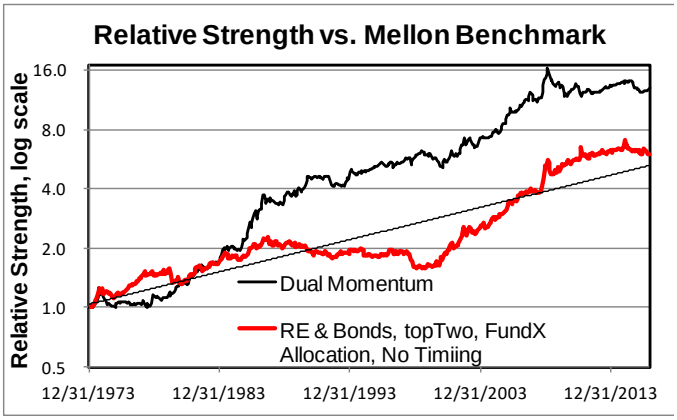
The bond approach involves career risk since the 36-month returns are less than the returns of the BNY Mellon benchmark nearly a quarter of the time. UPP is 24%.

Same Simulation with More Detail.



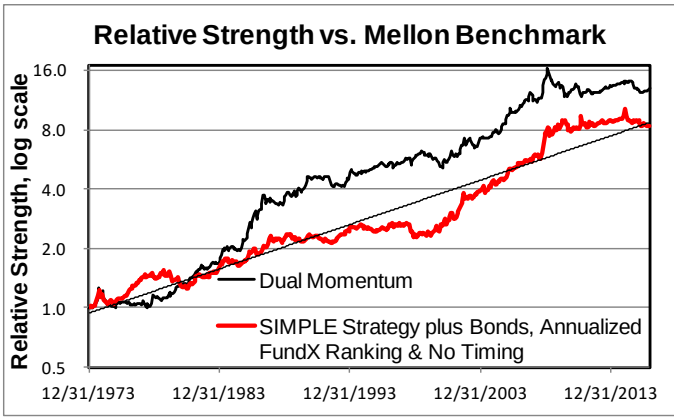
1974-2016	1974-1993	1994-2016
14.2%	18.0%	10.9%
11%	11%	11%
0.82	0.88	0.77
0.21	0.20	0.21
Nov-11	Nov-87	Nov-11
24%	84%	73%
5.1	9.0	5.4
0.25	0.12	0.14
US, xUS, RE, bonds	RelMom	No timing

The SIMPLE Strategy Without Timing, with FundX Ranking and Bonds



1974-2016	1974-1993	1994-2016
14.7%	16.5%	13.2%
11%	11%	11%
0.87	0.77	0.95
0.20	0.20	0.16
Nov-87	Nov-87	Aug-98
27%	29%	22%
8.1	7.5	9.4
0.15	0.13	0.09
US, xUS, RE, bonds	FundX	No timing

The SIMPLE Strategy Without Timing, with Annualized FundX Ranking and Bonds



1974-2016	1974-1993	1994-2016
15.6%	18.0%	13.5%
11%	10%	11%
0.97	0.97	0.96
0.16	0.11	0.16
Aug-15	Mar-80	Aug-15
17%	18%	19%
8.3	7.7	9.7
0.16	0.14	0.09
US, xUS, RE, bonds	AnFundX	No timing

RISK ADVERSE INVESTORS

The SIMPLE strategy is attractive for risk adverse investors because the downside risk is less than with traditional benchmarks and because retirement portfolios last longer. This section illustrates these benefits.

Downside Risk

We show four benchmarks in Table 1. We show performance statistics for the most recent twenty-three years because we can generally evaluate benchmark performance using real funds over this interval. The return of the SIMPLE strategy over this shortened interval is lower than for the longer interval discussed previously.

We show the benchmarks with static bond allocations because risk adverse investors probably would not identify with these benchmarks if the drawdowns were not mitigated by bonds.

Table 1. Comparison to Benchmarks, 1994-2016.

