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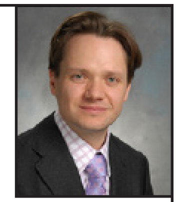
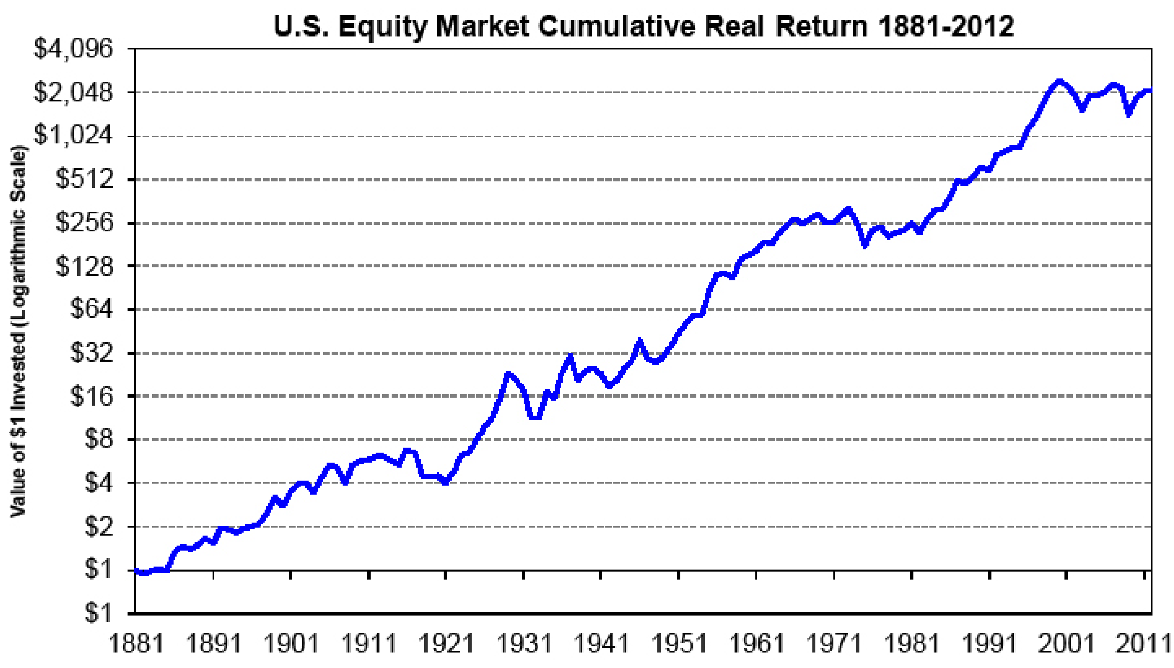


New Options for Equity Investors

Neil Constable

Since the late 19th century, the broad U.S. equity market[1] has generated annual returns of approximately 6.5% in excess of inflation (Exhibit 1). These exceptional long-run returns have become the baseline level of return that investors expect to generate from their equity portfolios. We have no opinion on whether or not the equity risk premium over the next one hundred years will match its value for the preceding century. We are, however, confident that equities, due to their very long duration, will continue to have commensurately high volatility. This essentially precludes the possibility that returns will be consistently in line with expectations: returns are much more likely to arrive via highly erratic and irregular swings.

Exhibit 1



Note: Market is market capitalization weighted portfolio of U.S. securities as defined by Shiller.

Source: Shiller, GMO As of 9/30/12

The red line in Exhibit 2 represents the rolling 7-year real return of the U.S. equity market from each of the starting dates indicated. As this chart makes clear, there have been several periods, lasting a decade or more, during which equities have delivered returns far below the equilibrium rate of return. The flip side to this is that there have also been decade-long bull markets in which equities have delivered far in excess of the long-term average.

