Black Swans, Portfolio Theory, and Market Timing

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This is an article that I have wanted to write for a long time, but a number of recent events have inspired me to finally commit it to paper. Phil DeMuth and Ben Stein recently published a book, ***Yes, You Can Supercharge Your Portfolio*** (Hay House 2008), in which they are attempting to bring the value and concepts of portfolio theory to a broad audience. The core of the book explains how a good statistical model of the portfolio can enable investors to build better portfolios and they use ***Quantext Portfolio Planner*** (which I developed) for their demonstration cases. The essence of 'better portfolios' is to get more return for less risk.

At the very start of February 2008, Phil decided to look at a few of the 'model' portfolios described in the book and how they had fared through the volatile previous quarter. This period (November 2007-January 2008) exhibited substantial market declines and Phil wanted to see whether what the models had suggested was indeed playing out. He published an article on this on Seeking Alpha:

http://seekingalpha.com/article/63070-a-practical-demonstration-of-the-value-of-portfolio-theory

The three portfolios that Phil analyzed were examples of some fairly standard and well regarded broad asset allocations. In the book, Phil and Ben had taken these portfolios and suggested that it was fairly simple to generate an extra 1% in return per year at no cost and without increasing risk through the use of portfolio theory. This is achieved by looking for sectors and specific stocks that have low correlation to the original portfolio. By looking at the incremental effects of these assets on the portfolio on an historical and forward-looking basis, ***Quantext Portfolio Planner*** suggested that it is possible to generate more return with less risk. In his article, Phil showed that these portfolios had done exactly what the portfolio analysis in the book had suggested: these portfolios have suffered in the last quarter (because they were still made up largely of the original asset allocations), but the impacts of the downturn were tempered. Further, Phil showed that the potential for the losses that these portfolios had taken were predicted quite nicely by the portfolio model as having a far higher probability than had been observed in recent years. Nowhere in this article or in the book did Phil or Ben suggest that these portfolios were optimal. These incremental improvements to three common asset allocations were a jumping-off point for the book.

The responses to Phil's article (posted on Seeking Alpha) were somewhat disappointing, if predictable, and seemed to come from two camps—and I have chosen representative posts. The first major camp of criticisms comes from those who believe that portfolio theory is useless and what we really need is market timing models so we can avoid those painful losses:

You demonstrated the Achilles Heel of Portf. Theory---D Swensen may have learned something but when things start to tank you must intervene and not sit back and rely on the theory protect you while you are down 10% in 3 mo.

and, of course, the predictable:

Or you could have just bought the gold ETF and made 17%. That's the difference figuring out which way the wind is blowing can make.

These two posts (from different respondents) are taking the tack that we can toss out portfolio theory if we just learn to predict what the market will do next week, next month, etc. The person who posted the first of these two responses is (correctly) noting that David Swensen, the Chief Investment Officer at Yale, is a proponent of the kind approach espoused in Phil and Ben's book. This person is then saying that Mr. Swensen's approach could be improved by adding some market timing. This is a bold statement, given that Mr. Swensen has soundly thrashed the S&P500 over 22 years, generating an average return of more than 16% per year when the S&P500 has averaged 12.3% year. Mr. Swensen is widely regarded as one of the best and most successful institutional managers in the world, and the respondent above is saying that Mr. Swensen needs add some market timing to his toolbox. I would find another conclusion: perhaps we need to learn something in the fact that the most successful investors for whom we have long-term documented track records are not those who think they can jump from one asset class to another to avoid declines.

Market Timing

Of course, these two people who responded to the article are correct. If we could really predict the market's moves, timing would be great—the problem is that the evidence is that market timers do not do well. An annual study by DALBAR, a research firm, showed that the average investor in equity funds has averaged only 4.3% per year in returns over the most recent 20-year period in which the S&P500 averaged 11.8% per year—and DALBAR finds that most of this under-performance of the basic market index is due to attempts to time the market. There are a host of other studies that show that market timing leads to returns that substantially lag the market—even before you account for the massive drag of tax on short-term capital gains. That said, perhaps those two people who posted are quietly running wildly successful portfolios using market timing. If they succeed over the long term, they will undoubtedly be far more successful than Mr. Swensen and then they can run their own hedge funds or university endowments--or perhaps they already do.