	CAGR, %	Sharpe	maxDD, %	UPP, %
S&P 500® Composite (VFINX) plus 40% bonds	7.8	0.61	33	49
S&P 500® Dividend Aristocrats® plus 40% bonds[31]	8.5	0.80	26	34
BNY Mellon benchmark (40% bonds)	7.8	0.61	33	Ref.
Wellesley Income (VWINX, 65% bonds)	8.0	0.88	19	53
SIMPLE strategy	13.0	0.91	19	4

The annualized returns for the benchmarks are all about 8% over this interval. The backtested return of the SIMPLE strategy is 13%, a full five percentage point improvement over the returns of the benchmarks.

The Wellesley Income fund exhibits the largest Sharpe ratio and lowest drawdown of these benchmarks. The SIMPLE strategy matches the Sharpe ratio and drawdown of the Wellesley Income fund and provides a higher return.

The SIMPLE strategy underperforms the BNY Mellon benchmark over rolling 36-month intervals only 4% of the time, which is less frequent than the underperformance of the other benchmarks.

The SIMPLE strategy should be attractive to the risk adverse investor because it is less volatile per unit of return, because it presents less downside risk than conventional benchmarks and because it underperforms less frequently.

[31] ProShares S&P 500 Dividend Aristocrats ETF (NOBL) has tracked this index since October 2013. The expense ratio is 0.35% and we have reduced the index returns shown above by 0.4%. The index went live in May 2005; prior returns are simulated.

Longevity Risk

Cloonan has written a book[32] dedicated to the thesis that advisers put too much emphasis on volatility and other measures of downside risk and not enough emphasis on return risk. Return risk evidences itself as having inadequate savings at retirement and inadequate longevity of the retirement portfolio. The higher return and Sharpe ratio which are characteristic of the SIMPLE strategy reduce these risks.

Determining an appropriate withdrawal rate during retirement involves many considerations as is evidenced by the numerous articles published in this *Journal* over the past twenty years[33]. We assumed a constant withdrawal amount, adjusted annually for inflation, and neglected optimization strategies.

We populated a 40 year sequence with inflation-adjusted monthly returns drawn randomly (with replacement) from the returns of the BNY Mellon benchmark or of the SIMPLE portfolio during the interval 1974-2016. We also used inflation-adjusted returns for the 60:40 portfolio of large cap stocks and bonds[34].

Using inflation-adjusted returns precludes the need to explicitly consider inflation in the analysis. Savings and withdrawal rates and future portfolio values are automatically adjusted for inflation.

We took the annual withdrawal at the beginning of each twelfth month. We repeated this process five thousand times and counted the number of failures which we define as the portfolio value reaching zero before the end of the time interval. This approach assumes that there is no serial correlation between the returns but it does not assume a normal or any other particular return distribution.

The results are shown in Figure 7. The curves reflect the risk of running out of money as a function of the elapsed time for several strategies. For example, the dashed black line indicates a 5% risk of running out of money within 30 years.

The solid black curve lies below the dashed black curve, which suggests that performance during 1974-2016 was slightly "safer" than over the longer interval tested by Bengen, *op. cit.* The curve based on the BNY Mellon benchmark lies lower still indicating that the returns of this benchmark are slightly "safer" than the returns of the 60:40 portfolio.

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[32] *Investing at Level3*, James B. Cloonan, AAII, 2016.

[33] *Conserving Client Portfolios During Retirement*, William P. Bengen, FPA Press, 2006. The appendix includes an extensive pre-2006 bibliography. For a review of the more recent literature, see "A 3-Step Procedure for Computing Sustainable Retirement Savings Withdrawals" by James S. Welch, Jr., *Journal of Financial Planning*, August, 2017.

[34] Ibbotson Associates, SBBI Yearbook, Morningstar. Since the Ibbotson data end at the end of 2014, subsequent returns reflect the returns of VFINX and VBMFX adjusted by DOL inflation data.

