Capital Diversification versus Risk Diversification

BY COREY HOFFSTEIN / ON DECEMBER 11, 2012

In this blog post, we explore the implications of asset-class based diversification on risk management and demonstrate that traditional passive 60/40 portfolios may actually be much less diversified than we think.

In Hedge Fund Market Wizards, Ray Dalio, founder of Bridgewater Associates, is quoted as saying,

> *People think that a thing called correlation exists. That's wrong. What is really happening is that each market is behaving logically based on its own determinants, and as the nature of those determinants changes, what we call correlation changes. For example, when economic growth expectations are volatile, stocks and bonds will be negatively correlated… However in an environment where inflation expectations are volatile, stocks and bonds will be positively correlated.*

While correlation sits as a foundation element in the computational solution of Modern Portfolio Theory, it really serves as a proxy for our common-sense solution to the risk of ruin: diversification. The issue, as Ray Dalio points out, is that correlation itself is not implicit in the market place, but is just a numerical measure we use to summarize relationships. Rather, what is implicit are the risk factors that drive asset returns and how assets relate to those risk factors in different economic environments.

Diversification is the solution for concentration risk, which is the unequal distribution of exposure to different risk sources. Historically, asset classes behaved more independently than they do now and thus actually served as useful proxies for risk factors. Unfortunately, as international commerce has increased due to the proliferation of technology and several critical trade agreements, the sensitivity of asset classes

to new risk factors has increased. The returns of a single asset class no longer represent a single risk factor, but now represent the complex and dynamic interaction of several non-linear risk factors.

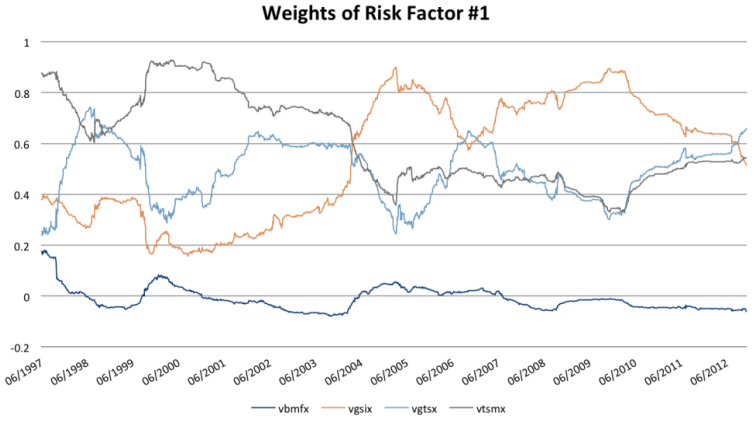
Yet the majority of retail investors have not evolved their portfolios beyond traditional "asset diversification."

To demonstrate the implicit danger of asset class based diversification, we will examine a passive 60/40 portfolio. For our example, we will consider the 60/40 "Core four" portfolio:

Fund	Ticker	Portfolio Weight
Vanguard Total Bond Market Index Fund	VBMFX	40%
Vanguard Total Stock Market Index Fund	VTSMX	36%
Vanguard Total International Stock Index Fund	VGTSX	18%
Vanguard REIT Index Fund	VGSIX	6%

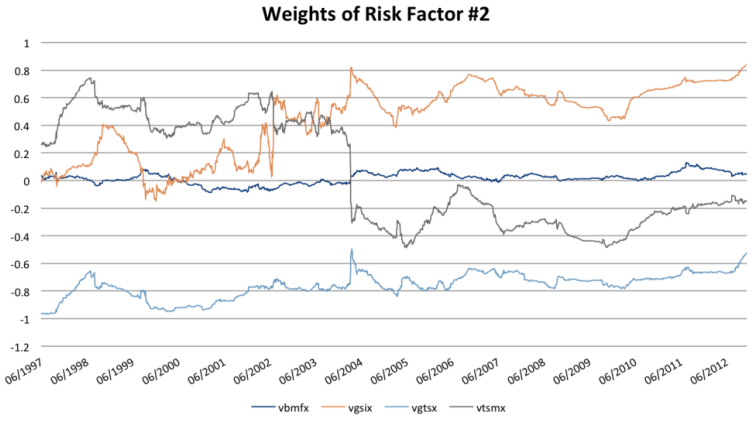
What we see in this portfolio is a focus on asset-class weight diversification with no consideration of the dynamic risk factor relationships they have. Using a statistical method called principal component analysis, we can decompose the asset class returns into their independent, driving risk factors as well as our portfolio's effective weights to those risk factors. Each risk factor is constructed as a portfolio from the assets in our portfolio and we can use the weights to determine the economic intuition of the risk factor. Because the risk factors are made up of the assets in our original portfolio, we often find them called "principal portfolios" in asset management literature.

