On Course Financial Planning
Facing the Future with Optimism and Courage
November 2018
Vectors

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Stocks Plunge!

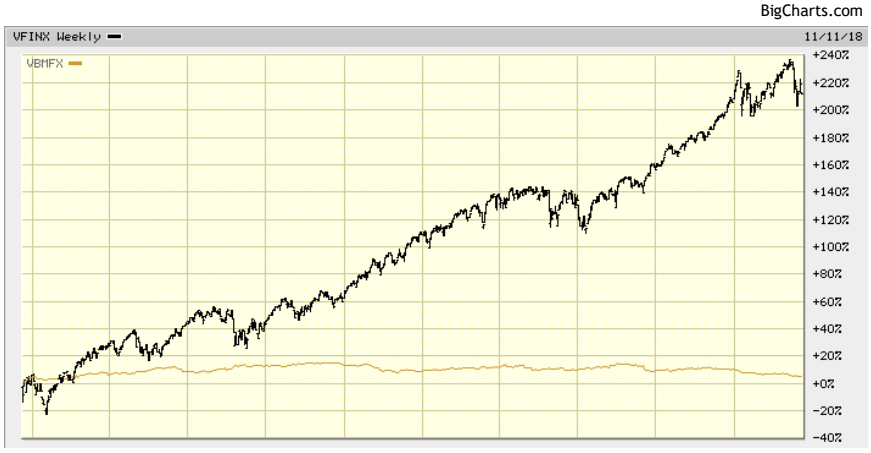
Plunge – it's a verb rarely used by the media except when describing aviation disasters, bridge collapses or a weekly stock market decline greater than 5% like we experienced in the second week of October. By month's end, the S&P 500 Index's **plunge**! reached 6.8%, 7.5% below its September 20th all-time high.

Investors are forever trying to find explanations for stock market volatility. The financial media is desperate for clicks, viewers and subscribers, so it always provides reasonable sounding, ominous causes for perfectly normal bouts of stock market volatility. The latest **plunge**! wasn't preceded by any bad economic news, so most commentators blamed the drop on (take your pick) - the expectation that the Fed will continue to raise interest rates, worries about a trade war with China, a fragile Eurozone economy, weakening emerging market economies, rising oil prices, or the upcoming election. Each may contain a grain of truth, but nobody really knows the cause of the sudden **plunge!** Simple descriptions of cause and effect provide false comfort; hinting that we can somehow make sense of the unpredictable, random stock market. We might not like to hear it, but the stock market rises and falls due to a multitude of ever-changing reasons that don't necessarily relate to what has happened in the past.

There have been 22 declines in the S&P 500 Index of more than 5% since the current bull market began in March 2009, the average decline being 9.3%. Each time, **plunge!** appeared somewhere in the financial media, usually in large fonts. All were eventually followed by new stock market highs. Will this happen again? Nobody knows. Every stock market **plunge!** brings out the same voices of doom. One day I suppose they'll be correct and then they'll spend the rest of their days reminding us of their prescience.

Investing is hard, and technical innovations don't make it any easier. No strategy or investment product can yield the long-term return of stocks without the volatility that accompanies stock investing. Last year, the domestic stock market went easy on us. The S&P 500 advanced every month and didn't have an intra-year decline that exceeded 3%. There were only four days in which the S&P 500 dropped 1%. This year, it's already happened 22 times. Many financial professionals can't admit to their clients that volatility is unavoidable or that stock prices change in a random, unpredictable manner. Consequently, they promote investment products that promise market-like returns with lower than market volatility. Volatility isn't just a normal part of equity investing; it's what delivers our reward, called the "equity premium" – the additional return that stocks have historically yielded over less volatile bonds.

The speed of the latest pullback was disquieting, but a sell-off of 5%-10% is modest by historical standards. The average intra-year decline in the S&P 500 since 1980 has been 14%. Many investors, with decades to go before retirement, react to every **plunge!** by making counterproductive, short-term decisions with their long-term capital. This is impulse, not strategy and regardless of what happens next, emotional portfolio tinkering is not the answer.



To put the latest **plunge!** in perspective, let's look at this chart that compares the weekly performance of the Vanguard S&P 500 Index Fund (VFINX) to the Vanguard Total Bond Market Index Fund (VBMFX) for the ten years ending November 11. To get the 220% return, all you had to do was ignore the **plunges!**

If you can't stomach a 10% decline in the stock portion of your portfolio, you need to revisit your risk tolerance and decide if you have too much invested in stocks. But without socks in your portfolio, accumulating enough money to retire at the time and in the lifestyle of your choosing is likely to be an improbable achievement. You can't expect to reach your retirement goal if your idea of investing is stashing away money in fixed income assets that are unlikely to yield an after-tax return greater than inflation.

