

# Tactical Asset Allocation with Macroeconomic Factors

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Since the onset of the Great Recession in 2008, the practice of tactical asset allocation has received increased interest from practitioners (Cloherty [2011], Kitces [2012]). Though commonly used in conjunction with strategic asset allocation, tactical asset allocation could also be employed as a separate investment strategy, and this is the stance taken in this article.

To provide clarity as to what is meant by tactical asset allocation and strategic asset allocation, we quote Anson [2004], who stated that tactical asset allocation “is intended to take advantage of opportunities in the financial markets when certain markets appear to be out of line ... [it] attempts to beat the market” (p.11) whereas “strategic asset allocation provides an institutional investor’s target allocation among the major asset classes ... [it] is the translation of an organization’s investment policy” (p.8). Although not explicitly stated, it suffices to say that investing via multiple asset classes has the dual objectives of diversification with an attempt to maximize returns. As such, we shall examine the efficacy of tactical asset allocation strategies when used together with macroeconomic factors, in a multiple-asset-class setting and implemented via exchange-traded funds (ETFs) instead of indexes.

Though this article is similar and complementary in some respects to our previous studies on low- (economic) volatility

investing (Chong and Phillips [2012, 2013]), there is much that differs, thereby advancing the literature. For one, the asset of choice is ETFs instead of stocks. This has the advantage of diversification since an ETF consists of many stocks, which addresses the issues of portfolio size and diversification highlighted by Chong and Phillips [2013]. Further, ETFs, increasing in both passive and active varieties, are well suited for investors in their quest for return-enhancement and risk management, and may already be investors’ preferred investment vehicle, over mutual funds and stocks. Second, there is resurgence in tactical asset allocation (Kitces [2012]). Therefore, to reconcile investor preference for tactical asset allocation and practicality of our study, it would be sensible to undertake such a research topic for the benefit of readers.

Third, even though numerous academic studies have underscored the benefits of low-volatility investing (see Chong and Phillips [2012, 2013] and the literature therein), investors are still inclined to focus on the return-generating process of an investment strategy. Hence, in addition to a low- (economic) asset allocation strategy, we have included a return-maximizing, mean-variance optimization, asset allocation strategy in this article. Lastly, the portfolios under assessment are rebalanced twice yearly instead of quarterly, reducing transaction costs incurred by investors. In terms of similarity between

our article and those by Chong and Phillips [2012, 2013], our study begins on January 31, 2006, and spans a period that covers the Great Recession, overlaying our investment strategies with macroeconomic factors used by the Eta pricing model, which has been found to be rather effective in constructing portfolios with desirable return and risk characteristics (see also Chong et al. [2012]).

## DATA

### Alternative Asset Classes

Since “within the investment management field, there is no universally accepted definition of ‘asset class’” (Ballentine [2013]), it is indeed at the prerogative of an investor to determine what constitutes an asset class and how many are to be employed within an investment portfolio. Though traditional asset classes are stocks, bonds, and cash, alternative asset classes have also been considered, which may include commodities (Ankrum and Hensel [1993], Greer [2000]), private equity (Ghaleb-Harter and Lamm [2001], Ennis and Sebastian [2005]), real estate investment trusts (REITs) (Mull and Soenen [1997]), hedge funds (Muhtaseb [2003]), Treasury inflation-protected securities (TIPS) (Chen and Terrien [2001]), and energy (Jennings [2012]), among others.

Compared with simply using traditional asset classes, incorporating additional asset classes (also known as multiple-asset-class strategies) produces additional return and diversification benefits. “For investors concerned primarily with maximizing portfolio returns, we see that multiple-asset-class strategies have dominated single-asset-class strategies. For investors who are more

concerned about volatility, again multiple-asset-class strategies are dominant. ... Again, we find multiple-asset-class strategies delivering much higher rates of risk-adjusted returns than single-asset-class strategies.” In other words, each additional asset class provides additional return-risk benefits (Gibson [1999]). Other findings lending support to a multiple-asset-class strategy include those by Schneeweis et al. [2010] and Jacobs et al. [2013].

### International Asset Classes

Further investment benefits could be derived from investing in international asset classes, such as those covering the Europe, Australasia, and Far East region (EAFE) and emerging markets. “The long-term empirical results suggest that international diversification indeed benefits the U.S. investor even with investment constraints, such as short sale, overweighting, and investing regions. Including the portfolios of developed countries allows the U.S. investor to effectively reduce portfolio volatility, while adding assets in emerging markets allows the U.S. investor to improve risk-adjusted returns” (Chiou et al. [2009]).

### Exchange-Traded Funds

Employed in this study are ETFs, representing the different asset classes. Since ETFs are investable, it would prove more helpful to readers that we conduct our study with ETFs over indexes. The nine asset classes and their corresponding ETFs are presented in Exhibit 1.

