

# A Performance Analysis of Variable Annuities With Risk Control

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## EXECUTIVE SUMMARY

- A variable annuity is a tax-deferred retirement vehicle with account values linked to the performance of underlying investment options, typically mutual funds.
- A variable annuity with risk control framework has the added feature of providing caps and floors to the investment performance, which in turn is linked to the performance of the underlying investment options, typically a price index.
- We construct hypothetical portfolios that allocate between a variable annuity with a risk control mechanism and a blended portfolio of stocks and bonds.
- Historical performance for the hypothetical portfolios with allocation to products with a risk control feature showed better downside protection than a stock portfolio or a traditional 60/40 stock/bond portfolio in some scenarios.

## INTRODUCTION OF VARIABLE ANNUITIES WITH RISK CONTROL

A variable annuity is a tax-deferred retirement vehicle with account values linked to the performance of the investment options chosen by the market participant. The investment options for a variable annuity are typically mutual funds that invest in stocks, bonds, money market instruments, or some combination of the three.

A variable annuity that uses a risk control framework has the added feature of providing caps and floors to investment performance that are linked to the performance of the underlying investment options. If the underlying index delivers returns greater than the cap level or lower than the floor level, market participants will receive guaranteed payments at the cap or floor level, respectively. Therefore, variable annuities with risk control offer downside protection to investors at the expense of forgoing a degree of upside return. They offer market participants better visibility and predictability on future cash flows from annuities by effectively incorporating risk management tools in investment products.

*A variable annuity with risk control provides caps and floors to the performance of the underlying investment options.*

A variable annuity with risk control features shares the same concept as and similar structure to those of risk control indices. Risk control indices are designed to measure the performance of underlying equity or futures-based indices at specified volatility levels. As a benchmark provider of risk control indices, S&P Dow Jones Indices finds it relevant and meaningful to investigate the impact of incorporating a risk control framework into investment products, such as variable annuities, in a portfolio context.

## PORTFOLIO CONSTRUCTION

We investigate the performance impact of adding a variable annuity with risk control features to a base hypothetical portfolio that allocates between global equity and U.S. fixed income. We look at three hypothetical base portfolios with different investment styles: balanced, moderate, and growth. The type of investment style is categorized based on the portfolio's hypothetical allocation between global equities and the domestic aggregate bond market (see Exhibit 1).

For variable annuities with risk control mechanisms, we consider a stylized fixed allocation to two index-linked accounts, using the [S&P 500®](#) to represent the U.S. large-cap equity space and the [S&P Developed LargeMidCap](#) to represent international equity. The conservative and moderately aggressive accounts are defined by different cap and floor levels on index price returns, and therefore represent different upside/downside risk tolerance (see Exhibit 2).

**Exhibit 1: Definition of Base Portfolio**

BASE PORTFOLIO STYLE	ALLOCATION (%)	
	S&P GLOBAL BMI	BARCLAYS U.S. AGGREGATE BOND INDEX
Balanced	50	50
Moderate	65	35
Growth	85	15

Source: Barclays, S&P Dow Jones Indices LLC. Table is provided for illustrative purposes.

*Back-testing of 22-year data shows variable annuities with risk control provided better downside protection than a traditional 60/40 portfolio.*

**Exhibit 2: Definition of Variable Annuities With Risk Control**

INDEX	TYPE OF ACCOUNT	CAP (%)	FLOOR (%)	RISK CONTROL ALLOCATION (%)
S&P 500	Conservative Account	5.00	0.00	25
	Moderately Aggressive Account	15.00	-10.00	50
S&P Developed LargeMidCap	Conservative Account	7.50	0.00	10
	Moderately Aggressive Account	17.50	-10.00	15
SUM=				100

Source: S&P Dow Jones Indices LLC. Table is provided for illustrative purposes.

Next, we constructed composite hypothetical portfolios that allocate between a risk controlled variable annuity and the base portfolio of three investment styles (balanced, moderate, and growth). We varied the allocation to the variable annuity at 75%, 50%, and 25% and compared the

performance of the resulting portfolios with that of the [S&P Global BMI](#), Barclays U.S. Aggregate Bond Index, and a 60/40 portfolio of the S&P Global BMI and Barclays U.S. Aggregate Bond Index.

