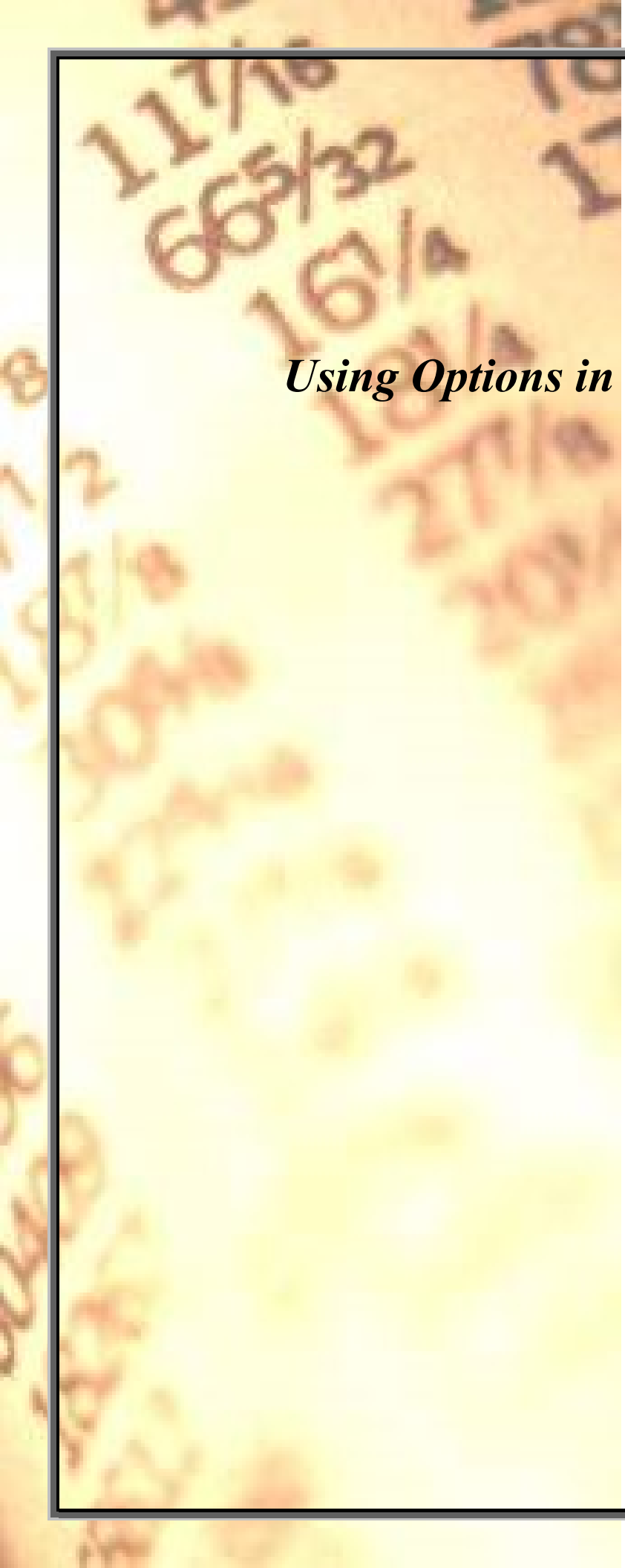

Using Options in Wealth Management

Part 2

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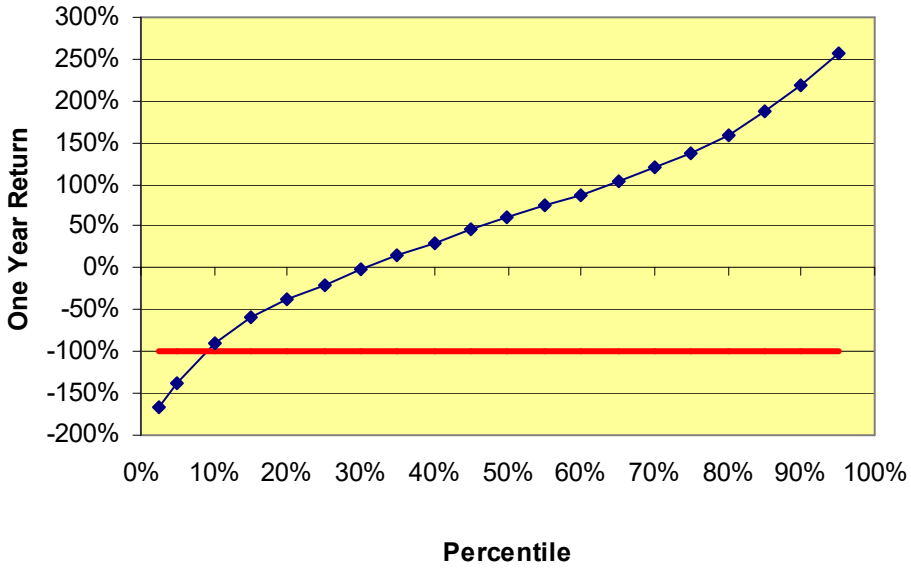
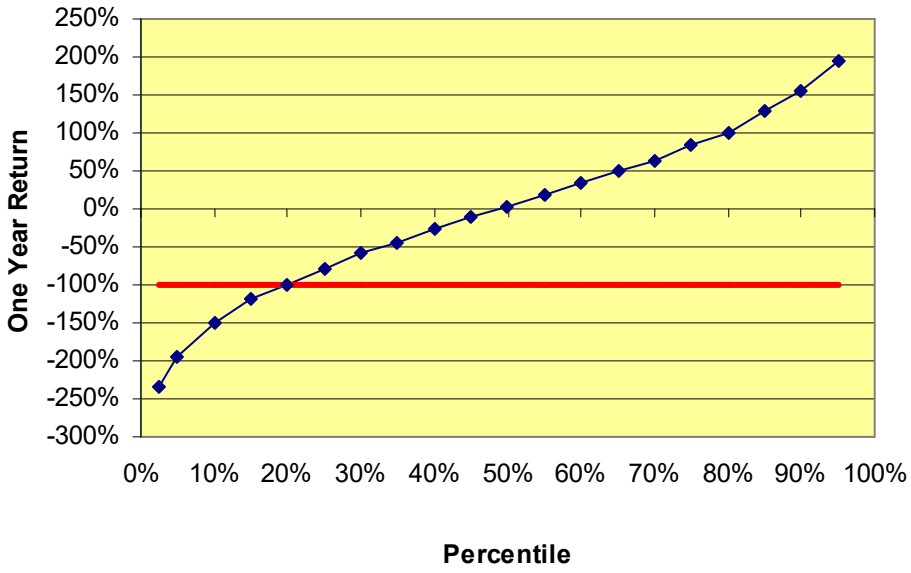
Options Prices and Default Risk

An important feature of options prices on individual stocks is that they provide useful information on the probability that a company will fail[1]. This is easiest to grasp if we look at the percentile charts for the payouts from a stock. Let's look at a small pharmaceutical firm by way of example. Keryx (KERX) is a biopharmaceutical firm that is in the midst of critical drug trials as of this writing. With a market cap of $130M, bad news would be very bad for the firm's long-term prospects. As of this writing (in November 2009), the Jun 2010 options on KERX (the longest data options as of this writing) have implied volatility of 123% (yes, really). This very high implied volatility tells us that the market thinks that the company has pretty good chance of going out of business. This is fairly simple to see if we use QPP to generate a one-year outlook for this stock (below).



Where the percentile chart crosses -100%, the stock has lost 100% of its value—i.e. it has failed. QPP is estimating that this occurs with a 1-in-10 chance, when we adjust QPP's volatility to match the implied volatility in the market. This is the connection between implied volatility and failure risk for a company. In this chart, QPP is projecting that KERX has an expected return of 58%--very high. This is not based on any fundamentals—just QPP's statistical model. This is not a value that I would bet on. Let's say that KERX's actual expected return is zero, which is to say that we just don't have any grounds for figuring whether KERX is going up or down.

[1] http://seekingalpha.com/article/68135-using-default-risk-to-limit-downside-in-individual-stock-investing



Now, KERX has a 20% chance of generating a -100% return over one year. If we discount the implied volatility on KERX and look instead at QPP's projections when we only adjust the implied volatility of the S&P500 and let this market level of volatility propagate through the model to truly forecast the volatility of KERX, we get a volatility of 175%, considerably higher than the implied volatility. Notably, when we look at a chart like the ones above using QPP's expected return and volatility in this case, we get a 20% chance of returns at or below -100%, which is identical to the projected probability of failure if we use the current implied volatility for KERX and 0% expected return. High implied volatility corresponds to high probability of default.

When you buy a stock, you cannot lose more than 100%, so your real payoffs will be flat from -100% and down, just like owning a call option with a strike of zero. The first question that one might ask in this case is whether it makes more sense to buy the stock itself or simply to buy the call option on the stock. My personal inclination is to own the call option and to take advantage of the leverage and the floor on losses that the call option provides. When stocks have such high volatility that they have a substantial chance of going to zero, you are really choosing between buying a call option with a strike well below the current price (if you buy the stock) or a call option with a strike that is at or above the current price. If you have a strong view that the stock will do well, the call option is a cheap way to take a position.

In my earlier research on the relationship between implied and projected volatility and the probability that a company will fail, I have a number of interesting results.

One of my first results (in March 2008) was that there was a remarkable correspondence between **projected** volatility (from Quantext Portfolio Planner), implied volatility, and the failure probability derived from credit default swaps[2]. This is one of my favorites of

[2] See article in previous footnote

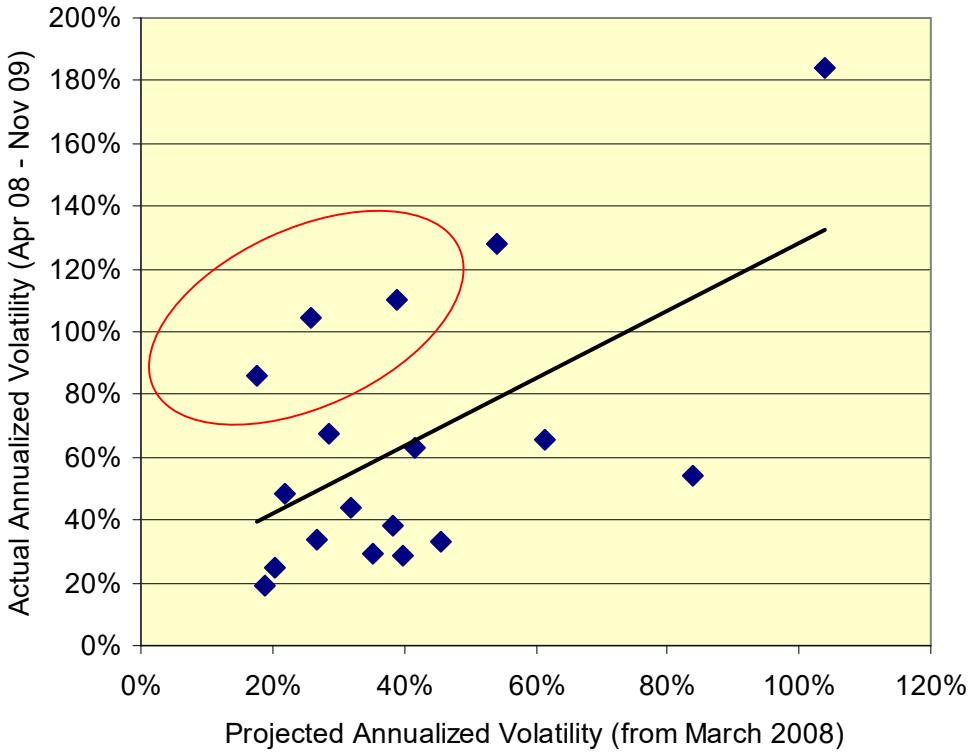
the articles that I have written. If the market is fairly rational, there should be a direct correspondence between projected volatility from Monte Carlo simulations and market-implied default risk (default risk derived from the prices of credit default swaps). What I found was that there is indeed a very close relationship. The timing of this article turned out to be quite prescient. The stocks that I analyzed in the article and for which the projected volatility from the Monte Carlo Simulations gave substantial risk of default were GM, Lennar Homes, Beezer Homes, Washington Mutual, and Pulte Homes. These are all firms that have had a very rough time since March 2008 (see table below).