We attempted to select asset class ETFs with the longest possible historical data. As such, we didn’t include ETFs of private equity or hedge funds. However, we

## EXHIBIT 1

### Asset Classes and their Respective ETFs/Indexes

Asset Class	ETF/Index	Inception Date
Large-cap U.S. stocks	SPDR S&P 500 (SPY)	1/22/1993
Mid-cap U.S. stocks	iSharesCore S&P Mid-Cap (IJH)	5/22/2000
Small-cap U.S. stocks	iShares Core S&P Small-Cap (IJR)	5/22/2000
Investment grade corporate bonds	iShares iBoxx \$ Investment Grade Corporate Bond (LQD)	7/22/2002
Treasury bonds 7–10 years	iShares Barclays 7–10 Year Treasury Bond (IEF)	7/22/2002
Commodities	S&P/GSCI Commodity Total Return Index (^GSCITR)	Approx. 1991
REITs	SPDR Dow Jones REIT (RWR)	4/23/2001
EAFE ex. U.S./Canada	iShares MSCI EAFE Index Fund (EFA)	8/14/2001
Emerging markets	BLDRS Emerging Markets 50 ADR Index (ADRE)	11/13/2002

included REITs and commodities among our choice of asset classes since “the mean-variance analysis suggests that adding real estate, commodities ... to the traditional asset mix of stocks and bonds creates the most value for investors” (Bekkers et al. [2009]). In addition, findings by Garcia-Feijoo et al. [2012] “generally support the diversification efficacy of commodity investments, because commodities show relatively strong return performance and rather low correlation with both equities and bonds.” However, for commodities, since the iShares S&P GSCI Commodity-Indexed Trust ETF (GSG) was only established on July 10, 2006, we instead employed the S&P/GSCI Commodity Total Return Index (^GSCITR).

Since three years of data is needed for calibrating our economic factor model, our study spans the period January 31, 2006, to December 13, 2013, a length of time slightly less than eight years, with a total of 1,982 daily observations.

Summary statistics for each asset class and their correlations with each other are presented in Exhibits 2<sup>1</sup> and 3, respectively. Their characteristics are consistent with current finance understanding. For example, annualized returns for small-cap U.S. stocks are higher than

those of mid-cap and large-cap U.S. stocks but so are their standard deviations. Likewise, return and risk for corporate bonds (emerging markets) are higher than those of Treasury bonds (EAFE). As for correlations between asset classes, corporate bonds, Treasury bonds, commodities possess low correlations with U.S. stocks and are also not highly correlated with each other; therefore, they are good candidates for portfolio diversification. On the other hand, EAFE and emerging markets are highly correlated with U.S. stocks and with each other.

## METHODOLOGY

### Economic Exposure

Our economic factor model of choice is the Eta pricing model, which has been described in detail in various research outlets (e.g., Chong et al. [2012], Chong and Phillips [2012, 2013]), and hence shall be summarized here.

The Eta pricing model<sup>2</sup> was introduced by Chong et al. [2012] as one that “applies the cointegration methodology that relates asset prices to a set of 18 economic

## EXHIBIT 2

### Summary Statistics of Asset Classes, Estimated Daily: January 31, 2006, to December 13, 2013

	Large-Cap	Mid-Cap	Small-Cap	Corporate Bonds	Treasury Bonds	Commodities	REITs	EAFE	Emerging Markets
Annual mean return	8.76%	10.56%	11.05%	6.07%	5.88%	-1.59%	11.37%	6.47%	9.24%
Annualized return	6.49%	7.73%	7.77%	5.79%	5.76%	-4.63%	3.06%	2.86%	3.43%
Annual std. dev.	22.24%	24.90%	26.68%	9.45%	7.40%	25.08%	40.90%	27.03%	34.34%
Maximum	14.51%	10.63%	8.40%	9.77%	3.43%	7.48%	18.19%	15.90%	25.03%
Minimum	14.51%	10.63%	8.40%	9.77%	3.43%	7.48%	18.19%	15.90%	25.03%
Sample	1,982	1,982	1,982	1,982	1,982	1,982	1,982	1,982	1,982

## EXHIBIT 3

### Correlations between Asset Classes: January 31, 2006, to December 13, 2013

	Large-Cap	Mid-Cap	Small-Cap	Corporate Bonds	Treasury Bonds	Commodities	REITs	EAFE	Emerging Markets
Large-cap	1.0000								
Mid-cap	0.9508	1.0000							
Small-cap	0.9140	0.9648	1.0000						
Corporate bonds	0.1358	0.0963	0.0527	1.0000					
Treasury bonds	-0.4338	-0.4261	-0.4195	0.3885	1.0000				
Commodities	0.3948	0.4016	0.3499	0.0744	-0.2459	1.0000			
REITs	0.7962	0.8219	0.8197	0.0402	-0.3074	0.2442	1.0000		
EAFE	0.9232	0.8781	0.8337	0.1842	-0.3912	0.4495	0.7137	1.0000	
Emerging markets	0.8808	0.8531	0.7984	0.1553	-0.3840	0.4743	0.6783	0.8888	1.0000

factors,” which are the FTSE 100 Index, Gold Index, Corporate Bond (BAA) Yield, Consumer Price Index (CPI), short-term government bond yield, intermediate-term government bond yield, long-term government bond yield, Tokyo Stock Exchange Index, Euro exchange rate, agricultural exports, housing starts, monetary base, M2 money supply, corporate cash flow, unemployment rate, auto sales, new durable goods orders, and energy prices.

