PGIM QUANTITATIVE SOLUTIONS

MARKET PROTECTION FOR TURBULENT TIMES

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ABOUT PGIM QUANTITATIVE SOLUTIONS

PGIM Quantitative Solutions began managing multi-asset portfolios for institutional investors in 1975. Today, we manage both systematic quantitative equity and global multi-asset strategies as part of PGIM, the global investment management businesses of Prudential Financial, Inc. (PFI).[1] Our investment processes, based on academic, economic and behavioral foundations, serve a global client base with $119.7 billion in assets under management as of 6/30/2021.

FOR MORE INFORMATION

To learn more about our MPS strategy, please contact us by email at contactus@pgim.com or by phone in the US at +1 (866) 748-0643 or in the UK at +44 (0) 20-7663-3400.

Key Ideas

- Investors have traditionally used asset allocation as a way to maximize risk-adjusted returns, but in the three most recent market crises: Tech Bubble burst, Global Financial Crisis (GFC) and the COVID-19 crisis, most growth asset classes became highly correlated, reducing their diversification benefits.
- Risk-mitigation strategies (RMS) have therefore become an important element of asset allocation decisions.
- Since its inception in 1992, PGIM Quantitative Solutions US Market Participation Strategy (MPS) has provided both upside participation in rising markets, and limited downside losses in falling markets.
- MPS compares well with other RMS, including low volatility, options-based protection and hedged equity strategies that are commonly used for risk management, uncorrelated alpha and downside protection.
- Using MPS as an equity or hedged equity substitute may provide higher risk-adjusted returns in a multi-asset portfolio; we offer MPS at a flat, asset based management fee, without carried interest or performance-based fees.

Introduction

A proliferation of complex investment strategies in recent decades has made the asset allocation process more challenging. The mathematical and analytical processes inherent in contemporary asset allocation techniques can be complicated by the idiosyncrasies of different risk mitigation and alternative investment strategies. These strategies became popular components of strategic asset allocation processes in the aftermath of the 2001 Tech Bubble burst and the GFC of 2008. Institutional and private clients have been increasingly turning to these non-traditional investments not only to supplement traditional long-only stocks and bonds, but also to replace them.

[1] PFI of the United States is not affiliated in any manner with Prudential plc, incorporated in the United Kingdom or with Prudential Assurance Company, a subsidiary of M&G plc, incorporated in the United Kingdom.

PGIM Quantitative Solutions MPS strategy is designed to mitigate large losses in portfolios and to provide growth by capturing market upside through a disciplined process that limits emotional decision-making — key features of risk mitigation strategies (RMS). MPS provides upside participation in rising equity markets, along with bond-like defensive features in turbulent markets.

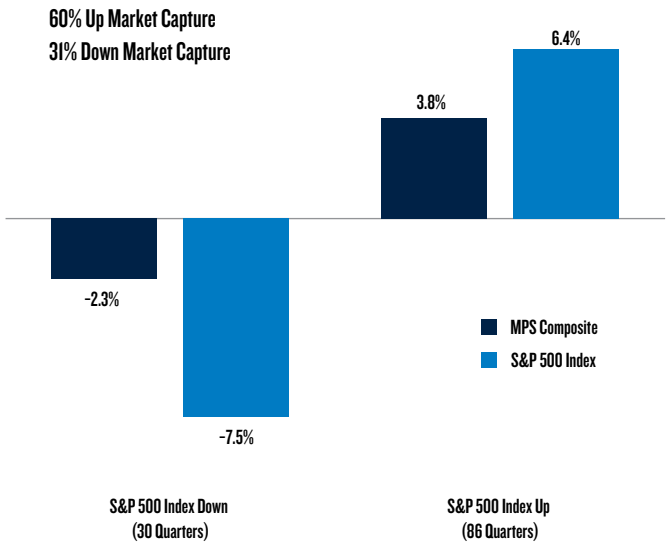
MPS has a nearly 30-year track record (inception date: 1/1/1992). It has sustained investors through multiple market environments, capturing about 60% of the S&P 500 Index on the upside, while participating in only 31% of the downside, over a full market cycle (see Figure 1b).

Figure 1a: MPS: Key Statistics

Inception-to-Date 1/1/1992–12/31/2020	MPS* (Net)	S&P 500 Index
Annualized Return	8.36%	10.07%
Standard Deviation	8.80%	14.52%
Sharpe Ratio	0.73	0.52
Maximum Drawdown	–19.03%	–50.95%
Sortino Ratio	1.19	0.86
Beta vs. S&P 500 Index	0.46	1.00

MPS Composite Returns. Source: PGIM Quantitative Solutions. As of 12/31/2020.* ***Past performance is not a guarantee or reliable indicator of future results*

Figure 1b: MPS: Upside/Downside Capture



**Inception 1/1/1992. Source: PGIM Quantitative Solutions. As of 12/31/2020*

Since inception, annualized returns for the MPS strategy have been slightly below the S&P 500 Index, but with significantly less volatility (see Figure 1a above).