Let's imagine that those two people who posted have generated impressive five-year or ten-year records that soundly beat those unfortunates (like Mr. Swensen and Mr. Buffett) who miss the benefits of successful short-term timing. Let's say that they can document their success (net of fees and taxes) and start hedge funds (or perhaps they already manage money). Would it be smart to give them your money? In essence, you have to bet on whether they can keep doing what they have done in the past, or whether the long-term evidence as to the very low success rate of market timing.

There is a large body of research that shows that the actively-managed funds that do beat the market in some period are not likely to continue to out-perform over any extended period. This is not to say that there is no evidence of persistence, but rather than the persistence effects die out beyond one year. Much of the evidence in favor if persistence

is due to momentum effects in individual stocks and sectors—and these do not extend for long periods. Two useful (albeit academic) review papers are:

http://cisdm.som.umass.edu/research/pdffiles/performancepersistence.pdf
http://www.fma.org/SLC/Papers/flows_persistence_skills.pdf

If a fund manager favors a specific sector, for example, and there is momentum in sector out-performance (which there is), you can have the appearance of skill because of a concentration in a specific sector. Even broad-based mutual funds often have some sector concentrations. This effect means that while a fund may have persistence in out-performance over some period, this effect is likely to disappear when then sector goes out of favor.

Now things get a bit more subtle. Even if we disregard attempts to use short-term timing, this does not mean that it is the best approach to set your asset allocation and then to hold it forever. There is a school of thought (albeit an old one) that the standard of practice for asset allocation is to determine a 'policy portfolio' and rebalance to maintain that same allocation, regardless of the market and economic environment. The best argument for this approach is that it tends to minimize costs and that most investors (i.e. like those in the DALBAR study) would be better off if they invested in a several diverse index funds and focused on managing costs. This is clearly true. This is why the 'policy portfolio' has long been a standard of practice among many investment advisors. On the other hand, there are some fundamental problems with the idea that it makes sense to buy and own a static asset allocation regardless of market conditions. In recent years, there has been renewed focus on this issue, much of it inspired by the assertion by influential analyst and advisor Peter Bernstein that "policy portfolios are obsolete" in 2003. An excellent overview of the issues was provided by Rob Arnott in the ***Financial Analysts Journal*** in 2004:

http://www.researchaffiliates.com/ideas/pdf/policy_portfolio1095916118.pdf

A lot of the discussion in the policy portfolio debate comes down to the idea that certain asset classes do better in certain environments. Further, it is clearly possible to measure when a sector or asset class is selling particularly cheaply (using fundamental measures, for example). To recognize and act upon these factors is, strictly speaking, a form of market timing (and this is what Mr. Buffett and Mr. Swensen do) but it is market timing on a far longer time horizon. The idea that asset classes might be selling cheaper than their 'fair values'—i.e. that there are estimates of 'fair value' that can be used to assess expected future returns, as well as risks, leads us directly to the next topic. This longer-term focus on asset allocation makes sense in the context of portfolio theory, as we will discuss.

The Problem With Portfolio Theory

The second major camp of criticisms of Phil's article are those people who simply believe that portfolio theory is hokum and has no value:

Good effort but you are still trying to squeeze blood from a turnip. You have made assumptions about asset allocation that are very outdated. Have you every wondered why: 1) you don't see outliers (black swans) in your models; 2) your models aren't able to respond to current market conditions, or 3) your Monte-Carlo models are ineffective at avoiding major sell-offs (thus being down so much in the time frame you examine)?

There is an influential vein of thought which motivates this author and it stems largely from a book called ***The Black Swan*** by Nassim Taleb. Dr. Taleb champions the perspective that the models of finance (embodied in portfolio theory and options pricing theory) are fundamentally flawed. His thesis is that very extreme events are unpredictable and that the financial models used in portfolio theory simply cannot capture these extreme events. Think of market crashes, for example. Dr. Taleb extends his critique to suggest that these 'fat tails' are so significant that portfolio theory is useless. While it is certainly true that there are extreme events that are inherently unpredictable in a statistical sense, the range of events and probabilities of these that are captured by statistical models is far better than Dr. Taleb suggests.