	Moody's		Quantext Portfolio Planner		
Ticker	Credit Default Swap Implied (MIR)	Investment Grade?	Projected 0.1% Percentile for 1 Year	Projected 1% Percentile for 1 Year	Percentile for 100% Loss
JNJ	Aaa	Y	-43%	-31%	
AXP	Baa3	Y	-43%	-31%	
KO	Aa1	Y	-47%	-34%	
USB	A1	Y	-51%	-37%	
BAC	Baa1	Y	-61%	-44%	
INTC	Aaa	Y	-62%	-45%	
DIS	Aa3	Y	-62%	-45%	
WFC	Baa1	Y	-67%	-48%	
BA	Aa2	Y	-70%	-51%	
HPQ	A1	Y	-81%	-59%	
COP	A2	Y	-87%	-64%	
NCC	Ba2	N	-89%	-65%	
C	Baa3	Y	-90%	-65%	
HD	Baa3	Y	-92%	-67%	
AA	Baa2	Y	-98%	-71%	
F	Caa1	N	-125%	-92%	0.5%
LEN	Ba1	N	-144%	-105%	1.5%
WM	B1	N	-177%	-129%	3.0%
GM	B3	N	-189%	-138%	4.0%
PHM	Ba1	N	-195%	-143%	4.5%
BZH	Caa2	N	-229%	-167%	6.8%

Moody's Rating vs. QPP Outlooks

Projected volatility and loss vs. CDS-implied risk from March 2008 (from original article)

Washington Mutual (which then had ticker WM, a ticker that is now used by Waste Management, Inc.) is bankrupt, as is GM. Of the three homebuilders, BZH has substantially under-performed Lennar and Pulte, as the models projected. When I chart the projected volatility for the stocks from the list above that did not go bankrupt (GM, WM) or get merged away (NCC) vs. the actual volatility observed from the end of March 2008 (when this article was published) through November of 2009, the following relationship is seen:



The correlation between the projected volatility (standard deviation in return) and the realized volatility is statistically significant, and is right on the threshold of being highly statistically significant (P=0.013, for those with a statistical inclination). The three outliers circled in red in the chart above are banks (AXP, C, BAC). My prediction is that as the time horizon increases for which we have data upon which to validate the sample, that the correlation between projected and actual volatility will improve. In general, the agreement is not especially good, but it seems quite satisfactory given that the 1.7 years of data used to calculate the ***Actual*** volatilities has been a true market anomaly.

The next interesting piece of the puzzle came in November of 2008[3], after market volatility had roared to historic highs, with VIX cracking 80%. At that time, I found that QPP's projected volatility for a series of stocks were far lower than the market implied volatility for these stocks:

[3] http://seekingalpha.com/article/107756-profiting-from-risk-aversion

Ticker	Expiration	Implied Volatility (at the money options)	QPP P Vola
SPY	Dec-09	45%	4
KO	Jan-10	44%	3
JNJ	Jan-10	38%	2
WMI	Jan-10	49%	2
PG	Jan-10	46%	2
DUK	Jan-10	44%	2

QPP Projected Volatility vs. Implied Volatility in November 2008 (from original article)

To arrive at the projections, I adjusted only one variable: I increased the projected volatility for the S&P500 in QPP until it matches the implied volatility for Dec 2009 options. This higher volatility for SPY then impacted all of the projected volatilities for individual stocks, to yield the results shown above. These results suggested that the market price for options on these stocks were far too high (because higher implied volatility means that the options are more expensive). The very high implied volatilities also told us something about the probability of failure that was being priced in—and it seemed very high, even given the high overall market volatility reflected in the implied volatility for options in the S&P500.

As I discuss in a later section, QPP's projections of volatility have turned out to be considerably better than the implied volatilities at the end of 2008. My point in looking at this example is that because implied volatilities are a measure of default risk, we can look at implied volatilities to provide a sense of the market's belief in the potential for companies to fail. Back in November 2008, the market was in a state of panic and implied volatilities were uniformly high. Even with market volatility high, the implied volatilities (and therefore implied risks) for a range of very stable companies seemed irrationally high. In general, implied volatility provides an important and reasonable basis for assessing future default risk, however.

There are a number of ways that investors can use the high volatility's signal of default risk. One approach is simply not to own individual stocks for which the implied volatility is extremely high. Another approach is to purchase call options if one wishes to have exposure to these stocks rather than owning the stocks themselves. Finally, there are opportunities if the market is implying a high probability of default in what the investor believes are robust firms—and this is the topic of a later section.

Big Picture Concepts

Zvi Bodie's Big Idea

The use of options in wealth management has been limited by the fact that people perceive options strategies to be difficult to use and risky. There is a basic appeal to the notion that you can buy a small number of index funds, hold them forever, and be fine. I

believe that the vast majority of investors would be far better off than they currently are if they invested in well-diversified low-cost portfolios[4]. Further, the popular theme in the financial press that the fundamental ideas of diversification and portfolio theory have been proven ineffective by the bear market of 2007-2008 is simply wrong[5]. If I were to die tomorrow, I feel that my family would be well-served with simple, well-diversified portfolios of ETF's. These caveats notwithstanding, I am increasingly of the opinion that there are some big picture themes that motivate the use of options in wealth management.

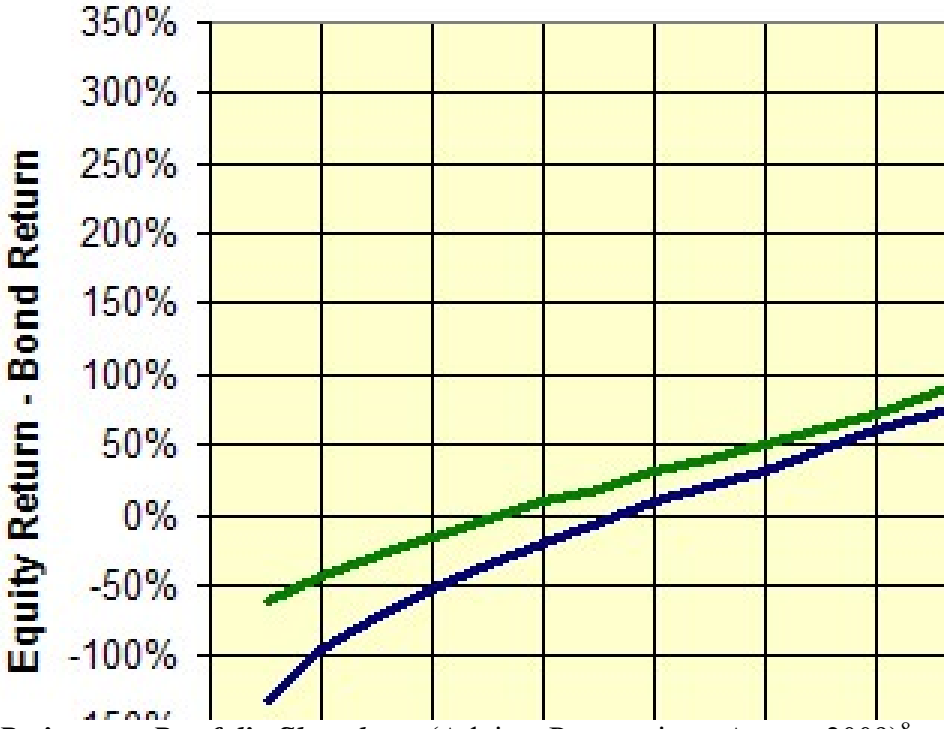
First and foremost, I have become convinced that Zvi Bodie's point on the risk of stocks over long periods of time is valid. Back in 1995, Bodie published a paper called ***The Risk of Stocks in the Long Run*** that set forth his theory[6]. The key argument in this paper is that, contrary to popular belief, equities have a substantial risk of under-performing bonds even over long periods of time. Bodie highlights a crucial misconception that is promulgated in a seemingly infinite variety of books and articles. A key argument in the 'stocks for the long run' concept is that your probability of under-performing bonds declines with longer holding periods. Bodie does not debate this point. His key contribution is to note that even as the probability of under-performing bonds declines with holding period, the <u>severity</u> of the potential under-performance increases (see footnote above):

The basis for the proposition that stocks are less risky in the long run appears to be the observation that the longer the time horizon, the smaller the probability of a shortfall. If the ex ante mean rate of return on stocks exceeds the risk-free rate of interest, it is indeed true that the probability of a shortfall declines with the length of the investment time horizon. For example, suppose the rate of return on stocks is lognormally distributed with a risk premium of 8% per year and an annualized standard deviation of 20%. With a time horizon of only 1 year, the probability of a shortfall is 34%, whereas at 20 years that probability is only 4%. But as has been shown in the literature, the probability of a shortfall is a flawed measure of risk because it completely ignores how large the potential shortfall might be.

I had been aware of Bodie's work for years, but I had never looked deeply into it. Even when I re-read his paper, I thought that there were shortcuts in arguments that made his conclusions unconvincing. In a 2009 study, I analyzed Bodie's strategy using a Monte Carlo simulation[7] (Quantext Portfolio Planner), expecting that the simulated results would be counter to Bodie's thesis-- but the results surprised me. My results confirmed Bodie's conclusion that the severity of extreme losses increases with holding period, even as the likelihood of such events decreases. What this means is that even long-term investors carry a small risk of serious loss.

[4] http://seekingalpha.com/article/76481-the-humble-arithmetic-of-portfolio-management
[5] http://www.financial-planning.com/fp_issues/2009_9/not-without-risk-2663735-1.html
[6] http://papers.ssrn.com/sol3/papers.cfm?abstract_id=5771
[7] http://www.advisorperspectives.com/newsletters09/The_Retirement_Portfolio_Showdown-Jeremy_Siegel_vs_Zvi_Bodie.php

In my Monte Carlo simulations, with all baseline settings, I found that even though stocks have considerably higher average returns than bonds, there is a high probability that stocks will under-perform bonds on ten-year periods and longer. For the ten-year time horizon (see chart below), there is a 10% chance that the S&P500 will under-perform an aggregate bond index (AGG) by cumulative return of 50%. In the median case (the 50th percentile) stocks will out-perform bonds by a cumulative 50% in total return, but the projected risk of under-performance is worse than most investors think. The potential for under-performance vs. TIPS (ETF: TIP) is even worse, and TIPS are considered a reasonable proxy for the long-term real income needs.



