Credit-Informed Tactical Asset Allocation

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Abstract

This paper outlines a tactical asset allocation (TAA) strategy that takes signals from the credit markets and applies them to the stock market. A power model is built using the Russell 2000 equity index and the Bank of America/Merrill Lynch High Yield B index. This model is then used in a tactical asset allocation strategy to judge whether equities are expensive or cheap relative to high yield bonds. Based on back-test results from 1997 to the present, the approach provides equity-like returns while lowering portfolio volatility.[1]

Introduction

Credit analysts claim that "credit anticipates and equity confirms." In other words, the credit market prices in anticipated trends before the stock market does. While anticipation does not always lead to confirmation, confirmation is provided often enough to implement a profitable TAA strategy that outperforms a buy-and-hold policy when standard performance metrics are considered. **In fact, our back-test of the strategy captures 65% of upside equity moves on a monthly basis while only taking 21% of the downside**. Additionally, the strategy can be extended for use with other equity alpha strategies as well as to achieve complementary portfolio goals such as capital preservation.

Until recently, it has been fashionable for institutional investors to dismiss TAA with an efficient market argument. Why would TAA opportunities exist if the market encompassed all available information? This is an especially important question when investing at the index level. Nevertheless, lackluster equity returns over the past decade coupled with gut-wrenching moves over the past three years created a receptive environment for TAA strategies. Why, the thinking goes, wouldn't one want to at least consider getting out of an asset class if signs point to short-term underperformance?

Before outlining our particular strategy, a brief discussion of TAA is in order. TAA is a

[1] The author would like to thank Roderick MacLeod and Tim Backshall for valuable comments and technical assistance.

dynamic investment strategy that adjusts asset allocations based on a particular model. Models vary from looking at company fundamentals to considering technical indicators such as moving averages. TAA complements Strategic Asset Allocation (SAA) but does not replace it.

Regardless of how a particular approach is developed, any TAA strategy makes use of market-timing signals with the goal of producing returns that outperform a benchmark on a risk-adjusted basis. This is in contrast to SAA which sets a portfolio's *policy* for how funds are to be invested among different asset classes.

TAA must also be distinguished from other sources portfolio of returns in excess of holding a benchmark index, known as active returns. TAA alters the systematic risk of the portfolio by overweighting or underweighting broad asset classes (stocks, bonds, commodities, etc.). Other active strategies change the idiosyncratic risk of a portfolio through individual security selection. A TAA strategy might lead to a preference of a 60/40 stock/bond allocation over a 70/30 allocation in order to underweight systematic equity risk. Within that 60% allocation, an investor might choose a basket of single-name stocks or invest in a particular actively-managed equity mutual fund (or hedge fund) to take on idiosyncratic risk.

Timing the Equity Market Using Signals from the Credit Market

The relationship between a firm's debt and equity is well established. As the market capitalization of a company rises, its credit risk (the risk of default on a company's debt) falls and vice versa. If a company's credit risk rises, its market cap will generally fall[2]. Deciding on the appropriate *capital* structure of a firm is a key task of management. If a company takes on too much debt, future earnings may be swallowed by interest payments. If too little debt is issued, growth opportunities may be missed.

For large firms with strong balance sheets, the link between credit and equity performance is tenuous at best. When there is very little perceived chance of credit distress, the two portions of the capital structure behave seemingly independently. However, when a company's debt trades with a fair amount of credit risk embedded in its price, the link strengthens. That is why high yield debt is highly correlated with stock market returns. The debt becomes more "equity-like" while the stock becomes much more sensitive to the company's credit risk.

This debt-equity relationship can be exploited profitably at the level of individual companies and forms the basis for one type of *capital structure arbitrage*. If a company's credit is going to outperform its equity, then a trade can be constructed to buy debt and sell (short) stock. If the two securities do move back into line, a profit can be made.

The debt-equity relationship can also be exploited at the level of the market as a whole. Specifically, using a bond index and an equity index, a view can be formed on whether equities are overpriced or underpriced relative to bonds.

[2] One notable exception to this is the case of a *leveraged buyout (LBO)* where almost all of a firm's equity is converted into debt at a premium.

