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Indexation of Principal Protection

A "S&P 500 Protective Put Index" Concept

Srikant Dash, CFA, FRM
srikant_dash@sandp.com
(212) 438 3012

Berlinda Liu
berlinda_liu@sandp.com
(212) 438 7834

- Principal protected investments are a staple offering in insurance and structured product distribution channels for investors seeking exposure to an asset with limited downside risk to the initial investment.

- Principal protected S&P 500 index products are among the most popular structured products issued to retail investors. Given retail investors' limited understanding of options pricing and general aversion to risk, these products sell briskly at relatively high loads and expenses.

- In this paper, we discuss the concept of a possible S&P 500 Protective Put index, which could be a benchmark for the legions of principal protected products available in the retail market, or be the basis of a lower cost index linked product.

- There are multiple instruments and techniques used to execute principal protection or portfolio insurance. For purposes of transparency and replicability, we use the liquid, publicly traded options market and explore various maturity, financing and strike scenarios.

- Our simple S&P 500 Protective Put Index concept, based on 2% collars, offers approximately two-thirds of market return at one-third overall risk. Downside risk as measured by maximum drawdown and Sortino ratio is significantly lower than the S&P 500 index.

Introduction

Principal protected investments are a staple offering in insurance and structured product distribution channels for investors seeking exposure to an asset or asset class with limited downside risk to the initial investment. The users of such products are concerned about principal risk and are willing to forgo some upside or yield in exchange for downside protection.

There are multiple instruments and techniques used to execute principal protection or portfolio insurance, and such techniques have been widely used in the investment community for more than 25 years. In this paper, we do not contribute anything new to the body of literature surrounding principal protection strategies. Rather, we explore the indexation of such strategies.

Equity indexation has traditionally covered whole markets or market segments that have distinguishable characteristics. The overriding feature of such broad indices is that they attempt to provide representation of their respective market or segment. Increasingly, investment strategies and techniques incorporating active risks are packaged into an index framework. Such strategy indexes provide transparency and replication efficiency, and lower the cost for active products. The indexes we explore in this paper fit in that mould of strategy indexes.

We explore a transparent framework for indexation of a put protected S&P 500 index strategy. We explore the trade-offs associated with various financing and maturity options while staying within the confines of liquid segments of the options market.

Put Protection 101

An option is a financial contract between two parties, the buyer and the seller. A **put** gives the buyer the right but not the obligation to sell the underlying security to the seller of the option at a certain time (the **expiration** date) for a certain price (the **strike** price). A **call** gives the buyer the right but not the obligation to buy the underlying security from the seller of the option at a certain time (the **expiration** date) for a certain price (the **strike** price).

The investing rationale for buying put options is to protect a long position in the asset and to limit downside risk. A portfolio with long positions is always exposed to the downside risk of the market. For example, if you buy an index at $100, you'll face a potential loss of up to $100. By going long a put at $95, however, you may exercise your option and sell your index at the strike once the index plunged below $95. Therefore, your maximum loss is limited to $5 curbed. The cost of the protection is the premium you paid upfront.

Exhibit 1: Buy Put to Protect Principal

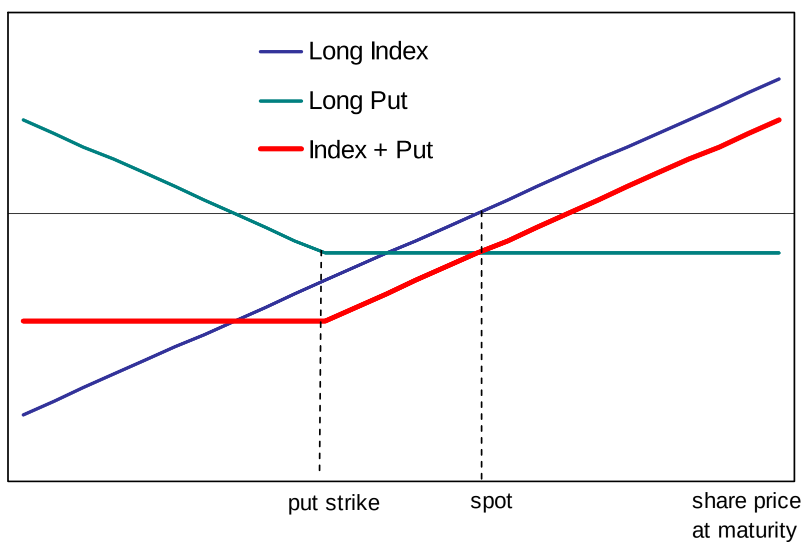
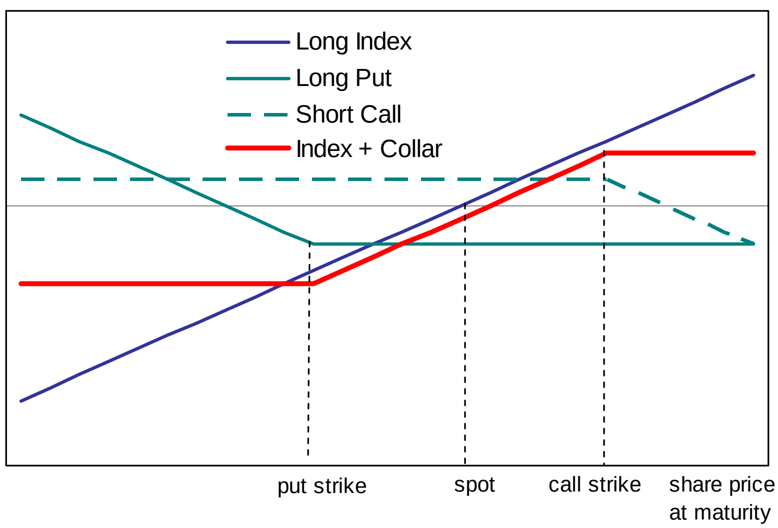