## HISTORICAL PERFORMANCE ANALYSIS

We formed back-tested, hypothetical portfolios for the 22-year period ending in 2017 and compared them with a traditional 60/40 stock and bond portfolio (see Exhibits 3a and 3b). For portfolios with allocation to risk controlled variable annuity, a degree of upside participation was sacrificed in exchange for lower volatility. Risk-adjusted returns seemed to improve for moderate or balanced style-based portfolios with relatively high (50% and 75%, respectively) allocations to a risk controlled variable annuity. However, the biggest benefit can be observed in the improvement in maximum drawdown. As expected and by design, risk control portfolios provided better downside protection for market participants. This last observation prompted us to take a closer look at portfolio performance during two historical scenarios of market turmoil: the stock market crash of 2000-2002 and the 2007-2008 global financial crisis.

*Risk control portfolios performed better than a stock-only portfolio, but not so for a 60/40 portfolio during the stock market crash of 2000-2002.*

**Exhibit 3: 22-Year Historical Performance Comparison**

ALLOCATION TO RISK CONTROL	BASE PORTFOLIO STYLE	ANNUAL RETURN (%)	ANNUAL VOLATILITY (%)	MAXIMUM DRAWDOWN (%)	RETURN/VOLATILITY	SHARPE RATIO
<b>RISK CONTROL PORTFOLIOS*</b>						
75%	Balanced	6.1	7.5	-15.2	0.82	0.54
	Moderate	6.3	8.2	-17.6	0.76	0.51
	Growth	6.4	9.2	-20.7	0.7	0.47
50%	Balanced	6.5	7.8	-12.5	0.83	0.56
	Moderate	6.7	9.3	-17	0.72	0.49
	Growth	7	11.3	-23.2	0.61	0.43
25%	Balanced	6.8	8.3	-15.6	0.81	0.56
	Moderate	7.1	10.6	-20.9	0.67	0.47
	Growth	7.4	13.6	-28.1	0.55	0.39
<b>NON-RISK CONTROL PORTFOLIOS*</b>						
60% S&P Global BMI + 40% Barclays U.S. Aggregate Bond Index		7.4	10.9	-23.4	0.67	0.48
S&P Global BMI		7.9	19	-42.4	0.42	0.31
Barclays U.S. Aggregate Bond Index		5.1	3.5	-2	1.47	0.87
T Bill		2.1	2.2	0	1	0

\*The non-risk control portfolios shown are hypothetical.

Source: Barclays, S&P Dow Jones Indices LLC. Data from 1996 to 2017. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

## SCENARIO ANALYSIS

### Scenario 1: Stock Market Crash of 2000-2002

Exhibits 4a and 4b show the performance data of hypothetical portfolios with risk control for the time period between Dec. 31, 1999, and June 28, 2002. With allocation to risk controlled annuities, portfolios had less loss and drawdown than a 100% stock portfolio. However, compared with a traditional 60/40 blended portfolio, risk controlled annuities did not offer better loss control. This may be due to the following reasons.

- (1) By allocating more to a risk controlled annuity, our hypothetical portfolios effectively decreased allocation to bonds.
- (2) During the equity-induced market crash, bonds effectively acted as a better risk management tool than a risk controlled annuity with a floor on stock performance.

*Bonds effectively acted as a better risk management tool than a risk controlled annuity with a floor on stock performance.*

It can be seen that in the stock market crash of 2000-2002, bonds returned 25.6% (the 10-year U.S. Treasury bond rallied 164 bps from a yield of 6.44%) and almost completely compensated for the stock loss of 27.8%.