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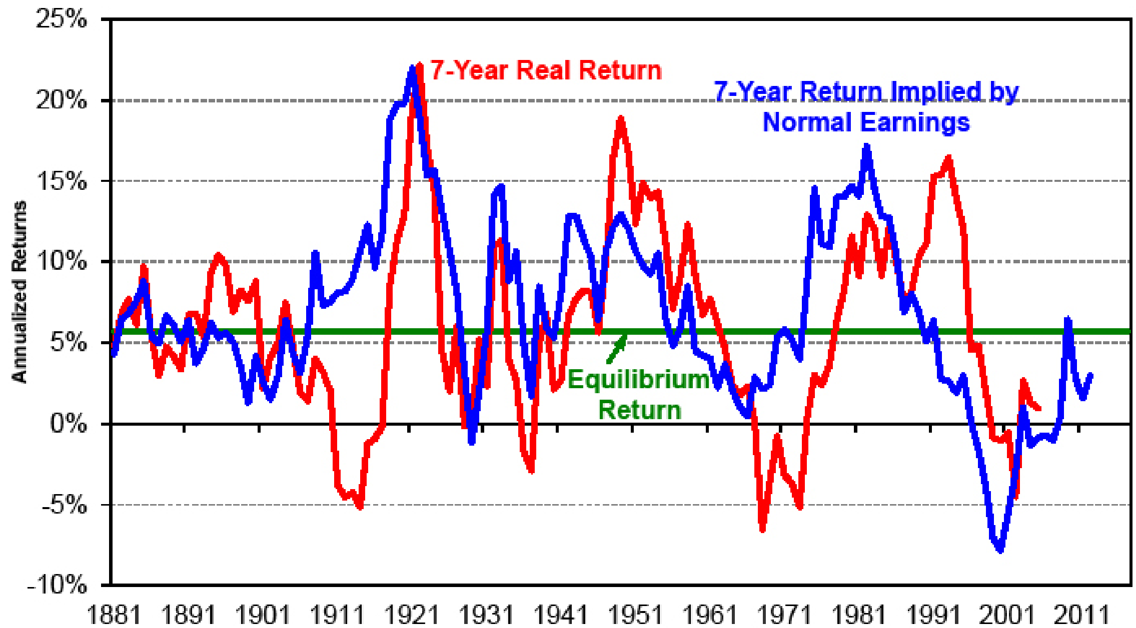
1 From 1926 to present, Shiller's data is from S&P. Prior to 1926, Shiller's data is compiled from various sources as detailed on his website [1].

Exhibit 2



Note: Market is market capitalization weighted portfolio of US securities as defined by Shiller.

Source: Shiller, GMO As of 10/31/11

As value investors, we think we understand a significant part of what drives this variability. The blue line in Exhibit 2 represents a very simple 7-year real return forecast for the U.S. equity market based on Shiller's [1] cyclically adjusted earnings yield measure. Broadly speaking, when equities have been priced to deliver poor returns they have done exactly that, and when they have been priced to deliver good returns they have duly obliged. The recipe for generating good long-term returns clearly involves steering clear of equities when they are expensive, but that only solves half of the problem. What are investors supposed to do during the lengthy periods when markets are expensive? Given that the market has been over-valued for around half of the last 130 years, this is no idle question. It is especially relevant today because we have just endured a long period of very poor returns and, despite this, there is not much relief in sight if current valuations are any guide.

In this paper we will attempt to explain how investors can get exposure to the equity risk premium in a way that is not as dependent on equity market valuations. Specifically, we will argue that by making use of equity index options investors can get compensated for taking equity risk at times when the returns offered by the market are less than those offered at equilibrium levels.

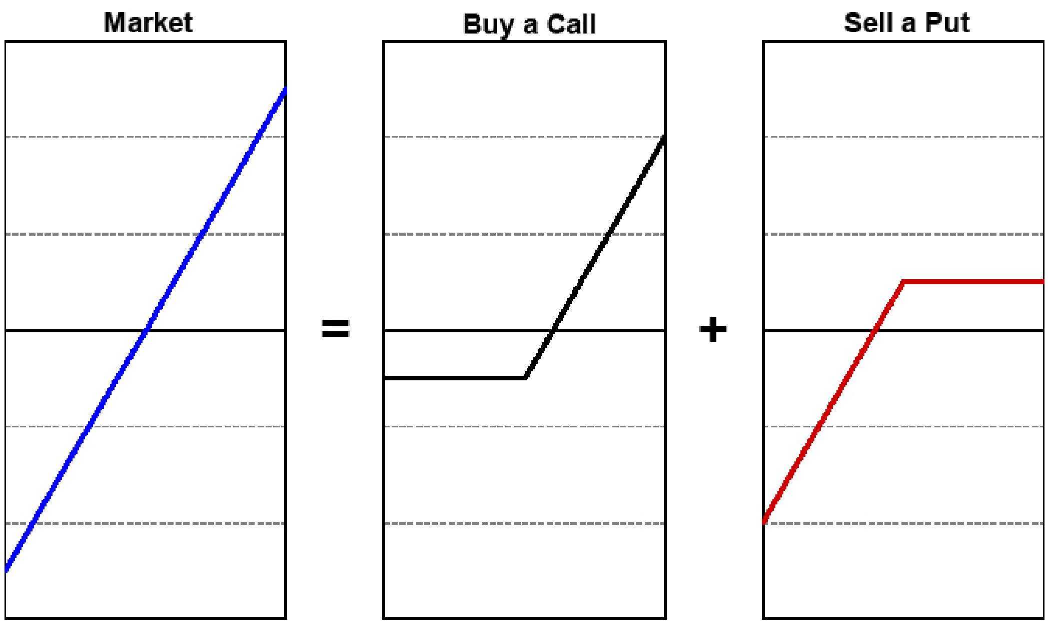
Deconstructing the Market

A standard technique for understanding the primary drivers of return for an investment strategy is to generate what are known as return attributions. In this section we are going to perform an attribution analysis on the "strategy" of owning the market itself. We want to consider how much of the market's return is due to an investor's exposure to the upside and how much has come from exposure to the downside. Investors who want to gain exposure to only the upside of the market can do so via the purchase of a call option. For every 1-point increase in the market, the owner of a call option will make $1, less the premium paid for the option. Investors who would like exposure only to the downside of the market may effect this by selling a put option. In this case for every 1-point decrease in the market, the seller of a put will lose $1, less the premium received for the put. Using this logic, an investor who owns a call and has also sold a put effectively owns the market. This concept is known as put-call parity. For our purposes, this amounts to the statement that an investment in the equity market is completely equivalent to investing in a portfolio that holds cash equivalent to the value of the equity index in question while selling short an at-the-money put option and using the proceeds to purchase an at-the money call option, viz.,