Figure 1: HY/B vs. Russell 2000 with Dividends, Source: Russell Investments, Bank of America

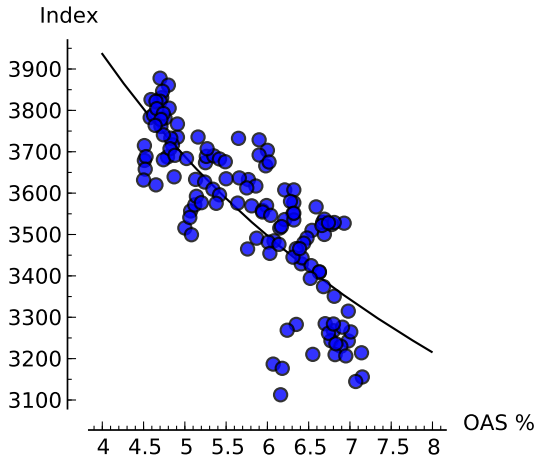


Figure 1 shows six months of the Bank of America/Merrill Lynch HY/B index OAS[3] (for simplicity, we'll subsequently refer to this index as the HY/B) on the X-axis and the Russell 2000 equity index on the Y-axis. Clearly, there is a lot of 'noise' in the relationship, but when credit spreads rise (that is, risk goes up), stock prices tend to fall.

We chose the Russell 2000 because small cap stocks tend to be more sensitive to the credit cycle. We chose the HY/B index as it provides a reasonably long history and, with its focus on B-rated debt, provides a stronger signal for stocks than other high yield indices like the HY/B's parent, the Bank of America/Merrill Lynch High Yield Master II index[4]. We will show below that the signal from the HY/B proves to be a good choice for the Russell 2000 as well as other indices like the Russell 1000, S&P 500 and assorted growth and value indices.

The strategy outlined in this paper can be summed up by the following two rules:

1. If stocks appear undervalued relative to corporate bonds, go long stocks.

2. If stocks appear overvalued relative to corporate bonds, exit stock positions and buy short-term Treasuries (or park your cash in a money market fund).

We chose to switch to Treasuries rather than corporate bonds because the strategy is based on the belief that the credit market provides an early warning that all corporate markets are due to correct downward (or upward). We are essentially switching in and out of a risky asset class (stocks) and a riskless asset (Treasuries) based on a signal from a third asset class (bonds) that has already started to move.

The 'early-warning' aspect of this approach is a key strength of the strategy. The quantitative model is constructed from tradable securities whose prices are available on a daily basis rather than fundamental or macroeconomic data that

[3]OAS = Option-Adjusted Spread. OAS provides a measure of credit risk. A higher OAS indicates a riskier bond (or collection of bonds in the case of an index like the HY/B).

[4]Russell Equity Index data is available on Russell Investments web site:
`http://www.russell.com/Indexes/data/default.asp`
The Russell 2000 index values reported on the Russell Investments web site do not match values reported on other financial web sites, however their returns do. BAML HY/B Index data (and others) can be found at the St. Louis Federal Reserve's Economic Data web site:
`http://research.stlouisfed.org/fred2/`

are published less frequently. There is no lag to information being incorporated into the model. Furthermore, the strategy does not rely on technical indicators like moving averages which recognize a market top or bottom only after that threshold has been reached.

Implementation

As stated above, we use the Russell 2000 and HY/B as our equity and credit indices respectively. In order to judge the relative value of the two indices, we first convert the HY/B from spreads into default probabilities[5] . When undertaking similar work on single-name credits, we find it advantageous to work with default probabilities to limit the dominance of higher spreads when calibrating model parameters. Spreads can theoretically go to infinity, but default probabilities can only go to 100%.

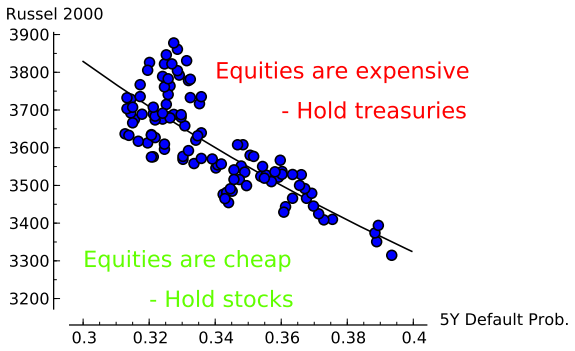
Once we convert spreads to default probabilities, we select a lookback period for our model. We find six months to be useful as it is a long enough time period for meaningful changes in both credit and equity to occur but it is short enough that (generally) there is no need to correct for the business cycle or inflation.

