Timing Bonds with Value, Momentum, and Carry

January 29, 2018

SUMMARY

- Bond timing has been difficult for the past 35 years as interest rates have declined, especially since bonds started the period with high coupons.
- With low current rates and higher durations, the stage may be set for systematic, factor-based bond investing.
- Strategies such as value, momentum, and carry have done well historically, especially on a risk-adjusted basis.
- Diversifying across these three strategies and employing prudent leverage takes advantage of differences in the processes and the information contained in their joint decisions.

NEWFOUND RESEARCH

January 29th, 2018

About Newfound Research

Founded in August 2008 Newfound Research is a quantitative asset management firm based in Boston, MA.

Investing at the intersection of quantitative and behavioral finance, Newfound Research is dedicated to helping investors achieve their long-term goals with research-driven, quantitatively-managed portfolios, while simultaneously acknowledging that the quality of the journey is just as important as the destination.

We work exclusively with financial advisors and institutions to help them manage the wealth of their clients through our suite of investment portfolios and mutual funds.

Portfolios Focused on Risk Management

Our strategies reflect our view that investing is not easy. Emotional decisions can derail even the best laid plan. Therefore, we believe that the optimal investment plan is, first and foremost, one that investors can stick with. Research shows that investors feel the pain of losses more than they feel the joy of gains. This is reflected in a deep desire to protect the capital that they have worked hard to accumulate. Accordingly, we seek to improve risk-adjusted returns and investor experience by prioritizing downside risk management and seeking to avoid large losses.

Our portfolios are available as separately managed accounts, through model manager platforms, and as mutual funds[1].

Multi-Manager Model Allocations

For investors looking to outsource their asset allocation and manager selection decisions, we offer our QuBe ("Quantitative Behavioral") portfolio series, a suite of strategically managed, behavior aware, hybrid active/passive portfolios offered with zero overlay fee[2].

Newfound was awarded 2016 ETF Strategist of the Year by ETF.com[3].

[1] See http://www.thinknewfoundfunds.com
[2] See http://www.thinknewfound.com/qube-managed-portfolios
[3] An ETF Strategist is a firm that builds portfolios primarily using exchange-traded funds.

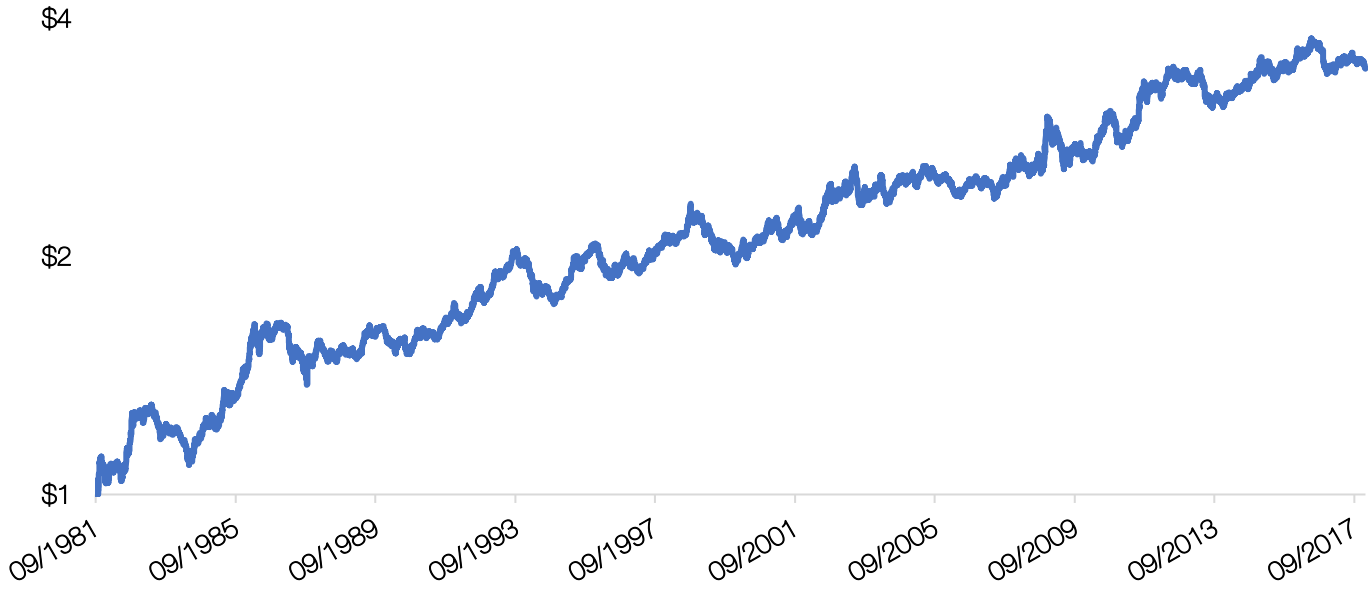
This commentary is a slight re-visit and update to a commentary we wrote last summer, Duration Timing with Style Premia[4]. The models we use here are similar in nature, but have been updated with further details and discussion, warranting a new piece.

Historically Speaking, This is a Bad Idea

Let's just get this out of the way up front: the results of this study are probably not going to look great.

Since interest rates peaked in September 1981, the excess return of a constant maturity 10-year U.S. Treasury bond index has been 3.6% annualized with only 7.3% volatility and a maximum drawdown of 16.4%. In other words, about as close to a straight line up and to the right as you can get.