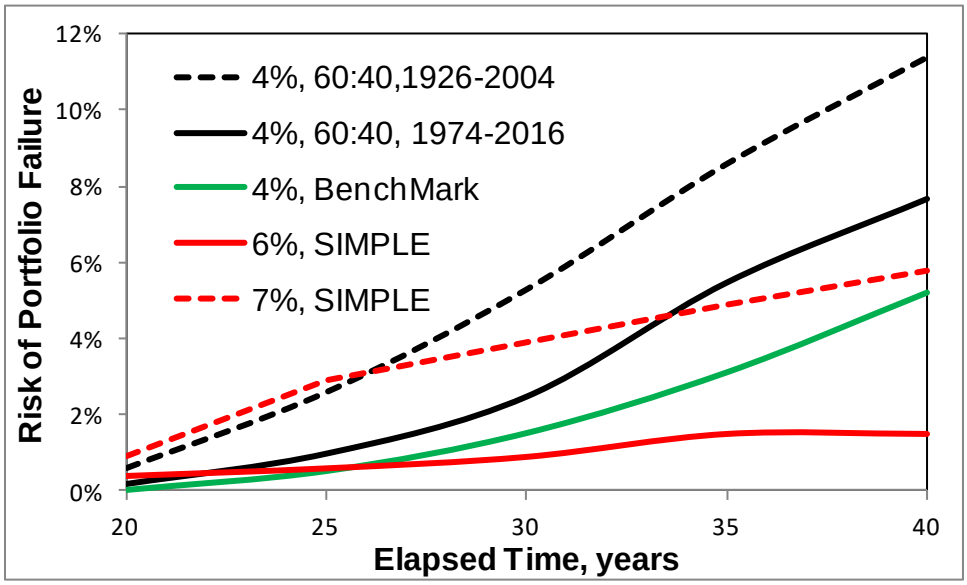
The differences among the five simulations are small, however. The risks of running out of money within thirty years range from 1 to 5%.

What is not small is the fact that the 60:40 and benchmark simulations assume an initial withdrawal rate of 4% while the SIMPLE simulations assume initial withdrawal rates of 6 and 7%.

The conventional wisdom has been that the "safe" withdrawal rate is about 4% of the initial portfolio value, with subsequent withdrawal amounts adjusted for inflation. The backtested performance of the SIMPLE strategy suggests that the initial withdrawal rate could be increased to 6% without increasing the risk of running out of money.

Increasing the initial withdrawal rate from 4 to 6% has, obviously, a large and beneficial impact on the amount that must be saved prior to retirement. If someone needs $70,000 annually from a retirement portfolio to supplement Social Security benefits and other income, he or she will need to have saved $1.8 million at retirement if the safe withdrawal rate is 4% but only about $1.2 million if the safe withdrawal rate is 6%.

Figure 7. Effect of the Return Population on the Indicated Risk of Running Out of Money.



The investment strategy also affects the rate of savings growth before retirement. If someone has $100,000 saved, the retirement portfolio would be worth about $1.6 million in real dollars thirty years hence assuming the returns of the SIMPLE strategy and no taxes or fees. A $1.6 million portfolio is well in excess of the $1.2 million needed.

The forecast of the future portfolio value is not a single value but a range of values. The estimates quoted are the lowest twenty-fifth percentile of the empirical distribution of five thousand future values. We developed the empirical

distribution was developed in the same manner as we modeled the decline of the portfolio value after retirement.

Let's put these two estimates together. If a customer needs $70,000 annually from a retirement portfolio to supplement Social Security benefits and other income, he or she needs about $1,750,000 at retirement if the safe withdrawal rate is 4% and about $1,170,000 if the safe withdrawal rate is 6%.