From ***The Retirement Portfolio Showdown*** (Advisor Perspectives, August 2009)[8]

Bodie's argument in his original article is somewhat abstract (it is based on option pricing theory). Having simulated the outcomes using Monte Carlo, I have become convinced that he is correct. Bodie's point is one the most important and least understood pieces research in wealth management in the last 10-20 years. I have communicated with Bodie and he remains convinced that this concept is both sound and crucially important. I have been surprised that he has not done exactly what I did in my Advisor Perspectives article to make this issue more concrete for those who did not find his original argument sufficiently convincing. This is a real game changer in terms of the best way to think about retirement investing. The chart above shows, for example, that you have a 20% chance (1-in-5) of generating 50% less total wealth in stocks than in TIPS over a ten-year period. Granted, Monte Carlo simulation is far from perfect but the main critique of

[8] http://www.advisorperspectives.com/newsletters09/29-RPShowdown2.php

these models is that they under-estimate risk of extreme events. If this is true, the potential shortfall risk in equities is worse than what is shown in the chart above.

The market declines of 2007-2009 have surely made Bodie's point manifest. Rob Arnott wrote a supporting article in the **Journal of Indexes** in March of 2009 called ***Bonds: Why Bother?***[9] In this article, he notes that long-term bonds had beaten stocks for the 41-year period through February 2009. This is not the only period of history in which this has occurred. Arnott identifies a 20-year period from 1929-1949 in which the same thing occurred.

Arnott goes so far as to suggest that the 'equity risk premium'—the increased return that investors expect with equities—may be something of a myth. I feel that he substantially over-states his case[10], but he is correct that there is no guarantee that such a premium must exist in any given time frame. What long-term investors hope is that their time horizons are sufficiently long that if there is an equity risk premium, they will see it manifested in their wealth accumulation. What the Monte Carlo simulations and recent years' returns demonstrate, however, is that an individual with a single life of accumulated returns has far higher risk of not being able to average away all the shortfall risk than most people realize.

Given these results, what is an investor to do? Bodie proposes that the solution is to use call options to gain access to the upside in equities, thereby clipping off the downside risk. I explore this strategy in detail in a later section.

The New Normal

Another 'big picture' theme that motivates the consideration of options is the 'New Normal' world view espoused by Bill Gross and Mohammed El-Erian of PIMCO[11]. This concept is based on an analysis of what the PIMCO folks see in terms of long-term global trends. Their thesis is that we will experience low-growth and high volatility for the foreseeable future, along with substantial inflation. The PIMCO New Normal may or may not come to be, of course, but it certainly seems plausible. For those who find the argument compelling, there are some interesting ways to use options. I discussed the New Normal in an article in late summer of 2009[12]. In a low growth environment, investors need to work harder to obtain a targeted income level. In addition, there is considerable volatility. Options can be useful in a number of ways in this scenario. It may be attractive to sell covered calls on high dividend stocks—a concept that will be explored in detail later. Particularly if growth is low, selling off the upside potential of stocks in the form of covered calls looks good. Further, with higher volatility comes higher potential for downside shocks, so using options to manage tail risk looks particularly attractive.

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[9] http://www.indexuniverse.com/publications/journalofindexes/joi-articles/5710-bonds-why-bother.html
[10] http://seekingalpha.com/article/127570-the-road-ahead-for-investors
[11]http://www.advisorperspectives.com/newsletters09/What_the_New_Normal_Means_for_Asset_Allocation.php

Black Swans

A third theme that would encourage the use of options is the world view espoused by Nassim Taleb in his well-known book, ***The Black Swan: The Impact of the Highly Improbable***[13]. Dr. Taleb feels that our knowledge of what can happen is so flawed that the ideal investment model is to put the vast majority of your assets in something almost risk-free and then swing for the fences with the remaining amount[14]. This is somewhat similar to what Bodie proposes, but Taleb's argument as to ***why*** is different. The valuation of options requires the use of historical market behavior as a driver—we look at past risk and return of assets to generate future projections. Taleb's argument is that the world is essentially defined by extreme events that happen so rarely that our ability to quantify their probability is nil. In other words, he wants to look at a world in which we believe that extreme events will happen with far greater probability than history suggests. How would one invest in such a world? Owning mostly risk-free assets and then using a small portion of your portfolio to make risky bets makes sense. Further, in this kind of world view, options will be chronically and persistently under-valued because the options pricing models do not capture the unquantifiable probabilities of massive upheaval. If there is some probability for massive swings in asset prices due to the unforeseen, options will be under-priced---especially those options with strike prices far from the current price of an asset. Options are, in fact, the ideal vehicle with which to bet on a world of black swans.

Most recently, a hedge fund that Taleb advises has been buying options that will benefit from either extreme inflation or extreme deflation[15]. Using Dr. Taleb's Black Swan thinking, the idea is that the risks of hyperinflation or massive deflation are under-weighted in the prices of options, meaning that these options are too cheap.

Dr. Taleb has written specifically about options valuation. In one article, he explains why he feels that Black-Scholes is an entirely incorrect way to value options[16]. Given Taleb's core belief that we cannot assess the probability of extreme events with any confidence, it is no surprise that he does not believe in Black-Scholes or other analytical options pricing models. From the Black Swan world view, options—especially those with strike prices far away from the current prices (called far out-of-the-money options) and especially put options-- will be chronically under-priced. I discuss black swan strategies in detail in a later section.

Tail Risk Insurance

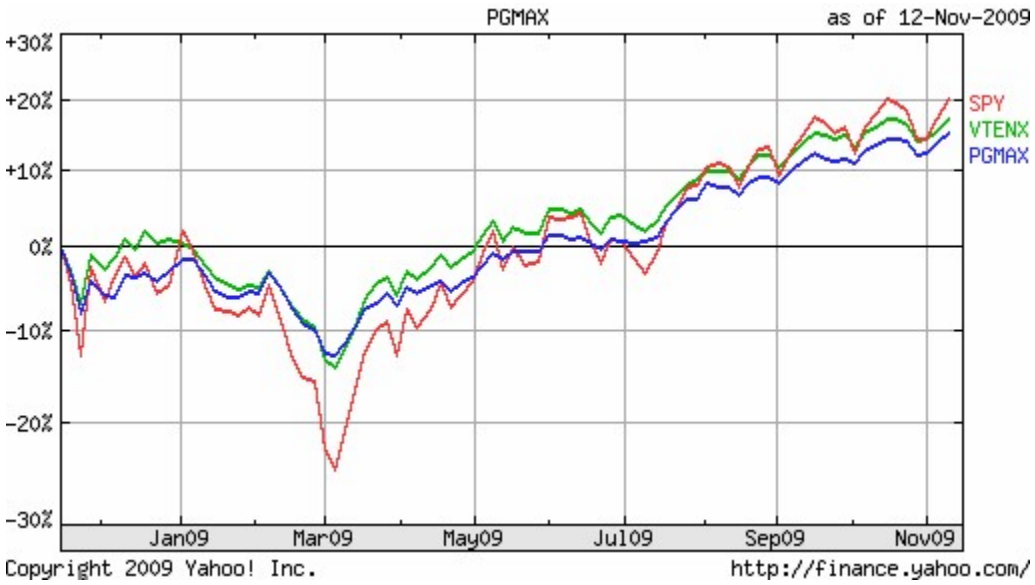
Mohammed El-Erian, in his wide-ranging book titled ***When Markets Collide***, discusses the Black Swan concept and the importance of creating 'portfolio tail insurance' to protect against the extreme events that are entirely un-predictable, even in a probabilistic

[13] http://www.amazon.com/Black-Swan-Impact-Highly-Improbable/dp/1400063515
[14] http://www.greenfaucet.com/?q=node/7007
[15] http://www.bloomberg.com/apps/news?pid=20601087&sid=aDVgqxiT9RSg
[16] http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1012075

framework. In an interview in Advisor Perspectives in 2008, Dr. El-Erian expressed the argument succinctly:

I mentioned previously the four components of building a successful portfolio. The fourth component involves asking what a really bad state looks like, and if there is cheap insurance against it. For example, when you buy car insurance, it is to protect against low probability and high impact events. You do not buy insurance because you expect to crash your car; at least most people don't! As long as risks can be partially insured cheaply, investors should be willing to forego some returns by paying out a premium. The mindset is very important. This type of tail insurance should run in parallel to the asset allocation process, and will be more important in the future.

PIMCO is implementing these strategies in a fund called the Global Multi-Asset Fund (PGMAX), launched in 2008. The good news is that this fund did not take nearly as large a hit in March 2009 as the S&P500 (see chart below), which suggests that the management of downside risk is working. That said, this fund generated returns that are very similar to those from Vanguard's 2010 Target Date Fund (VTENX) which is simply made up of a very conservative bond/equity mix:



We will reserve judgment on the effectiveness of this funds implementation of tail risk procedures until it has a longer track record.

The idea that it is important to consider 'tail insurance' as a component of portfolio planning is one that does not get a lot of attention. You will not find this topic discussed, even peripherally, in most books on wealth management and portfolio planning. We buy insurance to protect against events that are so catastrophic as to be unacceptable. This can certainly be the case with one's retirement portfolio. The most direct way to purchase 'tail insurance' is by buying options. Put options on the market have a very simple analogy to insurance—if the market goes down beyond a certain point, the put option pays out. You can also buy call options as a form of tail insurance. If you are

concerned about high inflation, you might buy call options on gold as a form of 'tail insurance' since we would expect gold prices to shoot up in the event of extreme inflation. We might also buy call options on VIX itself as a form of insurance against market meltdowns (this is discussed in detail later).

The most common form of tail insurance that retail investors hold is in the form of annuities, and a range of experts believe that annuities play a key role in wealth management (see, for example, Moshe Milevsky's writings). Wealth managers and motivated individual investors can explore how to build tail insurance into their portfolios using options—and this is discussed in detail in later sections. The lack of transparency and high fees of many annuities are a cause for concern, of course, but options prices can provide a sanity check on the costs of variable annuities for those who are considering them[17].

Evaluating cases in which tail insurance is attractive in the form of buying options requires that investors and advisors understand the volatility smile---put options become considerably more expensive on a relative basis as the strike price moves lower. On the other hand, the reason to purchase tail insurance at all is that the events that are being covered are so bad as to be unacceptable, so the fact that this insurance sells at greater than 'fair value' may not matter.

How Well Can We Really Estimate Future Risk or Return?