Risk, particularly the risk of large drawdowns, can be costly. In market environments like the current one, the advantage of a risk mitigation strategy is clear. For example, in Q1 2020, during the COVID-19 crisis, the S&P 500 Index returned -19.6%. Investors in the MPS strategy, however, were down only -4.07% (net).

We believe that most investors should consider allocating a portion of their portfolio to risk mitigation strategies. This protection pays off whenever there is a negative surprise or a "black swan event." But even when the need for RMS is obvious, the question of which RMS to choose may not be.

Many products on the market claim to offer downside protection or risk mitigation. They come in multiple flavors: low volatility, hedged equity, options-based (covered calls/buy-write or protective puts), etc. While each of these RMS may fall into the broad category of "downside protection" strategies, few consistently offer true risk mitigation, especially during times of large equity drawdowns or increased volatility. We believe that MPS combines the best of upside market participation and downside protection.

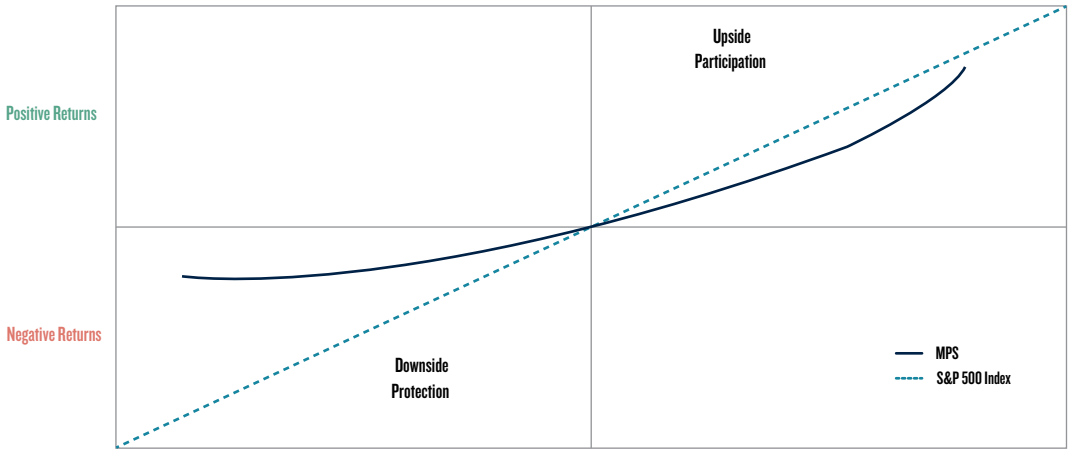
PGIM Quantitative Solutions US Market Participation Strategy (MPS) - Background

MPS seeks to provide upside participation when the US equity market advances, while reducing downside risk during sustained market declines.[2] The strategy utilizes long-dated S&P 500 Index call options in combination with US Treasuries to aim to meet this objective.

Call options seek to provide upside participation in rising equity markets, while US Treasuries serve as a safe haven during turbulent market events and provide downside protection. To provide this asymmetric payoff, PGIM Quantitative Solutions uses a disciplined process to actively manage exposures (market, volatility and interest rates) in response to changing market environments (see Figure 2).

[2] There is no guarantee these objectives will be achieved.

Figure 2: MPS: Expected Return Profile



Source: PGIM Quantitative Solutions. Shown for illustrative purposes only. ***Expected returns are not guaranteed and are subject to change.***

To understand how we can provide upside participation in rising equity markets and reduce downside risk in falling equity markets, we've provided detail into what securities we use in the MPS strategy and why.

This strategy uses:

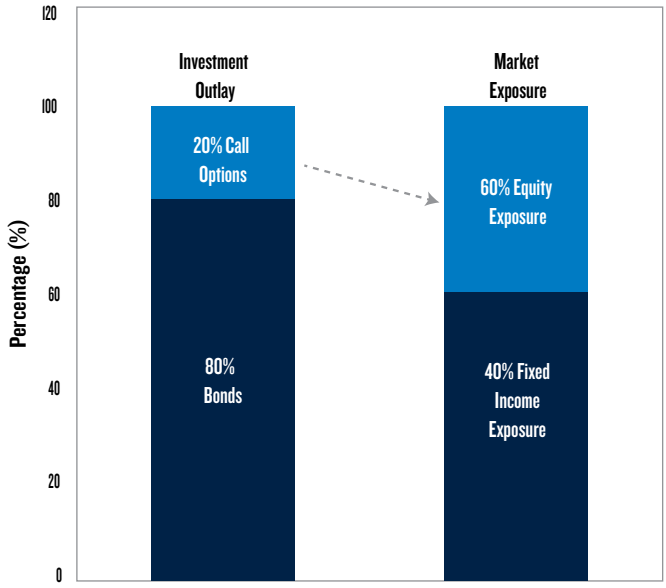
a) S&P 500 Index call options and futures, which provide upside equity participation with limited risk.