Market = Cash – Put + Call

Put-call parity says that over the lifetime of the options, the returns to both sides of this equation must be identical. As shown in Exhibit 3, the short put option is providing the investor with exposure to the downside of the equity market while the long call option is providing the exposure to the upside. In this sense we are decomposing the market return into the upside and downside of its return distribution.

Exhibit 3



Source: GMO

Our analysis covers the time period March 1983 through October 2012 and uses data for listed options on the S&P 500.[2] The attribution analysis involves 1-month, at-the-money (ATM) options.[3] On each monthly option expiration date, we form a portfolio that is long a 1-month ATM call and short a 1-month ATM put. In addition we hold cash, invested in 3-month T-bills, which is sufficient to fully collateralize the put option. Put-call parity guarantees that, absent transaction costs, the returns of this portfolio from the date of its formation through to the expiration of the options will exactly reproduce the returns of the S&P 500 over the same period.

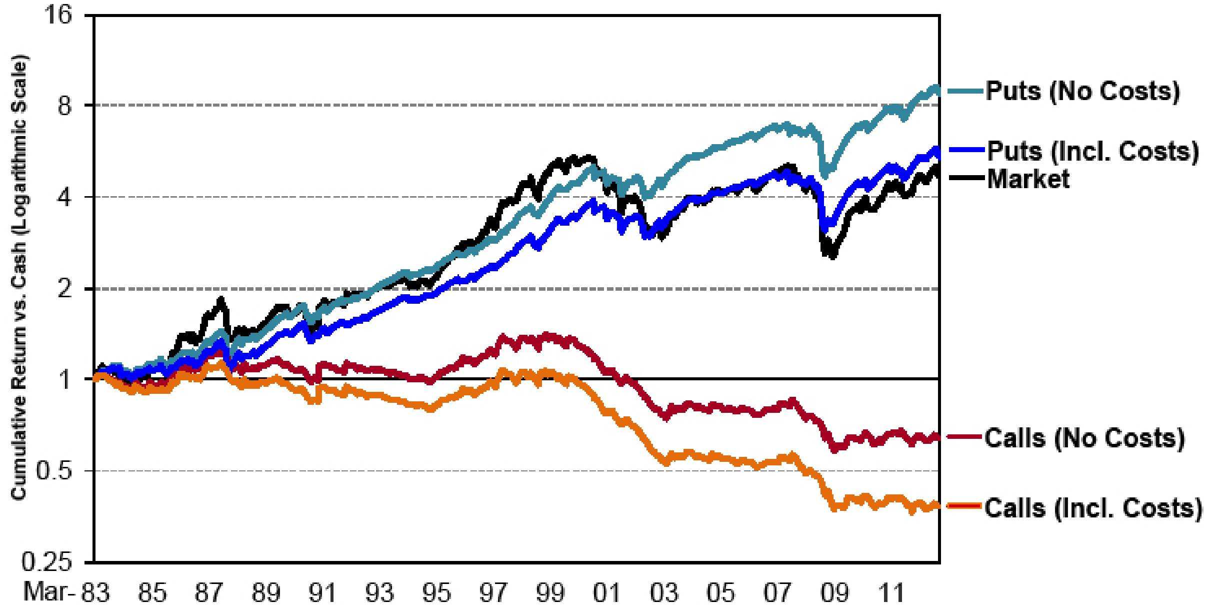
The questions we are trying to answer are how much of the S&P 500 return can be attributed to the collateralized short put option and how much to the long call option? Exhibit 4 shows the cumulative results of this study, both including and excluding transaction costs. All returns are presented as returns in excess of 3-month T-bills. The first thing to notice is that when transaction costs[4] are excluded, put-call parity holds to a very good approximation. When we include transaction costs, this is not the case. The second, and more interesting, observation is that since 1983 substantially ***all*** of the return of the S&P 500 has come from the collateralized short put options. In other words, an investor would have been able to realize all of the return of the market by only taking on exposure to the downside. Systematic exposure to the upside of what, until recently, was a great bull market for equities was a net drag on performance.

2 For the period 1983 through 1996 we have daily data for options on S&P 500 futures sourced from the CME. Beginning in 1996 our primary data source switches to the Option Metrics Ivy database, which has daily data for S&P 500 (SPX) index options.