After selecting the lookback period, we model equities using a power model[6] . We are not modeling returns. Rather, we are modeling actual price levels for the Russell 2000 and HY/B indices. There is an inverse relationship between default probabilities and equity prices.

[5]See Appendix 1 for an explanation of converting spreads to default probabilities.

[6]See Appendix 1 for an explanation.

Figure 2: Default Probabilities vs. Russell 2000 with Dividends, Market Data: Russell Investments



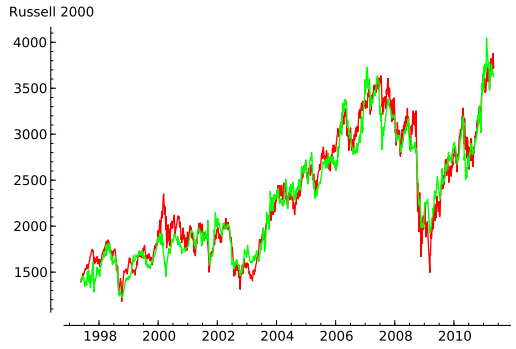
As default probabilities rise, equities go down. As default probabilities drop, equities go up. Figure 2 shows a plot of equity prices against default probabilities. We recalculate model parameters each trading day for use on the next trading day.

When the current market levels of the Russell 2000 and HY/B are below the relative value line, equities are cheap and we invest in stocks. Above the line, equities are expensive and we choose to invest in short-term Treasuries rather than stocks.

Figure 3 shows the Russell 2000 and our model's fair value since May 1997. Market and fair values tend to stay closely aligned with occasional exceptions.

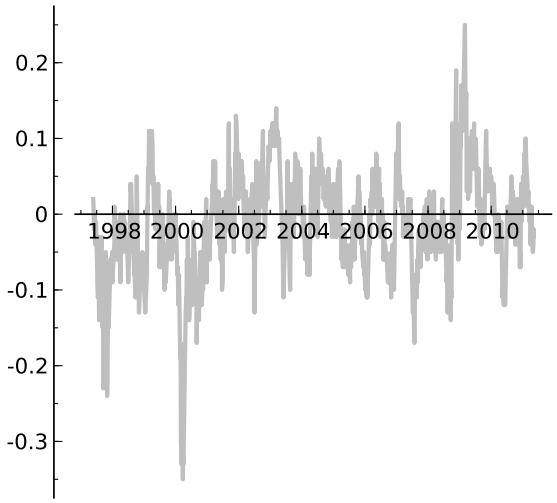
Figure 4 charts the difference over the same period of fair value minus market value. In Figure 4, a positive value indicates that equities are cheap (fair value is higher than market)

Figure 3: Time Series of Index (red) vs. Fair Value (green), Market Data: Russell Investments



and a negative value indicates that equities are expensive (fair value is less than market).

Figure 4: Equity Disconnect over Time



Results

Table 1 compares strategy performance to a buy-and-hold strategy for the Russell 2000 from May 1997 through the beginning of May 2011. Over this period, the strategy provides stellar results and a strong information ratio for a TAA strategy[7] .

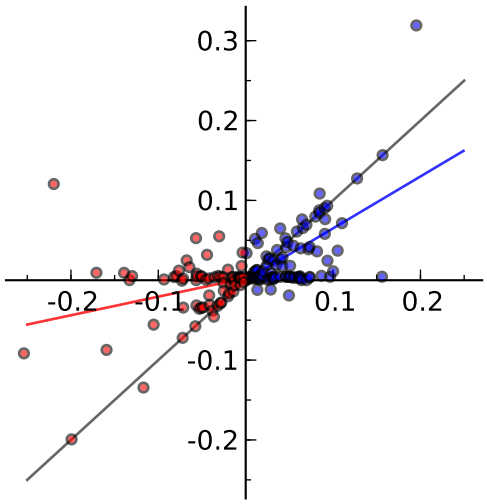
In our back-test, the strategy does a good job of limiting downside risk while capturing a substantial portion of upside gain. Figure 5 charts the monthly returns of the Russell 2000 (X-Axis) against the monthly returns of the strategy (Y-Axis). Positive returns are

Table 1: Strategy Performance

	Russell 2000	Strategy
Average Annualized Return	7.30%	16.10%
Average Annualized Volatility	24.90%	17.50%
Sharpe Ratio	0.18	0.76
Information Ratio		0.44

[7]The *information ratio* is defined as the excess return (strategy return minus benchmark return) divided by the standard deviation of the excess return. It provides a risk-adjusted measure of strategy performance. Positive numbers indicate outperformance.