Sensitivity and responsiveness of an asset price to each of these factors is represented by its Eta profile. Therefore, by extension, a portfolio also possesses its own Eta profile, which is composed of a combination of portfolio component Eta profiles. Optimizing or reconfiguring the component weights of a portfolio would alter its Eta profile, thereby adjusting the portfolio’s responsiveness to these economic factors. As such, the Eta methodology can be successfully applied to hedge fund replication (Chong and Phillips [2012]), the analysis of attribution stability (Chong et al. [2012]), and low- (economic) volatility strategies (Chong and Phillips [2012, 2013]).

### Economic Climate Rating

The economic climate rating (ECR), a derivation of the Eta pricing model, is a 1 through 5 scale based on the theoretical potential gain in the asset as well as a measure of the economic forces impacting the asset. By using the current values of the economic variables with the estimated factor loadings from the model, this statistic indicates whether the current economic climate (values of the predictive economic variables) is favorable, unfavorable, or neutral.

ECRs of 1 and 2 imply unfavorable economic climate for the asset; an ECR of 3 suggests a neutral economic climate, whereas ECRs of 4 and 5 indicate a favorable economic climate for the asset. In this article, only asset allocation ETFs with ECRs of 3, 4, or 5 will be shortlisted for the construction of return-enhancing portfolios. Note that the ECR estimates only the economic influence on an asset; it doesn’t incorporate firm-specific risks, apart from sensitivity to the selected economic factors.

### Mean-Variance Optimization

The mean-variance optimization (MVO) was originally proposed by Markowitz [1952]. Though it

remains in use today, its popularity<sup>3</sup> has been challenged by the introduction of other asset allocation optimization techniques, e.g., the Black-Litterman model<sup>4</sup> (Black and Litterman [1992]), which address the shortcomings of MVO.

One of the main criticisms of MVO is “its tendency to maximize the effects of errors in the input assumptions” (Michaud [1989]),<sup>5</sup> resulting in extreme positive and negative weights, leading to optimized portfolio holdings that don’t make investment sense. This is especially pertinent for an unconstrained portfolio (e.g., one wherein short-selling is allowed). “However, in practice the inclusion of constraints in the mean-variance optimization problem can lead to better out-of-sample performance, compared to portfolios constructed without these constraints” (Kolm et al. [2013]). The constraint of no-shorting or non-negative holding has been shown to stabilize portfolio weights and results only in a slight reduction in performance (Eichhorn et al. [1998]; Jagannathan and Ma [2003]).

In a series of papers, Mark Kritzman discusses how the various criticisms of MVO are vastly overstated and illustrates the minimal impact these criticisms have on optimal allocations (see Cremers et al. [2003], Kritzman [2006, 2011]).

### Forecasting Horizon

Before we proceed with the formation of various portfolios, we assessed the forecast efficacy of ECR and MVO for quarterly, semiannual, and annual horizons. As various asset allocation ETFs were introduced in the early 2000s, this exercise was carried out on daily prices of S&P 500 stocks (with a neutral or favorable ECR), from January 1996 to December 2005. The results (Exhibit 4) indicated a six-month forecasting horizon to be optimal for both ECR and MVO, consistent with that recommended by Larsen and Resnick [2001].

### Portfolio Construction

Unlike our previous studies (Chong and Phillips [2012, 2013]), which employed only a risk-reduction, or low- (economic) volatility investment strategy, here we also used a return-enhancing strategy by filtering ETFs with neutral or favorable ECRs and subsequently performing MVO to determine the asset allocation. We refer to this strategy as ECR-MVO.

## EXHIBIT 4

### Annualized Return of Economic Climate Rating and Mean-Variance Optimization of S&P 500 Stocks: January 1996 to December 2005

	Quarter	Semiannual	Annual
ECR of 3	20.91%	20.09%	20.67%
ECR of 4	19.83%	20.20%	19.58%
ECR of 5	18.46%	20.02%	19.91%
<b>Average ECR</b>	19.73%	<b>20.10%</b>	20.06%
<b>MVO</b>	24.29%	<b>28.09%</b>	24.72%

In the presence of increasing evidence suggesting the existence of a low-volatility premium, a low- (economic) volatility asset allocation portfolio is formed by weighing the asset classes in such a manner that the portfolio's responsiveness to the economic factors is minimized (see Chong and Phillips [2013] and the citations therein). We refer to this strategy as MIN.<sup>6</sup>

Two other portfolios are formed, with equal weights imposed on the asset classes (i.e., naïve diversification). The portfolio with an ECR filter is referred to as ECR-EW; the other portfolio (without the ECR filter) is simply EW.