3 Because we are using data for listed options, not every strike is available. By "ATM" we mean nearest-to-the-money.

4 Transaction costs comprise both crossing the full bid/ask spread and our estimates of actual commissions paid to a broker for executing each trade.

Exhibit 4



Note: The performance relating to "Puts" and "Calls" represents the performance that would have been obtained by selling puts or buying calls, respectively, solely on the S&P 500. All performance is presented ex-cash. For purposes of removing the cash component from performance, cash rates are assumed to be 3 month USD LIBOR. Those lines that represent included costs assume transaction costs and bid/ask spreads. Those lines that represent no costs exclude transaction costs and bid/ask spreads. Option strike is that closest listed option available to ATM on day of sale. Positions are rolled 2 days before expiration. Options are all 1-month options or durations close to 1 month. Benchmark is a total return index. All returns are in USD.

Source: Option Metrics, CME, GMO As of 11/14/12

These results probably raise many questions, however what we intend to focus on here is the relationship between risk and return. As summarized in Table 1, traditional risk metrics like return volatility and beta suggest that the put and call pieces of this decomposition should have very similar returns. The results above suggest that either there is something very wrong with the intuition that you get compensated in proportion to how much risk you bear, or that there is something very wrong with traditional risk metrics. We subscribe to the latter view. The one measure of risk that is consistent with our results is drawdown risk: the loss coincident with the maximum loss of the market in a single day or a single month.

Table 1

	Beta Relative to S&P 500	Volatility	Worst 1-Day Market Drawdown	Worst 1-Month Market Drawdown	Annual Return (over Cash)
Market	1	15.2%	-19.7%	-21.6%	5.2%
Short Put	0.57	9.9%	-28.5%	-19.1%	5.8%
Long Call	0.45	8.2%	-0.5%	-4.5%[5]	-3.8%

Note: Put selling and call buying data represent what would have been obtained by selling puts or buying calls, respectively, solely on the S&P 500. All performance is presented ex-cash. For purposes of removing the cash component from performance, cash rates are assumed to be 3 month USD LIBOR. Option strike is that closest listed option available to ATM on day of sale. Positions are rolled 2 days before expiration. Options are all 1-month options or durations close to 1 month. All transactions assumed to cross the bid/ask spread and pay market commissions. All returns are in USD. Study period is 1983-2012.

Source: GMO

[5] For those wondering how buying call options can lose 4.5% in a single month, this was roughly the magnitude of the premium paid for 1-month ATM call options in September 2008 in the days after Lehman Brothers filed for bankruptcy.

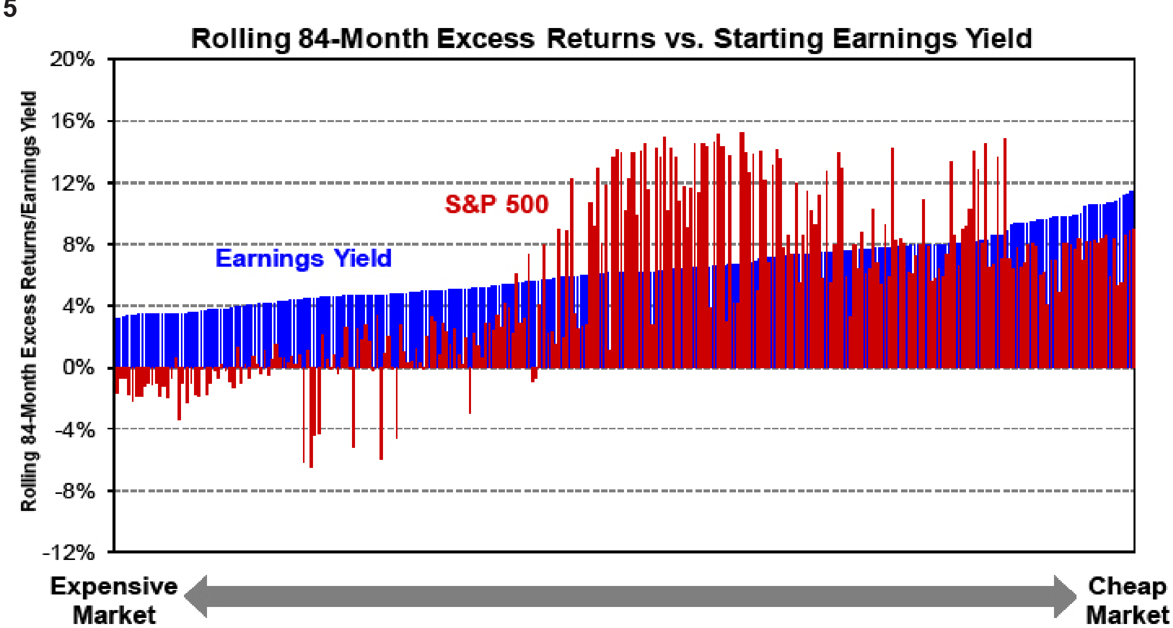
This supports our view that volatility, beta, and other statistical measures do not capture the type of risk that investors are paid to bear. Rather, investors are paid for bearing correlated downside risk.[6] The one risk that is shared by sellers of put options and long equity holders is that the market can crash. This risk is both un-hedgeable and non-diversifiable. Contrast this with owners of call options who bear no drawdown risk and have received no return for their efforts, yet they have borne plenty of volatility and beta.

