Inexpensive Protection Against Rising Rates

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We are standing at challenging point in history for financial planners. Government bond yields are low, as is the apparent rate of inflation. Investors are far more concerned with the safety of their principal than with the risk of losing purchasing power.

As is so often the case, the biggest risks are those that we discount.

The possibility of a surge in interest rates appears to be today's ignored risk, despite the warnings of many experts, including David Einhorn, Bill Gross, and Seth Klarman.

Regardless of the probability of various scenarios for future inflation or the mechanisms by which they may play out, investors and advisors should consider how to most cost effectively protect their portfolios against a rise in interest rates. Perhaps the most powerful way to do that is by purchasing out-of-the-money put options on bonds.

That strategy is the focus of this article, but before I explore it, let's examine the shortcomings of the more common ways investors protect against the the loss of purchasing power through inflation and the devastating consequences that can have.

The advantage of put options over other strategies

The simplest solution is to invest the bond portion of a portfolio in inflation-protected securities (TIPS). The problem with TIPS is that the embedded inflation protection tracks the Consumer Price Index (CPI), a statistical measure of inflation that may not properly track the inflation rate that individuals experience. As David Einhorn notes, for example, health care represents only $1/16^{th}$ of the CPI but $1/6^{th}$ of the Gross Domestic Product. More problematic, the government both determines the calculation of the CPI and has a clear incentive to make inflation rates appear as low as possible. The government has enormous financial liabilities (e.g. Social Security) that increase with CPI.

Another approach to sheltering a portfolio from inflation is to invest in real assets, such as land, commodities, precious metals, and oil and gas wells and pipelines. Real asset prices, at least theoretically, are tied to inflation. As Klarman pointed out recently, however, gold and real assets are far from a pure play on interest rates. Even with low inflation in recent years, gold is near record highs. Commodities prices tend to go up with inflation, but they are also tied to economic growth.

Real assets, commodities, precious metals, and TIPS provide protection against increasing interest rates and have an important role in asset allocation, but they are not perfect hedges against interest rate increases.

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Klarman has proposed buying put options on bonds. He is using deeply out-of-the-money put options to explicitly protect against a substantial rise in interest rates. The attraction of this approach is that put options on government bonds are truly a pure play on rising interest rates. There is no way for nominal interest rates to rise without driving down the prices of government bonds.

We are going to explore Klarman's strategy using bond ETFs, with a focus on options with a long time until expiration (called long-dated options). The use of long-dated options minimizes the need to frequently repurchase options. There are long-dated options markets on a number of bond ETFs than can provide the basis for implementing this strategy.

We are going to focus on the iShares long-term government bond index (TLT) and intermediate-term government bond index (IEF). TLT has trailing 12-month yield of 3.9% and IEF has trailing 12-month yield of 3.2%. If interest rates increase, the prices on these long- and intermediate-term bonds will decline, thereby increasing their yields. The value of put options on these ETFs will increase in this scenario, thereby gaining in value in a rising interest rate environment. Put options on these bond ETFs provide a form of insurance against rising interest rates.

Klarman emphasized that this strategy makes sense when put options are relatively inexpensive. His comments mirror Mohammed El Erian's description of tail insurance as "asking what a really bad state [of the world] looks like and if there is cheap insurance against it."

The cost of tail insurance matters. Investors and advisors who wish to explore the use of put options as a way to protect against a surge in inflation need to start by understanding the pricing of these options.

The inputs for option pricing

The first step in examining the prices of options is to understand the key variables that drive them. A put option gives the owner the right to sell the underlying asset (an ETF in our examples) for a specific price (called the strike price). If the price of the ETF goes below the strike price, the owner of the option can instantly make the difference between the strike and current price of the ETF. The key specifications for an option are the strike price and the expiration date of the option. The strike price on a put option is the price at which you can sell the underlying stock, index, or ETF. In Klarman's approach, one would buy put options with strike prices well below the current price of the bond ETF. The expiration date determines how long the option is in effect.

The variables that determine the value of options on a stock, index, or ETF are:

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1) Expected volatility of the asset on which the option is written (higher volatility means that both put and call options are more expensive)
2) Dividend yield of the ETF (higher dividend yield makes put options more expensive and call options less expensive)
3) Risk-free rate of return
4) Difference between the strike price of the option and the current price of the ETF
5) Expiration date of the option

The risk-free rate, the expiration date, the current price of the ETF, the dividend yield, and the strike price are all known inputs. To determine whether options prices are 'fair' requires an analysis using option pricing models. The goal of such analysis is to see whether options prices are consistent with volatilities across a range of assets.