	60:40	Benchmark	SIMPLE
Current Savings	$100,000	$100,000	$100,000
Necessary Future Value to support $70,000 withdrawals	$1,750,000	$1,750,000	$1,170,000
Future Value of current savings	$330,000	$381,000	$1,600,000
Future Value of current savings plus $25,000 annual additional savings	$1,768,000	$1,931,000	No additional savings

It has been remarked that forecasting is difficult, especially when it concerns the future, and we do not want to overemphasize the quantitative benefits of the SIMPLE strategy. Suffice it to say that the SIMPLE investment strategy could allow for earlier retirement and more protection against Social Security and market shocks and/or lower pro-retirement savings rates. Lower savings rates could translate into life style options, more protection against pre-retirement disability and/or increased contributions to children and charity.

We would expect the SIMPLE strategy to also improve performance with optimized withdrawal strategies.

The SIMPLE strategy is safer for the risk adverse investor than traditional investment strategies in the conventional sense of providing larger risk adjusted returns and smaller drawdowns. The SIMPLE strategy is also safer in Cloonan's sense of a reduced risk when saving for retirement and when taking withdrawals during retirement.

The potential benefits of the SIMPLE strategy are so many and so large as to suggest that we need to rethink our conventional advice about savings and withdrawal rates.

An Alternative Approach to Estimating Longevity Risk

Portfolio Visualizer, and likely other free software, offers Monte Carlo simulations of portfolio growth and longevity. These programs require the user to provide a mathematical description of the distribution of future returns.

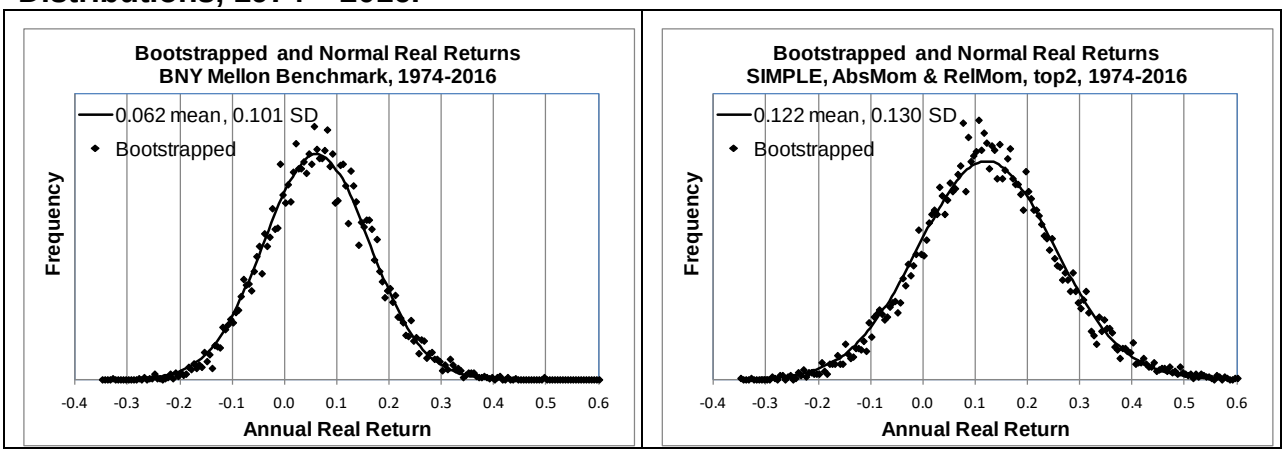
We developed historical return distributions for the BNY Mellon benchmark and for the SIMPLE strategy. We first adjusted each monthly return for inflation. We then drew 12 monthly real returns with replacement and calculated an annual inflation adjusted return. The random draw was

repeated ten thousand times for each strategy in order to develop return distributions which were consistent with the magnitudes, but not the order, of the monthly real returns.

This process is known as "bootstrapping." Because of the central limit theorem, bootstrapping tends to produce a near normal return distribution.

The return distributions are shown below as symbols and normal distributions are shown as solid curves. The visual comparison is good between the bootstrapped returns and the normal distributions. The bootstrapped distributions are not truly normal as they fail the Shapiro-Wilk normality test.

Figure 6. Comparison of the Bootstrapped Real Annual Returns to Normal Distributions, 1974 – 2016.