From this point of view, the fact that investors who are engaged in selling collateralized put options have received the same return as traditional equity investors should not come as a surprise. In a reasonably efficient market, sellers of collateralized put options would understand that they are bearing the same downside market risk as holders of the index itself and therefore would demand that, *in expectation,* they receive the same return. Otherwise, they would deploy their capital into the equity markets until such a time as there were insufficient sellers of puts to meet demand and the price of put options increased to the point that expectations about future returns were harmonized with those from equities. If puts were priced too rich, capital would flow toward the activity of selling them until the price was brought back to equilibrium. It is important to note that this equilibrium price is not fundamental; it is simply set by the long-run rate of return that investors, in aggregate, expect from the equity market. In summary, the fact that collateralized put sellers have received the same long-run return as the market is consistent with the idea that they are bearing the same risk as the market so long as the "risk" in question is drawdown or crash risk.

The Real Problem with Expensive Markets

As demonstrated above, sellers of collateralized put options have received the long-run equity risk premium over the entire life of the listed index options market in the U.S. This raises the question as to whether such a strategy has a place in an investor's equity portfolio. We aim here to answer in the affirmative. As we detailed above, the equity market is not a reliable source of return when, as today in the U.S., it is overvalued relative to long-term averages of metrics such as Shiller's cyclically adjusted price-to-earnings ratio. What we will now demonstrate is that the medium-term returns that a put seller has realized are remarkably insensitive to the valuation of the market. In Exhibit 5 we have recast the data used in Exhibit 2 for the period 1983-2012. Here we have sorted monthly observations of the S&P 500's cyclically adjusted earnings yield, in blue, from low to high and overlaid in red the subsequent 7-year return to the S&P 500 from each starting valuation. To reiterate our earlier point: expensive markets, as denoted here by low earnings yields, have led to disappointing returns.

Exhibit 5

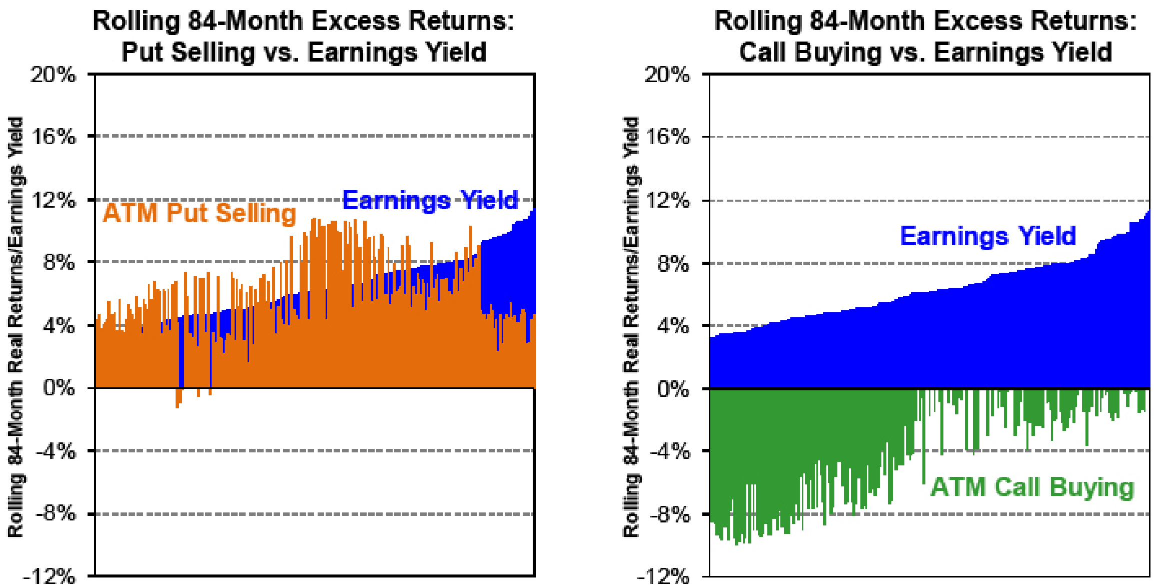


Source: GMO   Study period: 1983-2012

[6] For a general discussion of what investors should expect as compensation for exposure to risk factors see Antti Ilmanen, "Expected Returns" [2].

We now consider how our market decomposition from the previous section can be used to understand the underperformance of equities starting from points of overvaluation. In Exhibit 6 we have broken out the 7-year market returns into those attributable to collateralized short puts and those coming from long calls, just as above, and overlaid the results on the same earnings yield data as in Exhibit 5.