My final 'big picture' theme that motivates consideration of options has been explored and articulated by University of Chicago professor Lubos Pastor in a paper[18] titled ***Are Stocks Really Less Volatile In The Long Term?*** While the title is reminiscent of Bodie's earlier work, this research tackles a very interesting and distinct problem: how does uncertainty about the future expected return and risk from equities impact optimal decision making? The main finding of this paper is that our uncertainty about the parameters used in asset allocation (i.e. our uncertainty in estimating expected future return and risk) is sufficiently high that stocks do not, in fact, become less risky with long investing horizons. This is a fascinating point, and makes perfect sense as soon as you really think about it. Imagine that we have some ability to estimate the expected returns and risks of different asset classes. Because the world changes over time, the quality of our estimates inevitably declines for longer time horizons. This uncertainty in parameter estimation (that grows in time) acts against the tendency for the risk of stocks to become smaller over time. This relates nicely to Bodie's work. My Monte Carlo simulations use a specified average return and standard deviation of return, and it is assumed that these are 'correct.' In this case, the probability that stocks will under-perform bonds declines in time (which is the basis for the idea that stocks become less risky with holding time). Bodie and the Monte Carlo simulations show, however, that even as the probability of underperformance gets less with time, the potential severity of bad returns increases. Lubos adds yet another layer of risk: we cannot estimate the future average return and standard deviation of return with anything approaching certainty, and our ability to

[17] See Milevsky's ***Are You A Stock or a Bond?***, pp. 158
[18] http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1136847

estimate these parameters gets worse with longer holding periods. This effect works against the tendency for even the probability of under-performance of equities to become less with time.

Higher uncertainty in the outcomes of investing in risky assets will make options look like a more desirable way to invest because more uncertainty inherently increases the value of both call options and put options.

Thought leaders like Nassim Taleb, Bill Gross, Zvi Bodie, Lubos Pastor and Mohammed El-Erian provide food for thought in looking at how to plan a portfolio. The ideas that I have covered in this section are decidedly outside of the mainstream of wealth management and these experts also have plenty of areas in which they disagree with one another. The point of this section is not so suggest that one or all of these people have a lock on the future, but rather that their thinking is important in motivating the use of options strategies as a component of portfolio planning. The deeper that I go in examining the issues discussed in this section, the more I am convinced that options play an important role in wealth management. This does not mean that there is an obvious one-size-fits-all solution, however. I am leery of the potential for investors to use options in ways that are not appropriate and it is far easier to lose a lot of money with options than with traditional asset allocation.

In the next sections of this monograph, I present a series of strategies that use options as part of portfolio management. I present all of these various strategies through a consistent framework (Monte Carlo simulation) that, while far from perfect, illustrates the features of each of these strategies.

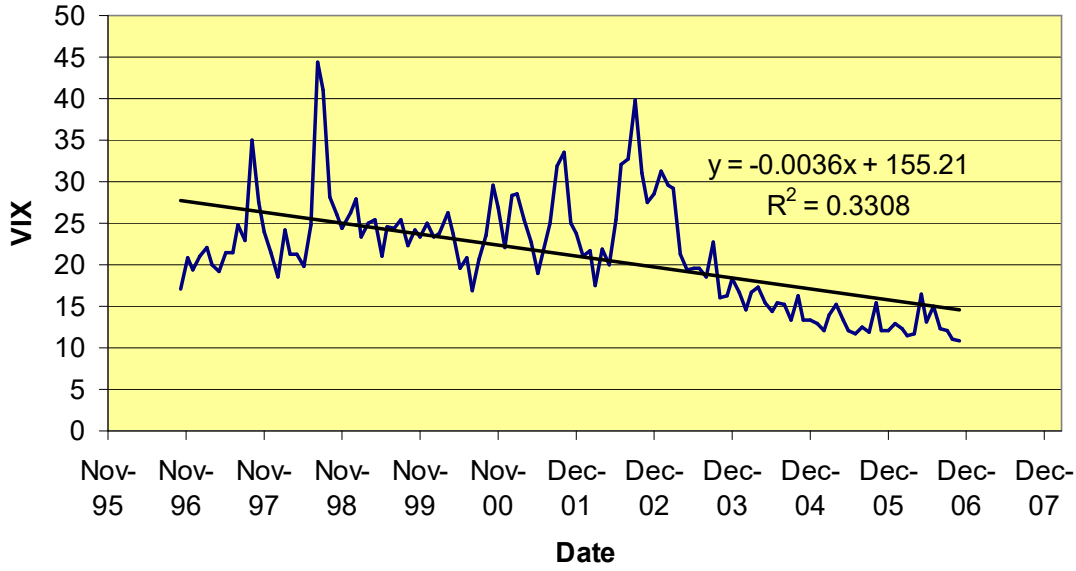
Ways to Use Options: Covered Call Strategies

One of the more common ways for investors to use options is via covered call strategies. In this strategy, you buy a stock (or ETF) and sell call options against that stock or ETF [19] [20]. This is often referred to as a ***buy-write*** strategy because you buy the ETF or stocks and than write (sell) an option against it (them). Your net remaining position is equivalent to having sold a put option—you have all the downside of owning the stock and you have sold off the upside, so your upside is limited to (1) the difference between the strike price of the calls and the current price, (2) what you received for the call option premium, and (3) the dividends that you receive from your holdings. Covered call strategies tend to look attractive when the market is up and down (what is often referred to as *range bound*) because you end up looking as though you haven't missed a lot of upside by selling the call but you lock in some income from the option premium. In a moderate down market, covered call strategies look good because the premium obtained from selling the call options offsets some of the losses from a falling market. In an extreme down market, however, the true risks of having a net position that is equivalent to selling a put option are clear: you hold all of the downside risk of market declines.

From my own research, I find that selling covered calls tends to look most attractive when the underlying portfolio has substantial income generation in the form of dividend yield (qualified or not) and the underlying portfolio is fairly low Beta. This will be discussed in more detail in a later section.

Because selling covered calls is equivalent to simply selling put options, it does not make sense that a simple mechanical approach to a covered call strategy should be particularly attractive. That said, there are some studies that find that a simple buy-write strategy against an index has historically generated higher risk-adjusted return than simply owning the index. In a 2007 study[21] called **The Risk and Return Characteristics of the Buy-Write Strategy on the Russell 2000 Index** the authors find that simply buying the Russell 2000 index (as with an ETF such as IWM), and repeatedly selling covered calls with one month to expiration against that index, generated higher risk-adjusted returns than simply buying the index over a ten-year period through November 2006. The authors find that the source of the enhanced performance is that the call options have ***implied volatility*** that is consistently higher than the ***realized volatility*** (i.e. the volatility that occurs). This means that the call options are consistently selling for a higher price than they are actually worth. This is a useful study, but the period of history used in the study is somewhat anomalous in that market volatility dropped precipitously over this time (see chart below).

[19] http://www.cboe.com/LearnCenter/pdf/CoveredCallsStrategy.pdf
[20] http://www.fool.com/investing/general/2009/01/08/5-stocks-for-strong-income.aspx
[21] http://papers.ssrn.com/sol3/papers.cfm?abstract_id=966287



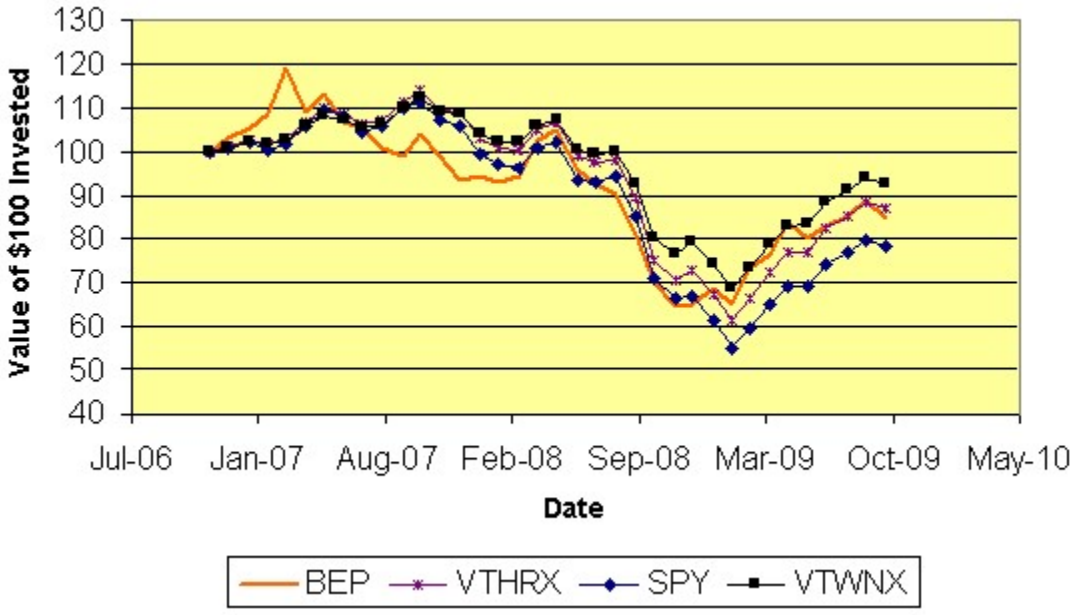
Because implied volatility (VIX) is largely determined by trailing historical volatility, a market with declining volatility tends to favor a buy-write strategy because the options that you sell are priced largely based on implied volatility that is higher than what actually occurs (because there is a long-term downward trend in VIX). Thus, while the Russell 2000 study is interesting, it is far from a conclusive case for always selling covered calls. Certainly there were some spikes in volatility over this period, but the long-term trend gives us almost a 50% drop in volatility over this period. This is consistent with the authors' conclusion that implied volatilities were too high relative to what actually occurred. In 2007-2008, this trend strongly reverses, and VIX went as high as 80. Any strategy that repeatedly bet against volatility (as with this buy-write strategy) would have done well in the period analyzed in the 10-year Russell 2000 study—but betting against volatility over the long-term is ultimately a directional bet.

Ibbotson Associates performed an analysis of the performance of the CBOE S&P500 Buy-Write strategy over the period from June 1998 through March 2004[22], a 16-year period. This study found that the CBOE Buy-Write Index (BXM) generated returns almost identical to those of the S&P500, but with only two thirds of the volatility of the S&P500. This period also exhibits a downward trend in VIX, although the trend is less severe than that in the period of the Russell 2000 study. The Ibbotson study concludes that including a buy-write index in some proportion in a portfolio will tend to increase the portfolio's risk-adjusted return.

I have concerns about simple buy-write strategies as the basis for a perpetual strategy or, for that matter, for mutual funds (such as BEP, FFA, and IGD) and I wrote a couple of

[22] http://corporate.morningstar.com/ib/documents/MethodologyDocuments/IBBAssociates/CBOE_SPBuyWrite.pdf

articles about these funds back in February of 2006[23] [24]. Back then, these funds were receiving a lot of positive attention. BEP is designed to track the CBOE S&P500 Buy-Write Index, an index that assumes that you repeatedly sell one-month call options against the S&P500. In principle, the three plus years since I wrote these articles should have been favorable for buy-write strategies because the market has declined. Selling off the gains from the S&P500 has not been any sacrifice at all. BEP has not particularly distinguished itself over the last three years (see chart below), however. One hundred dollars invested in BEP three years ago (through October 2009) is currently worth a good bit more than an equal investment in the S&P500 (SPY). But is this the right benchmark? By selling off the call options, you are clearly reducing the available upside, so perhaps BEP is better benchmarked against an asset allocation fund with some allocation to bonds, which also has less market exposure than the S&P500. The chart below also shows the value of $100 invested in Vanguard's low-cost 2020 target date fund (VTWNX) and 2030 target date fund (VTHRX). One would have been better off in either of these over the past three years than in BEP.