The risks of running out of money, shown in Table 3, are similar to the risks estimated previously using the empirical approach.

Table 3. Indicated Risk of Running Out of Money, percent. Monte Carlo simulations assume normal annual return distributions of (0.062, 0.101) and (0.122, 0.130). The risks for the empirical simulations described previously are identified by the suffix "E." All simulations assume no serial correlation; monthly serial correlations are 0.02 for the SIMPLE strategy and 0.07 for the benchmark.

	BNY Mellon Benchmark				SIMPLE, Dual Momentum, top2			
Initial W/D	**25**	**30**	**35**	**40**	**25**	**30**	**35**	**40**
4.0	0.6	1.8	3.7	5.6				
4.0E	0.5	1.5	3.1	5.2				
4.5	2.1	5.2	8.7	11.6				
5.0	5.3	10.3	15.1	19.4	0.1	0.1	0.2	0.2
6.0					0.4	0.8	1.0	1.1
6.0E					0.6	0.9	1.5	1.5
7.0					1.7	2.5	3.1	3.5

8.0					7.1	7.8	9.0	9.7

SUMMARY AND CONCLUSIONS

Factor investing offers the possibility of considerably higher returns than traditional benchmarks but practical issues limit the return potential of factor-based funds and large portfolios.

Downside risk mitigation by market timing is generally not cost-free but the cost is less than mitigation using a static bond allocation.

The SIMPLE strategy has, based on backtesting, provided higher returns, higher risk adjusted returns, smaller drawdowns and a lower underperformance percentage than traditional benchmarks.

The SIMPLE strategy has adequate capacity for most individual portfolios and for smaller advisory firms.

The SIMPLE portfolio reduces the return risks associated with saving for retirement and with withdrawals during retirement.

The potential improvements with the SIMPLE strategy are so large that planners should consider revising the guidelines for pre-retirement savings rates and for post-retirement withdrawal rates.

DISCLAIMER

Past performance is not necessarily indicative of future results and the SIMPLE strategy may not outperform in the future.

This article may contain errors. It would be foolhardy to recommend the SIMPLE strategy to a customer without you, the adviser, conducting appropriate due diligence.

Appendix A. Long Term Statistics

Table A-1. Variations on the SIMPLE Portfolio, topOne. Trade on the month-end signal date. Composite3 timing is equal parts Absolute Momentum, StormGuard® and Nicholas timing.

1974-2016 (43 years)	CAGR,%	Sharpe	MaxDD,%	Wins,%
US Large Caps	10.8	0.44	51	59
60:40 Benchmark	9.8	0.53	33	43
BNY Mellon Benchmark	10.0	0.56	33	reference
US stocks and foreign stocks				
Relative Momentum Allocation				
No timing	13.3	0.56	55	67
Absolute Momentum timing	16.8	0.92	21	87
Dual Momentum	**16.8**	**0.92**	**21**	**87**
StormGuard® standard timing	16.1	0.83	24	85
Nicholas timing	16.7	0.90	20	83
Composite3 timing	16.6	0.91	17	87
FundX RM timing	14.7	0.79	22	75
5AbsMom	16.7	0.95	18	86
S&P Risk Control	13.6	0.62	37	67
Spliced MSI	16.4	0.91	23	88
FundX Allocation				
No timing	12.9	0.54	53	68
Absolute Momentum timing	16.2	0.90	18	86
StormGuard® standard timing	15.5	0.79	24	79
Nicholas timing	16.0	0.86	18	81
Composite3 timing	16.0	0.88	18	86
FundX RM timing	14.1	0.77	22	70
5AbsMom	16.2	0.92	21	84
S&P Risk Control	13.2	0.60	36	69
US stocks, foreign stocks and intermediate bonds				
Relative Momentum Allocation				
No timing	14.7	0.77	21	75
FundX Allocation				
No timing	14.4	0.76	22	71
US stocks, foreign stocks and real estate				
Relative Momentum Allocation	13.8	0.59	63	78
No timing	16.3	0.87	22	92
Absolute Momentum timing	15.7	0.79	24	89
StormGuard® standard timing	16.6	0.87	16	85
Nicholas timing	16.2	0.87	16	90
Composite3 timing	13.4	0.67	24	68