Exhibit 6



Note: The rolling 84-month real returns relating to ATM Put Selling and ATM Call Buying represent what would have been obtained by selling puts or buying calls, respectively, solely on the S&P 500. All performance is presented ex-cash. For purposes of removing the cash component from performance, cash rates are assumed to be 3 month USD LIBOR. All transactions assumed to cross the bid/ask spread and pay market commissions. Option strike is that closest listed option available to ATM on day of sale. Positions are rolled 2 days before expiration. Options are all 1-month options or durations close to 1 month. Benchmark is a total return index. All returns are in USD.

Source: Option Metrics, CME, GMO

There are at least three things to notice about these plots. First, for the period from 1983 there were only a handful of rolling 7-year periods over which a put seller realized a return that underperformed cash. Second, the 7-year returns to put selling were reasonably insensitive to the starting valuation of the underlying equity market. Third, all of the pain associated with owning equities when they were expensive came from the call options. The losses incurred by investors from expensive markets were not a result of undue complacency about the downside, but rather overpayment for exposure to the upside. Said differently, poor equity returns were about upside expectations that did not materialize. The best example of this was probably the TMT bubble, in which the extreme valuations were said to be justified on the grounds that in the "new economy" these *avant garde* companies would grow into their multiples. When these arguments proved to be specious, systematic sellers of put options fared much better than buyers of calls or owners of the market.

Put selling is therefore a very useful tool in the context of an equity portfolio. It provides a method for gaining access to equity-like returns in a manner that is relatively insensitive to equity market valuations. As we will elaborate on below, put sellers are compensated for their efforts by collecting what amounts to an insurance premium. This contrasts with owners of equities, who are compensated by the earnings yield of the market. Since both activities are taking the same risk, an investor who adds put selling to his arsenal is achieving diversification via an increase in his opportunity set: selling puts and owning the market are attractive at different times. Specifically, selling puts is an attractive proposition when insurance premiums are high and owning equities is attractive when earnings yields are high, and there is no *a priori* reason that these must be coincident.

Where Do the Returns Come From?

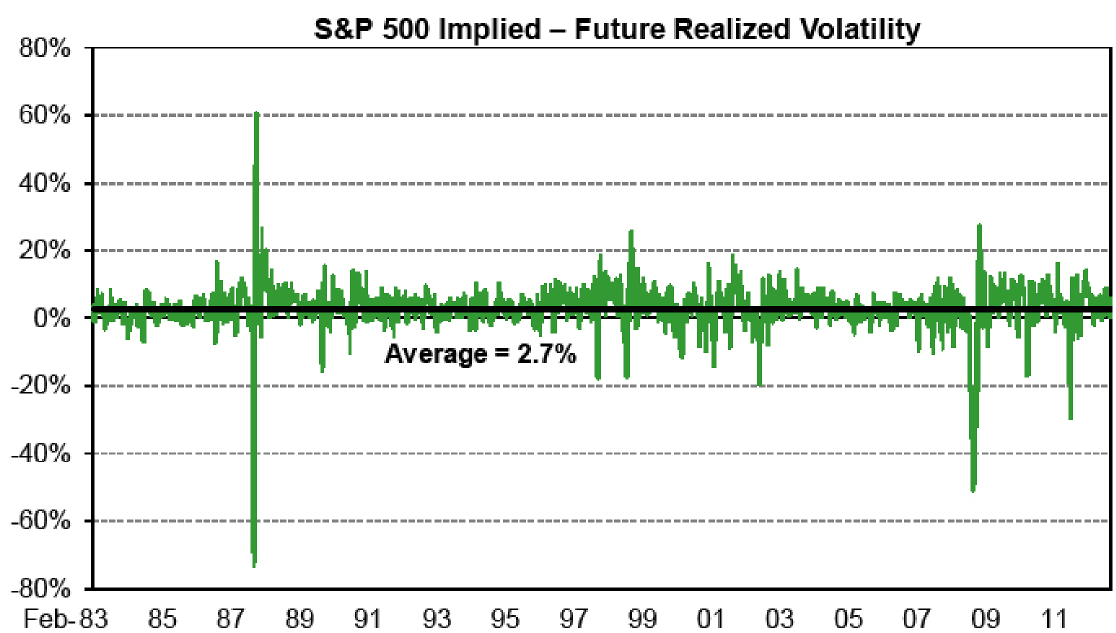
We now consider the question of what drives the long-term returns that accrue to sellers of put options. These investors generate cash flow by collecting what amounts to an insurance premium each month. The long-term returns that they realize are determined by how much of that premium, on average, they are able to keep as opposed to paying it out when options expire in the money. The amount of money that is retained in any given period is clearly a function of what happens to the S&P 500 over the life of the option, but there is more to it than this. It can be shown (see Appendix and Figelman's work [3]) that, under reasonable assumptions, the expected return for a seller of a 1-month ATM put can be broken into two components[7]:

Expected Return = ½(Expected Market Return) + (Expected Implied – Realized Volatility Gap)