In a recent article, I looked at the declines in financial stocks following the sub-prime meltdown—inspired by the fact that ***The Economist*** referred to this decline as an example of a 'black swan event'—i.e. one that is inherently unpredictable:

http://seekingalpha.com/article/58801-black-swans-real-estate-and-financial-stocks

My portfolio model (Quantext Portfolio Planner), the operational version running with all default settings and data available prior to the decline, predicted that the observed declines in Citigroup in 2007, for example, were likely at a considerably higher level of incidence than we have seen historically. The level of observed losses in C (2007 return of -45%) were predicted at a probability of about 2.5% (1-in-40). Over the last 25 years, the 2.5th percentile return for a 12-month period is -36%, so the model was predicting a considerably more severe downside tail than we have seen historically. This is certainly not the same as predicting that C ***would*** decline by 45%, but the predicted probability of declines at the observed level were also not at the lightning strike level of probability either—which is how many people are treating the collapse in the financial sector.

My article on modeling the fairly extreme events as statistically predictable (as opposed to being black swans) met with considerable response—some of it similar to the one posted above with regard to Phil's article. These comments suggested that it would be worthwhile to discuss the issues of statistical portfolio models and their value somewhat more deeply. Dr. Taleb suggests that statistical models used in portfolio theory are such a poor description of markets that they have no value. He goes so far as to suggest that using portfolio theory is worse than having no information at all because the models create a sense of knowing something that leads to bad decisions. I believe that this extreme perspective does investors a disservice.

For those who have not read ***The Black Swan*** or are otherwise unfamiliar with the ideas, a good place to start would be this review from the Wall St. Journal which explains the basic premise and the core notion of power laws:

http://www.opinionjournal.com/la/?id=110009979

The central theme of the book is that extreme and unpredictable events happen with far greater frequency than standard statistical models would suggest—specifically those standard statistical models upon which portfolio theory is based. Dr. Taleb's conclusion is that the presence of these extreme unpredictable events is so significant that mathematical models used in finance lead us to make dangerously misguided decisions.

Dr. Taleb's work draws upon the theories of Dr. Benoit Mandelbrot, the father of fractal theory and a longtime critic of financial modeling practices. For a good review of Dr. Mandelbrot's book, ***The (MIS) Behavior of Markets***, see this article in the Journal of Financial Planning (by William Jahnke):

http://www.fpanet.org/journal/articles/2005_Issues/jfp1005-art2.cfm

Like Dr. Taleb, Dr. Mandelbrot's central premise is that prices in the real world move in such extreme ways that they are poorly characterized by classical statistical models. There are numerous examples, but market crashes are the ones most often cited. Both Dr. Mandelbrot and Dr. Taleb make the point that the very extreme short-term moves in markets are not captured by financial models. This is no longer a controversial issue:

*"I think everyone accepts that his basic point is true," says **Eugene Fama**, professor of finance at the University of Chicago's Graduate School of Business. Traditional statistics don't predict the wild variability of the market very well. But by some measures, Fama says, the market starts too look smooth at larger timescales. "You're left with a situation where over short intervals his [Mandelbrot's] model looks good, but over long intervals it doesn't seem to work," Fama says.*

http://www.forbes.com/2002/04/02/0402mandelbrot.html

The point here is that the effectiveness of the standard models of mathematical finance is partly a function of the time scales that are of concern to you. If you rely upon the ability to predict the extremes of the market over short time periods, financial theory is far less effective. If you rely upon portfolio models to help in broad asset allocation and in estimating the relative risk and return of one portfolio to another, financial theory does far better. Further, even though Dr. Mandelbrot's models are more effective at characterizing these extreme events, the ability to ***describe*** them is a far cry from being able to ***predict*** them or their probabilities in a way that they are useful to making decisions: Dr. Mandelbrot is quite clear and specific in his interview with Forbes that his models are descriptive rather than predictive. William Jahnke puts it this way:

The fact that fractal geometry can "mimic" the existence of fat tails and, with modification, mimic other complexities observed in empirical data does not mean that the

return-generating process actually conforms to Mandelbrot's fractal and multifractal models.

http://www.fpanet.org/journal/articles/2005_Issues/jfp1005-art2.cfm

So, let's summarize the key ideas from the Taleb / Mandelbrot approach to financial modeling. First, there are extreme events in capital markets that defy our ability to characterize them using standard mathematical models of portfolio theory and option theory. Second, even the models that can characterize these events after the fact (such as power laws) have not been shown to have any value in modeling these events on a forward-going basis. Perhaps these models will be standardized in the future and will become part of our operational toolbox. Time will tell. The question that remains from Taleb and Mandelbrot is whether the standard models of quantitative finance can, indeed, be useful in portfolio management. Dr. Taleb, in particular, claims that these models lead to dangerously mis-guided decisions.