All four portfolios are long-only, rebalanced every six months, beginning January 31, 2006. With the

imposition of a no-shorting restriction, the ECR-MVO portfolio is less likely to suffer from issues arising from estimation error, as previously discussed.

## RESULTS

In this section, we shall examine the asset allocation portfolios ECR-MVO and MIN against various benchmarks, as represented by ECR-EW, EW, and the S&P 500 Index (SPX).

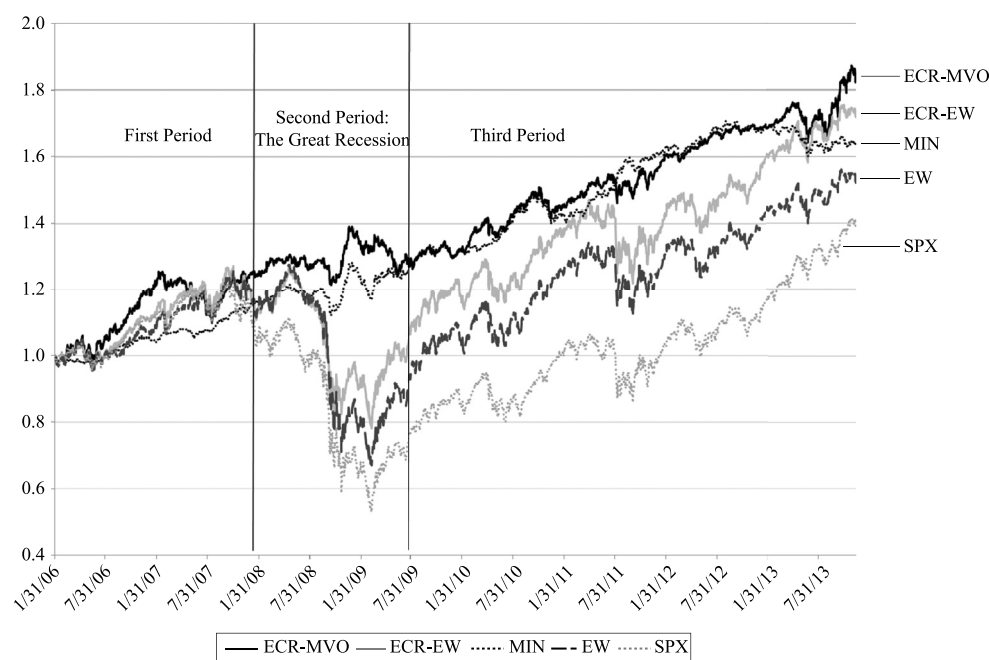
The period of study, from January 31, 2006, to December 13, 2013, is unprecedented. It begins with a bull market, which is followed by the Great Recession of 2007–2008, and a tremendous post-crash market run-up interspersed with economic and political events, such as quantitative easing (2007 and ongoing), the Greek/Eurozone sovereign debt crisis (2009 and ongoing), the U.S. debt ceiling crisis of 2011 and 2013. Indeed, such challenging times provide a sterner test for the portfolios but also ensure the robustness of our performance results.

### Portfolio Performance

A graphical illustration of how the various portfolios and benchmarks performed is presented in Exhibit 5.

## EXHIBIT 5

### Cumulative Wealth for Various Portfolios: January 31, 2006, to December 13, 2013



This should be viewed in conjunction with Exhibit 6, where we present portfolio performances by year.

Right from the onset, we witnessed a separation between the ECR-filtered portfolios (ECR-MVO and ECR-EW) and the other portfolios. ECR-MVO performed particularly well, registering an annualized return of 21.81% in 2006. MIN, on the other hand, trailed all portfolios in 2006, but as the economy began to experience difficulties, it performed better and culminated with an annualized return of 10.03% during the Great Recession. ECR-MVO was marginally ahead of MIN and was ranked first in 2008, with an annualized return of 10.08%. During the depth of the Great Recession, only ECR-MVO and MIN had positive annualized returns whereas the other portfolios suffered double-digit losses.

In this period (2006–2008), MIN dominated all portfolios in terms of lowest standard deviation, and

this in turn aided its return-to-risk ratio for 2007 and 2008. The ECR-MVO portfolio did respectably over the 2006 to 2008 period. In addition to its top-ranked annualized return in 2006 and 2008 and return-to-risk ratio in 2006, it was second in terms of return-to-risk ratio in 2008 and second in terms of standard deviation for 2007 and 2008. Once again, ECR-MVO and MIN came through during the Great Recession, registering single-digit standard deviations, whereas the other portfolios had standard deviations of at least 25%.