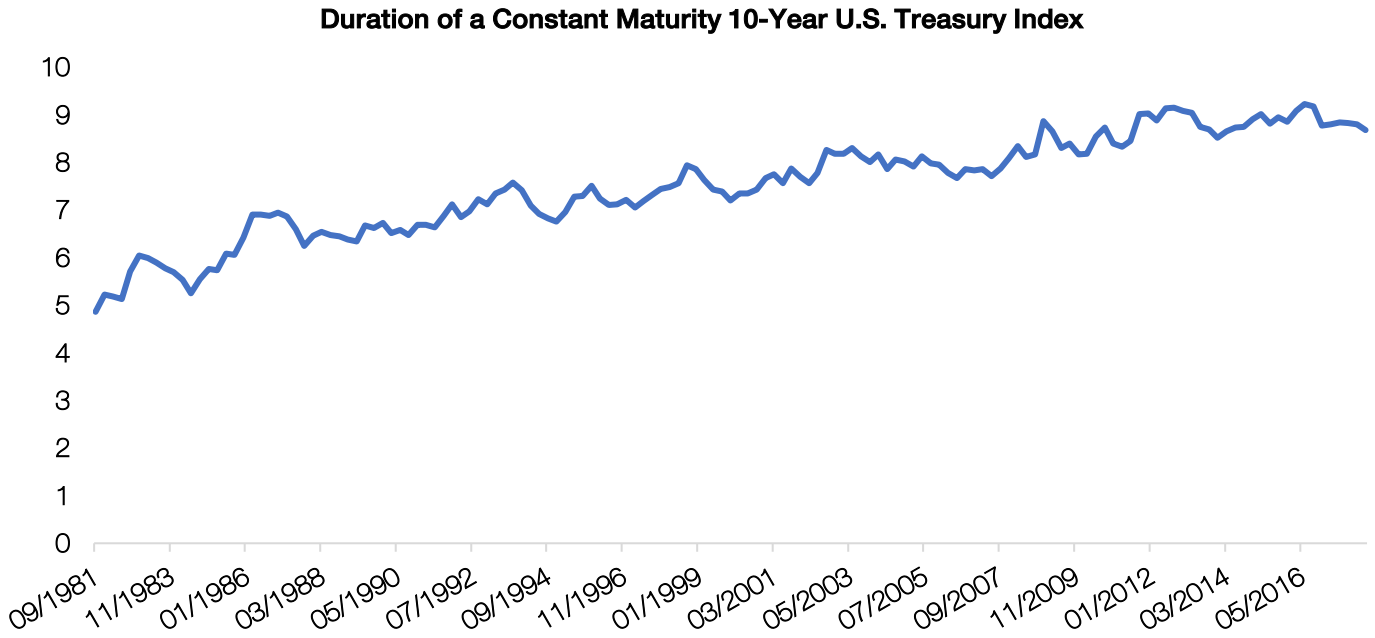
Growth of $1 (Log Scale) – Excess Return of 10-Year U.S. Treasury Index



Source: Federal Reserve of St. Louis. Calculations by Newfound Research.

With the benefit of hindsight, this makes sense. As we demonstrated in *Did Declining Rates Actually Matter?*[5], the vast majority of bond index returns over the last 30+ years have been a result of the high average coupon rate. High average coupons kept duration suppressed, meaning that changes in rates produced less volatile movements in bond prices.

[4] https://blog.thinknewfound.com/2017/06/duration-timing-style-premia/
[5] https://blog.thinknewfound.com/2017/04/declining-rates-actually-matter/



Source: Federal Reserve of St. Louis. Calculations by Newfound Research.

Ultimately, we estimate that roll return and benefits from downward shifts in the yield curve only accounted for approximately 30% of the annualized return.

Put another way, whenever you got "out" of bonds over this period, there was a very significant opportunity cost you were experiencing in terms of foregone interest payments, which accounted for 70% of the total return.

If we use this excess return as our benchmark, we've made the task nearly impossible for ourselves. Consider that if we are making "in or out" tactical decisions (i.e. no leverage or shorting) and our benchmark is fully invested at all times, we can only outperform due to our "out" calls. Relative to the long-only benchmark, we get no credit for correct "in" calls since correct "in" calls mean we are simply keeping up with the benchmark. (Note: Broadly speaking, this highlights the problems with applying traditional benchmarks to tactical strategies.) In a period of consistently positive returns, our "out" calls must be very accurate, in fact probably unrealistically accurate, to be able to outperform.

When you put this all together, we're basically asking, "Can you create a tactical strategy that can only outperform based upon its calls to get out of the market over a period of time when there was never a good time to sell?"

The answer, barring some serious data mining, is probably, "No."

This *Might* Now be a Good Idea

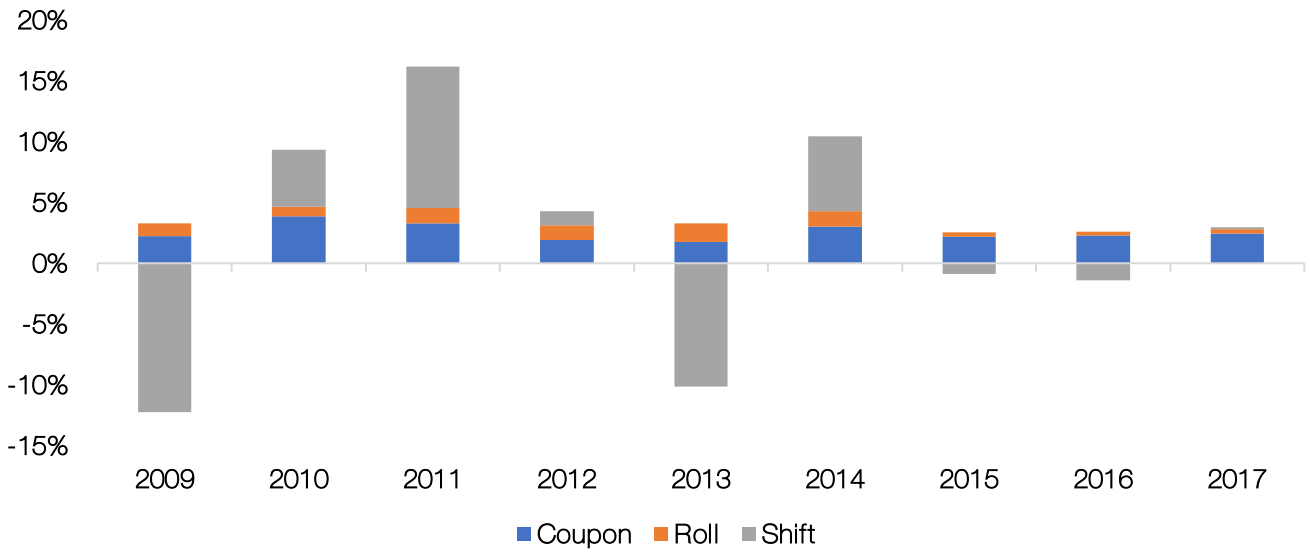
Yet this idea might have legs.

Since the 10-year rate peaked in 1981, the duration of a constant maturity 10-year U.S. bond index has climbed from 4.8 to 8.7. In other words, bonds are now 1.8x more sensitive to changes in interest rates than they were 35 years ago.

If we decompose bond returns in the post-crisis era, we can see that shifts in the yield curve have played a large role in year-to-year performance. The simple intuition is that as coupons get smaller, they are less effective as cushions against rate volatility.

Higher durations and lower coupons are a potential double whammy when it comes to fixed income volatility.