Risk Factor #1:



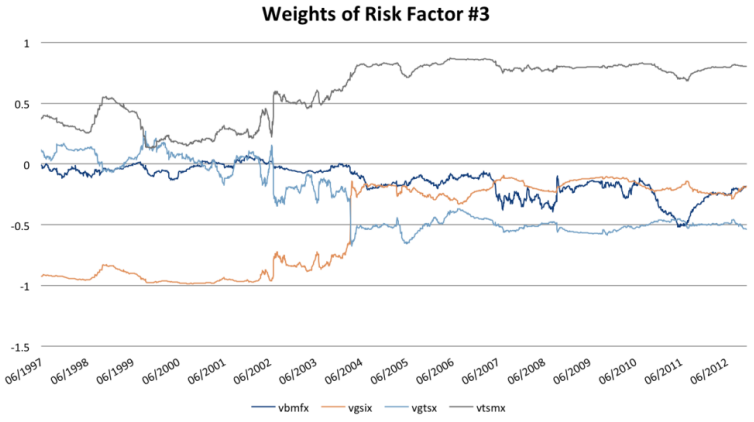
This risk factor puts a zero-weight on the total bond fund, giving us a good indication that it likely represents equity risk. We can see that early on, the weights between the international and US equity funds move opposite to one another, but later converge to move in unison, likely representing the realized tie between international economies. We can also see the growing importance of the REIT fund, serving as a proxy for real-estates importance in the latest economic cycle. From this interpretation, we can call this risk factor either general market risk, or economic expansion sensitivity.

Risk Factor #2:



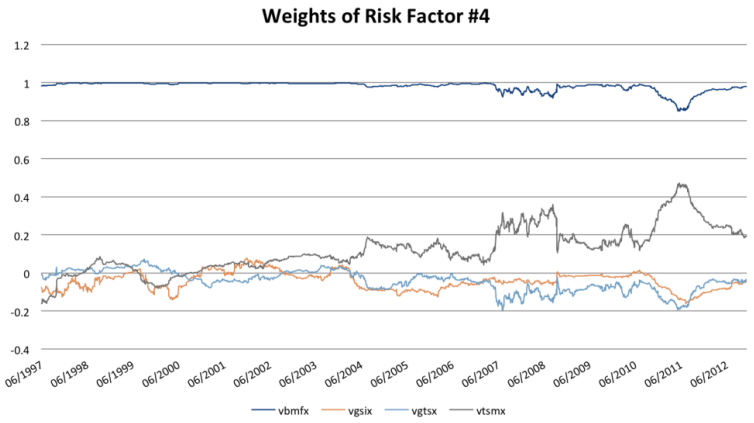
Again, the weight on the total bond fund is zero. The factor initially begins with a spread between US and international equities, but later converges to a spread between US REITs and equities. Since REITs often have equity like behavior, we can consider the negative US equity position as "hedging" out the equity behavior, and the factor becomes a spread between US real-estate (a recent economy driver) and international equities.

Risk Factor #3:



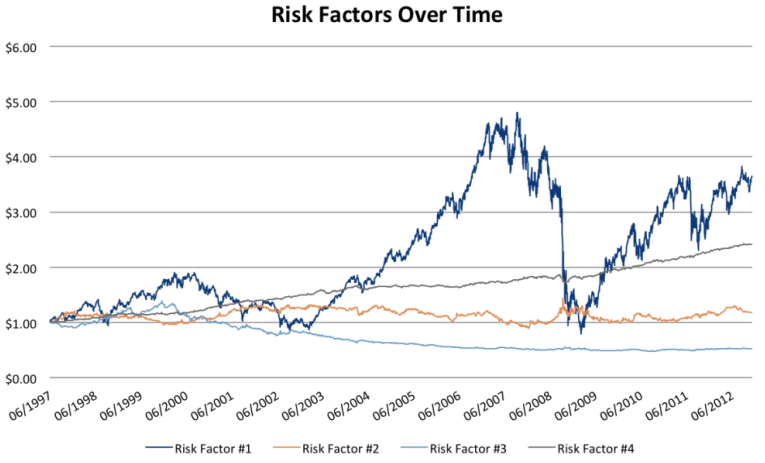
The third risk factor has a positive exposure to US equities with a negative exposure to every other asset class, though with the greatest spread between US equities and international equities, likely indicating that this factor represents U.S. economic growth versus international economic growth.