Exhibit 1 illustrates how put options protect portfolio principal. The blue line shows the profit of a naked long position of index. It has unlimited upside potential and downside risk driven by the spot of the index. A long put position is illustrated in green. The investor pays a premium regardless of the share price at maturity, but will benefit from the predetermined floor set by put strike if the index declines. The combined position of index and put still has the unlimited upside potential, but the profit from the put offset the loss from the index once the index goes below the strike. The maximum loss of the combined position is limited to the difference between the spot and strike, plus the premium paid upfront.

In addition to straight put options, one could finance the put by shorting out of the money (OTM) calls. This implies that one is willing to give up some of the upside in return for lowering the cost of the protection.

Exhibit 2 illustrates the effect of financing a long put by selling a call option. If one believes that the underlying will not go above the call strike by the expiration date, he may opt to short the call and pocket the premium. This premium will reduce the cost of the put option and hence decrease the maximum downside exposure. However, if the index does exceed the call strike, the loss from the call will offset the profit from the index. Therefore, the maximum profit is also capped.

Exhibit 2: Finance Put with Short Call Position



Research Methodology

We measure the impact of various combinations of put protection for S&P 500 over a 15 year period ending 2007.

Scope: Liquidity and cost are the major considerations in limiting the scope of our research in terms of breadth of maturities and option strikes. The longer dated the option and the closer the strike is to current index level, the higher the option cost. Similarly, liquidity fades of as one moves away from at the money (ATM) strikes and as one considers longer maturities. Given this, we consider ATM, 2% OTM, and 5% OTM options with a maturity of one month or three months.

Calculation: The performance of each strategy is evaluated by the accumulated total return of the combined position, i.e. the long S&P 500 index position, dividends from the index, a long put position and a short call position, if applicable.

On Day 1, we select the put and call options. The strike target is calculated based on the opening price of the S&P 500 index. For both put and call options, we select the contracts immediately above the strike target. We set the initial value of the total return index (I) as 100.

For the underlying security, we only have the open and close prices. Intra-day price and volume data are not available. Therefore, we assume that the option strikes are determined by the open price of the trading day. In reality, the option traders may use the volume weighted average prices or other derived prices as their basis.

On any subsequent non-expiration day, we calculate the accumulated total return on a close-to-close basis as follows:

$$R = \frac{PX_t + DVD_t + C_t^{put} - C_t^{call}}{PX_{t-1} + C_{t-1}^{put} - C_{t-1}^{call}}$$

$$I_t = R * I_{t-1}$$

where

PX = index closing price

DVD = index dividend points

C = option close price

On the option expiration day, we close the expiring options and buy new options for the next period. We only have open and close option prices of the options. Although one could buy and sell options in several trades at different prices, we close the expiration contracts at their settlement value calculated from the SOQ (Special Opening Quotation), and roll to the new contracts based on their opening prices.