FundX RM timing				
FundX Allocation				
No timing	14.3	0.61	55	76
Absolute Momentum timing	16.2	0.86	24	88
StormGuard® standard timing	15.6	0.77	24	83
Nicholas timing	16.4	0.85	17	81
Composite3 timing	16.2	0.86	17	83
FundX RM timing	14.9	0.77	22	78
US stocks, foreign stocks, real estate, intermediate bonds and long bonds				
Relative Momentum Allocation				
No timing	14.8	0.71	26	75
Absolute Momentum timing	14.9	0.78	26	81
StormGuard® standard timing	14.6	0.74	24	76
Nicholas timing	15.6	0.82	22	81
Composite3 timing	15.1	0.80	21	82
FundX RM timing	12.4	0.61	24	61
FundX Allocation				
No timing	15.4	0.75	21	77
Absolute Momentum timing	14.9	0.78	17	79
StormGuard® standard timing	14.6	0.73	24	76
Nicholas timing	16.0	0.83	18	79
Composite3 timing	15.2	0.80	17	80
FundX RM timing	14.1	0.77	22	70

Source: SIMPLE_August2017.xlsb

Table A-2. Variations on the SIMPLE Portfolio, topTwo. Trade on the month-end signal date. The BNY Mellon benchmark is 50% spliced VFINX, 10% spliced HAINX and 40% spliced VBMFX rebalanced monthly. Composite3 timing is equal parts Absolute Momentum, StormGuard® and Nicholas timing.

1974-2016 (43 years)	CAGR,%	Sharpe	MaxDD,%	Wins,%
US stocks, foreign stocks and real estate				
Relative Momentum Allocation				
No timing	13.8	0.63	60	89
Absolute Momentum timing	15.6	0.91	22	95
StormGuard® standard timing	15.8	0.89	23	95
Nicholas timing	16.1	0.94	19	84
Composite3 timing	15.9	0.94	21	95
FundX RM timing	14.0	0.81	19	70
5AbsMom timing	15.3	0.92	19	85
FundX Allocation				
No timing	13.0	0.59	59	76
Absolute Momentum timing	15.2	0.90	22	89
StormGuard® standard timing	15.3	0.86	24	85
Nicholas timing	15.7	0.93	19	78
Composite3 timing	15.4	0.92	21	89
FundX RM timing	14.0	0.81	19	69
5AbsMom timing	14.9	0.90	19	81
US stocks, foreign stocks, real estate, intermediate bonds and long bonds				
Relative Momentum Allocation				
No timing	14.2	0.82	21	76
Absolute Momentum timing	14.3	0.86	21	84
StormGuard® standard timing	14.2	0.84	20	74
Nicholas timing	14.9	0.90	19	78
Composite3 timing	14.5	0.88	19	80
FundX RM timing	12.4	0.75	19	63
5AbsMom timing	13.3	0.81	19	75
FundX Allocation				
No timing	14.7	0.87	20	73
Absolute Momentum timing	14.4	0.89	20	83
StormGuard® standard timing	14.0	0.83	20	70
Nicholas timing	14.8	0.91	19	72
Composite3 timing	14.4	0.89	19	74
FundX RM timing	12.3	0.71	19	62
5AbsMom timing	13.5	0.81	19	74
S&P Risk Control	14.3	0.86	19	72
RelMom & FundX Allocation				
No timing	14.5	0.87	20	73

Source: SIMPLE_August2017.xlsb

Appendix B. Momentum Methodologies

Index providers require a dozen pages to describe their methodologies. This summary is approximate and interested readers should refer to the source documents for full details.

AQR Capital Management LLC. Large and small cap momentum indices.