Figure 5: Comparison of Monthly Returns, Market Data: Russell Investment



represented by blue dots while negative returns are represented by red dots. The black line indicates the level where the strategy returns match the market. Dots above the black line represent strategy outperformance and dots below the line represent underperformance. Even though monthly returns are shown, the strategy is traded on a daily basis.

Applying a linear regression to the red and blue scatter plots, we find the blue trend line has a slope of 0.65, meaning, on average, the strategy picks up 65% of any monthly gain. The red trend line has a slope of 0.21 which means the strategy only takes on 21% of the downside when the index had a negative monthly return.

This disconnect in returns is the essence of the strategy. **If one is willing to give up a portion of the upside (35%), then one is protected from a much larger portion of the downside (79%)**. In a strong bull market, the strategy will underperform as the market rises month after month. In a sideways or declining market, the strategy excels. Figure 6 charts the portfolio value of $100 invested in both the strategy and the Russell 2000 since May 1997. Transaction costs and taxes are ignored. **$100 invested in the strategy in May 1997 would be worth over $800 in early May 2011 compared to roughly $270 for buying and holding the Russell 2000**.

Moving from returns over the entire time period, Figure 7 considers 1 year (blue line) and 5 year (red line) rolling excess returns. A positive number indicates the strategy outperformed the index. The strategy does quite well over some periods and underperforms during others, even over five years. On average, excess returns are positive both over 1 year and 5 year time horizons.

As noted above, the strategy results in a positive information ratio from May 1997- May 2011. Given the fact that the strategy is invested in only two assets, it is not surprising that the rolling information ratio, which is plotted in Figure 8, shows a great deal of similarity to the rolling returns. On average, 1Y and 5Y information ratios are positive. We discuss evaluating performance effectiveness further in the following section.

Figure 6: Performance Results (red), Index (blue) 1997-2011, , Market Data: Russell Investments