Annual Decomposition of Returns of Constant Maturity 10-Year U.S. Treasury Index



Source: Federal Reserve of St. Louis. Calculations by Newfound Research.

With rates low and durations high, strategies like value, momentum, and carry may afford us more risk-managed access to fixed income.

Timing Bonds with Value

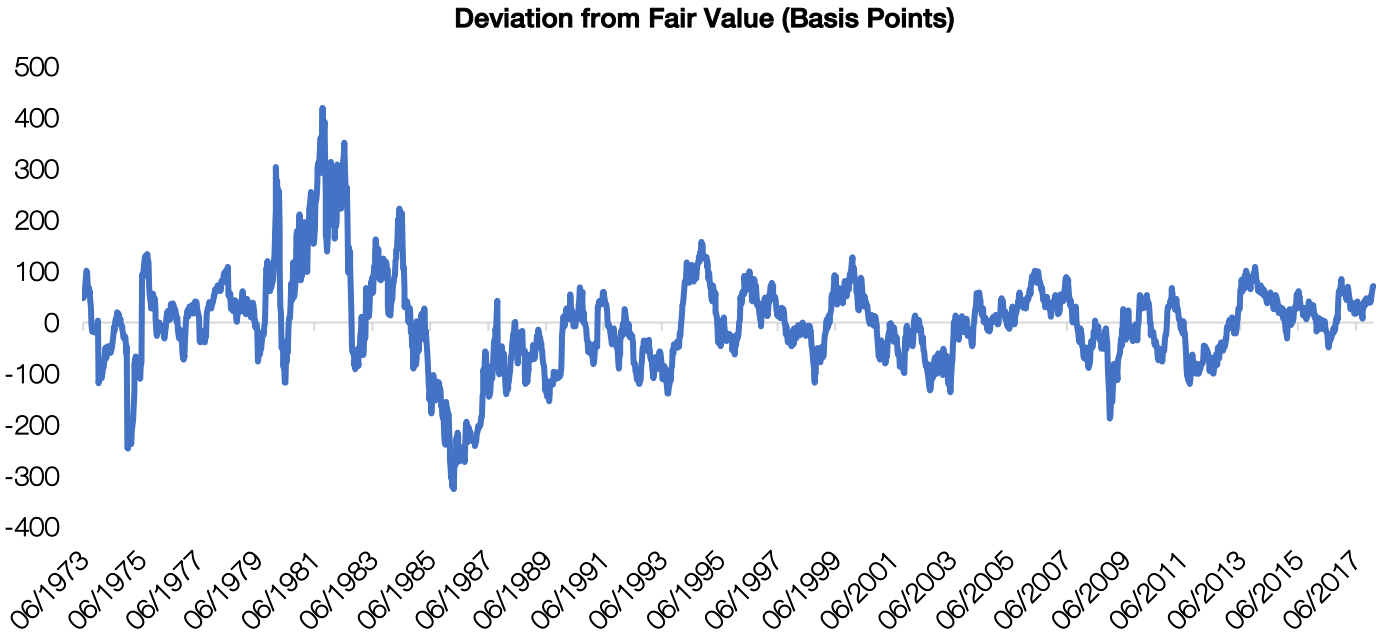
Following the standard approach taken in most literature, we will use real yields as our measure of value. Specifically, we will estimate real yield by taking the current 10-year U.S. Treasury rate minus the 10-year forecasted inflation rate from Philadelphia Federal Reserve's Survey of Professional Forecasters.[6]

To come up with our value timing signal, we will compare real yield to a 3-year exponentially weighted average of real yield.

Here we need to be a bit careful. With a secular decline in real yields over the last 30 years, comparing *current* real yield against a *trailing average* of real yield will almost surely lead to an *overvalued* conclusion, as the trailing average will likely be higher.

Thus, we need to de-trend twice. We first subtract real yield from the trailing average, and then subtract this *difference* from a trailing average of differences. Note that if there is no secular change in real yields over time, this second step should have zero impact. What this is measuring is the deviation of real yields relative to any linear trend.

After both of these steps, we are left with an estimate of how far our real rates are away from fair value, where fair value is defined by our particular methodology rather than any type of economic analysis. When real rates are below our fair value estimate, we believe they are overvalued and thus expect rates to go up. Similarly, when rates are above our fair value estimate, we believe they are undervalued and thus expect them to go down.



Source: Federal Reserve of St. Louis. Philadelphia Federal Reserve. Calculations by Newfound Research.

[6] Prior to the availability of the 10-year inflation estimate, the 1-year estimate is utilized; prior to the 1-year inflation estimate availability, the 1-year GDP price index estimate is utilized.

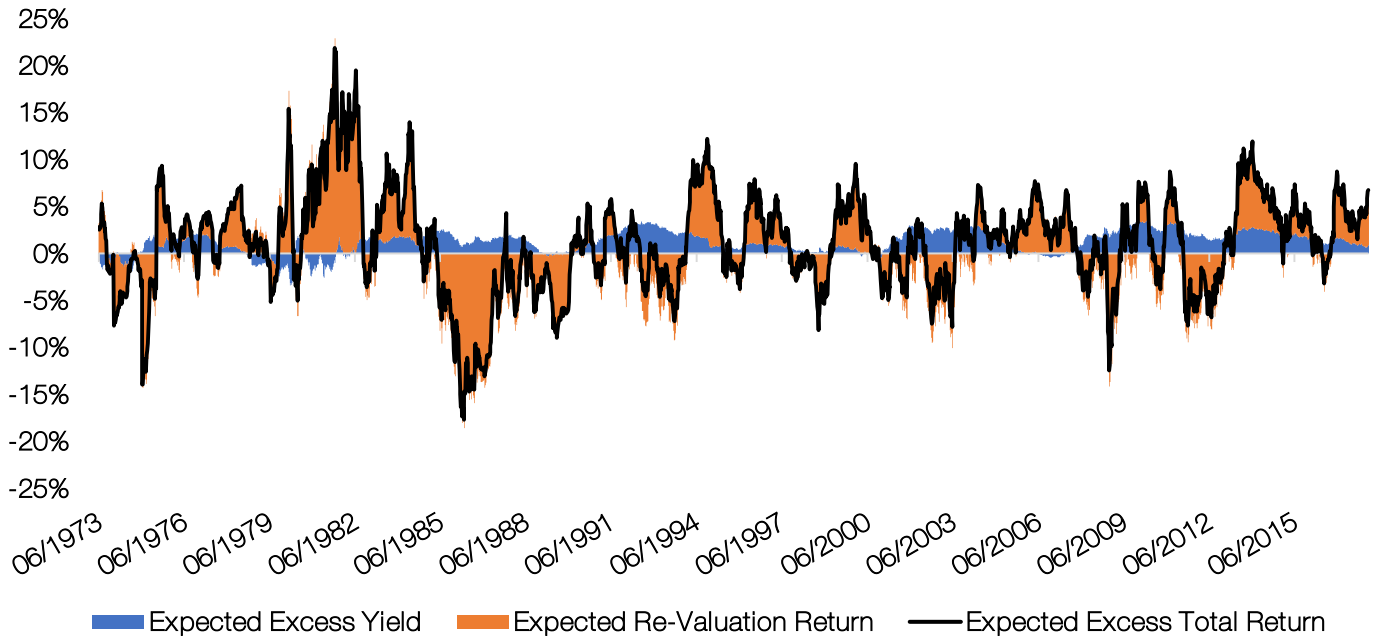
Before we can use this valuation measure as our signal, we need to take one more step. In the graph above, we see that the deviation from fair value in September 1993 was approximately the same as it was in June 2003: -130bps (implying that rates were 130bps below fair value and therefore bonds were overvalued). However, in 1993, rates were at about 5.3% while in 2003 rates were closer to 3.3%. Furthermore, duration was about 0.5 higher in 2003 than it was 1993.