Using historical data from Jan 1990 through March 2009 on BXM, VIX, and the S&P500 obtained from the CBOE website, I examined the degree to which the performance of the BXM compares to the S&P500 in terms of total return as a function of VIX. In months when VIX increases, BXM beats the S&P500 buy an average of 0.79% (though both BXM and SPY average negative returns in these months). In months in which VIX

[23] http://seekingalpha.com/article/6829-further-thoughts-on-call-writing-closed-end-funds-bep-ffa-igd-jpz-jsn-mcn-nfj

[24] http://seekingalpha.com/article/6560-call-writing-closed-end-funds-hard-to-judge-future-risk-return-bep-ffa-igd-jpz-jsn-mcn-nfj

decreases, SPY beats BXM by an average of 0.59% per month. In months when VIX is less than 20%, BXM beats the S&P500 by 0.04% per month. In months when VIX is greater than 20%, BXM beats the S&P500 by 0.57% per month. When VIX is high, selling covered calls looks especially attractive (and vice versa). When VIX is rising, selling covered calls looks attractive (and vice versa). The result that rising VIX will be good for a covered call strategy in these data seems a bit paradoxical in light on the opposite conclusion in the discussion of the Russell 2000 study. This effect is complicated by the negative correlation between the return on the index and the implied volatility on the index. In a rising market, VIX tends to fall, and both of these effects will tend to make the buy-write strategy under-perform the index. This correlation is not 100%, however, so there can be periods in which VIX and return do not move in opposite directions. The dynamics are complex and the potential gains from a mechanical buy-write strategy are driven by a number of forces that are not constant in time.

In summary, I am intrigued by historical studies of the risk-return proposition of buy-write strategies. My own research suggests that selling of covered calls appears to make more sense on a period-by-period analysis rather than being applied as a perpetual strategy. The further issue that I have with covered call strategies is that the net position that you hold is equivalent to selling put options. Selling put options into the market gives you limited upside and unlimited downside. That said, the research supports the practice of selling near-term (1-month) covered calls as a way to reduce portfolio volatility with both the Russell 2000 and the S&P500. Furthermore, the research studies cited above found that selling longer-dated options does not work nearly as well, if at all. A short-term approach to selling covered calls has provided value over extended periods of time, but such strategy should be undertaken with considerable care due to the high level of transaction costs incurred and the potential tax consequences.

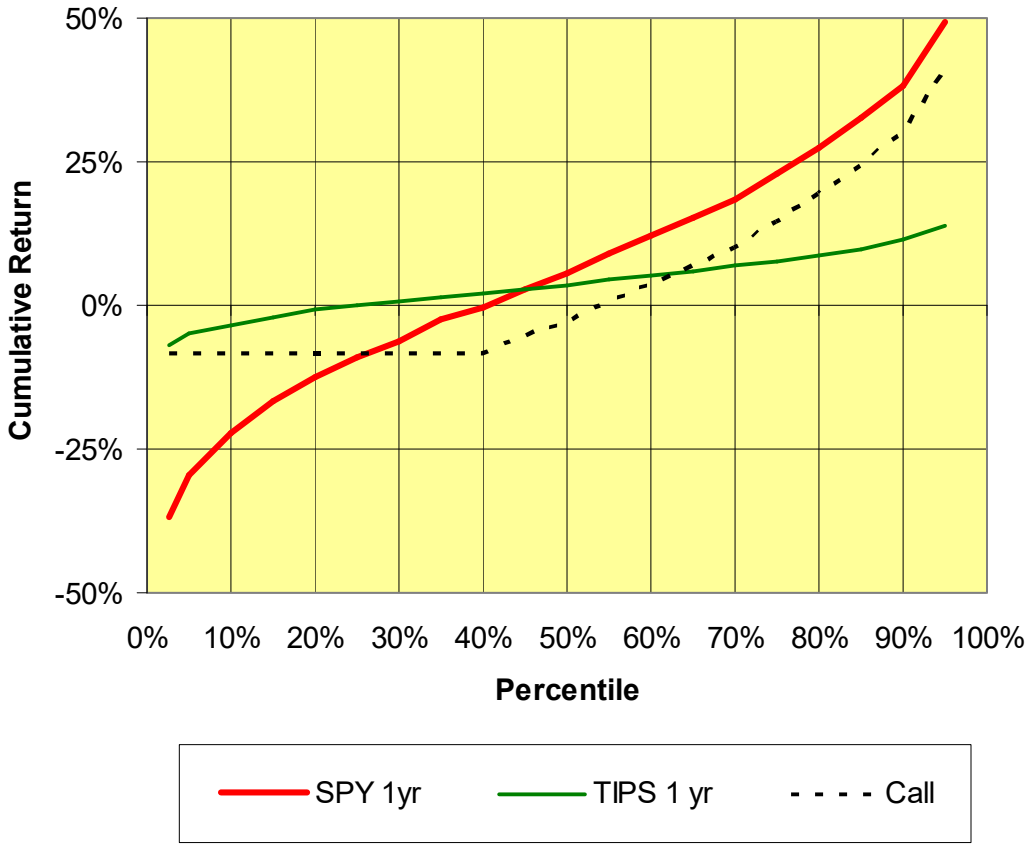
Because the purpose of this book is to explore alternative options strategies, it is worthwhile to note that a simple buy-write strategy is implicitly a bet against black swans and the case made by Zvi Bodie. In the buy-write approach, you are holding a net position of consistently selling put options and receiving dividend payments (because being long the stock and selling the calls leaves you with a net position of having sold a put). Bodie and Taleb think that investors should have net positions in which they own options rather than selling them.

For buy-write to make sense, what conditions need to be satisfied? First, if dividends are out of favor, this might make sense. Second, if implied volatility is too high and the market is therefore willing to pay a lot for the call options, this can make sense. If the market is over-estimating the potential for large declines, selling covered calls can make sense (this is synonymous with high implied volatility). On the other hand, Bodie and Taleb make compelling cases that markets tend to discount the probability of large improbable events, which would make selling covered calls unattractive as the basis for a long-term strategy. The bottom line is that there is an implicit bet against large improbable events—both up and down—when you pursue a buy-write strategy.

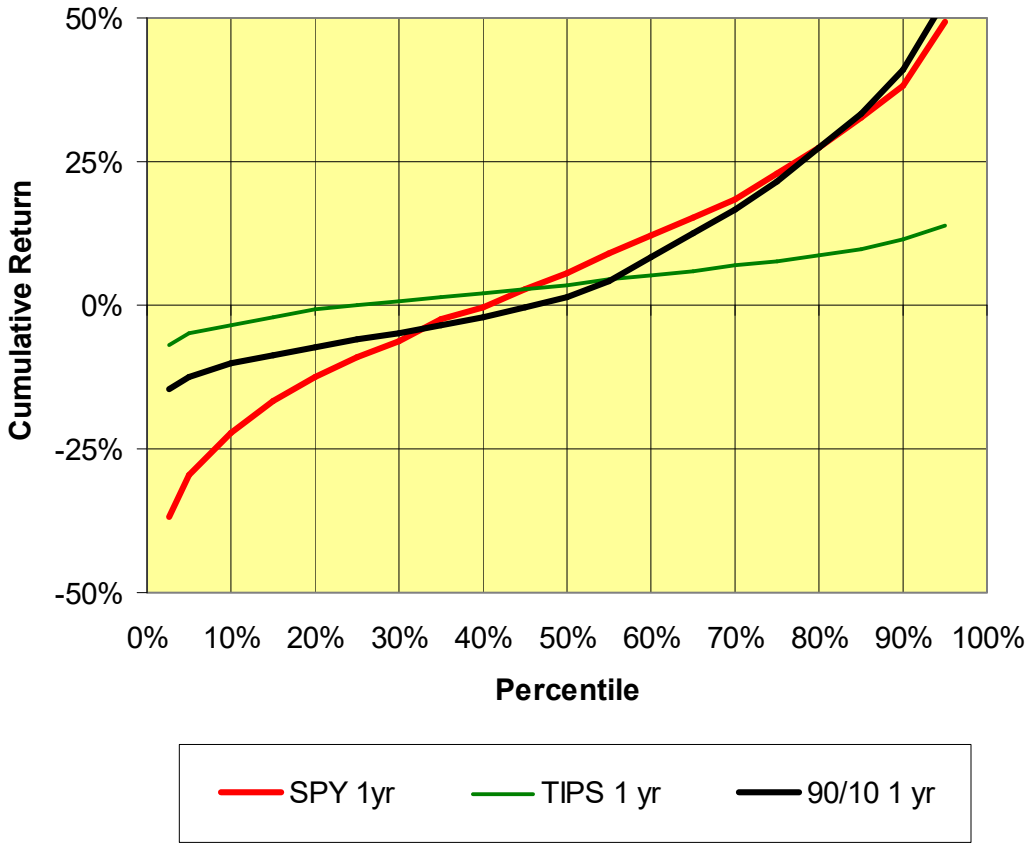
Ways to Use Options: Zvi Bodie's Concept

As a counterpoint to the strategy of **selling** (covered) calls, let's now consider a strategy that has an investor **buying** call options. Back in 2001, Professor Zvi Bodie made what was at the time a radical suggestion. He wrote an article in which he suggested that stocks actually get riskier the longer you hold them, rather than less risky (as most people believe). I summarized his position in the 'Big Picture Concepts' section. If stocks do not become less risky over time, what is an investor to do? Bodie proposes that the most sensible alternative is to put 90% of your portfolio in TIPS and 10% in call options on the S&P500. Why might this make sense?

To begin, let's revisit the percentile payouts for the S&P500 (SPY), TIPS (TIP) and a call option on SPY with a strike price just slightly above the current price of the S&P500. The chart below shows projected returns for a one-year horizon.



Based on these projections (from QPP), we can simulate the performance of a portfolio that is 90% invested in TIPS and 10% invested in at-the-money call options on SPY (see below).



Outcomes for the Bodie 90/10 Strategy

This example (and there are a number of similar and detailed examples in my article devoted to this topic[25]) highlights the attractive features of Bodie's model. The S&P500 has a 5% chance of losing about 30% ore more in a year in these Monte Carlo simulation results (the level of the 5th percentile in the chart above). TIPS, by contrast have a 5% chance of losing about 6% or more. At the median outcome (the 50th percentile), the S&P500 returns 8% (5% after inflation), TIPS return about four and a half percent, and the 90/10 strategy returns less than TIPS. Remember, however, that the median is not equal to the average here. On the other hand, in a very good year (90th percentile and above), the 90/10 strategy generates as much return (and even perhaps a little more) than the S&P500, even though 90% of the portfolio is in bonds. In a bad down market, your losses are largely capped because you have 90% in TIPS. In a big bull rally, you are sufficiently leveraged with the call options that you have as much upside as if you had 100% in equities.

