

White Paper

Risk Management Overlay Strategies

➤ Changing the Way Investors Think About Hedging
Using the S&P 500[®] Index and CBOE Exchange
Traded Options

March 2015

Jointly presented by:



Foreword by Tony Robbins

It's no secret that investor behavior continues to be one of the core reasons investors fail to meet their financial objectives. Historically speaking, stocks are by far the best place to be in terms of absolute returns. Yet, one must be equipped to stomach up to 50% drawdowns to realize those gains. Making poor decisions, primarily resulting from volatility and the subsequent fear, drastically erodes returns. Just how much?

Over a 20-year period, December 31, 1993, through December 31, 2013, the S&P 500 index returned an average annualized return of 9.28%. But the average stock mutual fund investor made just over 2.54%, according to Dalbar, one of the leading industry research firms. Some of this can be attributed to fees and active managers who fail to match the market/benchmarks, but it's fair to say that much of it can be assigned to emotionally reactive decisions.

Investors can do everything right – minimize fees, minimize taxes, not chase performance and hold strong during periods of volatility. But if they need to start spending during one of these periods, when the market is spiraling or even flat, there can be a devastating impact on their nest-egg which could very well impact their ability to care for a loved one, pay for retirement or send a child to school. There is no assurance that the market will cooperate with our life plans.

As an expert in human behavior, we certainly need better and less expensive solutions that mitigate against poor emotional decisions and protect against the sequence of returns risk. This is why downside protection is critical while maintaining exposure to equity market returns. My hope is that this white paper will shed some light on how certain risk management overlay strategies can help investors achieve the financial freedom they truly deserve.

Tony Robbins, Author of #1 New York Times
Bestseller "Money; Master the Game"

Executive Summary

Both institutional and retail investors are in search of effective downside protection. The cost of investment guarantees and downside protection where the hedge objective is to eliminate or minimize the risk exposure associated with an already designed product, investment and/or liability can be prohibitively expensive. This is especially true in periods of high volatility which drives the cost of hedging.

This paper presents a new way for investors to think about hedging and examines an approach to providing effective downside protection by reshaping the risk distribution based on performance objectives using a new class of risk management overlay (“RMO”) strategies. These overlays can be put on an existing fund without affecting the underlying holdings. The RMO is effectively an embedded hedge portfolio inside the fund that allows for the pass through of hedging performance to the investor. The class of RMOs analyzed in this paper are distinguished by the following characteristics:

- An overlay on top of the fund.
- Gains and losses from the RMO flow directly into fund performance.
- Objective is not necessarily to strictly hedge a liability or absolute risk exposure. Instead, the RMO may have multiple performance-based objectives, including providing downside protection.
- Risk distribution is reshaped based on desired hedging and performance objectives.
- Uses dynamic hedging techniques similar to those used by insurance companies along with structured hedges to further customize the desired risk distribution.
- Changes in the market value of an RMO intentionally may or may not track changes in the value of a liability depending on the hedge objectives.

We illustrate the potential benefits to variable annuity writers and policy holders of designing products based on the risk management and hedging considerations using RMOs driven off of the S&P 500 index and CBOE exchange traded options. Outside of guaranteed investment products, retail funds and pension plans may also benefit from these strategies.

In Search of Effective Downside Protection

Both retail advisors and institutional investors are worried about volatility and downside risk. To hedge against these risks some managers employ strategies that purchase downside protection using S&P 500 index put options traded on the Chicago Board Options Exchange (“CBOE”). However, purchasing protection that attempts to eliminate this investment risk can be prohibitively expensive, mainly due to the relatively high costs of implied volatility.