As a quasi-irrelevant aside, I will note that I have some experience with the classes of models that Dr. Taleb and Dr. Mandelbrot promote, having studied non-linear dynamics and chaos as an undergrad in Physics at Georgia Tech and as a grad student at the University of Colorado. My experience mirrors the opinions of Dr. Fama and Dr. Jahnke. These models are very interesting as descriptive tools but break down as prognostic tools.

Making Portfolio Theory Work

In the comments on my article on Black Swans and those to Phil's article there is a lot of verbiage about efficient markets and the issues associated with efficient market theory. I do not know of any credible expert who argues that markets are efficient on short time scales. There is short-term persistence in returns on a range of assets and there is long-term evidence of mean reversion, and both have implications for portfolio performance:

http://seekingalpha.com/article/14858-sector-momentum-and-etf-performance

QPP (the model that I developed and that Phil and Ben used in their book) is not a classical efficient market model. The statistics are non-stationary, which means that the projected probabilities evolve in time. The projected risk and return of a portfolio analyzed today will not be the same as if you analyzed that portfolio in one year. I have written numerous articles demonstrating how this works and that the forward-looking projections of expected risk and return can add value to portfolio planning. For example:

http://seekingalpha.com/article/38568-projecting-portfolio-risk-and-return

The effective application of portfolio theory to asset allocation is certainly a function of reversion to the mean, for example, as I discuss in the article above. Reversion to the mean is inconsistent with the classical efficient market / random walk model. QPP therefore also is inconsistent with CAPM.

In numerous articles, both in real-time and in historical out-of-sample analysis, I have shown that this portfolio model adds value in estimating forward-going risk and return on

portfolios. The ability to segregate the universe of investment alternatives by their (forward-looking) risk levels is useful. The existence of effective capital markets is predicated on the ability of investors to weigh the relative risk and return of any given investment choice. This type of model allows investors to approach this problem more efficiently by providing a consistent framework in which to judge both the standalone merits of an investment but also the incremental portfolio impacts of that investment.

The paragraph above does not refute the fact that there are events that have occurred and will occur that were judged by financial models to have a vanishingly small probability of happening. The example that Mr. Taleb uses (and that his followers often cite) is the complete collapse of Long Term Capital Management (LTCM), a previously much-admired hedge fund. LTCM was founded and run by very well respected quantitative traders. The common understanding is that the firm sustained its massive crippling losses via an event that they had estimated (using their portfolio models) would happen at such a low probability that they did not need to worry about it. This example is, in my opinion, a perfect example of confirmation bias on Mr. Taleb's part. LTCM is a very special case and is far from representative of the standard practices in quantitative portfolio analysis. LTCM was highly leveraged and was taking highly concentrated positions in very illiquid assets. Both of these massively amplified the impacts of the assumptions in their models. The 'liquidity risk' of these positions was largely ignored, apparently. In essence, LTCM was making a very strong bet on their ability to model low probability events. This is hardly an example of a standard use of portfolio theory.

On the other hand, market crashes and their impacts certainly defy forward-looking statistical models that are the core of portfolio theory. If we have another terrorist attack on U.S. soil, the short-term losses to any portfolio are likely to be far greater than Quantext Portfolio Planner or any other portfolio model can estimate. This kind of massive disruptive event is not what these models are capable of estimating.

Where We Stand

While it is dramatic and gets lots of attention to indict all of modern financial theory as Dr. Taleb has done, portfolio theory is routinely used to enable investors to make far better decisions than they would otherwise make. I present some examples below, but there are many more to be had.