Our results, from the perspective of the ECR-EW and EW portfolios, confirm what most experts observed during major crises, that “the return correlations among the asset classes rise during bear markets ... even if this is so, diversification still confers significant benefits” (Arshanapalli and Nelson [2010]). Naïve diversification of asset classes does confer some diversification benefits in that the equally weighted portfolios did not plunge

## EXHIBIT 6

### Annualized Return, Standard Deviation, and Ratio\*, by Year

	ECR-MVO	ECR-EW	MIN	EW	SPX
<b>Annualized Return (%)</b>					
Whole Period	<b>8.00</b>	7.14	6.43	5.50	4.25
2006	<b>21.81</b>	11.97	5.38	8.70	11.78
2007	3.65	7.98	8.99	<b>11.36</b>	3.65
2008	<b>10.08</b>	−19.45	10.03	−29.37	−37.58
2009	−4.82	23.34	3.12	<b>24.98</b>	19.67
2010	11.23	12.06	9.13	<b>14.13</b>	11.00
2011	7.92	−1.60	<b>13.56</b>	−0.74	−1.12
2012	7.27	<b>12.35</b>	4.51	10.31	11.68
2013 YTD	8.88	9.64	−3.13	8.02	<b>22.48</b>
<b>Annual Standard Deviation (%)</b>					
Whole Period	8.26	16.73	<b>5.95</b>	18.53	22.33
2006	10.79	9.22	<b>4.36</b>	10.45	9.94
2007	9.27	14.84	<b>4.42</b>	13.45	15.99
2008	7.86	27.52	<b>7.10</b>	31.33	40.97
2009	9.20	20.98	<b>8.89</b>	25.53	27.29
2010	7.09	14.06	<b>5.90</b>	16.08	18.05
2011	7.47	18.36	<b>5.76</b>	18.35	23.27
2012	<b>3.47</b>	9.92	4.42	10.42	12.77
2013 YTD	9.14	8.78	<b>5.14</b>	9.29	11.15
<b>Ratio*</b>					
Whole Period	0.9689	0.4269	<b>1.0790</b>	0.2968	0.1902
2006	<b>2.0223</b>	1.2981	1.2324	0.8330	1.1854
2007	0.3943	0.5375	<b>2.0332</b>	0.8442	0.2286
2008	1.2825	−0.7068	<b>1.4131</b>	−0.9373	−0.9173
2009	−0.5239	<b>1.1123</b>	0.3515	0.9783	0.7210
2010	<b>1.5832</b>	0.8580	1.5471	0.8786	0.6095
2011	1.0597	−0.0871	<b>2.3552</b>	−0.0404	−0.0482
2012	<b>2.0963</b>	1.2447	1.0221	0.9897	0.9147
2013 YTD	0.9723	1.0988	−0.6099	0.8638	<b>2.0151</b>

\*Ratio = Annualized return divided by annual standard deviation.

as much as the SPX in 2008. Filtering by ECR provided further diversification; with the exception of 2007, ECR-EW had lower standard deviations than EW.

Starting in 2009, the beginning of a major bull market, and for the next five years, the EW portfolio and SPX performed very well in terms of annualized return. For much of 2009–2013, they traded positions as the top- and second-ranked portfolios by annualized return. The other portfolios (being ECR-MVO, ECR-EW, and MIN) had reasonable returns but on occasions experienced disappointing results.

In terms of standard deviation, once again, MIN dominated during 2009–2013, accompanied by ECR-MVO, which had single-digit volatility. As a result, this boosted their return-to-risk ratios, reaching highs in 2011 for MIN, and in 2010 and 2012 for ECR-MVO.

Although low-volatility and MVO investment strategies, in general, have their fair share of critics, when viewed over a reasonable length of time and coupled with an economic-based filter, they tend to outperform SPX, especially when measured against standard deviation and return-to-risk ratio. Their performances are also very consistent. ECR-MVO had positive annualized returns for all but one year (−4.82% in 2009) and likewise for MIN (−3.13% in 2013). With regard to risk management, ECR-MVO had single-digit annual standard deviation for all years but one (10.79% in 2006) whereas MIN had single-digit volatility numbers for all years.

Exhibit 7 presents summary statistics for the various portfolios by business cycle, which would provide a broader perspective of investing by asset classes, in contrast to our earlier analysis by year. Further, since our portfolios tend to be economically based, it makes sense to analyze by business cycle.

For the whole period (Panel A), and when viewed in conjunction with Exhibit 5, it would be obvious that ECR-MVO had the highest annualized return (8.00%) among all portfolios. It should also be apparent that MIN had the lowest volatility (5.95%), with ECR-MVO ranked second lowest (8.26%). In terms of return-to-risk ratio, ECR-MVO and MIN had by far the best compensation for risk. They were also not correlated with the broader market (for the whole period as well as subperiods), which did rather poorly, with a ratio of 0.1902.

For the first period, January 2006 to November 2007 (Panel B), both ECR filtered portfolios had the highest annualized return (12.85% for ECR-MVO and 11.36% for ECR-EW). MIN had the lowest annualized return (7.91%) but also the lowest standard deviation (4.26%). Taken together, MIN ranked first, with a return-to-risk ratio of 1.8577. On the other hand, the higher annualized returns of the ECR portfolios were accompanied by higher volatilities, dropping their return-to-risk ratios to second and third, respectively. Once again, SPX came in last, with a ratio of 0.6178, whereby the return it generated could not sufficiently compensate for its inherent risk.