Factor Investing and Data Mining

A market-cap weighted, total stock market index fund is the easiest and least expensive way for investors to receive the return of the stock market. But all stocks do not have the same expected return. In their seminal 1992 *Journal of Finance* article, "The Cross-Section of Expected Stock Returns" professors Eugene Fama and Kenneth French of the University of Chicago claimed that three factors – market risk, company size and price-to-book ratio – account for most of the above average return of a portfolio.

The first factor is stock market risk. Since the long-term return of stocks is expected to be greater than the long-term return of bonds, a portfolio's long-term return should be proportional to its allocation to stocks. For the past 90 years, large company domestic stocks have yielded a 10.1% annualized average return compared to 5.5% for long-term government bonds and 6.1% for long-term corporate bonds. From 1927-2017, stocks outperformed bonds in 91% of 10-year rolling periods (1927-1936,1928-1937, etc.) and 97% of 15-year rolling periods.

The second factor is company size. For the past 90 years, the annualized average return of small company stocks has been about 2% more than large company stocks. Small-cap stocks are riskier and more volatile than large-cap stocks and an efficient market offers risk takers the *expectation* of higher returns. Before overweighting small-cap stocks in your portfolio, you must decide if the potential return premium is worth the added volatility. From 1927-2017, small-cap stocks outperformed large-cap stocks in 77% of 10-year rolling periods and 85% of 15-year rolling periods.

The third factor is the value factor. Stocks with a low price-to-book ratio (stock price divided by book value per share) - usually called value stocks - have outperformed growth stocks over the long term. Value stocks are like new cars that sell for $100 over sticker price. Growth stocks, on the other hand, have high price-to-book ratios and are like popular cars that sell for a premium over sticker price. For the past 90 years, the annualized average return of large-cap value stocks has been about 1.2% more than the return of all large-cap stocks. From 1927-2017, value stocks outperformed growth stocks in 86% of 10-year rolling periods and 94% of 15-year rolling periods.

Fama and French asserted that by overweighting small company stocks and value stocks in a portfolio an investor could receive higher risk adjusted returns than a total stock market index over the long term. They noted that their so called "three-factor model" isn't designed to capture short-term gains and it might take up to 15 years for the size and value factors to yield higher returns in investor portfolios. Debate continues as to whether these factors will provide excess returns in the future.

Index investors fall into two camps - those who adopt a total stock market (TSM) strategy and own a market-cap weighted, total stock market index fund and those who adopt a "slice and dice" strategy by adding value and small-cap funds to a portfolio. Advisers who follow the Fama-French three-factor model, your humble scribe included, consider the "slice and dice" strategy as a legitimate, low-cost way to increase the expected return of a passive, indexed portfolio *over the long term*. Investors who chose to overweight value and/or small-cap stocks must exercise discipline and maintain their factor allocations during the inevitable periods when large companies outperform small companies and growth stocks outperform value stocks.

But, of course, Wall Street can't leave well enough alone. Investors have an insatiable appetite for any strategy that promises to outperform the market and who's to say that there aren't dozens of factors that might enhance returns over the long run? For the past decade, researchers have been on a backtesting crusade, testing a multitude of potential factors using past data in search of new factors that might lead to market beating performance. The years used in a backtest make up the "in-sample" backtest. An "out-of-sample" backtest is a subsequent backtest of the same potential factor using different years. For a factor to be valid, the in-sample and out-of-sample back-tests must yield similar results. Unfortunately, any large body of data will contain random patterns that appear to reveal new factors. It's long been said that if you torture the data long enough, it will tell you whatever you want to hear. As the number of failed backtests increases, it becomes more likely that a subsequent successful backtest is just a random occurrence – a false positive produced by luck alone. Data mining occurs when factors that produced the hoped-for results are reported while those that failed to do so are ignored. Backtest overfitting occurs when the out-of-sample results fail to verify the in-sample results and only the in-sample results are reported. Many backtests are done using data from a suspiciously short period of time - less than a decade in many cases - so the claim is often made that most backtesting is just high-tech performance chasing. Investors should discount backtests that are not independently verified by sources outside the research firm, published without noting out-of-sample backtests and those that do not disclose how many failed tests preceded the successful backtest.