Source: "AQR Momentum Indices — U.S. Equities Methodology Description"

Primary Ranking	Secondary Ranking	Number
12/2 total return	none	Top third of 1000 or of 1001-3000 eligible US companies. Cap weighted. Rebalanced March, June, September and December.

Alpha Architects. US and international momentum indices.

Source: "Quantitative Momentum Indexes (QMOM and IMOM)," July 2017.

Primary Ranking	Secondary Ranking	Number
12/2 total return of about a thousand US stocks with market caps above about $2 billion.	Apply the FIP quality screen to the top decile.	Top half, about fifty. Equal weighting Rebalance February, May, August and November to capture seasonality.

MSCI. Multiple US and foreign momentum indices.

Source: "MSCI Momentum Indexes Methodology," June 2017.

Primary Ranking	Secondary Ranking	Number
7/2 price momentum: price only return minus local risk free rate. 13/2 price momentum: price only return minus local risk free rate. For the US, the local risk free rate is the 3-month T-Bill rate.	Momentum score is the average of • 7/2 price momentum divided by SD • 13/2 price momentum divided by SD where SD is the standard deviation of 3-years of weekly price returns. Similar to average of 6 and 12 month Sharpe ratios.	Generally, a sufficient number to represent 30% of the market cap of the parent index. Weighted as the market cap in the parent index times the momentum score. Rebalanced May and November and as needed.

S&P. Numerous price, total return and net return indices. The S&P 500 and US LargeMid Cap Momentum indices have backtested results from 1994.

Source: "S&P Momentum Indices Methodology," July 2017.

Primary Ranking	Secondary Ranking	Number
12-month return, lagged by about six weeks. E.g., rankings in mid-March are based on January to January returns.	Momentum score is 12-month return divided by standard deviation of daily returns over same interval.	Top 20%. Weighted as the market cap in parent index times the momentum score. Rebalanced March and September and as needed.

FTSE Russell. "Tilt" indices, all stocks in parent index with revised weights. The SPDR ETF ONEO tracks the focused momentum index.

Source: Russell 1000 Focused Factor Indexes, Methodology overview, © 2017.

Primary Ranking	Secondary Ranking	Number
Quality, Value and Size	Momentum: 12/2 month return.	1000 Weight is product of cap weight in parent index times quality, value, size and momentum scores. Rebalanced semiannually.

NoLoad FundX. Mutual funds and ETFs; from the 1970s.

Source: www.fundX.com

Primary Ranking	Secondary Ranking	Number
Groups 1, 2 3 and 4 ranked by similar risk (standard deviation)	Average of annualized total returns over 1-, 3-, 6- and 12 months plus hysteresis and credits	Top 5 of one to two hundred funds

Antonacci. US and foreign stock funds; from 1974.

Primary Ranking	Secondary Ranking	Number
12-month Total Return	Absolute Momentum timing	Top one of two

SectorSurfer®. Primarily applicable to mutual funds and ETFs; generally not applicable prior to 1989 due to lack of daily data.

Primary Ranking	Secondary Ranking	Number
Double exponential moving average of daily total returns; FWPT	StormGuard® timing	Top one of twelve Rebalanced monthly.

SIMPLE portfolio. US and foreign stocks and real estate from 1974.

Primary Ranking	Secondary Ranking	Number
12-month total return	Absolute Momentum timing	Top two of three. Equally weighted. Rebalanced monthly.

SIMPLE portfolio plus an intermediate and a long bond fund; from 1974.

Primary Ranking	Secondary Ranking	Number
Average of • 12-month total return • Average total returns over 1-, 3-, 6- and 12 months	No timing	Top two of five. Equally weighted Rebalanced monthly.

28 US equity funds plus short, intermediate and long bond funds, from 1990.

Primary Ranking	Secondary Ranking	Number
Double exponential moving average of daily total returns with 20-day trend constant	StormGuard® standard timing	Top two of 31. Equally weighted. Rebalanced monthly.

NASDAQ 100 stocks. Bias-free history from 19xx.