During the Great Recession of December 2007 to June 2009 (Panel C), ECR-MVO and MIN registered positive annualized returns (1.86% and 5.83%, respectively) while maintaining relatively low risk levels (8.91% and 8.48%). As expected from our earlier analysis, the other portfolios performed poorly in terms of returns and risk.

Subsequent to the Great Recession (Panel D), the previously poor-performing portfolios rebounded with strong growth, with annualized returns of 16.22%, 13.12%, and 12.81% for SPX, EW, and ECR-EW, securing the top three positions. However, they did not perform as well on standard deviations, coming in with the three highest volatility numbers. As a result, their return-to-risk ratios suffered, allowing ECR-MVO and MIN to rank first and second, with returns-per-unit risk of 1.1699 and 1.1046, respectively.

## Maximum Drawdown

Although tactical asset allocation attempts to take advantage of short-term market fluctuations, its primary objective is still one of diversification.

“Unfortunately, under conditions of severe market stress, such as occurred in the second half of 2007 and continued through 2008, many investors who thought their portfolios were well diversified were surprised that diversification failed to protect them from losses” (Baltimore [2013]). Therefore, another measure to assess the effectiveness of our portfolio construction is maximum drawdown.

As we have already mentioned, “periods of high market volatility have tended to coincide with periods when the prices of those asset classes have moved in

## EXHIBIT 7

Summary Statistics by Business Cycle, Estimated Daily: January 31, 2006, to December 13, 2013

	ECR-MVO	ECR-EW	MIN	EW	SPX
<b>Panel A: Whole Period (1/31/06–12/13/13)</b>					
Annual Mean Return	8.04%	8.30%	6.40%	7.07%	6.65%
Annualized Return	8.00%	7.14%	6.43%	5.50%	4.25%
Annual Std. Dev.	8.26%	16.73%	5.95%	18.53%	22.33%
Maximum	3.43%	10.42%	3.13%	9.15%	11.58%
Minimum	–2.19%	–7.46%	–1.57%	–7.65%	–9.03%
Ratio*	0.9689	0.4269	1.0790	0.2968	0.1902
Correlation	0.2487	0.9409	0.0597	0.9534	1.0000
Sample	1,982	1,982	1,982	1,982	1,982
<b>Panel B: First Period (1/31/06–11/30/07)</b>					
Annual Mean Return	12.59%	11.51%	7.46%	10.93%	8.83%
Annualized Return	12.85%	11.36%	7.91%	10.78%	8.17%
Annual Std. Dev.	10.10%	12.18%	4.26%	11.89%	13.23%
Maximum	2.37%	2.79%	1.02%	2.51%	2.92%
Minimum	–2.10%	–3.23%	–1.07%	–2.85%	–3.47%
Ratio*	1.2733	0.9330	1.8577	0.9063	0.6178
Correlation	0.6598	0.9358	0.0900	0.9071	1.0000
Sample	462	462	462	462	462
<b>Panel C: Second Period, the Great Recession (12/1/07–6/30/09)</b>					
Annual Mean Return	2.24%	–8.20%	6.11%	–14.52%	–22.95%
Annualized Return	1.86%	–10.72%	5.83%	–17.30%	–25.84%
Annual Std. Dev.	8.91%	26.65%	8.48%	30.99%	38.28%
Maximum	3.43%	10.42%	3.13%	9.15%	11.58%
Minimum	–1.63%	–7.46%	–1.57%	–7.65%	–9.03%
Ratio*	0.2085	–0.4023	0.6875	–0.5583	–0.6752
Correlation	–0.0844	0.9379	0.2266	0.9613	1.0000
Sample	397	397	397	397	397
<b>Panel D: Third Period (7/1/09–12/13/13)</b>					
Annual Mean Return	8.22%	12.81%	6.07%	13.12%	16.22%
Annualized Return	8.30%	12.43%	6.03%	12.63%	15.80%
Annual Std. Dev.	7.10%	13.49%	5.46%	14.44%	17.02%
Maximum	2.26%	3.97%	1.42%	4.09%	4.74%
Minimum	–2.19%	–5.40%	–1.41%	–5.40%	–6.66%
Ratio*	1.1699	0.9216	1.1046	0.8745	0.9285
Correlation	0.4524	0.9582	–0.1513	0.9535	1.0000
Sample	1,123	1,123	1,123	1,123	1,123

\*Ratio = Annualized return divided by annual standard deviation.

the same direction at about the same time” (Ballentine [2013]); hence, we shall compute the portfolios’ maximum drawdown, starting from the peak of the S&P 500 Index, which occurred on October 9, 2007 (at the closing level of 1,565.15), and ending at its trough on March 9, 2009 (676.53).