I explored this strategy in various forms in my article devoted to this analysis[26] and I found that the general strategy looked attractive under a range of stress tests. In one stress test, I examined the case in which the call options that were purchased were

[25]http://www.advisorperspectives.com/newsletters09/Managing_Downside_Risk_in_Retirement_Planning.php

[26] See footnote 24

systemically over-priced by 25% and the basic features of the outcomes were the same, albeit slightly less attractive. I looked at this strategy using call options on the NASDAQ 100 index (QQQQ) or emerging markets (EEM) rather than the S&P500, and the results continue to hold up.

In general, the Monte Carlo results look even more favorable when we use call options in higher-Beta[27] indices (such as QQQQ and EEM) because these tend to have higher diversification benefits relative to TIPS (because TIPS are very low Beta). This makes sense on a number of levels. The goal of the 90/10 strategy is to combine a large allocation in low risk assets with a small allocation in a highly leveraged risky asset class. Higher Beta essentially provides additional leverage relative to the S&P500. Further, there is some evidence that options on high-Beta assets are under-priced relative to options in low-Beta assets—so call options on high-Beta assets are relatively cheap[28]. In limited analysis, my Monte Carlo simulations agree with this assessment (more on this later).

This sounds great, so where are the potential problems? First, of course, there is the question of the relative cost of the call options. If long-term call options (with one year or more to expiration) are too expensive, we might end up buying options that are too expensive and never getting adequately compensated in the payouts from these options (which is exactly what the authors of the covered call study on the Russell 2000 find for one-month options[29]). The authors of the Russell 2000 study find that their covered call strategy is not a good choice for options with expirations longer than one month, however, which would suggest longer dated options were ***not*** consistently over-priced in their data set—which provides support for the 90/10 approach. I will admit that concern over the relative valuation of the long-dated call options was a factor for me for quite some time. The answer to this question is far from perfect, but here is what I conclude. Whether you are buying stocks and ETF's or call options on these stocks and ETF's, you are faced with the problem is determining the best estimates for future risk and return. There is no more inherent risk in buying over-priced call options than in buying over-priced assets themselves.

When you buy a stock or ETF or an option on that stock or ETF, you are buying at the price the market is offering. An ETF may be over-priced when you buy it, and this may also be the case with a call option. There is no reason to believe that a long-dated call option is ***more*** likely to be over-priced relative to the risk you bear than the ETF or stock. If we think of investing as a process of making decisions in the face of uncertainty in estimates of risk and return, taking a small leveraged position in risky assets and keeping the majority of your allocation in a safe asset class makes a great deal of sense—and this favors owning call options vs. owning stocks.

I believe that the discomfort that most investors and advisors feel with regard to options is that options 'feel' more risky because you can (and quite often will) lose 100% of the

[27] Higher Beta with respect to the S&P500
[28] http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1324605
[29] See section on covered call strategies

money used to buy the calls. I believe that buying stock makes people feel more comfortable because they 'own' something—a piece of a company. I understand and I can relate. There is definitely an emotional comfort is buying a piece of a company as opposed to buying a call option which gives me the right to buy stock but does not actually confer ownership in anything. My conclusion with regard to this behavioral aspect of options vs. buying the assets is that it is just that: a feeling or perception that is not grounded in a justifiable reality. Knowing that our discomfort is 'all in our heads' does not make it any easier to overcome, of course, but simply thinking about the fact may help in motivating people to become more conversant with options.

A Concrete Example of Bodie's Strategy

The Bodie strategy can strike readers as somewhat theoretical or abstract. As a concrete example, we can start with an article that I wrote in February of 2007 in which I valued long-dated options on the S&P500 (SPY)[30]. Back then, you could buy Dec 2009 call options on SPY with a strike price of $145 for about $20.50 and SPY was trading at $145.65. You could have purchased call options at the same strike, but with an expiration of December 2008 for about $15.50, and with an expiration of Dec 2007 for about $9.50. This snapshot in time provides a nice way to really see how Bodie's strategy would have played out. As a starting point, I will note that QPP (with all default settings) estimated at that time that these call options were priced at (or slightly below) fair value.

The December SPY options do not always expire on the same date, but they do expire in the last two weeks of the month. For reference purposes, I am going to look at how the Bodie 90/10 strategy would have worked as of mid-December 2009 in the case that you implemented it in Feb 2007, when the options quotes were obtained and the options were valued.

Before getting into the details, let's try to set to the stage somewhat realistically. In February of 2007, the market had been enjoying quite a rally. Back then, the Dow got well above 12,500. As of December 2009, the Dow is around 10,500. In the period between these two dates, the Dow dropped below 6,500. In February 2007, you could buy all of the potential upside of the S&P500 between then and December 2009 by buying the call on SPY for $20.50 vs. paying $145.65 to buy a share of SPY.

Case Study: Buy Dec 2009 calls and TIPS in February 2007

Let's assume that we were back in February 2007 and we were looking at implementing the Bodie 90/10 using the Dec 2009 call options. What would have happened if we had purchased 90% TIPS (in the form of the TIP ETF) and 10% Dec 2009 call options?

Since that article was written and published in February 2009, I only had data available through January 2007 as model input. When the article was published in mid-February of 2007, SPY was trading at $145.60 and today SPY is at $109.60. This does not account

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

for dividends, however. When we do so, we find that SPY actually declined 20.1% over this period.

If we had purchased 90% in TIPS and 10% in Dec 2009 $145 call options, how would things have turned out? The $145 call options would be getting close to expiring absolutely worthless, given that SPY is at $109.60. On the other hand, only 10% of the portfolio was invested in these call options, so you would be down 10% vs. being down a hair over 20% if you had simply purchased SPY. TIP, a TIPS ETF, closed at $99.16 on Feb 14 and it is at $106.51 as of this writing. When we account for the impact of dividends, TIP has returned a cumulative 19.3%. *The 90/10 position has returned a total of 17.3% (90% x 19%). A portfolio 60% allocated to SPY and 40% allocated to TIP has returned a cumulative -4.4%.*

If we run QPP using all baseline settings (three years of historical data as input) through Jan 2007, how did things look back then? A portfolio allocated 60% to SPY and 40% to TIP was projected to be able to provide $45,000 per year in real income (assumed to increase by 3% a year) for a retired 65-year old, with only a 20% chance of running out of money by age 91[31]. If that same 65-year-old was invested 100% in TIPS, he was projected to have a 20% chance of running out of money by age 85.

If the 65-year-old had 90% of his portfolio invested in TIPS and 10% invested in the Dec 2009 $145 call options, he had a 20% chance of running out of money by age 87. What is crucial to note here is that our hypothetical 65-year-old had no way of knowing what call options would cost in the future—so we are just calculating how the one-time investment in Dec 2009 call options impacts his/her future. Putting 10% of his/her portfolio in a one-time investment in the call options was projected to add 2 years to his/her reliable retirement income vs. investing in TIPS alone, and this portfolio had a maximum 10% loss due to a decline in the equity markets.

A portfolio with 90% in TIPS and 10% in SPY was also projected to have a 20% chance of running out of funds by age 87, so where is the attraction of Bodie's 90/10? First, the 90% TIPS/10% calls strategy is a one-time investment in the SPY calls, and assumes a 100% investment in TIPS thereafter vs. a portfolio that maintains a perpetual 10% allocation to SPY. Second, if the market had rallied rather than fallen over the period from February 2007 through December 2009, the 90/10 portfolio would have provided far more gains than a portfolio with 90% in TIPS and 10% in SPY.

Third, it is hoped and anticipated that there will be an opportunity to purchase another batch of call options at the expiration of the first batch, which could add *another* two years to the projected retirement horizon—but this cannot be determined because we did not know back in February 2007 what would happen to options prices—and it has been quite a ride. The VIX index is much higher than it was in February 2007 and it was much higher still through most of 2009. A higher VIX means that at-the-money call options are more expensive. In a practical sense, the attractiveness of buying call options is partly

[31] A 50% SPY / 50% TIP portfolio also gives a 20% chance of running out of funds by age 91

determined by the prices of those options relative to estimates of long-term fair levels of market volatility.

Even with the unknown of market volatility (and options prices) we had a situation in early 2007 in which using 10% of a portfolio of TIPS to purchase call options with 2.9 years to expiration was expected to add 2 years to projected safe retirement income vs. simply investing 100% in TIPS. By contrast, we would have had to add a perpetual 10% allocation to SPY to obtain the same benefit.

The period from February 2007 through December 2009 provides a very good motivation for the Bodie 90/10 kind of strategy and serves as a stark reminder that counting on the averages of market returns may not work out.

Rolling and Laddering

The case study above highlights one of the challenges with assessing Bodie's 90/10 strategy for long-term planning: you cannot know how much at-the-money options are going to be selling for at a specific date in the future. Options prices move with implied volatility and with the price of the underlying asset class. To deal with this issue an investors can 'ladder' options by putting a portion of the 10% allocated to options into options with a number of different expiration dates. This provides a very small amount of diversification. An easy way to examine this effect is to use RiskGrades, an excellent free tool (www.riskgrades.com) from RiskMetrics, the leading firm in providing risk management tools to large banks and trading operations. If you register for the site, you can enter a portfolio (including options) and look at its projected risk. You can also track how these portfolios far over time, how the risk evolves etc.

I created three model portfolios at RiskGrades in September 2009. The first was a generic 60/40 portfolio: 60% in SPY and 40% in AGG. The site projects that the 60/40 portfolio is **0.57** times as risky as the S&P500. My generic Bodie strategy portfolio has 10% in options (with two years until expiration in September—i.e. Sep 2011 expiration) that were close to being at-the-money (strike = $110), and 90% in TIPS (TIP). As of December 09, RiskGrades projects that this portfolio is **0.67** times as risky as the S&P500. I also created a portfolio that I called *Bodie v2*, which splits the 10% invested into call options into three groups—all with the same strike price of $110, but with three different expiration dates: September 2010, September 2011, and September 2012). As of December 2009, this portfolio is estimated to be 0.72 times as risky as the S&P500—more risky than the portfolio with just one call option expiration date for the entire 10%. This is caused by the fact that there is almost no diversification benefit from combining options on SPY with different expiration dates, and the risk associated with the combined portfolio of options is actually higher than the risk of the original single-period options.

It is very important to remember, of course, that risk (as measured by the RiskGrades) is based on volatility (standard deviation in return) and thus does not account for the attractive skewness effects created with the 90/10.

An investor may also use a ***roll forward*** strategy in which he/she sells off some or all of the un-expired options at some point in their lifetime and then buys options with a longer expiration date. So, for example, if you buy at-the-money call options with a one-year expiration, you might plan on rolling these forward by selling the options in six months and buying another batch of one-year at-the-money options. The benefit of a roll forward strategy is that you can never end up in a situation in which all of your call options expire and you end up purchasing call options at a much higher price. I can see merits in a roll forward strategy combined with Bodie's general 90/10 approach, but this is an area of active research on my part—I have come to no conclusions and there have been no articles published on this topic that I am aware of.

As I have written elsewhere, I feel that Zvi Bodie's 90/10 proposal is a true innovation in thinking about retirement savings. I have already devoted considerable time to analyzing it and I have corresponded with Dr. Bodie, who remains a steadfast advocate of the approach. I am also surprised that there has not been more quantitative interest focused on this approach for retirement savings. This is, for me, a topic of ongoing active research.