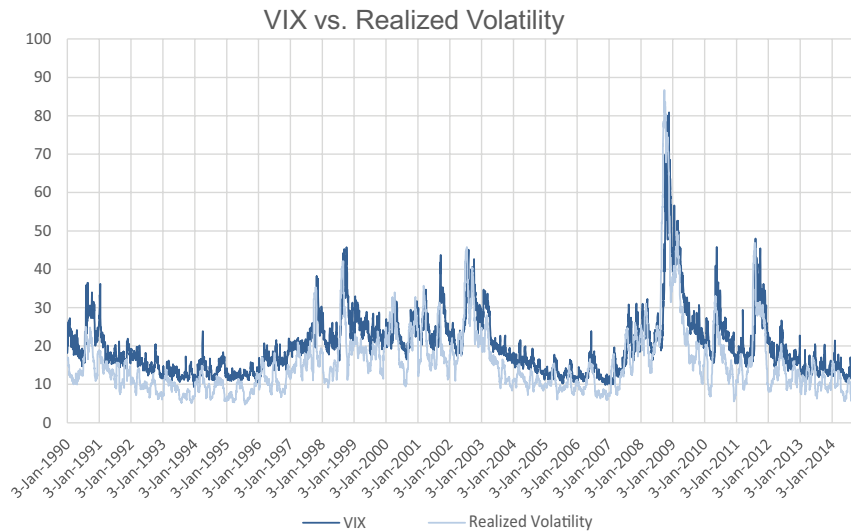
Volatility

Volatility is a key driver of the protection cost. High implied volatility results in higher option premiums while high realized volatility generally results in higher hedging costs especially if hedging without options. An investor who is long volatility (e.g. by purchasing options) benefits when market volatility increases. Option premiums increase when volatility increases. Conversely, an investor who is short volatility (e.g. has sold or is replicating a put option) benefits when market volatility decreases. Volatility is often viewed as synonymous with downside risk and sometimes becomes the hedging objective itself, i.e. rather than hedging downside risk, the hedge objective focuses on reducing volatility. However, it is important to understand that higher volatility can result in higher returns, and reducing volatility can not only reduce returns but also has the potential to lock in losses¹.

1. Risk management strategies that systematically reduce volatility and exposure to risky asset classes as losses increase may reach a point where there is little or no exposure to non-cash assets thereby making it impossible to make up for losses incurred.

The option premium paid by an investor is a function of the implied volatility for a given strike price and maturity. For first order hedging, realized volatility drives the cost. When an investor is short volatility, higher realized volatility over the period increases the cost of hedging while lower realized volatility decreases the cost. While implied volatility is known up front, realized volatility will only be known at the end of the period in question. Realized volatility may be lower or higher over the period than the implied volatility at the beginning of the period². Figure 1 below shows the implied volatility represented by the CBOE Volatility Index® (VIX® Index) plotted against realized volatility from 1990 through 2014. Over this time period, the VIX Index was 4.3 points higher than realized volatility on average³.

Figure 1 - VIX vs. Realized Volatility



Source: CBOE, Bloomberg

There are a number of ways an investor can act on the view that implied volatility is overpriced. Depending on the time horizon, an investor may choose to run the risk “naked” (e.g. invest in the S&P 500 index with no protection). This is likely to have the highest expected return but also the greatest possible loss. At the other extreme, an investor may buy a put option on the S&P 500 index. This is likely to have the lowest expected return and the lowest possible loss (equal to the option premium). In between this range, an investor may hedge the risk themselves or buy a product that manages risk on their behalf. This will tend to have a higher expected return than buying a put option and a lower possible loss than running the risk naked. Alternatively, an investor may reduce the allocation to risky assets thereby reducing volatility and expected return.

Traditional hedging approaches employed by insurance companies have not taken advantage of the tendency for implied volatility to trade at a premium to realized volatility. Instead, insurance companies have generally been victims of rich implied volatilities because they have tended to be buyers of long-dated index put options. We now turn our attention to a new way of thinking about hedging that taps into this premium in implied volatility to help offset downside protection costs.

2. In addition to the level of implied volatility for a given strike, volatility skew is a key driver of the cost of options.