Risk Factor #4:

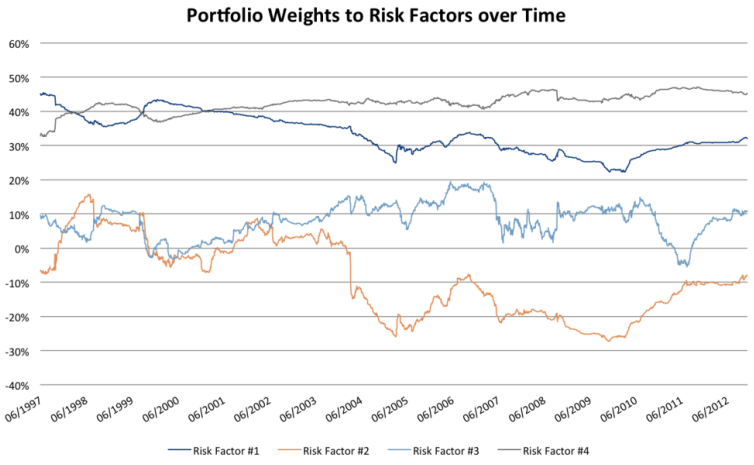


Finally, our fourth factor heavily weights the fixed income vehicle and puts little to no weight on the other asset classes until 2007, where a positive US equity exposure begins to grow. This factor likely represents the impact of US interest rates on the portfolio, or duration. Here, an increase in interest rates would negatively impact our portfolio.

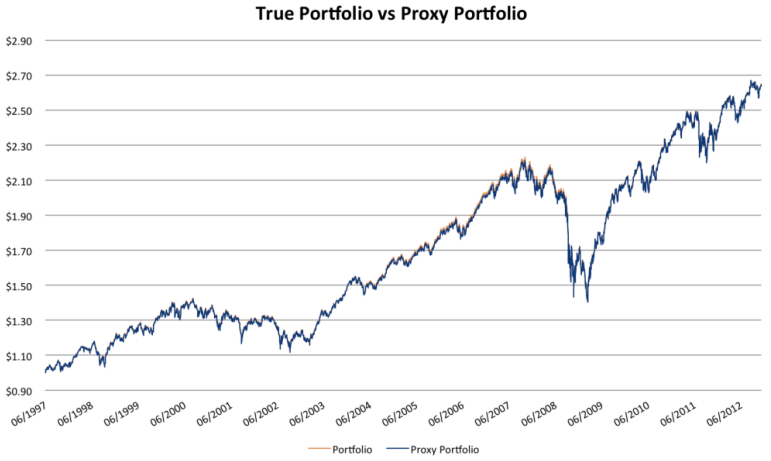
We can also take these risk factors and re-construct the portfolios over time:



Now that we have an economic understanding of our risk factors, we want to determine how much weight we place on each in our portfolio.

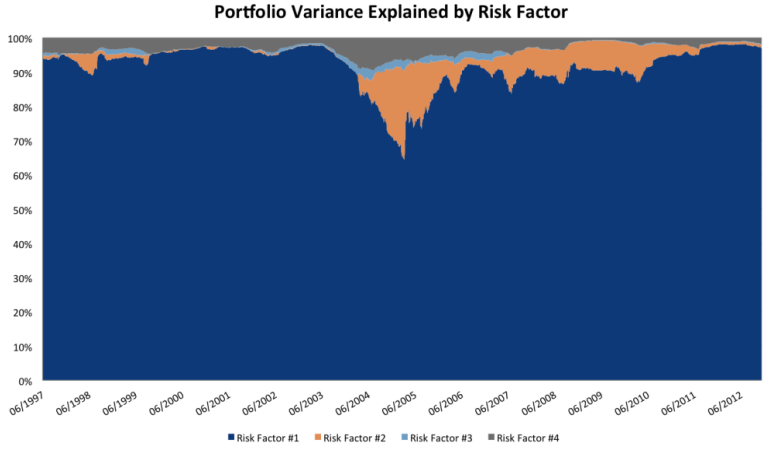


What we find is that we have a consistent, and positive, sensitivity to the interest rate factor and general market risk. We have a varying and low sensitivity to the US to international economic growth spread (likely because we are long both), and a negative exposure to the US real-estate and international equities spread. Of course, with any statistical method, we need to determine if our estimates are effective. Namely, taking our weights and the returns of these risk factors, do we get back our original portfolio?



It looks like we do, meaning that we can give more weight to any inference we make from this data.