Options with strike prices close to the current price of the underlying ETF or stock are referred to as being *at the money*. Call options with strike prices well above the current price of the underlying ETF and put options with prices well below the current price of the underlying ETF are called *out-of-the-money* options.

Expected volatility

The expected volatility for a stock or ETF is a major determinant of an option's value. The starting point for understanding expected volatility is to use current options prices to back out the volatility levels that are implied by current options prices.

This estimate of volatility is called the *implied volatility*. Determining the implied volatility requires the use of an option pricing model. Fortunately, there are a number of good free tools available on the web that calculate implied volatility (e.g., see here and here). The implied volatility of options varies as a function of expiration date and strike price. For financial planning applications, I prefer to use the longest-dated options available. There are options that expire in January 2012 for TLT, IEF, SPY, and GLD. The implied volatilities for at-the-money options on these four ETFs are shown below

Asset Class	Ticker	Projected Volatility	Implied Volatility
Long-Term Gov't Bonds	TLT	21%	20%
Intermediate-Term Gov't Bonds	IEF	11%	11%
S&P500	SPY	26%	26%
Gold	GLD	28%	25%

Projected and Implied Volatility for four ETFs

I have used the at-the-money options to provide a baseline for volatility. The higher the implied volatility, the more expensive the options, so we need to have a sense of whether these implied volatility levels are reasonable. To test the current levels of implied volatility, I have run Monte Carlo simulations of the four ETFs using Quantext Portfolio Planner, and I have adjusted the baseline projected volatility for the S&P 500 (SPY) to be equal to that

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of the implied volatility on the S&P500. The model then generates projected volatilities for the other ETFs, given the historical relationships between these ETFs and the S&P 500. The volatilities projected in this way are shown in the table above. The projections use data available through the end of the May 2010 and the implied volatilities are from June 3, 2010. The projected and implied volatility for long-dated bonds (TLT) is very high. Over the past three years, the volatility of TLT is 17%, so the projections suggest that long-term bonds will be somewhat more risky going forward.

The results demonstrate a remarkable consistency in the relationships between implied volatility on a number of asset classes, as we see in the table above. Given the current implied volatility on S&P 500 options, the implied volatilities of the options on the bond ETFs and on the gold ETF are reasonable and these options are fairly priced. This test provides a sanity check. If the implied volatilities on the bond ETFs were substantially greater than the projected volatilities from the Monte Carlo, we would have reason to believe that the options are over-priced.

Hedging with options

We are going to focus on long-term government bonds, because these bonds are more sensitive to interest rates than the intermediate-term bonds. As of June 9, TLT was trading at $97.9 and yielding approximately 3.9%. The prices of two out-of-the-money put options on TLT, expiring in January 2012 (the longest-dated options currently available) are shown below:

Strike Price	Price of Put Option
$65	$2.30
$75	$4.00

Put Options on TLT with Jan 2012 Expiration

Assuming that these prices are 'fair,' the 'break-even' probability of the $65 put option is 11% and that the break-even for the $75 put option is 18%. This means that we will only make money on the $65 put 11% of the time and on the $75 put option 18% of the time. Morningstar provides an estimate of break-even probabilities on their options pages, although their numbers will differ somewhat from my own calculations because of differences in our option pricing models.

Those break-even calculations provide some insight, but the best way to understand the impact of options on a portfolio is through the use of percentile charts. The percentile chart below shows the projected total returns for buying and holding TLT between now and Jan 2012 vs. buying TLT and one Jan 2012 $75 put option for every share of TLT purchased.

