CSSA

new concepts in quantitative research

"2D Asset Allocation" Using PCA (Part 1)

JULY 23, 2018
by david varadi

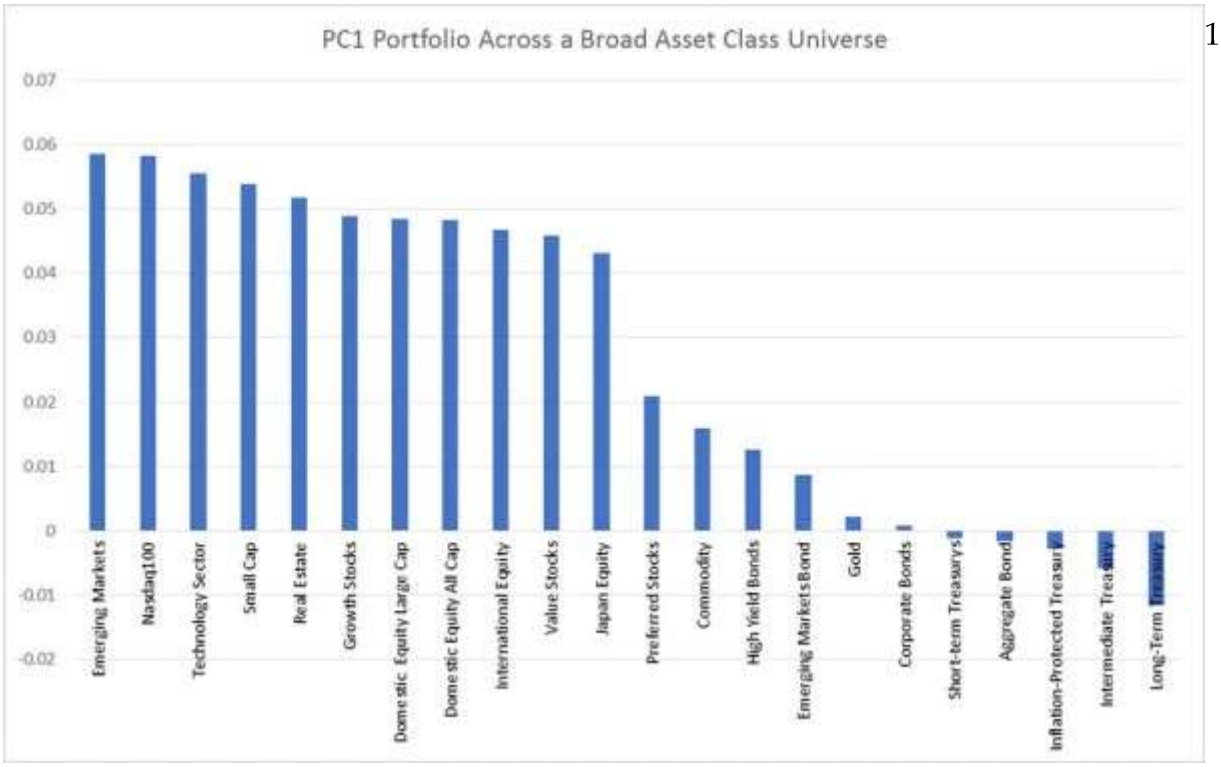
Asset allocation is a complex problem that can be solved using endless variations of different approaches that range from theoretical like Mean-Variance to heuristic like Minimum Correlation or even "tactical strategies." Another challenge is defining an appropriate asset class universe which can lead to insidious biases that even experienced practitioners can fail to grasp or appreciate. Reducing dimensionality and the number of assumptions is the ultimate goal. The simplest way to manage a portfolio is to revert to a CAPM world where there is a market portfolio and you can leverage or hold cash to meet your risk tolerance requirements. But this method also requires one to define a "market portfolio" which in theory can be defined as the market-cap weighted mix of investable asset classes, but in practice is elusive to define and also determine on a real-time basis. What we really want is a sense of what drives systematic risk across a range of asset classes and to identify a portfolio that best represents that systematic risk (offense), and a portfolio that is inversely correlated to that systematic risk (defense). A parsimonious way to make that determination is to use Principal Component Analysis (PCA) by isolating the PC1 or first principal component portfolio that explains most of the variation across a broad set of asset classes. In most cases, the first principal component will explain between 60-70% of the variation across asset classes and represents a core systematic risk factor. If we take a large basket of core asset classes we can use PCA to identify this PC1 portfolio over the period from 1995-2018 using ETFs with index extensions. In this case we used the R code provided by Jim Picerno's excellent new book **Quantitative Investment Portfolio Analytics in R (http://www.capitalspectator.com/excerpt-part-ii-quantitative-investment-portfolio-analytics-in-r/)**.

We can see that this PC1 portfolio makes a lot of intuitive sense: The highest weights are in Emerging Markets, Nasdaq/Technology, and Small Cap (Offense). Asset classes with negative weights have an inverse relationship to this core systematic risk factor, and the lowest are Long-Term Treasurys followed by Intermediate Treasurys, Inflation-Protected Treasurys, the Aggregate Bond Index and Short-Term Treasurys (Defense). Effectively the "Offense" portfolio is positively tilted toward the most aggressive asset classes that likely perform the best during a bull market, while the "Defense" portfolio is positively tilted toward the most defensive asset classes that likely perform the best in a bear markets. With one calculation we have mathematically separated the asset classes into two broad groups/dimensions which can be used to create a wide variety of different simple asset allocation schemes. In a subsequent post we will show some examples of how this can be done.

from → Uncategorized

One Comment leave one →

Trackbacks



1. Quantocracy's Daily Wrap for 07/23/2018 | Quantocracy