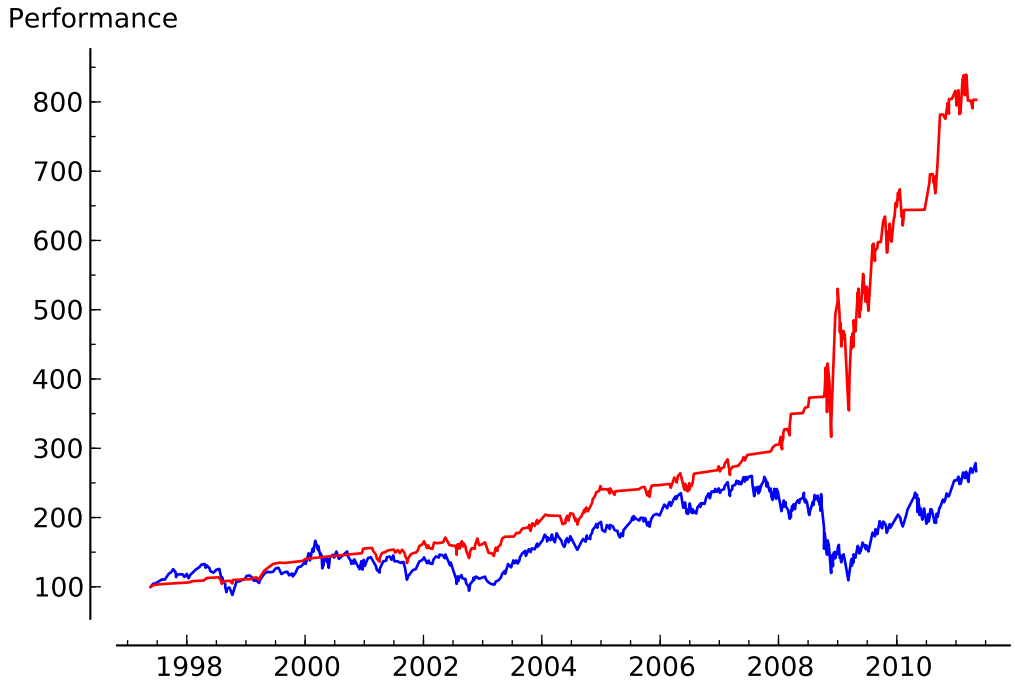


Figure 7: 1Y (red) and 5Y (blue) Excess Strategy Returns

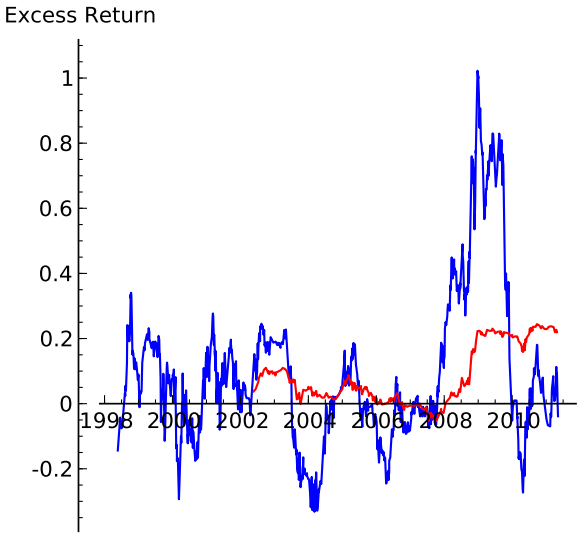


Figure 8: 1Y (blue) and 5Y (red) Rolling Information Ratios

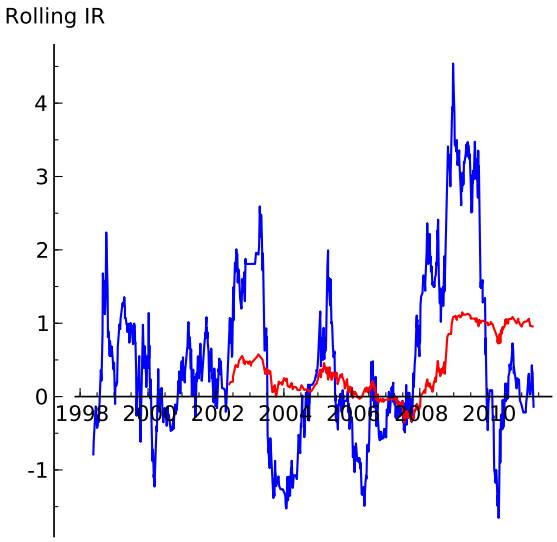


Table 2: Quantitative Performance Measures

Measure	Result
Geometric Average Alpha	7.70%
Arithmetic Average Alpha t-statistic	3.1
Information Ratio	0.41
Hit Ratio	47.30%
Excess Skewness	2.1

Performance Metrics

It is not difficult to construct an investment strategy that does well, maybe even spectacularly so, over a back-test time period of a year or two. To judge whether the strategy is durable, it is useful to employ quantitative measures[8] . Table 2 lists the results of five different measures based on monthly returns. All measures except the hit ratio indicate durable alpha (outperformance).

Descriptions of each quantitative measurement are taken from Stockton & Shtekhman.

Geometric Average Alpha is the difference between the geometric average return of the strategy and the geometric average return of the benchmark (the Russell 2000 in our case). By this measure, the strategy outperformed the benchmark by 7.7% annually. A positive geometric average alpha indicates historical

[8]Kimberly A. Stockton & Anatoly Shtekhman, *A primer on tactical asset allocation strategy evaluation*,https://institutional.vanguard.com/iip/pdf/tacticalassetallocation_052006.pdf (July 2010)

outperformance.

Arithmetic Average Alpha t-statistic tests whether the average alpha (outperformance) is different from zero. A value greater than 2, as is the case for the strategy, indicates that outperformance can be expected in any given investment period. That is, the outperformance is statistically significant.