The daily returns of the expiring options are denoted as *Ra*. We assume that the new options are bought at open based on the open price of the underlying. Their intra-day returns are denoted as *Rb*. The total return index shall be calculated as follows:

$$R = Ra * Rb$$
$$I_t = R * I_{t-1}$$

where

$$Ra = \frac{SOQ_t + DVD_t + V_t^{old\ put} - V_t^{old\ call}}{PX_{t-1} + C_{t-1}^{old\ put} - C_{t-1}^{old\ call}}$$

$$Rb = \frac{PX_t + C_t^{new\ put} - C_t^{new\ call}}{SOQ_t + O_t^{new\ put} - O_t^{new\ call}}$$

$$V^{old\ put} = \max(0, K^{old\ put} - SOQ)$$
$$V^{old\ call} = \max(0, SOQ - K^{old\ call})$$

V = option value at expiration

K = option strike at the time of position establishment

O = option open price

SOQ = CBOE's special opening quotation

The new put and call options are selected based on the moneyness and maturity constraints in a similar way as on Day 1. We purchase the new contracts at the open of the expiration date. To incorporate a realistic price of buying a put or selling a call, we do not use opening prices by themselves. Rather, we devise an “opening ask” for the put option we are buying and an “opening bid” for the call option we are selling. For put options, we add a spread to the open price. For calls, we subtract a spread from the open price. The spread we use is half of a historical average of the closing bid/ask spreads. (An alternative would be to purchase the new contracts sometime in the middle of the day and use a volume weighted average price at a certain window.)

Results

We evaluate our results among three different dimensions:

- Impact of rollover frequency
- Impact of put strike
- Impact of financing choice

Impact of rollover frequency. As expected, quarterly rollover is more efficient than monthly rollover. As we can see from Exhibit 4, for ATM options, quarterly rollover has almost the same volatility as monthly, but its average return is increased from 2.52% to 4.27%. This is also the case for OTM options. The average annual return of 5% OTM put protection increases from 5.62% to 6.72% if the rollover frequency is changed from monthly to quarterly.

Exhibit 4: Impact of rollover

	ATM Put		5% OTM Put	
	Monthly	Quarterly	Monthly	Quarterly
Average Annulized Return	2.52%	4.27%	5.62%	6.72%
Volatility	7.87%	8.40%	12.16%	10.99%
Median Yearly Return	2.20%	4.22%	6.22%	8.24%
Max Yearly Return	18.61%	27.27%	34.45%	33.80%
Min Yearly Return	-14.58%	-9.20%	-19.34%	-11.88%

Source: Standard & Poor's.

One might consider longer dated contracts such as six month options or LEAPS (Long-Term Equity Anticipation Securities, i.e. publicly traded options with expiration dates that are longer than one year). Unfortunately, liquidity drops off after three months and longer dated contracts are far less liquid. For example, on 12/20/2007, the June 08 put contracts were not traded at all at strike 1460 (ATM) or 1290 (5% OTM).

Impact of moneyness. The naïve approach is to buy straight ATM put options to protect full value of the underlying. ATM options are usually the most actively traded in the option market. However, ATM options also have the richest premium, resulting in extremely high insurance costs.

Exhibit 5 shows the risk-return trade-off of different strike prices. If the contracts are rolled quarterly, giving up 5% protection will increase the average return from 4.27% to 6.72%. It also comes with higher risk, but the increase in volatility is relatively mild (an increase from 8.40% to 10.99%).

Exhibit 5: Impact of moneyness.

	Quarterly Put		
	ATM	2% OTM	5% OTM
Annulized Return	4.27%	5.25%	6.72%
Annualized Volatility	8.40%	9.36%	10.99%
Median Yearly Return	4.22%	5.33%	8.24%
Max Yearly Return	27.27%	30.59%	33.80%
Min Yearly Return	-9.20%	-10.75%	-11.88%

Source: Standard & Poor's.

Options further away from 5% are less liquid. For example, on January 18, 2008, March 2008 7% OTM put were not traded until four days later.

Impact of financing: The cost of puts could be financed by selling calls. We summarize the results of various such collar strategies in Exhibit 6.

Exhibit 6: Impact of Financing

		2% OTM Put (Quarterly)		5% OTM Put (Quarterly)	
	S&P 500	Straight Put	Collar	Straight Put	Collar
Annulized Return	10.34%	5.25%	6.57%	6.72%	6.00%
Annualized Volatility	16.22%	9.36%	5.54%	10.99%	8.15%
Median Yearly Return	13.01%	5.33%	9.27%	8.24%	6.58%
Max Yearly Return	38.13%	30.59%	12.53%	33.80%	23.41%
Min Yearly Return	-20.49%	-10.75%	1.29%	-11.88%	-4.65%

Source: Standard & Poor's.

From Exhibit 6, we can see that 5% collar is not a big improvement over the 5% straight put since the 5% calls are not sufficient to cover the cost of the puts. Therefore, no big difference in the average return is observed in the paste 15 years. However, if we move a little closer to the strike and use 2% OTM collars, the corresponding calls start to improve both the return and the volatility.