Where, the "implied – realized volatility gap," or simply, the "gap" is a measure of the premium charged by sellers of options as compensation for un-hedgeable drawdown risks. We now explain what is meant by this last statement: in the original Black-Scholes-Merton option pricing model [4], the price of an option is a function of the expected price volatility of the underlying index. All else being equal, the higher the estimate of future volatility, the more expensive the option will be. If option traders used historical realized volatilities to price options they would implicitly be assuming that events such as Black Monday in October 1987 are essentially impossible. Since these types of drawdowns in fact happen, the sellers of options have to ensure that the premium they charge compensates them for this risk. This can be accommodated in the Black-Scholes-Merton model by using an estimated future volatility that is systematically higher than historical realized volatilities. The level of input volatility that corresponds to the actual market price of an option is called the *implied volatility*.[8] The "implied – realized volatility gap" is thus a measure of how much option traders are charging to insure 1987-like events. Since these events are relatively rare, the expected returns in any given month include this "excess" premium.

In Exhibit 7 we have plotted the time series of the difference of the actual implied volatility of 1-month ATM put options and the subsequent realized volatility of the index over the next 30 days. The long-term average value of this series is 2.7%.

Exhibit 7



Source: Option Metrics, CME, GMO As of 9/30/12

7 The factor of ½ that appears is a result of the fact that a short-dated ATM put option has a delta of roughly 0.5.

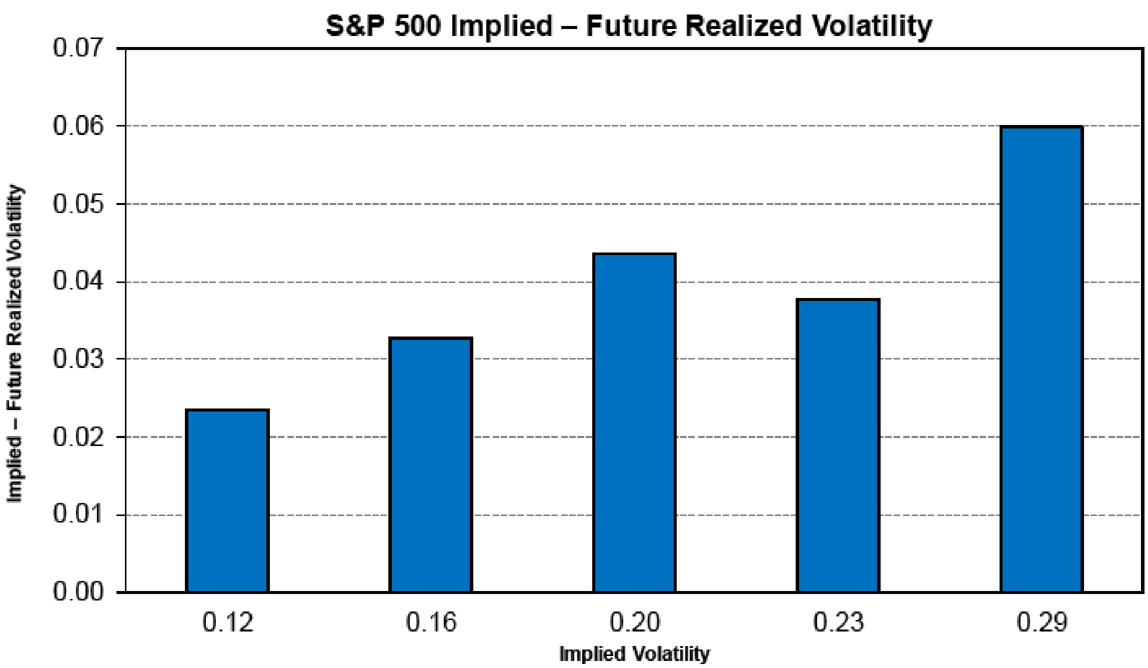
8 Implied volatility is a standardized way of quoting the price for options and plays much the same role for options as the price-to-earnings ratio does for stocks.

Many market participants view the gap as evidence of some sort of inefficiency in the options market. Our view is that the observed gap is in fact evidence of reasonably efficient markets: the gap has historically been what it needed to be in order to ensure that sellers of put options had the same return as investors who were simply long the market. In other words, the gap is set in the market so that investors who take exactly the same downside equity market risk have the same long-term expected return.

To reiterate the above point, we see no evidence of structural inefficiencies in the options market. However, just as with equity investing, there are clearly times when selling put options is more or less attractive than the historical averages suggest. In the case of equities we can use valuation measures such as Shiller's cyclically adjusted earnings yield discussed earlier as our measure of attractiveness. For put selling, our schematic equation for expected returns above implies that there are two components to this assessment, namely the expected return of the market and the expected implied – realized gap. All else being equal, a large forecast for the implied – realized gap is good for selling puts, while a low forecast for this gap is not. The question is then, how does one go about forecasting the implied to realized gap?