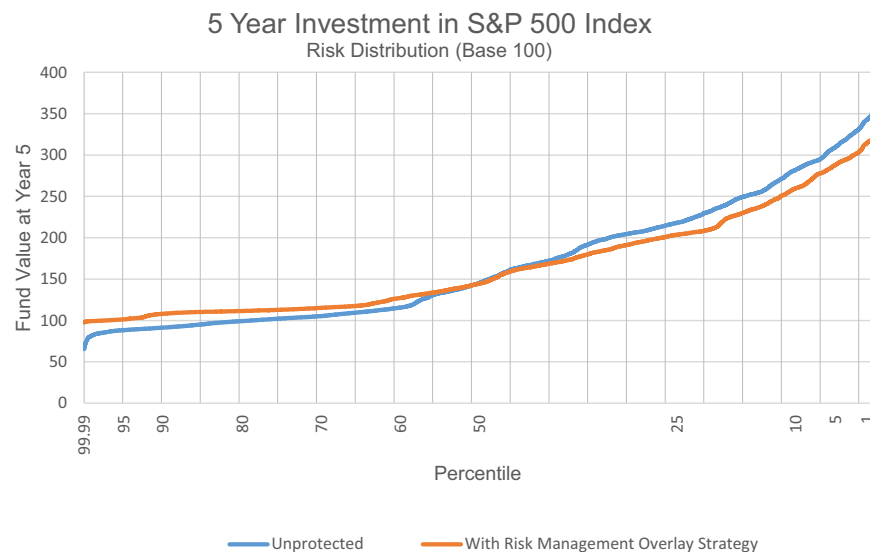
3. The average VIX Index level was 19.9 while the average realized volatility was 15.6.

A New Way for Investors to Think About Hedging

Risk Management Overlay Strategies

Unlike other risk management strategies where the goal is to hedge a liability or absolute loss by matching the associated greeks and exactly tracking the changes in the liability, RMOs provide a new approach to providing effective downside protection by reshaping the risk distribution based on performance objectives. Figure 2 below shows the distribution of ending fund values assuming an initial investment of \$100 invested for 5 years in the S&P 500 index both with and without an RMO strategy from January 1, 1990 to December 31, 2014. The RMO reshapes the risk distribution, providing downside protection by foregoing some of the upside.

Figure 2: Risk Distribution of Ending Fund Values



Source: Bloomberg, Nexus Risk Management, Inc.

The RMO presented in this paper is a rules based risk management strategy that consists of highly liquid, exchange traded futures and options. Gains and losses from the hedge portfolio flow directly into the fund performance. The RMO can be thought of as comprising two components:

- (i) A dynamic hedging component that seeks to replicate a notional liability such as a put option, and
- (ii) A structured hedge component that further reshapes the risk distribution

The notional liability is designed in such a way as to express the desired downside protection. The greeks measuring the sensitivity of the notional liability to changes in index levels, volatility, interest rates and other financial variables are monitored in real time. A hedge portfolio is constructed in order to match one or more of the greeks and is continually rebalanced based on the "in-the-moneyness" of the notional guarantee. The desired hedge performance is derived in part from the behavior of the notional liability to changes in financial variables. The structured hedge typically involves an option strategy that may provide second order downside protection and/or premium income from selling options to help cover the cost of the downside protection similar to a quasi-synthetic collar that moves with the market.

Illustrative Example of a Risk Management Overlay

Below is an example of an RMO strategy for illustrative purposes. Here we assume that an investor has the following hedge objectives: 1) Maximum exposure to the S&P 500 index, 2) Protection of initial investment over 5 years, 3) Willing to forgo some upside, and 4) Minimize overall drag / expected hedging cost.

As a first step, we define a notional liability that will behave the way the investor wants under various market conditions based on the above objectives. In our example, we define the notional liability to be a simple 5-year at-the-money put option on the S&P 500 index.

The RMO strategy will be to hedge 80% of the net delta of the notional liability and structured hedge using short S&P 500 index futures. The structured hedge will consist of a long position in short-dated CBOE SPX put options on 20% of notional struck at 98.3% and a short position in short-dated CBOE SPX call options on 100% of notional struck at 101.4%. The options positions will be rolled monthly while the short futures position will be rebalanced daily. Table 1 below summarizes the RMO strategy:

Table 1: Summary of Risk Management Overlay Strategy

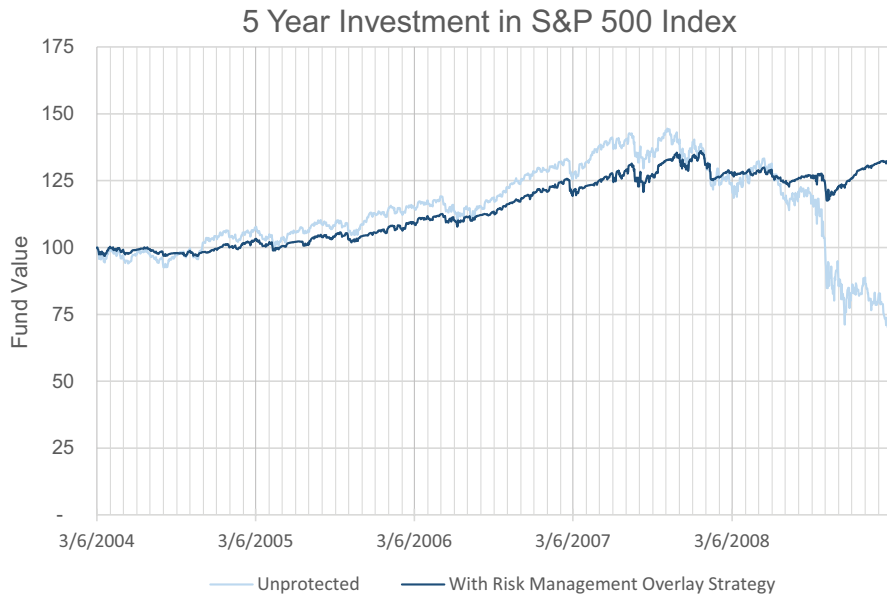
POSITION	INSTRUMENT	STRIKE	NOTIONAL	TRADING FREQUENCY
Short	S&P 500 Index Future	N/A	80%	Rebalance net delta daily
Long	SPX Put Option	98.3%	20%	Rolled monthly
Short	SPX Call Option	101.4%	100%	Rolled monthly

In our example, the RMO strategy is not strictly trying to hedge a 5 year at-the-money put option. The objective of the strategy will be delta neutral replication of 1) the notional liability and 2) a portion of the delta from the other options using S&P 500 index futures contracts. In general, the net premium from the monthly rolled long out-of-the-money put options and short out-of-the-money call options may be positive or negative. Net premium income and gamma / vega exposure help to improve overall hedge performance and help ensure the strategy does not end up in a cash lock position. This is a departure from pure dynamic hedging as the RMO strategy is not seeking to solely replicate the underlying liability.

Historical Back Testing

Figure 3 below shows the performance of an RMO strategy over the worst 5 year investment period. An unhedged \$100 investment in the S&P 500 index on March 6, 2004 would have been worth \$65.20 on March 2, 2009. Over the same period using this RMO strategy it would have had a value of \$109.10.

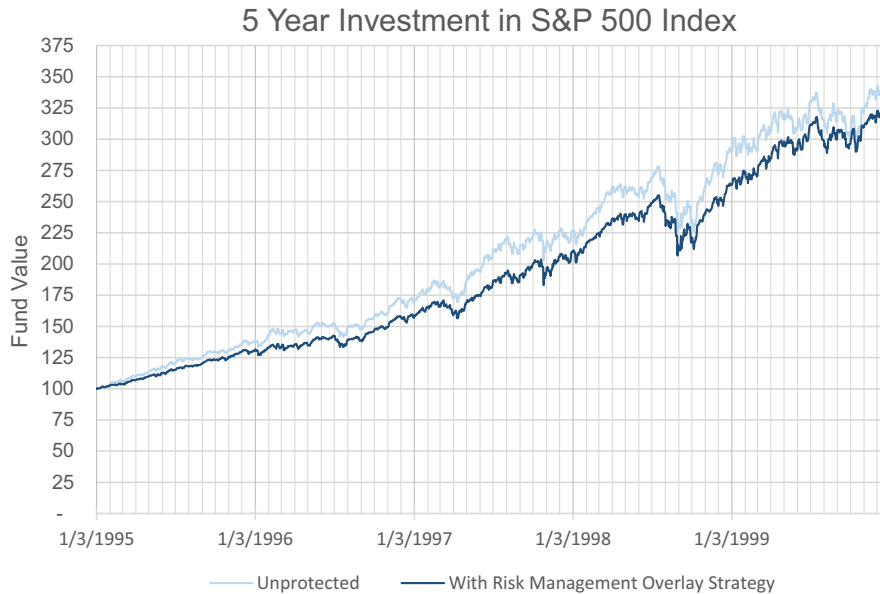
Figure 3: 5 Year Investment in S&P 500 index with and without Risk Management Overlay Strategy



Source: Bloomberg, Nexus Risk Management, Inc.