Primary Ranking	Secondary Ranking	Number
Average of • Average total returns over 1-, 3-, 6- and 12 months • Double exponential moving average of daily total returns with 20-day trend constant	Average of • Nicholas timing • StormGuard® standard timing	Top six. Equally weighted. Rebalanced monthly.

Appendix C.

Funds for Backtesting.

Funds, and Associated Trading Volumes, for Implementation.

	Backtesting	Implementation	Volume, $MM/day
US Stocks	SBBI/VFINX	SPY, VTI	19,000; 300
Foreign Stocks	MSCI EAFE/HAINX	EFA. VEU, VXUS	1,200; 100; 40
Real Estate	NAREIT/FRESX	VNQ (not xxx)	350
Intermediate Bonds	SBBI/VBMFX	BND, BOND, AGG	150, 15, 300
Long Bonds	SBBI/VUSTX	TLT	1,200

Appendix D. Factor Loadings. Determined Using Portfolio Visualizer.

Factor loadings are determined by a regression technique. I do not know how to interpret.

	Ticker	Volume	R-sqrd	Market	Size	Value	Momentum	Unexplained
SIMPLE								
S&P 500	VFINX							
Balanced 60:40	VBINX							
Wellesley Income	VWINX							
AQR Large Cap Momentum Style	AMONX		95%	1.0	0.0	(0.2)	0.2	-2%
AQR Small Cap Momentum Style	ASMNX		98%	1.1	0.9	0.1	0.3	-4%
Powershares DWA Momentum	PDP	105,000	90%	1.1	0.1	(0.2)	0.2	-2%
iShares Edge MSCI US Momentum Factor	MTUM	268,000	92%	0.9	(0.2)	(0.3)	0.2	2%
QuantShares US Market Neutral Momentum	MOM	2,000	42%	(0.0)	0.1	(0.3)	0.5	-1%
MomentumShares US Quantitative Momentum	QMOM	6,000	80%	0.8	0.4	(0.2)	(0.1)	-10%

ValueShares US Quantitative Value	QVAL	10,000	77%	0.8	0.0	(0.0)	(0.3)	-6%
Vanguard Small Cap Value	VBR or VISVX	440,000	93%	1.0	0.5	0.6	(0.1)	1%
Goldman Sachs ActiveBeta US Large Cap	GSLC	194,000						
Vanguard (Large Cap) Value Index	VTV or VIVAX	1.3 million	96%	1.0	(0.2)	0.3	(0.1)	0%
iShares S&P600 Value	IJS	213,000	96%	1.0	0.8	0.5	0.0	1%
DFA US Small Cap Value	DFSVX		96%	1.0	0.8	0.6	(0.1)	0%
DFA US Micro Cap	DFSCX		96%	1.0	1.0	0.3	(0.0)	0%
Guggenheim S&P500 Equal Wt	RSP	917,000	98%	1.1	0.1	0.0	(0.1)	0%
NT FlexShares Morningstar US Factors Tilt Index	TILT	20,000	99%	1.0	0.2	0.1	-	-1%
Deutsche R1000 Comprehensive Factors	DEUS	26,000	85%	0.8	0.2	(0.2)	(0.1)	-1%
JPMorgan Diversified Return Global Equity	JPGE	7,000	79%	0.6	(0.1)	(0.4)	(0.2)	-1%

PowerShares S&P500 High Div, Lo Volatility	SPHD	662,000	51%	0.7	(0.2)	0.0	0.1	4%
PowerShares S&P500 Low Volatility Portfolio	SPLV	2.2million	61%	0.7	(0.2)	(0.0)	0.3	3%
PowerShares S&P500 Enhanced Value Portfolio	SPVU	3,000	77%	1.3	0.2	0.6	0.4	1%
PowerShares S&P500 High Quality Portfolio	SPHQ	256,000	84%	1.0	0.1	(0.1)	0.2	-2%
PowerShares S&P500 Momentum	SPMO	2,000	70%	0.8	(0.1)	(0.2)	(0.0)	0%