In other words, a -130bps deviation from fair value does not mean the same thing in all environments.

One way of dealing with this is by forecasting the actual bond return over the next 12 months, including any coupons earned, by assuming real rates revert to fair value (and taking into account any roll benefits due to yield curve steepness). This transformation leaves us with an actual forecast of expected return.

We need to be careful, however, as our question of whether to invest or not is not simply based upon whether the bond index has a positive expected return. Rather, it is whether it has a positive expected return *in excess* of our alternative investment. In this case, that is "cash." Here, we will proxy cash with a constant maturity 1-year U.S. Treasury index.

Thus, we need to net out the expected return from the 1-year position, which is just its yield.[7]



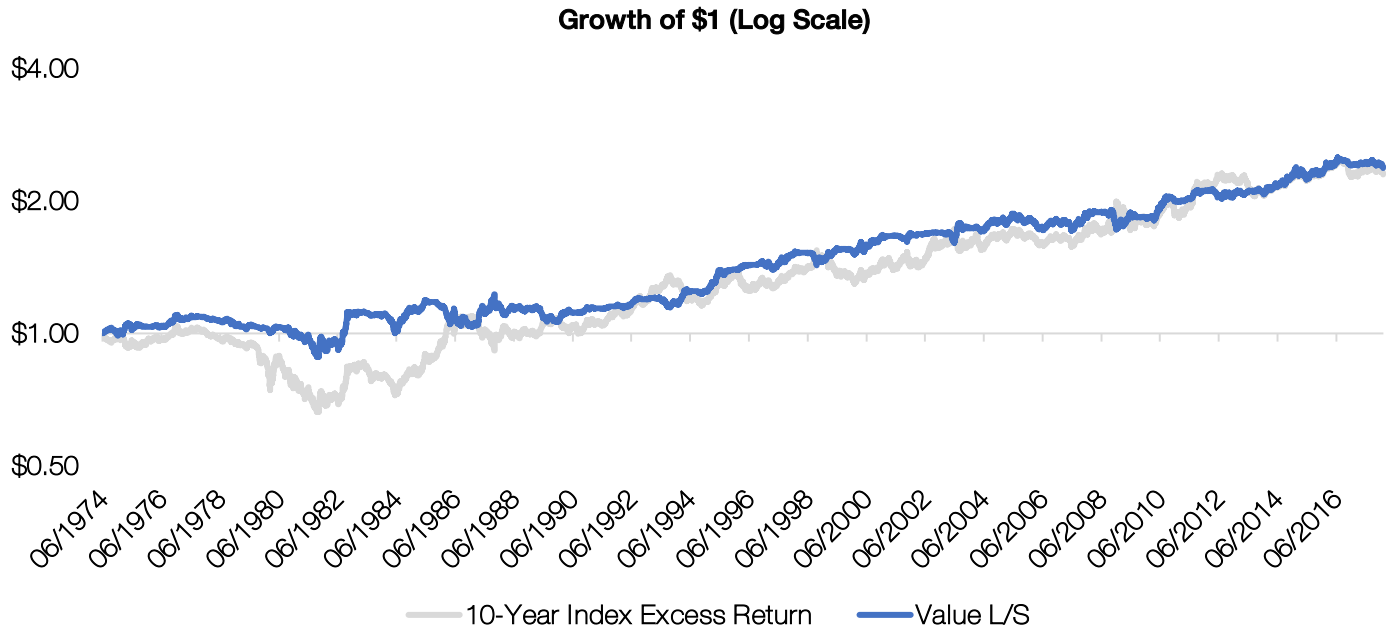
Source: Federal Reserve of St. Louis. Philadelphia Federal Reserve. Calculations by Newfound Research.

[7] This is not strictly true, as it largely depends on how the constant maturity indices are constructed. For example, if they are rebalanced on a monthly basis, we would expect that re-valuation and roll would have impact on the 1-year index return. We would also have to alter the horizon we are forecasting over as we are assuming we are rolling into new bonds (with different yields) more frequently.

While the differences here are subtle, had our alternative position been something like a 5-year U.S. Treasury Index, we may see much larger swings as the impact of re-valuation and roll can be much larger.

Using this total expected return, we can create a simple timing model that goes long the 10-year index and short cash when expected excess return is positive and short the 10-year index and long cash when expected excess return is negative. As we are forecasting our returns over a 1-year period, we will employ a 1-year hold with 52 overlapping portfolios to mitigate the impact of timing luck.

We plot the results of the strategy below.



Source: Federal Reserve of St. Louis. Philadelphia Federal Reserve. Calculations by Newfound Research. Results are hypothetical and backtested. Past performance is not a guarantee of future results. Returns are gross of all fees (including management fees, transaction costs, and taxes). Returns assume the reinvestment of all income and distributions.