From the point of view of a value investor, one would be more inclined to sell put options when premiums are high and less so when premiums are low. Because premiums are interchangeable with implied volatility (as described above), a decent place to start is simply to look at implied volatility as a forecast of future implied – realized volatility, and hence as a measure of attractiveness for selling puts. In Exhibit 8 we have used spot implied volatility of 1-month ATM puts to sort implied – realized volatility over the next 30 days into quintiles. In other words, we are asking how good of a forecast of next month's gap is the current level of implied volatility?

Exhibit 8



Source: GMO, Option Metrics   Study period: 1996-2012

The results imply that a decent starting point for building an assessment of attractiveness for selling put options on the S&P 500 is to focus on periods when implied volatility is elevated relative to long-term averages. From the point of view of an insurance operation, this amounts to having a preference for selling insurance when fears of a disaster are the highest. In practice, this often corresponds to periods immediately following a large drawdown in the market. As with hurricanes and property insurance, so too with market crashes and put options.

Just as the cyclically adjusted earnings yield of the market serves as a good starting point for building forecasts for equity returns, the level of implied volatility can also be used as a jumping-off point for building return forecasts for selling put options. The fact that valuations and implied volatilities are not expected to be highly correlated and yet can both be used to assess the attractiveness of taking equity risk provides the diversification of opportunity set mentioned above.

Conclusions

Today, as has so often been the case, investors are stuck between the rock of expensive equity markets and the hard place of needing to grow their assets at a consistent 6.5% per annum. History suggests that investing in equities with the hope that the growth implied by current valuations will materialize is reckless. Meanwhile, sitting on the sidelines impairs the long-term prospects for most investors because their annual spending commitments do not shrink in line with the diminished expected returns of the stock market. Therefore the utility of a source of equity-like returns that is insensitive to valuations should be obvious. The basic put selling strategy that we have outlined in this paper provides this type of return.

Adding put selling to an equity portfolio does not provide diversification via a reduction in overall risk. As we have been at pains to emphasize, a collateralized short put option and a long market position have identical drawdown risk. Rather, put selling provides a diversification of opportunity set: the prospective return to put selling is a function of how high the insurance premiums are (as measured by implied volatility) and the expected return of the market is a function of current valuations. The fact that these can be attractive at different points in time is indicative of the reality that they each represent a different way of getting compensated for taking equity risk. More simply, implied volatility offers another dimension along which to evaluate the attractiveness of taking downside market risk and put options offer the vehicle by which to do so.

Appendix: More on Expected Returns

Following Figelman's work on covered calls [3], it can be shown that when, $t \ll 1$ and for, $S = K$, the expected value, at expiration, of a short ATM put option, P, is given by,

$$E(-P) = -\Delta \mu t S + \frac{S\sqrt{t}}{\sqrt{2\pi}}(\sigma_I - E(\sigma_R))$$

Where

E(•) is the expected value operator

Δ is the option delta

μ is the expected drift rate of the market (ERP)

S is the spot price of the index at the time the option is sold

K is the strike price of the option

t is the time to expiration of the option measured in years

σ_I *is the implied volatility at which the option is sold*

σ_R *is the realized volatility of the index over the life of the option*

For an ATM put option with 1 month until expiration, the delta is approximately -0.5. Absent any other information the expected drift rate of the S&P 500 is simply the annualized long-term equity rate of return, often called the Equity Risk Premium, or ERP.

We have a strong prior that the seller of a put option ought to have the same expected rate of return as a long holder of the index for the very basic reason that they are bearing the same fundamental downside risk. This can be represented algebraically by setting $E(-P)=\mu t S$ in the above equation. Thus, our equivalence principle can be summarized as,

$$\sqrt{\frac{\pi t}{2}}\mu = \sigma_I - E(\sigma_R)$$

Therefore the expected implied – realized gap is set by μ. The expected implied – realized gap, as defined here, is frequently referred to as the "variance risk premium" or VRP. The statement we wish to make is that the VRP is determined so that a put seller, *in expectation,* will receive the ERP. In other words, these are not separate concepts. They are linked by the principle that two investments that share the same downside risk ought to have the same expected return. Substituting 6.5% for μ and using a 1-month horizon gives an expected implied – realized gap of 2.4%, which is very nearly the actual average value for the 1-month implied – realized gap over the period for which we have available data (see Exhibit 7). In other words, this is evidence that the realized value of the VRP is consistent with sellers of put options, in aggregate, expecting to get paid the ERP for their efforts.

References

[1] Shiller's definitions and the actual data used in our analysis are available at:

http://www.econ.yale.edu/~shiller/data.htm

[2] Ilmanen, Antti. "Expected Returns," Wiley, 2011.

[3] Figelman, Ilya, "Expected Return and Risk of Covered Call Strategies," J*ournal of Portfolio Management,* Summer 2008: 81-97.

[4] Black, Fischer; Myron Scholes (1973). "The Pricing of Options and Corporate Liabilities." *Journal of Political Economy* 81 (3): 637–654; Merton, Robert C. (1973). "Theory of Rational Option Pricing." *Bell Journal of Economics and Management Science* (The RAND Corporation) 4 (1): 141–183.

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