Ways to Use Options: Contrarian Strategies and Volatility

One of the more interesting ways to use options is to take a contrarian view with respect to volatility. When the market is complacent (as it was in the years up to 2007), risk is priced cheap (implied volatilities tend to be low). When the market is under stress, implied volatilities can go very high and risk coverage is expensive. In the years leading up to the crash of 2007-2008, I wrote repeatedly about how anomalously low implied volatility was[32]. The market was becoming indiscriminate in taking on risk, and implied volatilities were historically low across every major asset class. This meant that options were cheap.

After October of 2008, implied volatilities had skyrocketed, so options were very expensive. What is the rational thing to do when investors are exceedingly risk averse? Sell options. Standing at the end of 2008, it would have taken a pretty gutsy investor to sell put options, but the data suggested that this was a good course of action.

In late November of 2008, I wrote an article called ***Profiting from Risk Aversion***[33] in which I tried to determine whether options were reasonably priced, given the massive increase in market volatility. To begin, I projected volatility for a range of stocks, given the assumption that the implied volatility on the S&P500 was 'fair.' At that time, the implied volatility for SPY for at-the-money options with an expiration of December 2009 was 45%. I increased QPP's baseline projected volatility for the S&P500 to this level, and then looked at the projected volatilities for a range of stocks and compared these to the implied volatilities of Jan 2010 at-the-money options on these stocks (I used Dec 2009 for SPY and Jan 2010 for the stocks because SPY has different expiration dates than individual stocks for options).

Ticker	Expiration	Implied Volatility (at the money options)	QPP Projected Volatility	Trailing 3-Year Volatility
SPY	Dec-09	45%	45%	15%
KO	Jan-10	44%	32%	16%
JNJ	Jan-10	38%	24%	14%
WMI	Jan-10	49%	23%	16%
PG	Jan-10	46%	22%	16%
DUK	Jan-10	44%	23%	13%
GSK	Jan-10	47%	21%	15%
SO	Jan-10	37%	20%	12%
KMB	Jan-10	45%	14%	11%

Implied volatility for long-dated options vs. QPP projections

Table from the original article in November 2008

What was immediately notable when I performed this analysis is that even if you believed that the extremely high implied volatility for SPY was 'fair', the resulting

[32] http://seekingalpha.com/article/27508-foreign-and-domestic-market-risk-outlook-from-february-2007
[33] http://seekingalpha.com/article/107756-profiting-from-risk-aversion

projected volatilities of individual stocks were still far higher than one would expect. The implied volatilities on these individual stocks were as high as three times the level that was projected by the Monte Carlo model, given a 45% projected volatility for SPY. These levels of volatility seemed irrational, given that there are generally fairly consistent risk/return relationships across asset classes (see ***Volatility Across Asset Classes***). The implications of these results are that options on these stocks would be far over-priced and thus it was attractive to sell call options on these high-yielding stocks. One might also have sold put options (because selling covered calls leaves you with a position similar to having sold put options), but the high dividend yields that were available (which you receive if you sell covered calls but not if you sell puts) made covered calls look especially attractive.

In the Nov 2008 article, I listed the current market prices of a series of these over-priced call options:

Ticker	Expiration	Strike Price	Price of Stock	Bid Price of Option
SPY	Dec-09	$90.00	$83.40	$10.45
KO	Jan-10	$50.00	$43.93	$4.80
JNJ	Jan-10	$65.00	$58.22	$5.50
WMI	Jan-10	$35.00	$29.95	$3.30
PG	Jan-10	$70.00	$63.02	$6.70
DUK	Jan-10	$17.50	$15.04	$1.25
GSK	Jan-10	$40.00	$34.38	$3.30
SO	Jan-10	$40.00	$35.22	$2.60
KMB	Jan-10	$70.00	$55.95	$3.60

Table from original article in November 2008

Since this article was written, the SPY dropped for a while, but has risen dramatically to more than $110 (vs. $83.40 at the time the article was written). This would not seem to be a period in which writing covered calls would have been a great idea. Let's look at where things would stand as of this writing (11/23/2009). The results are summarized below.

Ticker	Option Expiration	Strike	Price of call option (as of 11/23/2009)	Price of Stock (as of 11/23/2009)	Outcome from buying stock / selling call	Outcome from buying stock
SPY	Dec-09	$90.00	$20.80	$110.8	23.4%	32.9%
KO	Jan-10	$50.00	$8.25	$58.2	10.8%	16.6%
JNJ	Jan-10	$65.00	$0.51	$62.7	17.9%	7.7%
WMI	Jan-10	$35.00	$0.42	$33.3	23.3%	11.1%
PG	Jan-10	$70.00	$0.12	$62.7	11.1%	-0.5%
DUK	Jan-10	$17.50	$0.08	$16.5	19.0%	9.6%
GSK	Jan-10	$40.00	$2.70	$42.1	26.9%	22.6%
SO	Jan-10	$40.00	$0.03	$31.9	-2.4%	-9.6%
KMB	Jan-10	$70.00	$0.25	$65.7	25.0%	17.4%

Outcomes as of 11/23/2009

The original article suggested that selling covered calls against the individual stocks (not SPY) was a reasonable way to bet that the options on these stocks were over-priced,

without having to deal with margin requirements associated with selling naked calls. The average return on simply buying these stocks over the roughly one-year period since the article was published is 9.4%, while the average return for the covered call strategy is 16.5%. It is a mark of how over-priced the call options were that selling covered calls still resulted in positions that generally out-performed simply owning the stocks in a broadly rising market. In general, this would not be the case—and it was certainly not the case for the S&P500, for example (SPY).

The example above is not intended as proof, but rather an example of how one might think through positions in which market volatility seems irrational and worth exploiting. While the market has rallied dramatically since November 2008, this was not a foregone conclusion. Selling calls into an irrationally risk-averse market provided protection if the market had declined.

The opportunity to sell call options at such a high price relative to fair value is not something that can be counted on as an 'all the time' strategy. When it is present, however, it is worth paying attention to. The idea that options can be so badly mis-priced suggests that there are substantial tactical benefits to trying to exploit the mis-pricing. This would seem to run counter to a strategy such as Bodie's 90/10 in which one is essentially betting that options are consistently priced fairly. On the other hand, if options are mis-priced it is also likely that the underlying assets are mis-priced, so the real question becomes whether options are likely to be worse priced than the broader market. It is, ultimately, not inconsistent that Bodie's 90/10 strategy has performed well in recent years and that there were tactical strategies that performed well within this period.

The basic idea applied here is that you can value options based on their correlation to the broader market and the implied volatility of the market index, and compare the volatility that you would expect from the correlation to the option implied volatility. This framework for valuing options is a topic of ongoing research, but seems to make considerable sense.

Ways to Use Options: Are You Long or Short Volatility?

One very interesting strategy using options is to adjust the exposure of your portfolio to market volatility. Among professional traders, it is quite standard to ask whether a portfolio is net long or short volatility. What this means is whether a portfolio will benefit from increased levels of volatility (long volatility) or will be hurt by increased in volatility (short volatility).

Any portfolio that was long the major asset classes would have be net short volatility. What investments would tilt a portfolio towards being net long volatility (or at least neutral with respect to volatility)?

The average retail portfolio is naturally net short volatility: the portfolio will suffer losses if market volatility increases. Why is this? The returns on most major asset classes are negatively correlated to market volatility (VIX). For a useful overview of VIX and how VIX moves relative to the S&P500, Standard and Poors has produced a useful whitepaper[34].

In August of 2007, before the market crashed, my analysis showed the following correlations between returns on a wide range of major asset classes and VIX[35]:

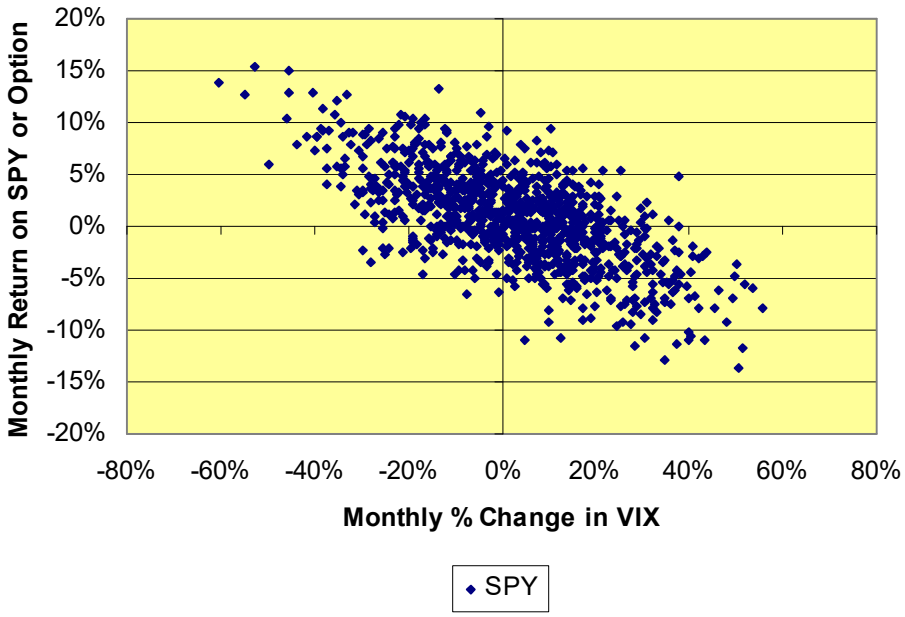
[34] http://www2.standardandpoors.com/spf/pdf/index/SP_500_VIX-ShortTermFutures_WhitePaper.pdf
[35] http://seekingalpha.com/article/43453-portfolio-management-in-increasingly-volatile-markets

ETF	Ticker	Correlation to VIX
iShares S&P 500 Value Index	IVE	-67%
iShares S&P 500 Index	IVV	-67%
SPDR DJ Wilshire Large Cap Value	ELV	-63%
iShares Russell Midcap Value Index	IWS	-61%
iShares Russell Midcap Index	IWR	-61%
iShares MSCI Mexico Index	EWW	-61%
iShares S&P SmallCap 600 Value Index	IJS	-60%
iShares MSCI Singapore Index	EWS	-59%
MidCap SPDRs	MDY	-57%
iShares S&P Latin America 40 Index	ILF	-55%
Vanguard Financials ETF	VFH	-55%
iShares MSCI Hong Kong Index	EWH	-55%
iShares MSCI Sweden Index	EWD	-54%
BLDRS Emerging Markets 50 ADR Index	ADRE	-54%
iShares MSCI Emerging Markets Index	EEM	-52%
iShares Dow Jones US Financial Sector	IYF	-51%
iShares Dow Jones Select Dividend Index	DVY	-50%
iShares Dow Jones US Telecom	IYZ	-49%
iShares MSCI Brazil Index	EWZ	-47%
iShares MSCI Netherlands Index	EWN	-47%
iShares Dow Jones US Basic Materials	IYM	-46%
iShares Dow Jones US Real Estate	IYR	-45%
Materials Select Sector SPDR	XLB	-45%
iShares MSCI Austria Index	EWO	-43%
iShares MSCI Pacific ex-Japan	EPP	-43%
iShares MSCI EAFE Index	EFA	-43%
iShares MSCI Spain Index	EWP	-43%
iShares MSCI Germany Index	EWG	-42%
BLDRS Europe 100 ADR Index	ADRU	-42%
Telecom HOLDRs	TTH	-42%
iShares MSCI France Index	EWQ	-42%
DJ Wilshire REIT ETF	RWR	-41%
iShares MSCI Switzerland Index	EWL	-40%
iShares MSCI South Korea Index	EWY	-40%
iShares MSCI Italy Index	EWI	-40%
iShares Cohen & Steers Realty Majors	ICF	-40%

Correlations between VIX and Return on Major Asset Classes from August 2007

These high negative correlations were suggesting that if VIX increased, returns on these asset classes would be substantially negative. Further, I noted in this article (and many articles in this period) that VIX had nowhere to go but up because VIX had declined to historically low levels at that time.