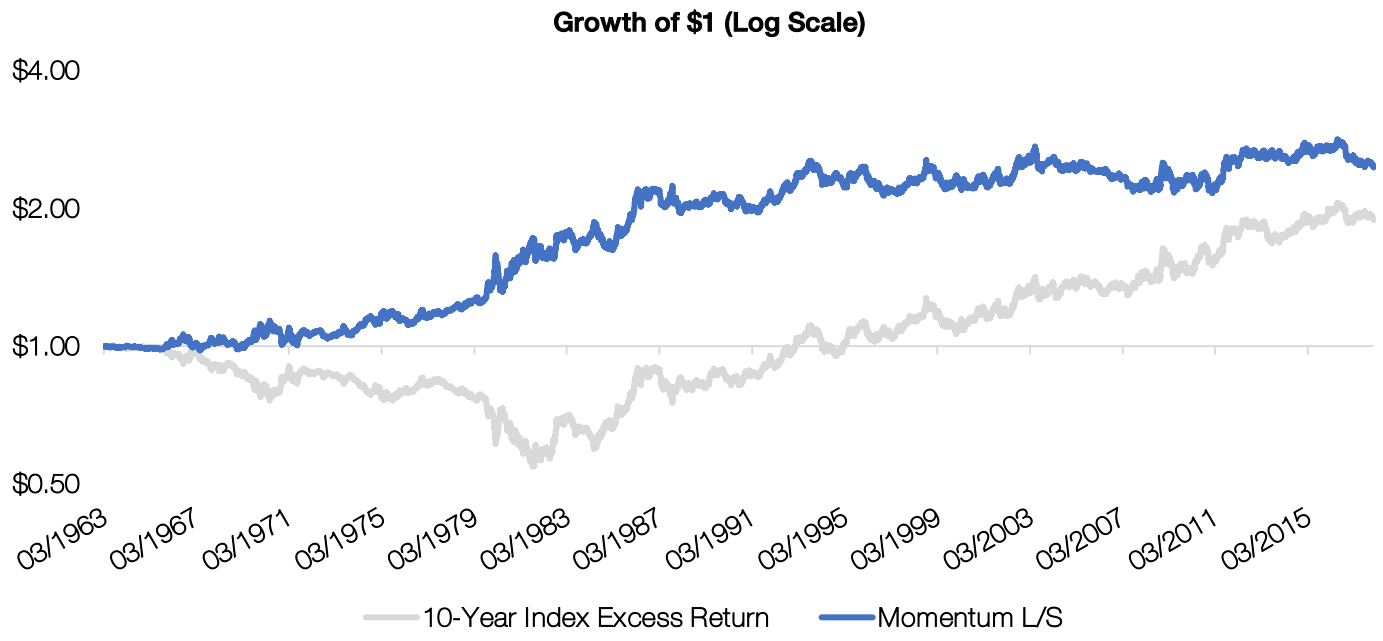
The value strategy return matches the 10-year index excess return nearly exactly (2.1% vs 2.0%) with just 70% of the volatility (5.0% vs 7.3%) and 55% of the max drawdown (19.8% versus 36.2%).

Timing Bonds with Momentum

For all the hoops we had to jump through with value, the momentum strategy will be fairly straightforward.

We will simply look at the trailing 12-1 month total return of the index versus the alternative (e.g. the 10-year index vs. the 1-year index) and invest in the security that has outperformed and short the other. For example, if the 12-1 month total return for the 10-year index exceeds that of the 1-year index, we will go long the 10-year and short the 1-year, and vice versa.

Since momentum tends to decay quickly, we will use a 1-month holding period, implemented with four overlapping portfolios.



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(Note that this backtest starts earlier than the value backtest because it only requires 12 months of returns to create a trading signal versus 6 years of data – 3 for the value anchor and 3 to de-trend the data – for the value score.)

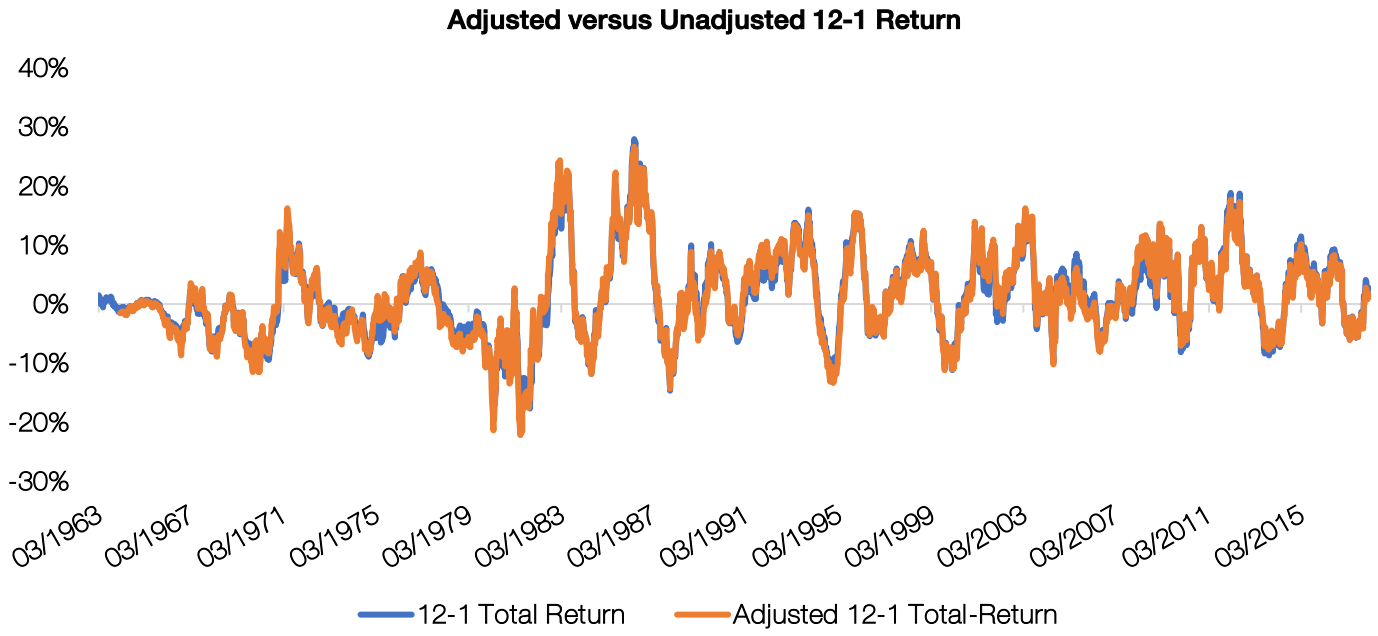
Compared to the buy-and-hold approach, the momentum strategy increases annualized return by 0.5% (1.7% versus 1.2%) while closely matching volatility (6.7% versus 6.9%) and having less than half the drawdown (20.9% versus 45.7%).