**Exhibit 4: Historical Performance for Scenario 1**

ALLOCATION TO RISK CONTROL	BASE PORTFOLIO STYLE	TOTAL RETURN (NOT ANNUALIZED) (%)	MAXIMUM DRAWDOWN (%)	WORST MONTHLY RETURN (%)
<b>RISK CONTROL PORTFOLIOS*</b>				
75%	Balanced	-14.8	-17.5	-6.2
	Moderate	-16.5	-19.1	-6.5
	Growth	-18.8	-21.2	-7
50%	Balanced	-11.2	-14.5	-5.4
	Moderate	-14.8	-17.7	-6.1
	Growth	-19.5	-22	-7
25%	Balanced	-7.6	-12.3	-4.6
	Moderate	-13.2	-17.2	-5.6
	Growth	-20.3	-23.4	-7
<b>NON-RISK CONTROL PORTFOLIOS*</b>				
60% S&P Global BMI + 40% Barclays U.S. Aggregate Bond Index		-9	-15.9	-5.4
S&P Global BMI		-27.8	-32	-9.8
Barclays U.S. Aggregate Bond Index		25.6	-2	-1.7
T Bill		11.4	0	0.1

\*The non-risk control portfolios shown are hypothetical.

Source: Barclays, S&P Dow Jones Indices LLC. Data from Dec. 31, 1999, to June 28, 2002. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

## Scenario 2: Global Financial Crisis of 2007-2008

Similar analysis can be conducted for the time period between June 29, 2007, and Dec. 31, 2008 (see Exhibits 5a and 5b). For this scenario, risk controlled variable annuities proved to be much more effective in managing the risk of stocks than that of bonds. It can be seen that eight of the nine hypothetical portfolios performed better than a traditional 60/40 portfolio, and the more allocation to risk controlled annuities, the less loss was realized.

Though government bonds rallied significantly during the time period studied (the 10-year U.S. Treasury bond rallied 280 bps from a yield of 5.03%), bonds as a whole returned 11.5%, far less than the stock loss of 41.7%. In the credit-induced market crash of 2007-2008, the results showed that bonds provided less downside protection than risk controlled variable annuities and an explicit floor level.

*The results showed that bonds provided less downside protection than risk controlled variable annuities and an explicit floor level.*

**Exhibit 5: Historical Performance for Scenario 2**

ALLOCATION TO RISK CONTROL	BASE PORTFOLIO STYLE	TOTAL RETURN (NOT ANNUALIZED) (%)	MAXIMUM DRAWDOWN (%)	WORST MONTHLY RETURN (%)
<b>RISK CONTROL PORTFOLIOS*</b>				
75%	Balanced	-10.4	-14	-4
	Moderate	-12.5	-16.1	-4.4
	Growth	-15.2	-18.9	-4.9
50%	Balanced	-13	-18	-5.7
	Moderate	-17.1	-22	-7.1
	Growth	-22.2	-27.1	-8.9
25%	Balanced	-15.7	-21.8	-8.6
	Moderate	-21.6	-27.6	-10.6
	Growth	-28.9	-34.7	-13.3
<b>NON-RISK CONTROL PORTFOLIOS*</b>				
60% S&P Global BMI + 40% Barclays U.S. Aggregate Bond Index		-23.5	-30.6	-13.3
S&P Global BMI		-41.7	-47.8	-20.5
Barclays U.S. Aggregate Bond Index		11.5	-3.8	-2.4
T Bill		3.4	0	0

\*The non-risk control portfolios shown are hypothetical.

Source: Barclays, S&P Dow Jones Indices LLC. Data from June 29, 2007, to Dec. 31, 2008. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

## CONCLUSION

Variable annuities with risk control features may improve the predictability of future cash flows by capping and flooring the price performance of the underlying instruments. The concept combines the traditional risk management mechanism of portfolio diversification directly with defined cap and floor risk levels in a packaged solution. Based on the back-tested results, having risk control features embedded into a portfolio could offer downside protection to a stock-only portfolio. Depending on the correlation between stocks and bonds in various scenarios, at times variable annuities with risk control features could prove to be more effective in managing portfolio risk than adding bond exposure.

*Variable annuities with risk control features may improve the predictability of future cash flows by capping and flooring the price performance of the underlying instruments.*

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