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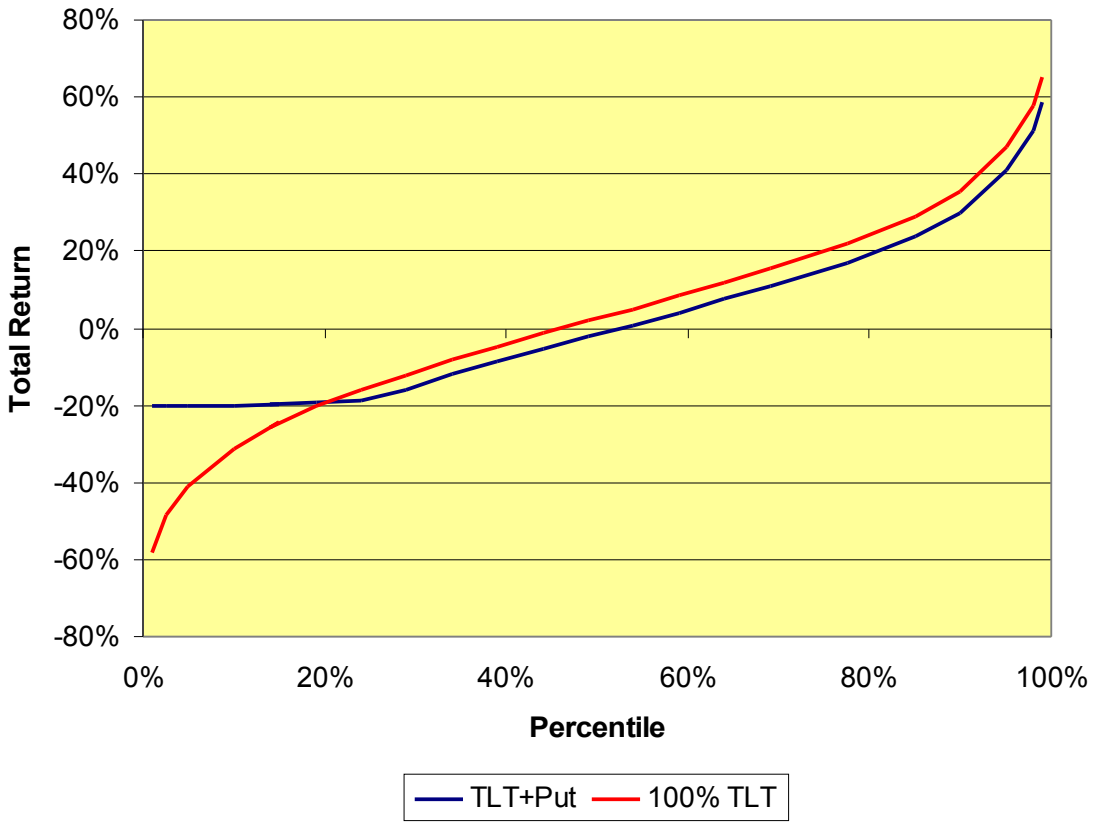

TLT vs. Hedged TLT with $75 Put Option

The vertical axis shows the projected total return for holding the position over the period between now and Jan 2012, and the horizontal axis shows the probability that we will be at or below this return for the period. The straight investment in TLT, for example, can lose almost 60% at the first percentile between now and Jan 2012. The combination of TLT with the $75 put option never loses more than about 20%.

You will be better off most of the time if you simply own TLT, as the break-even value of the put option tells us. The value of the put option shows up when the long-term bonds suffer their highest losses – and this will occur when interest rates rise.

The purchase of a $4 put option to hedge a share of TLT that costs about $98 provides protection if bond prices drop and TLT trades below $75. On the other hand, we will simply lose that $4 most of the time, because the option will expire worthless. Over most outcomes, TLT alone will return more than the combination of TLT with a put option.

What would interest rates have to be to drive the price of TLT down to $75? I have performed an historical regression analysis using TLT data and data on long-term