Of course, it cannot be ignored that the momentum strategy has largely gone sideways since the early 1990s. In contrast to how we created our bottom-up value return expectation, this momentum approach is a very blunt instrument. In fact, using momentum this way means that returns due to differences in yield, roll yield, and re-valuation are all captured simultaneously. We can really think of decomposing our momentum signal as:

10-Year Return – 1-Year Return = (10-Year Yield – 1-Year Yield) + (10-Year Roll – 1-Year Roll) + (10-Year Shift – 1-Year Shift)

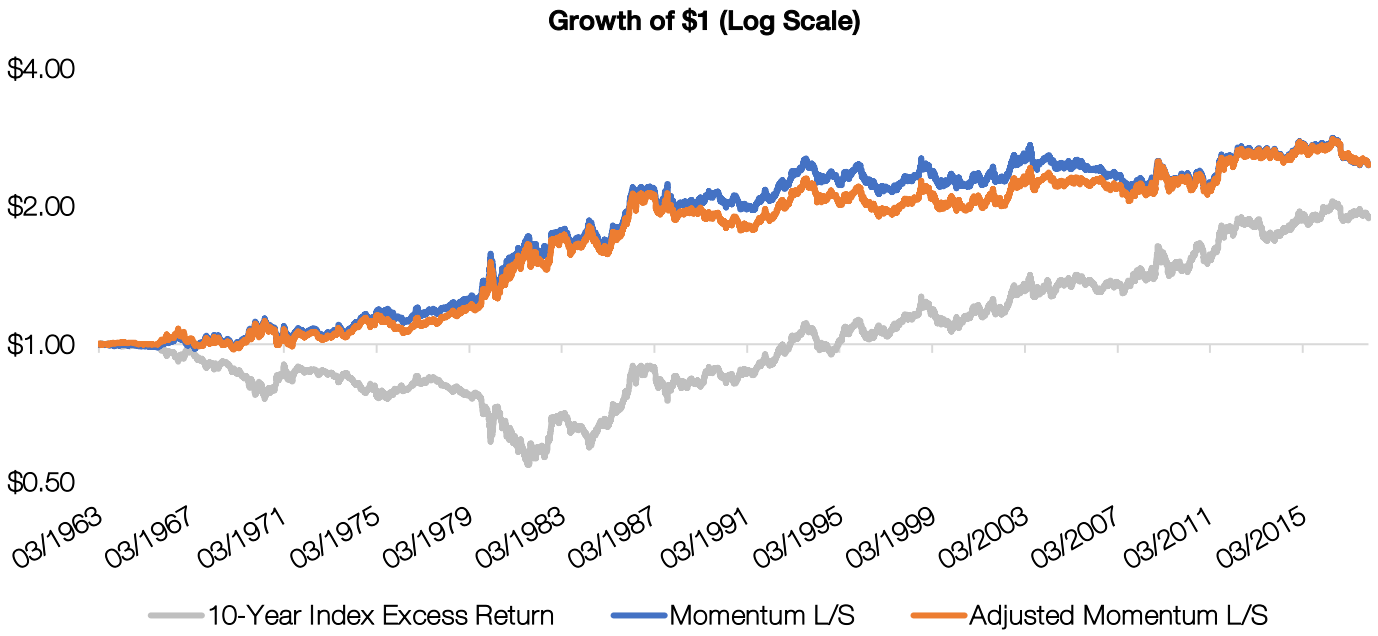
Our momentum score is indiscriminately assuming momentum in all the components. Yet when we actually go to put on our trade, we do not need to assume momentum will persist in the yield and roll differences: we have enough data to measure them explicitly.

With this framework, we can isolate momentum in the shift component by removing yield and roll return expectations from total returns.



Source: Federal Reserve of St. Louis. Calculations by Newfound Research.

Ultimately, the difference in signals is minor for our use of 10-year versus 1-year, though it may be far less so in cases like trading the 10-year versus the 5-year. The actual difference in resulting performance, however, is more pronounced.



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Ironically, by doing *worse* mid-period, the adjusted momentum long/short strategy appears to be more consistent in its return from the early 1990s through present. We're certain this is more noise than signal, however.

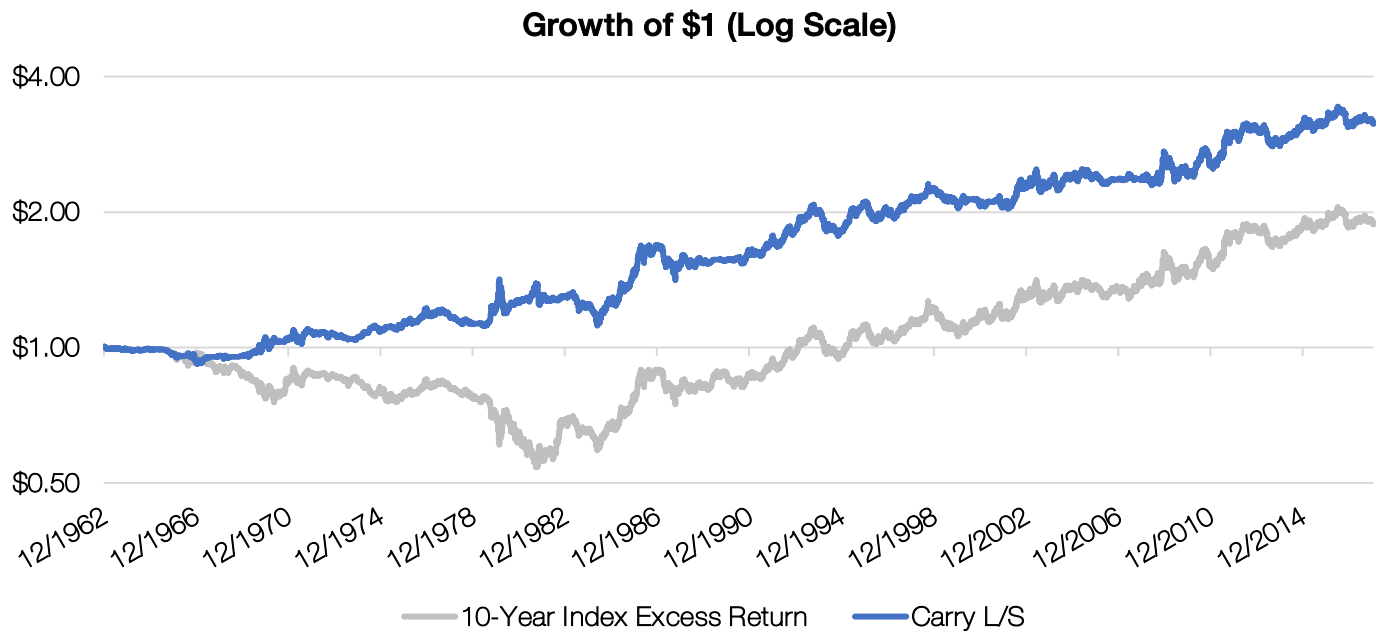
Timing Bonds with Carry

Carry is the return we earn by simply holding the investment, assuming everything else stays constant. For a bond, this would be the yield-to-maturity. For a constant maturity bond index, this would be the coupon yield (assuming we purchase our bonds at par) plus any roll yield we capture.