Exhibit 8 presents our results. The index itself experienced a massive decline of 56.78% in value. The equally weighted asset allocation strategies didn’t do much better, with ECR-EW and EW registering drops in value of –38.42% and –45.91%. On the other hand, ECR-MVO and MIN had positive gains. Though some observers highlighted the failure of diversification via

## EXHIBIT 8

Maximum Drawdown

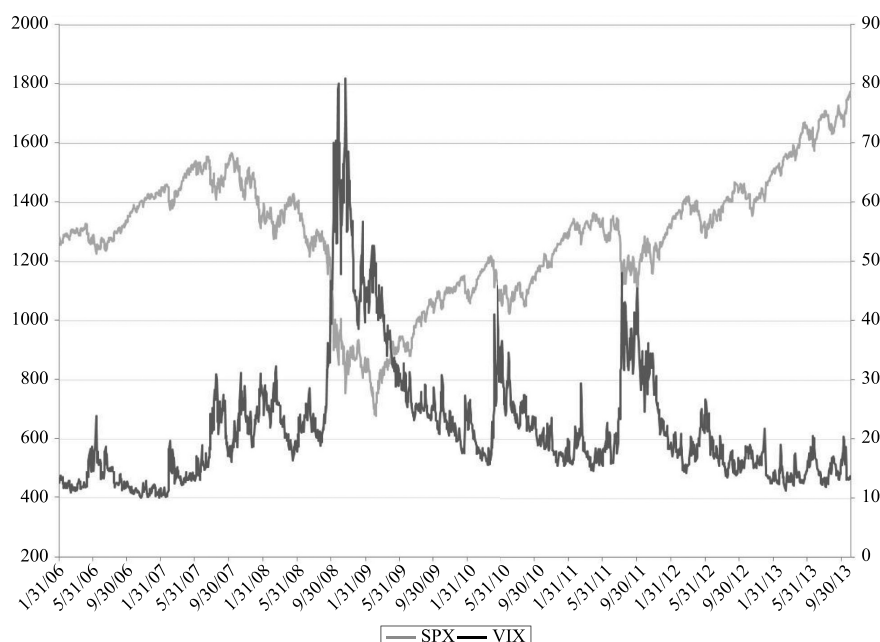
	10/9/07	3/9/09	Return
ECR-MVO	1.2015	1.3269	10.44%
ECR-EW	1.2684	0.7811	–38.42%
MIN	1.1083	1.1694	5.51%
EW	1.2370	0.6692	–45.91%
SPX	1.2227	0.5285	–56.78%

asset allocation during this stressful period (e.g., Ballentine [2013]), that is not always the case. With the aid of optimization, thereby altering the portfolio component weights, and rebalancing, it is possible to construct a



## EXHIBIT 9

### S&P 500 Index (SPX) and CBOE Volatility Index (VIX)



vehicle suited for effective diversification, even in the midst of severe economic events.

### Portfolio Composition

In this section, we shall further analyze our portfolios with regard to their compositions, thus providing a clearer picture of our portfolios' asset class allocation and reallocation, during key time periods, as well as ascertain the effectiveness of our economic forecast.

Using the CBOE Volatility Index (VIX) as a guide (Exhibit 9), there were three obvious groups of volatility spikes, revealing tremendous market stress during those periods. The first occurrence is sometime between October 24, 2008, and November 20, 2008, followed by the second on May 20, 2010; the third occurred between August 8, 2011, and October 3, 2011. Since the portfolios were rebalanced on January 31 and July 31, the relevant dates for examining the portfolio components are July 31, 2008; January 31, 2010; and July 31, 2011. Exhibit 10 presents the portfolio composition on these dates.

We note that in these tumultuous times, both ECR-MVO and MIN tilted their portfolios toward corporate and Treasury bonds months before the turn

of events.<sup>7</sup> For ECR-MVO, it allocated 89.40% (July 2008), 77.82% (January 2010), and 62.13% (July 2011) of its portfolio to either corporate or Treasury bonds or both, and at the same time, attempted to balance risk with returns by targeting asset classes with potentially high returns, such as emerging markets (10.58% in July 2008), small-cap U.S. stocks (22.14% in January 2010), and mid-cap and large-cap U.S. stocks (32.58% in July 2011). In contrast, the low- (economic) volatility approach undertaken by MIN focuses purely on minimizing economic risk. As such, it allocated 89.33% (July 2008), 85.80% (January 2010), and 86.92% (July 2011) of its portfolio to bonds and less to potentially high returning but also more volatile asset classes.