A S&P 500 Protective Put Index Concept

Principal protected S&P 500 index products are among the most popular structured products issued to retail investors. For example, a cursory search of an industry database (www.structuredretailproducts.com) showed more than 175 various protected S&P 500 index linked products. Given retail investors' limited understanding of options and general aversion to risk, these products are a staple offering sold at relatively high loads and expenses.

Given our results, we explore a possible S&P 500 Protective Put index using 2% collars. This index could potentially be a benchmark for the legions of principal protected products available in the retail market, or be the basis of a lower cost index linked product.

Exhibit 7 summarizes the performance of the 2% quarterly collar in the past 15 years. It offers approximately 2/3 market return at 1/3 overall risk, and significantly lower downside risk as measured by maximum drawdown and Sortino ratio.

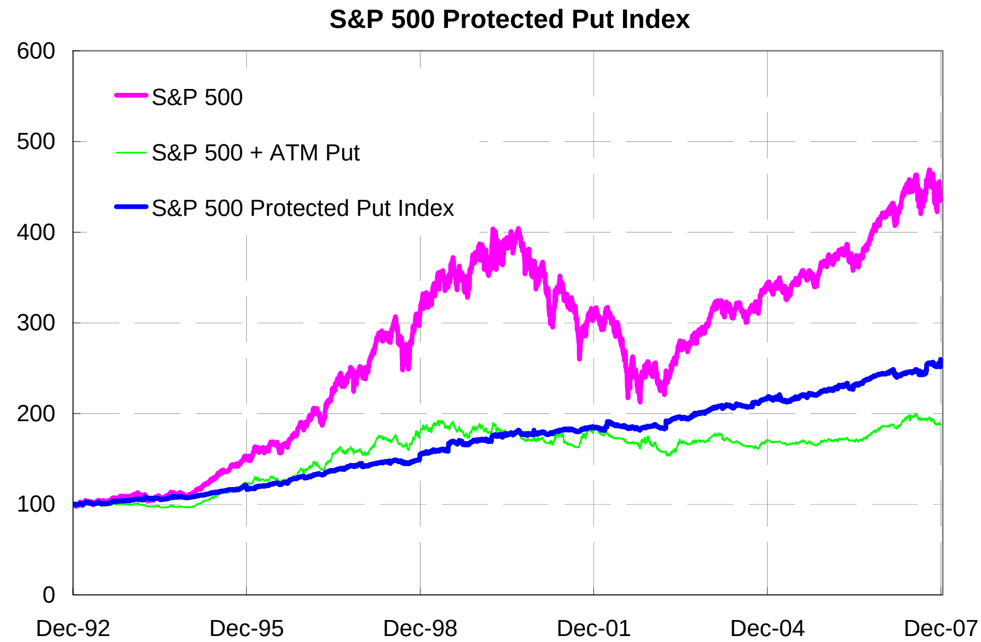
Exhibit 7: Possible S&P 500 Protected Index

Statistics	S&P 500	S&P 500 Protected Put
Annulized Return	10.34%	6.57%
Annualized Volatility	16.22%	5.54%
Sharpe Ratio	0.52	0.59
Sortino Ratio	0.76	1.04
Max Drawdown	-47.42%	-5.09%

Source: Standard & Poor's.

Exhibit 8 shows the protected put indices based on accumulated total returns of this index. The stability of the line chart for the S&P 500 Protective Put index is striking.

Exhibit 8: Performance of S&P 500 Protective Put Index



Source: Standard & Poor's.

Conclusions

Principal protected S&P 500 index products are among the most popular structured products issued to retail investors. Given retail investors' limited understanding of options pricing and general aversion to risk, these products sell briskly at relatively high loads and expenses. In this paper, we discussed the concept of a possible S&P 500 Protective Put index, which could be a benchmark for the legions of principal protected products available in the retail market, or be the basis of a lower cost index linked product. There are multiple instruments and techniques used to execute principal protection or portfolio insurance. For purposes of transparency and replicability, we use the liquid, publicly traded options market and explore various maturity, financing and strike scenarios. Our simple S&P 500 Protective Put Index concept, based on 2% collars, offers approximately two-third of market return at one-third of overall risk. Downside risk as measured by maximum drawdown and Sortino ratio is significantly lower than the S&P 500 index. This is certainly not the only manner in which to implement such a concept. One could choose a different combination of options, or could use a combination of risk free assets and futures in the traditional portfolio insurance framework. Separately, one could extend the idea we present to tap into the large annuities market by adding a fixed distribution to the S&P 500 Principal Protected index.

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