Figure 4 below shows the performance of an RMO strategy over the best 5 year investment period. A \$100 investment in the S&P 500 index on January 3, 1995 would have been worth \$351.23 on January 2, 2000. This RMO strategy would have had a value of \$330.75.

Figure 4: 5 Year Investment in S&P 500 index with and without Risk Management Overlay Strategy



Source: Bloomberg, Nexus Risk Management, Inc.

Potential Advantages to Variable Annuity Writers and Policy Holders

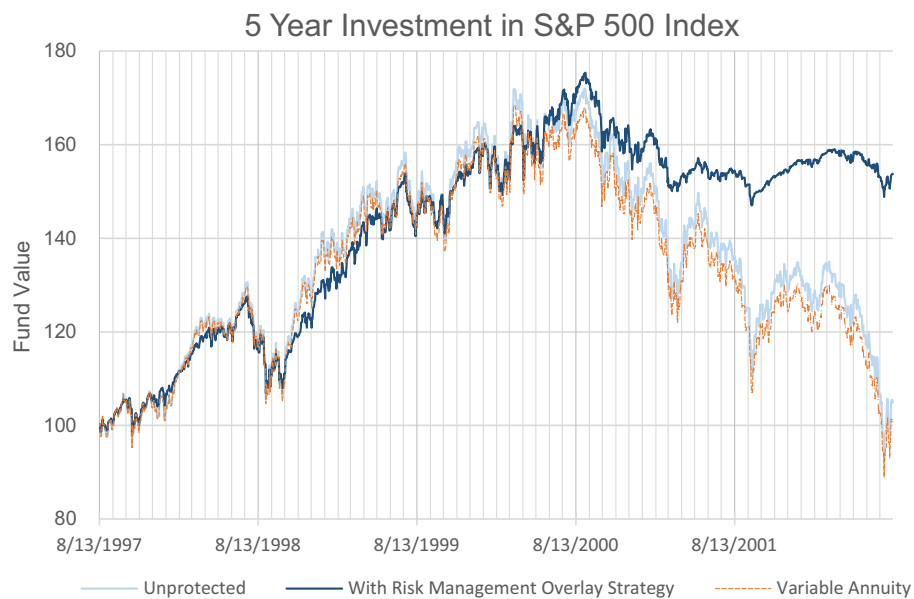
RMO strategies provide new opportunities for insurance companies and their policy holders. Insurers can design guaranteed products that pass through / share risk with policy holders by embedding an RMO hedge portfolio inside the underlying fund. Risk sharing with policy holders may otherwise not be appropriate if the insurer was running the risk naked and could be too expensive if purchasing over-the-counter options. Table 2 below shows key differences between a VA and a fund with an RMO.

Table 2: Comparison of a Variable Annuity and Fund with Risk Management Overlay

VARIABLE ANNUITY	FUND WITH RISK MANAGEMENT OVERLAY
Insurer offers guarantee at death or maturity.	Fund with RMO does not necessarily offer guarantee.
Hedge portfolio backs general account assets of insurer.	Hedge portfolio embedded inside the fund.
Variable annuities will decline as market declines.	Offsetting gains and losses flow into fund performance.
Risk charge must be sufficient to cover cost of guarantee.	In lieu of risk charge, cost of hedging is path dependent.
Hedging objective is to mitigate relative risk associated with guarantee.	Multiple hedging objectives including mitigating shortfall risk within investor specified risk tolerance, increasing / decreasing volatility, increasing / decreasing market exposure, reducing hedging cost and optimizing overall fund performance.
Hedging objective achieved using dynamic hedging so that changes in hedge portfolio offset changes in liability.	Hedging objectives achieved by reshaping risk distribution using dynamic hedging techniques and structured hedges.

Figure 5 below shows a backtest comparison between a hypothetical VA based on the S&P 500 index that provides a guaranteed minimum accumulation benefit on death or maturity, the S&P 500 index, and, lastly the S&P 500 index with an RMO strategy. For purposes of comparison, no fees are charged other than a risk charge of 80 basis points on the VA. Both the S&P 500 index and the VA outperformed the S&P 500 index with the RMO slightly during steep rising markets. During the market downturn in 2001, gains from the hedge portfolio embedded inside the fund with the RMO offset losses and provided positive outperformance over the unprotected fund and the VA. Gains realized by the insurer from the dynamic hedging program supporting the VA would have flowed into the general account assets of the insurer. The policy holder has the guarantee provided by the insurer but it is only paid out on death or maturity of the policy.