Information Ratio is the ratio of alpha to the standard deviation of alpha (the *tracking error*). It provides a measure of risk-adjusted return. An information ratio of 0.41 means that the strategy outperformed the benchmark over the period 1997-2011, but it would not be placed in the top quartile of active returns[9]. However, for a 'simple' TAA strategy, an information ratio of 0.41 is impressive.

Hit Ratio is the proportion of times the strategy outperforms the benchmark. Over 167 months, the strategy outperformed the market 79 times for a hit ratio of 47.3%. The relatively low hit ratio is not surprising given that the strategy stayed fully invested in the market for 18 of the monthly periods. By employing the strategy, one has an almost 50% chance of beating the market and an almost 60% chance of doing no worse than the market.

Additionally, the hit ratio does not address the magnitude of the outperformance or underperformance. To us, the fact that the strategy captures 65% of the upside of the benchmark and only 21% of the downside is a more compelling metric[10] .

Excess Skewness judges how positively skewed results are relative to the benchmark. Over the time period considered, monthly strategy returns were positively skewed while monthly benchmark returns were negatively skewed. One way to view the skewness is that the strategy provides a greater opportunity for a few big upside returns balanced by many returns just below the average. The time series of returns appears to bear this out.

With the exception of the Hit Ratio, performance metrics all point to a TAA strategy that has been effective over a time period of 14 years. Past performance is, of course, no guarantee of future gains, but alpha provided by the strategy appears to be the result of more than just luck.

Challenges

While we firmly believe the TAA strategy outlined above adds value, it is not without its challenges both from an implementation and psychological perspective.

Transaction Costs and Tax Issues - we perform our analysis of the strategy while ignoring trading costs and tax issues. While tax issues can be muted in certain situations, transaction costs are always present and will degrade relative performance. Many individual investors may not be able to trade the strategy efficiently as it requires daily monitoring and the movement into and out of stocks multiple times

[9] Grinold, Richard C. and Ronald N. Kahn, 2000. *Active Portfolio Management: A Quantitative Approach for Providing Superior Returns and Controlling Risk* . New York: McGraw-Hill.

[10] This type of analysis is in the spirit of the Merton-Henriksson timing test.

a year. Given the liquidity of the instruments traded, institutional investors, and individuals with the ability to trade efficiently, should be able to minimize transaction costs compared to trading a large basket of individual stocks.

Scalability - the strategy as presented requires switching from 100% equities to 100% risk-free asset and back and raises scalability issues. A more sophisticated entry/exit policy should be able to capture much of the upside of the strategy and eliminate some of the churn.

Disappearance of Arbitrage - any strategy is vulnerable to being a victim of its own popularity. As more traders pile in, arbitrages disappear. This strategy is not immune, but the fact that the relationship traded utilizes broad-based indices should provide a measure of longevity to the opportunity.

Psychological/Practical Barriers - the strategy, as is evidenced in Figure 4 above can stay in or out of stocks for extended periods of time. Imagine exiting stocks in December 1999, as recommended by the strategy, and not getting back in for any meaningful period of time until February 2001. In February 2001, you would be happy to have earned a risk-free return over the previous 14 months. You might have felt differently in March 2000 after sitting out 3 months of a continued equity rally. It would take an extremely disciplined investment manager to stick with the strategy in the face of an equity bubble.

Data Mining - as with any strategy for which long-run audited returns do not exist, it is quite possible that the performance outlined is due more to data mining than to strategy value. Despite whatever safeguards and care were used when developing the back-test, it is undeniable that knowledge of the past 14 years is embedded into the strategy. At the most basic level, we have found modeling the credit-equity relationship using a power model to be beneficial over the past few years.

Short Time Period - while 14 years may seem like a long time, it is short for evaluating the effectiveness of equity strategies. Unfortunately, we do not have access to a longer time series of data. However, the past 14 years encompassed multiple economic cycles that included several bubbles and crashes. With that in mind, strong performance metrics over the examined time period provide ample confidence in the strategy.

Extending the Strategy

The strategy outlined above provides strong results and is valuable on its own. Still, more can be done to enhance and extend its value.

Multiple Equity Indices - Table 3 in Appendix 2 outlines performance characteristics when the Russell 2000 strategy was applied to other equity indices from May 1997 to early May 2011. The same signal (from the Russell 2000-HY/B relationship) was used for each index. Given the correlation of equity returns, it is not surprising that the strategy can be deployed across a broader spectrum of equity indices.