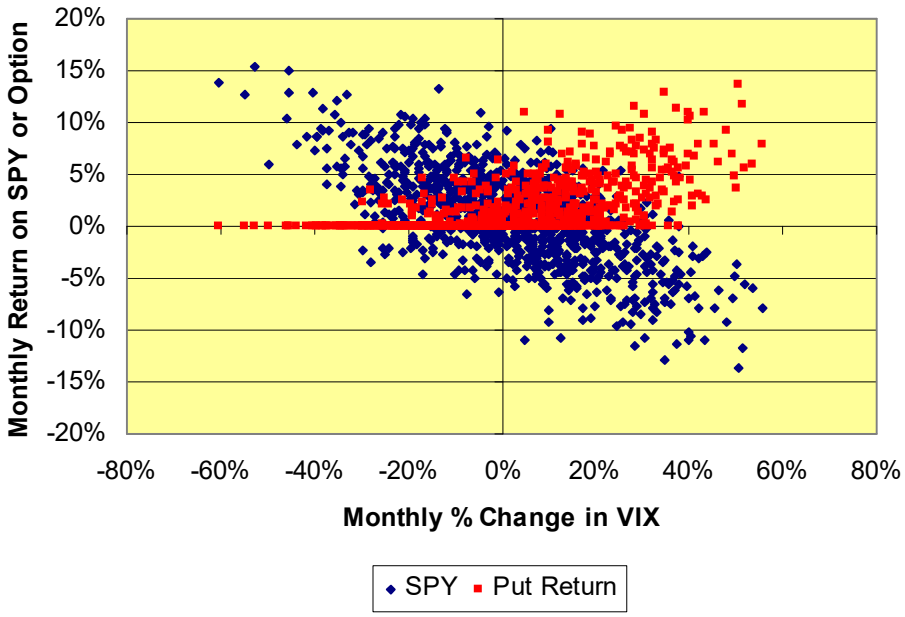
As of the end of October 2009, the correlation between SPY and VIX remains at -67%. What does that mean in terms of our basic expectations?



Simulated 1-Month Returns on SPY vs. VIX

The chart above shows Monte Carlo Simulations of VIX vs. Monthly returns on the S&P500. This really shows how powerful the -67% correlation is between the returns on the S&P500 and the changes in VIX. The return on SPY can be positive when VIX is rising, but you are far more likely to have negative returns (and vice versa).

How can we use options to change the correlation of a portfolio with VIX? The simplest thing to do is to purchase put options. The payout from a one-month put option vs. a change in VIX is shown below:



The payoff from the at-the-money put option is positively correlated with VIX.

The chart above simply shows the payoffs of a put option as a function of VIX but does not show the change in expected value of an option as a function of VIX. As VIX rises, the expected values of both call options and put options increases, although the price of the underlying asset tends to falls so that the value of puts increases and the value of calls decreases. Put options are thus more of a pure play on a rising VIX. Note, however, that simply buying call options for your equity exposure (a la Bodie) is equivalent to buying an equity index and buying a put option on that index.

An alternative to buying options for managing the directional tilt of a portfolio with respect to VIX is to purchase one of the new ETN's that are designed to track the VIX index[36]: VXX which is designed to track short-term futures on VIX and VXZ which is designed to track mid-term futures on VIX. These ETN's are very new and I am interested in examining them in more depth once they have more market history. For the time being, options seem like a more trustworthy vehicle for managing exposure to overall market volatility.

There is no consensus as to whether it is desirable to seek out a portfolio that has low or zero correlation to changes in VIX, but it is worth understanding that the vast majority of investors are substantially short VIX—they will do well in an environment of falling market risk and poorly in an environment of rising market risk. This was especially germane in 2007 when VIX levels were at near historic lows.

[36] http://finance.yahoo.com/q?s=VXX

Ways to Use Options: Managing Tail Risk

I earlier cited El-Erian on the topic of 'tail risk insurance.' We know that our ability to quantify the probability of very extreme events is limited (at best). Even if we could quantify these risks, we still need to realize that even if the odds are low, we need to make sure that a 1-in-100 event is survivable. This, all by itself, is something of a challenge. If we have learned anything from 2007-2008, however, it is that really bad scenarios can occur and propagate through our economy with breathtaking speed. What tools are available for managing tail risk? At its simplest level, this equates to buying put options on the downside of a portfolio. El-Erian and his cohorts described their strategy in more depth in an interview in 2008[37]:

There are four basic ways we can implement our tail risk hedges:

- *Purchase Treasuries or Eurodollar futures, which should rally during a flight to quality or monetary policy easing.*
- *Acquire options or option-like securities such as puts or calls on macro markets, swaptions, or out-of-the-money tranches on CDX or iTraxx indexes[38].*
- *Take positions with negative correlation to tail risk, such as momentum strategies that move with volatility indicators including the VIX (CBOE Volatility Index).*
- *Simply move off the mean-variance efficient frontier by reducing exposure to risk assets, such as credit or stocks.*

For the moment, I am going to focus on the elements of these strategies that involve options. First, note that El-Erian suggests buying options—the obvious choice—but he has made it clear that the price you pay matters (as in the quote in the ***Big Picture*** section). Also note that he advocates taking on positions that have negative correlation to tail risk via positive correlation to VIX, the topic of the previous section.

In El-Erian's earlier comments, he is quoted as saying that *"the fourth component [of building a successful portfolio] involves asking what a really bad state looks like, and if there is cheap insurance against it."* Addressing the question of whether the available tail insurance is cheap or not is the hard part of the problem. It seems simply rational to look at the price of available 'insurance' and to look at whether it can enhance your portfolio. Oddly, very few people do this. It is important to keep in mind that the simplest approach to 'insurance' is to buy put options on the major indexes that your

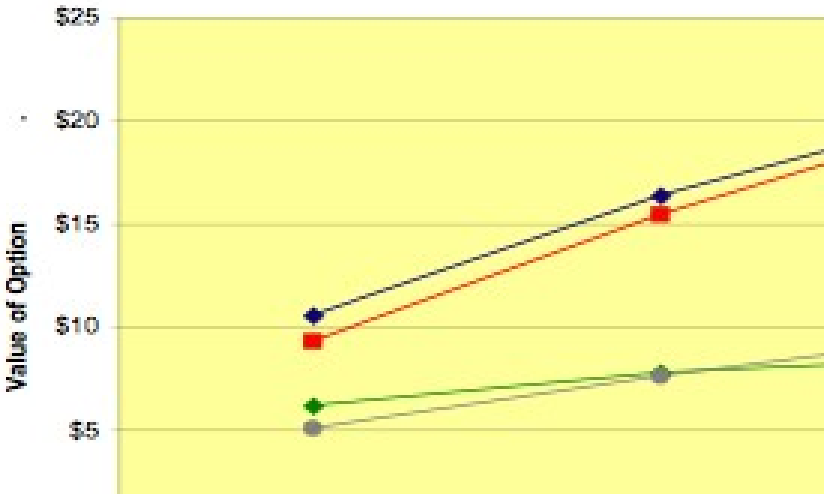
[37]http://www.pimco.com/LeftNav/Product+Focus/2008/Product+Focus+Global+Multi+Asset+Strategy+October+2008.htm

[38] CDX and iTraxx are credit default indexes (http://www.markit.com/news/2005%2008%20CDS%20Index%20Primer%20-%20Final.pdf)

portfolio tracks but that simply buying call options is equivalent to owning the underlying index and buying puts on that index.

The simplest approach to buying 'tail insurance' is to buy far out-of-the-money put options on major indexes (such as the S&P500). This strategy becomes less attractive in the presence of a 'volatility smile.' You pay proportionately more for options as they go further out of the money, so the relative cost of insurance gets higher. The effectiveness of a put buying strategy hinges on buying options when they are cheap—and that is precisely when people tend to think they don't need to buy the puts.

Back in February of 2007, I noted that you could buy puts on the S&P500 that expired at the end of 2008, with a strike of $145, for about $7.50[39]. The chart below shows this case, along with other expiration dates, as well as prices of calls.



Call and Put Options on SPY with a Strike of $145 (from original article)

In the February 2007 article, I wanted to look at the degree of correspondence between the prices of call and puts on SPY and EFA (which tracks the EAFE index) with projected fair values generated using Quantext Portfolio Planner (QPP). Note that the agreement was very good, which means that the options prices appeared (broadly) to be quite fair. At that time, however, these options appeared expensive if you compared the implied volatility for the options (about 15%) to the trailing historical volatility for the S&P500, which was at about half this level. In other words, in the context of recent years, these options looked expensive, whereas they looked to be priced at fair value using a Monte Carlo projection from QPP. The Dec 2009 put options on SPY were trading at about $10 a chare and the Monte Carlo projections put the fair value at about $9 a share. As of this writing, SPY is at about $109 and the Dec 2009 put options will expire in about two weeks—and the put options with a $145 strike are trading at $36 per share, more than three and half times what they cost back in February 2007.

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

The big question is why so few investors purchased put options on the broad indexes as a form of insurance. The answer, I believe, is simply that they did not recognize that these options were trading at a fair value. These options only looked like they were trading at fair value if you assumed that overall market volatility would return to its long-term historical levels at about twice the levels of the recent years. In other words, options prices looked fair in the context of long-term historical market volatility, but expensive in the context of recent years.

So what is the solution? How do we determine if it is cost effective to buy 'tail risk' insurance for our portfolios? One answer is that the 'fair' value of the insurance doesn't enter into it. We don't consult actuarial tables to be sure that we are getting a fair price for our life insurance (or at least most of us don't)—we assume that we should get a few quotes and take the best among them. From the perspective of game theory, some outcomes are so bad that we will be willing to pay considerably more than fair value to protect against them. An institutional money manager is charged with knowing whether tail risk insurance is cost effective, however, as El-Erian states. Where does the individual investor or advisor stand on this continuum? There is no broad consensus here. As I have noted previously, owning equities and then buying puts to protect these equities is equivalent to simply buying call options for your equity exposure (except that the call buyer does not receive the dividends). Thus, one way to have 'tail risk' insurance is simply to have equity exposure without the downside tail, as in owning calls.