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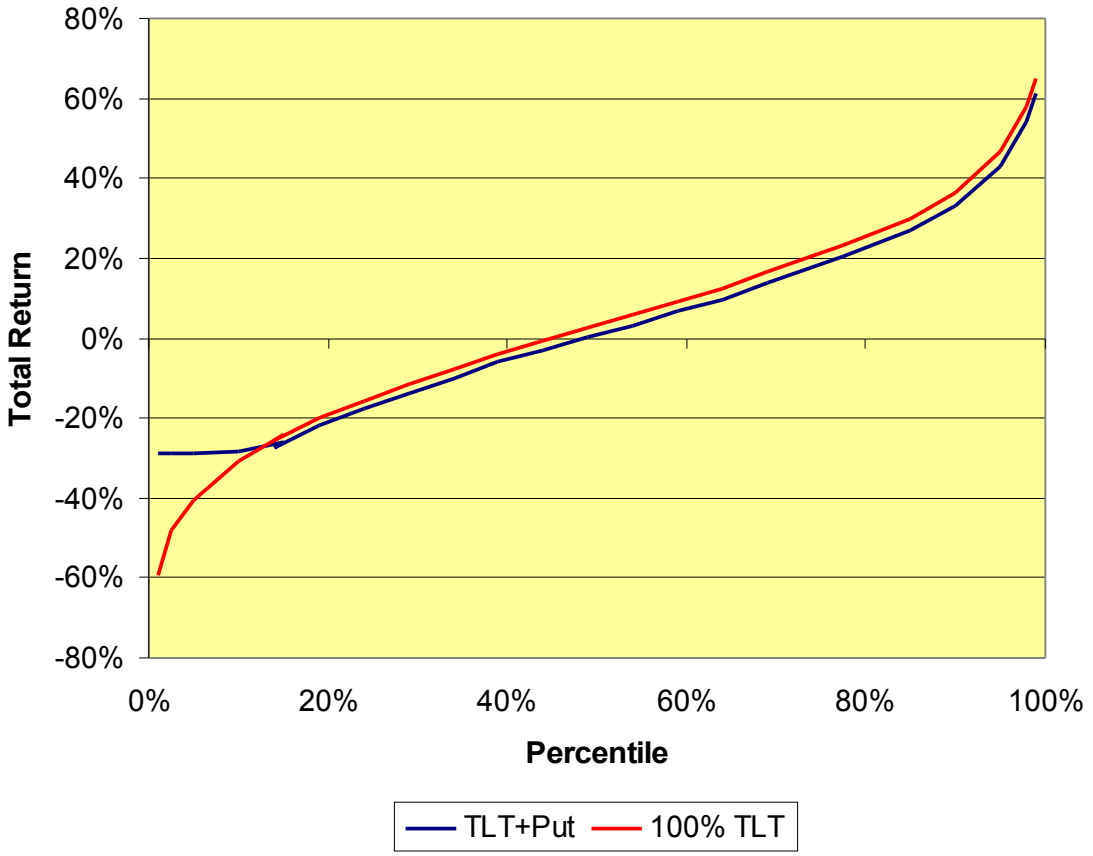
Treasury yields. Long-term interest rates of about 6.6% over the life of these options would correspond to TLT at $75.

Let's now consider the put option with a strike of $65, implying a yield of 7.5%. This option provides far less protection, because it starts to pay out only if TLT drops below $65. On the other hand, this option costs only $2.30 per share. The $65 put is true 'tail insurance,' in that it protects against truly extreme events – in this case, a rise in interest rates massive enough to drive the price of TLT below $65. The percentile chart for TLT with and without the $65 put option is shown below:



TLT vs. Hedged TLT with $65 Put Option

These examples show how put options can protect a long-term bond position from the worst-case scenarios that may occur.

Could an investment in long-term government bonds really lose as much a 60% over 1.6 years (the period between now and the expiration of the Jan 2012 options)? This corresponds to a rise in long-term interest rates to almost 10% over this period. Our model projects just a 1% chance for this level of loss, but our approach does not incorporate 'fat tails' – we assume Gaussian returns that will adhere to a bell curve. Given the possibility

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of 'black swan' events, our estimates might be criticized as not being extreme enough. Our ability to estimate the probability and magnitude of truly extreme moves is quite limited – and this is precisely why we should hedge against such outcomes.

With TLT trading at $98, we can buy the $65 put option for $2.30 for 1.6 years of protection. This is a cost of about 1.5% per year to protect against the truly extreme downside for long-term bonds. In the current environment, that seems like a pretty good deal. We can still lose upwards of 30% on our position in TLT, however, before the protection from the put option kicks in.

The $65 put option is not the furthest out-of-the-money option. Put options with strike prices as low as $50 are traded, but those have relatively little open interest. Further out-of-the-money options, provided their open interest is sufficient to insure adequate liquidity, would be less expensive but would provide less total coverage from the range of possible changes in rates.

Thoughts on strategy

Commodities, precious metals, and TIPS are imperfect hedges, but put options on long-term government bonds provide a perfect hedge for nominal interest rates. Rising nominal interest rates will drive down the prices of bonds – those of long-term bonds most dramatically. The most cost-effective way to protect against a sharp rise in nominal interest rates is, therefore, to buy put options on those bonds. Unsurprisingly, there is substantial open interest in the $65 put options expiring in Jan 2012, the longest dated options available on TLT.

Today's high volatility means that put options are more expensive than usual, but the prices of the put options appear to be quite 'fair' in the current environment. The buyer of options gains the potential to benefit from the truly unpredictable extreme events (the black swans), and this added benefit makes these put options even more attractive.

Although US equities have generally performed well in moderate inflation environments, equities have fared poorly during rapid inflation, at least in the one notable experience of the 1970s. This form of tail insurance may provide additional protection in such an environment.

For investors who would be adversely affected by a rise in nominal interest rates (those who derive a substantial portion of their income from fixed income and whose liabilities track inflation), buying out-of-the-money put options on TLT provides a sensible alternative for guarding against the unexpected.

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