After a new factor is "discovered" a new factor index is created that contains stocks that exhibit that specific factor. Then, a fund company develops a new exchange traded fund (ETF) that holds the stocks in the new index. Current popular factors include low volatility (stocks with a relatively stable share price), profitability (highly profitable

companies with stable earnings), equal weighting (owning equal amounts of each stock in the S&P 500), momentum (stocks that have recently outperformed), and stocks that pay high dividends. Factor funds, often called smart beta funds, have attracted billions of investor dollars in recent years by promoting the idea that investors can receive higher portfolio returns or lower portfolio volatility by following factor-based rules of investing. Their proponents claim that market-cap weighted indexes, such as the S&P 500, are flawed because most investors' money is in the largest, highest priced stocks in the index, which they consider to be a poor allocation of capital. But expensive and overvalued are not necessarily synonymous. There is no academic evidence that cap-weighted indexes overweight overpriced stocks and underweight underpriced ones. Factor funds shift allocations away from market-cap weighting but still concentrate shareholder dollars in a relatively small number of stocks. There are now hundreds of factor funds that follow unique indexes that reside somewhere on the spectrum between traditional active management and passive index investing. Factor funds usually require more frequent rebalancing and have higher turnover and higher expense ratios compared to traditional index funds.

For example, let's assume that researchers discover that stocks with three letter ticker symbols consisting only of vowels have outperformed the S&P 500 Index by a significant margin over the past 10 years – the "in-sample" backtest. The fund company then creates an "alphabet index" consisting of companies with three-letter, all vowel ticker symbols. Soon thereafter, it launches its new Alphabet ETF with promises of outperformance. Investors have no way of knowing how many failed letter combinations preceded the discovery of the "alphabet factor", if in-sample and out-of-sample backtests produced the same results or if the backtest was independently verified by outside researchers. Like many recently discovered factors, there is no clear, sensible economic reason for the outperformance of the alphabet factor. Wise investors would greet the arrival of the Alphabet ETF with a great deal of skepticism.

More than 300 new factors have been "discovered" by backtests over the past decade. Yet, according to S&P, during the past decade, only 11% of actively managed large-cap stock funds and 7% of mid-cap and small-cap funds outperformed their S&P benchmark indexes. If there are 300 different ways to weight a portfolio and outperform market-cap weighted index funds, how do we explain the pitiful performance of active managers? Clearly, most of these factors were an illusion, a product of data mining and/or backtest overfitting.

According to a 2012 Vanguard study, more than half of new ETFs launched between 2000 and 2011 tracked indexes that were in existence less than six months. *"We find that ETFs are most likely to be created with indexes that have performed well relative to the broad US stock market before the inception date, but that such performance, on average, does not persist"* The study compared the performance of 370 smart beta ETFs to the performance of a total stock market index. The average factor index used by these funds outperformed the total stock market by 10.3% annually in the 5 years before the creation of the fund but the average fund underperformed the total market index by 1% annually for the five years after fund inception. The study concluded: *"The adage that "past performance may not be an indicator of future results" is especially true when the past performance is hypothetical."*

"Pseudo-Mathematics and Financial Charlatanism: The Effects of Back Test Overfitting on Out-of-Sample Performance" is a paper written by four mathematicians who lament that many recently discovered factors are the product of faulty mathematical analysis and backtest overfitting. *"We suspect that a large proportion of backtests published in academic journals may be misleading…In our experience, overfitting is pathological within the financial industry".* The authors note that as the number of unsuccessful backtests increases, the minimum number of years of data used in a backtest must increase to avoid false positive discoveries. Without knowing how many failed trials preceded the discovery of a new factor, it is impossible for investors to know if the results are valid. *"The higher the number of configurations tried, the greater the probability that the backtest is faulty. Because financial analysts rarely report the number of configurations tried for a given backtest, investors cannot evaluate the degree of overfitting in most investment claims and analyses."* They also criticize their peers for failing to hold financial researchers to a high standard of mathematical rigor - *"mathematicians in the 21st century have remained disappointingly silent with regards to those in the investment community who, knowingly or not, misuse mathematical techniques…Our silence is consent, making us accomplices of these abuses."*

The active fund industry is on a relentless quest to find new factors with the potential to outperform simple market-cap weighted index funds. Unfortunately, most recently discovered factors are false, the result of data mining and backtest overfitting. Fund companies routinely promote successful backtests, ignore failed backtests and fail to rigorously test new factors in out-of-sample years. No wonder then that the supposed benefits of smart beta funds have proven to be more marketing hype than reality. There may be additional legitimate factors beyond those in the Fama French three-factor model, but it is likely that they can be counted on one hand.