### LIMITATIONS

This article has an obvious limitation from a practitioner's perspective in that all the optimizations were done without maximum holding constraints. Though this is consistent with how the authors have conducted previous studies, it is not clear that most wealth managers would be comfortable tilting as much into an asset class as some of the optimized results would dictate. However, the creation of constraints for the optimization

## EXHIBIT 10

### Portfolio Composition

	ECR-MVO	ECR-EW	MIN	EW
<b>Panel A: July 31, 2008</b>				
Large-cap		20.00%		11.11%
Mid-cap			4.65%	11.11%
Small-cap			1.96%	11.11%
Corporate bonds		20.00%	7.70%	11.11%
Treasury bonds	89.40%	20.00%	81.63%	11.11%
Commodities				11.11%
REITs				11.11%
EAFE		20.00%	1.99%	11.11%
Emerging markets	10.58%	20.00%	2.04%	11.11%
<b>Panel B: January 31, 2010</b>				
Large-cap		16.67%		11.11%
Mid-cap		16.67%		11.11%
Small-cap	22.14%	16.67%		11.11%
Corporate bonds	77.82%	16.67%		11.11%
Treasury bonds		16.67%	85.80%	11.11%
Commodities				11.11%
REITs			0.23%	11.11%
EAFE		16.67%	13.96%	11.11%
Emerging markets				11.11%
<b>Panel C: July 31, 2011</b>				
Large-cap	19.40%	11.11%	5.82%	11.11%
Mid-cap	13.18%	11.11%		11.11%
Small-cap		11.11%		11.11%
Corporate bonds	30.56%	11.11%		11.11%
Treasury bonds	31.57%	11.11%	86.92%	11.11%
Commodities	5.21%	11.11%	5.21%	11.11%
REITs	0.07%	11.11%	1.96%	11.11%
EAFE		11.11%	0.06%	11.11%
Emerging markets		11.11%		11.11%

adds a level of complexity—namely, which is the right constraint set to impose—that detracts from the pure comparison of optimization methods presented here.

## CONCLUSION

Since the Great Recession of 2008, the practice of tactical asset allocation has witnessed increased interest from practitioners. In this article, we examined the effectiveness of tactical asset allocation as a stand-alone strategy, over one that is used in conjunction with strategic asset allocation, overlaid with macroeconomic factors and implemented with ETFs.

The period under consideration is from January 31, 2006, to December 13, 2013, which began with a bull market, followed by the Great Recession, and subsequently reverted to a tremendous post-crash market run-up. This period also witnessed various unprecedented economic and political events, such as quantita-

tive easing, the Greek/Eurozone sovereign debt crisis, and the U.S. debt ceiling crises. Indeed, such challenging times provide a sterner test for, and ensure robustness of, any investment strategy.

The portfolios under consideration are economically based, employing the methodology adopted by the Eta pricing model. Whereas one is mean-variance optimized (ECR-MVO), the other is constructed to reduce its economic exposure (MIN). Both are long-only portfolios and are rebalanced semiannually.

Although it has been widely observed that asset classes tend to be highly correlated during times of economic stress, such tendencies could be curtailed by overweighting asset classes that exhibit lower correlations with the market, should one be able to identify these asset classes. As illustrated in this study, the S&P 500 Index and the equally weighted portfolios plunged in value during the Great Recession. However, both ECR-MVO and MIN, with the aid of the Eta methodology, provided positive returns to investors by tilting their exposures to bonds prior to the onset of the recession. By and large, ECR-MVO and MIN performed well, by year as well as by business cycles,

despite skepticism toward the mean-variance optimization and low-volatility methodologies.

These findings bode well for tactical asset allocation, especially when used in combination with the Eta pricing model.

## ENDNOTES

<sup>1</sup>Note: Annual mean return = Daily mean return  $\times$  252; Annualized return = (Ending asset value/Beginning asset value)<sup>1/Year</sup>-1; Annual standard deviation = Daily standard deviation  $\times$   $\sqrt{252}$

<sup>2</sup>The Eta pricing model was developed by the Center for Computationally Advanced Statistical Techniques (c4cast.com, Inc.) and is made available on its MacroRisk Analytics platform.

<sup>3</sup>At least within the broker-dealer (B/D) and registered investment advisor (RIA) community that practices tactical asset allocation, MVO is still widely used. In a recent survey conducted jointly by Cerulli Associates, the Investment Man-

agement Consultants Association, and Advisor Perspectives, it was reported that 54% of advisors employ tactical asset allocation (either stand-alone or as an overlay with strategic allocation), and “for these advisors, mean-variance optimization was the preferred method to establish the baseline portfolio allocations, basing decisions on historical risk and return profiles for each asset class” (Cloherty [2011]).

<sup>4</sup>Note that, unlike MVO, the implementation of the Black-Litterman (BL) model “may not be as straightforward. In particular, we have provided both theoretical and empirical results to shed light on how the straight application of the BL framework in active investment management can lead to unintended trades and risk-taking, which in turn leads to a more risky portfolio than desired” (Da Silva et al. [2009]).

<sup>5</sup>Some cynics have come to refer to MVO as “error maximizers.”

<sup>6</sup>Unlike ECR-MVO, no filtering via ECR is necessary for MIN since it is not a return-enhancing strategy.

<sup>7</sup>A tilt toward bonds should benefit one’s investments during stressful economic periods, since there is “strong support for the risk reduction attributes of bonds for U.S. equity investors” (Garcia-Feijoo et al. [2012]).

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