Refined HY Index - while the HY/B provides a strong foundation for the TAA model

outlined, custom CDS indices can refine the strategy. Index member selection and model implementation are beyond the scope of this paper.

Combined with Other Equity Alpha Strategies - the strategy outlined above attempts to lower *systematic* risk while generating alpha. It can also be used as a signal to be net long equities or adopt a market-neutral stance (a *long/flat* strategy). For example, Capital Context uses the signal to help select the level of market exposure (beta) for an equity portfolio composed of single-name stocks.

Foundation for a Capital Preservation Strategy - the strategy also fits well with *capital preservation* strategies. As Figure 5 illustrates, it provides an expected payout somewhat similar to a call option. This provides a head start to hedging strategies that limit downside risk by foregoing some upside profit.

Conclusion

The tactical asset allocation strategy outlined above lowers equity portfolio risk while boosting overall returns. **By its nature, it captures most of an equity index's upside return and greatly limits the expected downside risk**. Statistical analysis of the strategy shows that an implementer can expect positive alpha. Further, the strategy holds up well on its own but can also be extended for use with other alpha strategies and to achieve complementary portfolio goals like capital preservation. While there are barriers to successful implementation, the strategy is worth the consideration of investors looking to manage equity portfolio risk and traders looking for new sources of alpha.

Appendix 1 Formulae

Stylized Default Probabilities

To convert spreads to default probabilities, we make a time to maturity assumption T and recovery rate assumption RR. This yields a simple approximation of default probabilities from spreads of:

$$\textit{default probability (oas)} = 1 - exp(-T\lambda)$$

$$\textit{hazard rate}= \lambda(oas) = \frac{oas}{10000}\frac{1}{1-RR}$$

OAS is expressed in basis points (hence the division by 10,000). This 'default probability' is not intended to be interpreted as a real probability, risk-neutral or otherwise. Simply, when modeling equities relative to credit, high spreads tend to dominate when, in fact, big changes in high spreads result in only modest changes to default probabilities. In other words, this 'stylized' default probability provides a useful 'fiction' when judging relative value across the capital structure.

$$\textit{index value}= A * defprob^{-B}$$

defprob is a default probability calculated using the formulas above. A & B are constants calibrated from 6 months' worth of time series data using a proprietary calibration methodology developed when modeling single-name CDS-equity relationships. Simple regression can also be used but with slightly degraded performance in the back-test.

Appendix 2 Equity Index Results

Table 3 compares buying and holding a benchmark index against switching between the benchmark and 3 month Treasuries over the period May 22, 1997 - May 6, 2011. The switching strategy is based on the signal generated when comparing the Russell 2000 index to the ML/BA High Yield B index. Correlation was calculated using daily returns.

Table 3: Performance Comparison of Strategy vs. holding various indices.

	Correlation to Russell 2000	Average Annual Return		Average Annualized Volatility		Sharpe Ratio		Information Ratio
	Index	Index	Strategy	Index	Strategy	Index	Strategy	Strategy
S&P 500	0.87	3.40%	11.30%	21.20%	15.00%	0.03	0.57	0.49
Russell 1000	0.89	5.70%	12.40%	21.20%	15.00%	0.13	0.64	0.41
Russell 1000 Growth	0.86	4.20%	11.80%	23.10%	15.40%	0.06	0.58	0.41
Russell 1000 Value	0.85	6.50%	12.90%	21.10%	15.40%	0.17	0.65	0.41
Russell 2000	1	7.30%	16.10%	24.90%	17.50%	0.18	0.76	0.44
Russell 2000 Growth	0.98	5.20%	14.90%	27.10%	18.00%	0.09	0.67	0.44
Russell 2000 Value	0.97	8.90%	17.10%	23.80%	17.60%	0.25	0.81	0.45
Russell 3000	0.91	5.80%	12.70%	21.30%	15.10%	0.14	0.66	0.42
Russell 3000 Growth	0.88	4.30%	12.10%	23.10%	15.50%	0.06	0.6	0.42
Russell 3000 Value	0.87	6.60%	13.20%	21.10%	15.50%	0.18	0.67	0.42