Our carry signal, then, will simply be the difference in yields between the 10-year and 1-year rates plus the difference in expected roll return.

For simplicity, we will assume roll over a 1-year period, which makes the expected roll of the 1-year bond zero. Thus, this really becomes, more or less, a signal to be long the 10-year when the yield curve is positively sloped, and long the 1-year when it is negatively sloped.

As we are forecasting returns over the next 12-month period, we will use a 12-month holding period and implement with 52 overlapping portfolios.



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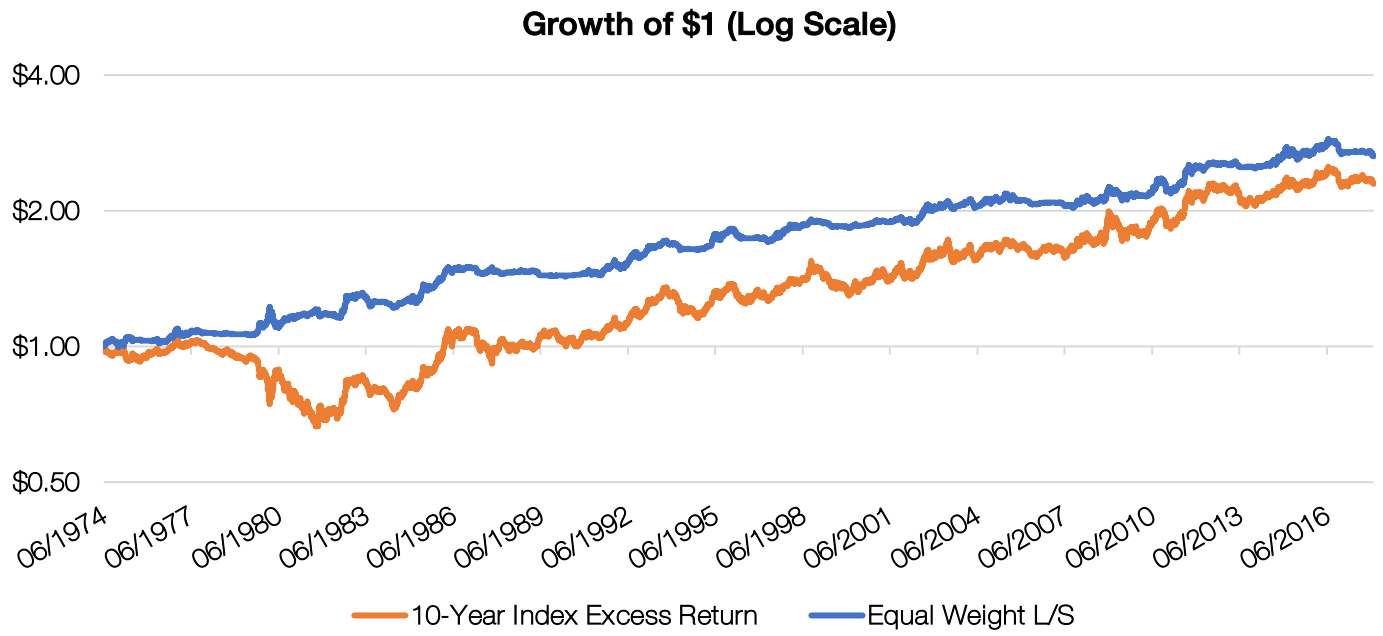
Again, were we comparing the 10-year versus the 5-year instead of the 10-year versus the 1-year, the roll can have a large impact. If the curve is fairly flat between the 5- and 10-year rates, but gets steep between the 5- and the 1-year rates, then the roll expectation from the 5-year can actually overcome the yield difference between the 5- and the 10-year rates.

Building a Portfolio of Strategies

With three separate methods to timing bonds, we can likely benefit from process diversification by constructing a portfolio of the approaches. The simplest method to do so is to simply give each strategy an equal share. Below we plot the results.



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Indeed, by looking at per-strategy performance, we can see a dramatic jump in Information Ratio and an exceptional reduction in maximum drawdown. In fact, the maximum drawdown of the equal weight approach is below that of any of the individual strategies, highlighting the potential benefit of diversifying away conflicting investment signals.

Strategy	Annualized Return	Annualized Volatility	Information Ratio	Max Drawdown
10-Year Index Excess Return	2.0%	7.3%	0.27	36.2%
Value L/S	2.0%	5.0%	0.41	19.8%
Momentum L/S	1.9%	6.9%	0.27	20.9%
Carry L/S	2.5%	6.6%	0.38	20.1%
Equal Weight	2.3%	4.0%	0.57	10.2%

Source: Federal Reserve of St. Louis. Philadelphia Federal Reserve. Calculations by Newfound Research. Results are hypothetical and backtested. Past performance is not a guarantee of future results. Returns are gross of all fees (including management fees, transaction costs, and taxes). Returns assume the reinvestment of all income and distributions. Performance measured from 6/1974 to 1/2018, representing the full overlapping investment period of the strategies.

One potential way to improve upon the portfolio construction is by taking into account the actual covariance structure among the strategies (correlations shown in the table below). We can see that, historically, momentum and carry have been fairly positively correlated while value has been independent, if not slightly negatively correlated. Therefore, an equal-weight approach may not be taking full advantage of the diversification opportunities presented.

	Value L/S	**Momentum L/S**	**Carry L/S**
Value L/S	1.0	-0.2	-0.1
Momentum L/S	-0.2	1.0	0.6
Carry L/S	-0.1	0.6	1.0

To avoid making any assumptions about the expected returns of the strategies, we will construct a portfolio where each strategy contributes equally to the overall risk profile ("ERC"). So as to avoid look-ahead bias, we will use an expanding window to compute our covariance matrix (seeding with at least 5 years of data). While the weights vary slightly over time, the result is a portfolio where the average weights are 43% value, 27% momentum, and 30% carry.