Users of Quantext Portfolio Planner (QPP) and other tools like it never fell for the myth of the decoupling in global markets that led many investors to believe that they were highly diversified because they invested both domestically and abroad:

http://www.iht.com/articles/2008/01/27/business/26delink.php

Decent portfolio tools made it very clear that the correlation between international markets and U.S. markets was never very low (i.e. around 80%) — even back when this de-coupling theory was all the rage. See, for example, these two articles:

http://seekingalpha.com/article/25146-select-foreign-index-etfs-as-defensive-assets-anything-doing

http://seekingalpha.com/article/18817-targeting-low-correlation-assets-for-a-portfolio

On the other hand, Quantext Portfolio Planner (QPP) has consistently shown the highly attractive features of utilities over the past several years--something that has proven very valuable, even as volatility has skyrocketed over the past six months—this is noted, for example, in the second article linked above.

The 'reversion to the mean' issue has also proven very valuable for users of QPP and is likely to do so again. A portfolio model must project expected return and risk for each asset in a portfolio. In general, these models enforce some relationship between trailing returns, risk, and assumed equity premiums and thereby generate a forward-looking expected return. In March of 2007, for example, we compared trailing three-year returns to projected 3-year returns for a series of the best and worst performing sector ETF's using Quantext Portfolio Planner and we noted that REIT's had the highest disparity between historical and expected returns. The expected average annual returns from QPP were less than half the historical returns and this, we noted, was a big warning for a 'reversion to the mean' in which REIT's would have to experience substantial correction:

http://seekingalpha.com/article/30306-outlook-for-select-ishares-etfs

A good portfolio model will also capture reversion to the mean effects associated with volatility. In February of 2007, we noted that QPP was suggesting that the volatility of broad market indexes would double over trailing three years' value and that this had important implications for investors:

http://seekingalpha.com/article/27508-foreign-and-domestic-market-risk-outlook-from-february-2007

Clearly, this has come to pass, with VIX levels about double what they were back in February of 2007. We also noted that foreign markets showed the same trend, again emphasizing that these markets were not decoupled from U.S. markets.

Ultimately, portfolio models are perhaps most useful because they give investors objective tools to :

1) examine diversification benefits in their portfolios
2) estimate total portfolio risk (albeit not very well for market crashes, wars, epidemics, etc.)
3) estimate total portfolio returns in light of assumptions

Most investors simply don't know how well diversified they are. A good portfolio model can help investors to identify ways to increase return without increasing total portfolio risk—and this is very valuable. Indeed, this is precisely the topic of Ben and Phil's book, as well as being the central theme of many of my articles.

With all of this said, it is certainly true that Quantext Portfolio Planner and tools like it will never capture the true dynamics of the market when extreme really extreme events

occur. As Mr. Taleb emphasizes, these things do happen. To indict quantitative models on this basis is, however, to largely miss the value of these models. These models need to be non-stationary (which means that their projected statistics change in time), but there are quite a few portfolio models that are non-stationary (including QPP). I worry more about the non-stationarity than I do about the unpredictably rare events. The unpredictable events are, well, unpredictable. For investors who really believe Mr. Taleb's thesis, the best approach might be to buy some way-out-of-the-money put options on the major indexes (assuming that the Black Swan event that tanks the market does not also bankrupt your counterparty or close the exchange permanently). Despite the world-changing events that were unpredictable, however, investors who are willing and able to ride out these extreme events have been well-compensated. This tends to be true when investors don't leverage up in response to rising / low volatility markets—something that portfolio theory helps to warn against.

The fact that the markets are statistically non-stationary has major implications for the idea of a static 'policy portfolio' that never changes, as Mr. Arnott notes in the article cited earlier. When REIT's had generated average returns far above the expected value generated by QPP, it was wise to avoid loading up on REIT's. This sort of thinking is inconsistent with the strict interpretation of efficient markets (i.e. that prices instantaneously reflect all available information on fair value). Markets may be efficient on average over very long time scales, but there is clearly the capacity for massive mis-pricings over fairly long periods (think dot-com's and, more recently, real estate). Investors need to understand that while classical portfolio models made strong assumptions about market efficiency, more current models (like QPP) do not.

Finally, it is important to note that what I have been writing about the value of portfolio models is not true for all portfolio models. There are plenty of bad applications. In developing QPP, I have spent thousands of hours testing the model in various scenarios and writing up the results—and the fruits of that labor can be found on Seeking Alpha,, at Quantext.com, and elsewhere. The use of portfolio models requires care and due diligence on the part of users and anyone considering the use of such models should look at how they have been tested and benchmarked.

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