Figure 5: Comparison against Variable Annuity without RMO



Source: Bloomberg, Nexus Risk Management, Inc.

New Opportunities for Pension Plans and Money Managers

In addition to the potential advantages RMOs provide for variable annuity writers and policy holders, RMOs on non-guaranteed funds can be attractive to fund managers looking to deliver products to retail investors seeking more downside protection while maintaining exposure to equity market returns. Pension plans investing heavily in non-fixed income assets such as equities to back largely fixed income liabilities can use RMO strategies that can be structured to provide protection against equity downturns, and also help immunize the interest rate risk exposure.

Charles L. Gilbert, FSA, FCIA, CFA, CERA
President and CEO

Nexus Risk Management
Exchange Tower
130 King Street West
Suite 1210, PO Box 120
Toronto, ON, M5X 1A4 CANADA
+1 416 593 9500 x226
charles.gilbert@nexusrisk.com
www.nexusrisk.com

Matthew McFarland
Director — Business Development

Chicago Board Options Exchange
400 S. LaSalle Street
Chicago, IL 60605
312-786-7978
mcfarland@cboe.com
www.cboe.com

J. Alan Grissom
Global Head of Insurance

S&P Dow Jones Indices
55 Water Street, 27th Floor
New York, NY 10041
212-438-1910
alan.grissom@spdji.com
www.spindices.com

Mike Warsh
Director — Business Development

Chicago Board Options Exchange
400 S. LaSalle Street
Chicago, IL 60605
312-786-8616
warsh@cboe.com
www.cboe.com

No statement within this paper should be construed as a recommendation to buy or sell a security or futures contract or to provide investment advice. Options involve risks and are not suitable for all investors.

Prior to buying or selling an option, an investor must receive a copy of Characteristics and Risks of Standardized Options. Copies are available from your broker, by calling 1-888-OPTIONS, or from The Options Clearing Corporation at www.theocc.com. Futures trading is not suitable for all investors, and involves risk of loss. The information in this paper is provided for general education and information purposes only and is not intended to provide, and should not be relied on for financial, legal or tax advice. The general information contained in this paper should not be acted upon without obtaining specific legal, tax and investment advice from a licensed professional. Past performance does not guarantee future results. This paper contains index performance data based on back-testing, i.e., calculations of how the index might have performed prior to launch. Back-tested performance information is purely hypothetical and is provided in this document solely for information purposes. Back-tested performance does not represent actual performance and should not be interpreted as an indication of actual performance. In order to simplify the computations, commissions, fees, margin interest and taxes have not been included in the examples used in this paper. These costs will impact the outcome of all transactions and must be considered prior to entering into any transactions. Investors should consult their tax advisor as to how taxes affect the outcome of contemplated options transactions. The information and data contained in this paper (collectively "Data") are presented "as is" and without representations or warranties of any kind. Chicago Board Options Exchange, Incorporated (CBOE), Nexus Risk Management, Inc. (Nexus) and S&P Dow Jones Indices (S&P DJI) and their respective affiliates and their respective directors, officers, employees, agents, representatives and third party providers of information shall not be liable for loss or damage, direct, indirect or consequential, arising from any use of the Data or action taken in reliance upon the Data. CBOE®, Chicago Board Options Exchange®, CBOE Volatility® and VIX® are registered trademarks of CBOE. S&P 500® is a registered trademark of Standard & Poor's Financial Services, LLC and has been licensed for use by CBOE. Financial products based on S&P indices are not sponsored, endorsed, sold or promoted by S&P DJI, and S&P DJI makes no representation regarding the advisability of investing in such products. Redistribution, reproduction and/or photocopying in whole or in part are prohibited without the written permission of CBOE, Nexus or S&P DJI.

S&P Dow Jones Indices receives compensation for licensing its indices to third parties, and it does not sponsor, sell or promote any investment product. Standard & Poor's® and S&P® are registered trademarks of Standard & Poor's Financial Services LLC, and Dow Jones® is a registered trademark of Dow Jones Trademark Holdings LLC.