The ERC approach matches the equal-weight approach in annualized return, but reduces annualized volatility from 4.2% to 3.8%, thereby increasing the information ratio from 0.59 to 0.64. The maximum drawdown also falls from 10.2% to 8.7%.

A second step we can take is to try to use the "collective intelligence" of the strategies to set our risk budget. For example, we can have our portfolio target the long-term volatility of the 10-year Index Excess Return, but scale this target between 0-2x depending on how invested we are.

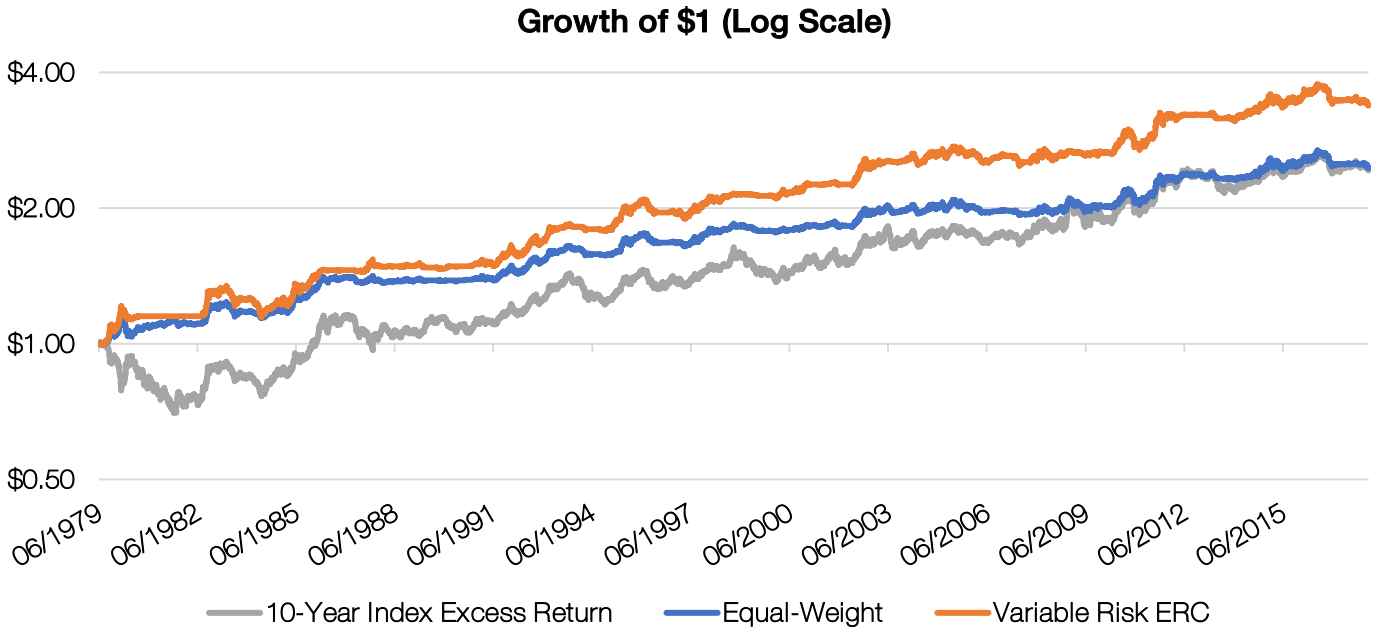
For example, if the strategies are, in aggregate, only 20% invested, then our target volatility would be 0.4x that of the long-term volatility. If they are 100% invested, though, then we would target 2x the long-term volatility. When the strategies are providing mixed signals, we will simply target the long-term volatility level.

Unfortunately, such an approach requires going beyond 100% notional exposure, often requiring 2x – if not 3x – leverage when current volatility is low. That makes this system less useful in the context of "bond timing" since we are now placing a bet on current volatility remaining constant and saying that our long-term volatility is an appropriate target.

One way to limit the leverage is to increase how much we are willing to scale our risk target, but truncate our notional exposure at 100% per leg. For example, we can scale our risk target between 0-4x. This may seem very risky (indeed, an asymmetric bet), but since we are clamping our notional exposure to 100% per leg, we should recognize that we will

only hit that risk level if current volatility is greater than 4x that of the long-term average and all the strategies recommend full investment.

With a little mental arithmetic, the approach it is equivalent to saying: "multiply the weights by 4x and then scale based on current volatility relative to historical volatility." By clamping weights between -100% and +100%, the volatility targeting really does not come into play until current volatility is 4x that of long-term volatility. In effect, we leg into our trades more quickly, but de-risk when volatility spikes to abnormally high levels.



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Compared to the buy-and-hold model, the variable risk ERC model increases annualized returns by 90bps (2.4% to 3.3%), reduces volatility by 260bps (7.6% to 5.0%), doubles the information ratio (0.31 to 0.66) and halves the maximum drawdown (30% to 15%).

There is no magic to the choice of "4" above: it is just an example. In general, we can say that as the number goes higher, the strategy will approach a binary in-or-out system and the volatility scaling will have less and less impact.

Conclusion

Bond timing has been hard for the past 35 years as interest rates have declined. Small current coupons do not provide nearly the cushion against rate volatility that investors have been used to, and these lower rates mean that bonds are also exposed to higher duration.

These two factors are a potential double whammy when it comes to fixed income volatility.

This can open the door for systematic, factor-based bond investing.

Value, momentum, and carry strategies have all historically outperformed a buy-and-hold bond strategy on a risk adjusted basis despite the bond bull market. Diversifying across these three strategies and employing prudent leverage takes advantage of differences in the processes and the information contained in their joint decisions.

We should point out that in the application of this approach, there were multiple periods of time in the backtest where the strategy went years without being substantially invested. A smooth, nearly 40-year equity curve tells us very little about what it is actually like to sit on the sidelines during these periods and we should not underestimate the emotional burden of using such a timing strategy.

Even with low rates and high rate movement sensitivity, bonds can still play a key role within a portfolio. Going forward, however, it may be prudent for investors to consider complementary risk-management techniques within their bond sleeve.

Corey Hoffstein & Justin Sibears

About Newfound Research

Investing at the intersection of quantitative and behavioral finance, Newfound Research is dedicated to helping clients achieve their long-term goals with research-driven, quantitatively-managed portfolios, while simultaneously acknowledging that the quality of the journey is just as important as the destination.

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