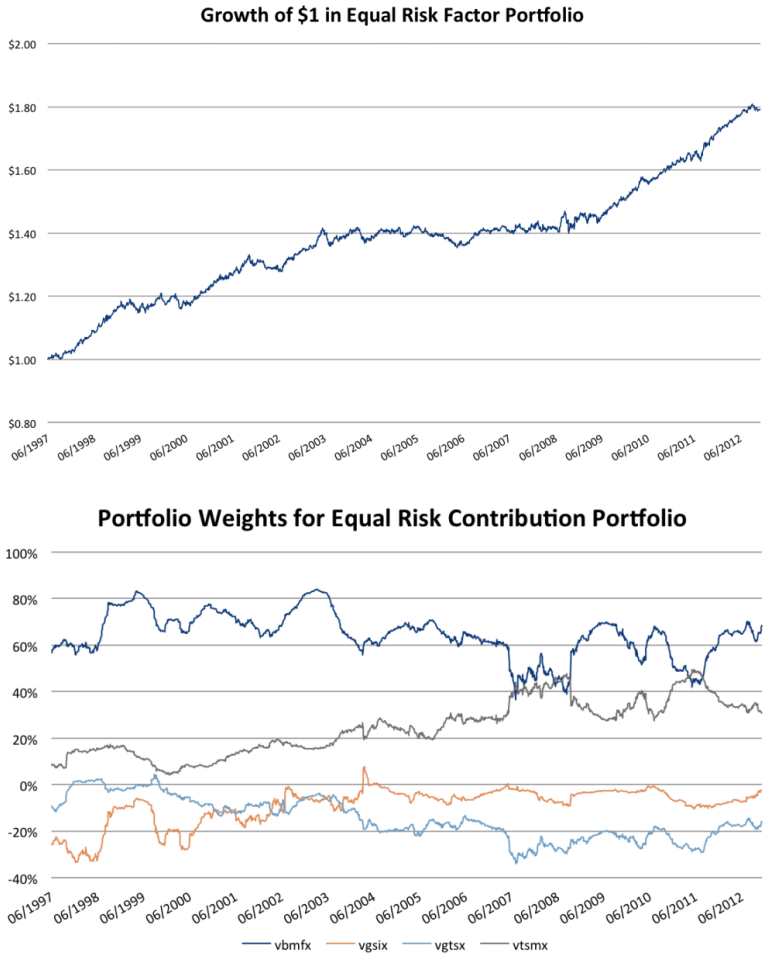
Determining our weights to each factor is not where our analysis should end. Since our weight to the interest rate factor is the highest, we might falsely conclude that our portfolio is most sensitive to interest rate risk. This would be wrong, since associated with each factor is a volatility level. Re-examining the reconstruction of these risk factors over time, we can see that the amount of volatility in each portfolio actually decreases as our factor number increases (we did this by design). In fact, when we determine how much of our portfolio variance is explained by each risk component, we find something very interesting:



Over the entire history of our portfolio, the volatility of our returns has been at least 70% explained by our exposure to the general market risk factor.

So while we have been trying to diversify by asset class, we've really been creating a concentration by risk factor! Since we know that it is economic risk factors that truly drive asset returns, we've effectively reduced our portfolio down to a single factor sensitivity.

While Dalio seems to want to throw correlation measures out the window completely, we still find use for them. For example, we can see that so long as cross-asset and cross-geographic correlations continue to climb, we will not be able to diversify our risk factor exposures via long-only portfolios. Rather, to create a portfolio that has an equal weight to the four risk factors identified here, we'd have to employ shorting to isolate the factors and leverage to scale our portfolio to a given risk level. Once we have, however, we've created a portfolio with equal exposure to four independent risk factors, which actually diversifies our risk, evident by the smooth equity curve below.



Corey Hoffstein

Corey is co-founder and Chief Investment Officer of Newfound Research, a quantitative asset manager offering a suite of separately managed accounts and mutual funds. At Newfound, Corey is responsible for portfolio management, investment research, strategy development, and communication of the firm's views to clients. Prior to offering asset management services, Newfound licensed research from the quantitative investment models developed by Corey. At peak, this research helped steer the tactical allocation decisions for upwards of $10bn. Corey holds a Master of Science in Computational Finance from Carnegie Mellon University and a Bachelor of Science in Computer Science, cum laude, from Cornell University. You can connect with Corey on LinkedIn or Twitter. Or schedule a time to connect.

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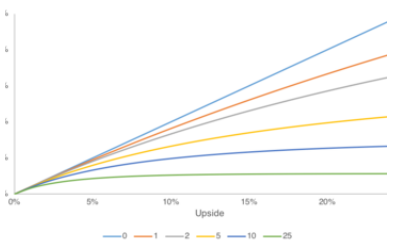

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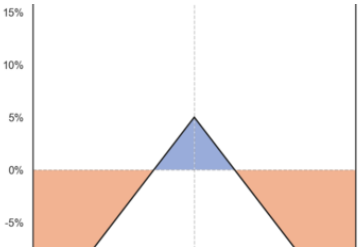

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