S&P 500 Index call options allow us to obtain significant exposure to the index for a relatively small price. Call options are used to express a bullish view of the market, with limited downside (maximum loss of the premium paid). We use long-term call options in MPS, which typically provide about 60% exposure to the S&P 500 Index for about 20% in premium (the price paid for the option). Options can provide significant gains if the index rises.

In the case of a significant drop in the level of the index, there could also be a meaningful loss of the premium. But the options premium is typically only 20% of the portfolio. As long as there is time left until expiration, there is always some value left in the option. Also, as part of our investment process, we don't hold the option to maturity; we roll the existing option(s) into a new one(s) well before expiration – this ensures that there is always some "time value" remaining in the option.

The biggest advantage of using call options is implied leverage. The 20% weight in the MPS portfolio (the premium) can provide 60% exposure, or delta, to the S&P 500 Index (see Figure 3 below). This is a particularly desirable feature of options – they control a greater portion of equity exposure than the amount of the premium invested. While there is implied leverage with the use of options, MPS does not employ economic leverage, i.e., there is no borrowing employed in this strategy.

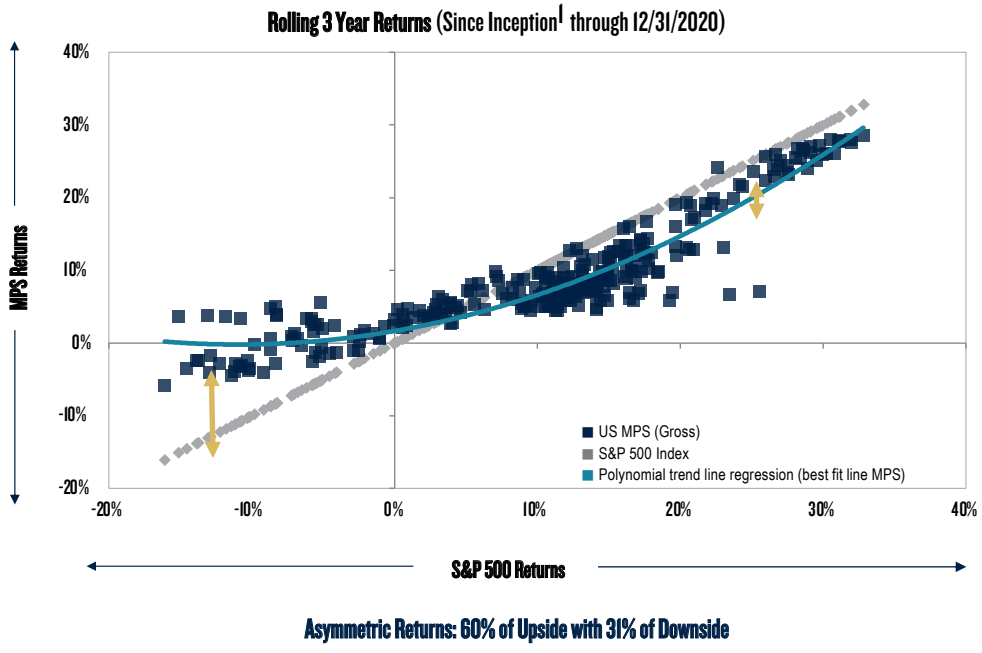
Figure 3: Option Premium vs. Equity Exposure



Source: PGIM Quantitative Solutions. Shown for illustrative purposes only.

Prior to expiration, call options also exhibit convexity. As the price of the index goes up, the exposure to the index automatically increases. If the price of the index goes down, the exposure automatically decreases in the same manner (assuming volatility, interest rates and dividend yields remain the same). This provides the natural upside/downside return profile that is so attractive in MPS (see Figure 4 below).

Figure 4: MPS Return Profile vs. S&P 500 Index



Source: PGIM Quantitative Solutions, S&P Dow Jones Indices LLC.
[1]Inception date of PGIM Quantitative Solutions US Market Participation Composite is 1/1/1992. The since inception gross performance for PGIM Quantitative Solutions US Market Participation Strategy as of 12/31/2020 would have been reduced from 8.83% to 8.36% if netted by PGIM Quantitative Solutions highest advisory fee in effect for the strategy.
Past performance is not a guarantee or a reliable indicator of future results.

By buying options in MPS, we are also "long" volatility. This means we have positive exposure to implied volatility, a key component in the pricing of options (an investor who sells options would be "short" volatility, and would thus have a negative exposure to increasing volatility). When volatility rises, especially in times of elevated risk, or during a crisis, the value of the call options in MPS also rises. Sellers of call options will lose money when volatility rises.

We use long-dated options (usually around 5 years' maturity), since the time decay (the rate of decline in the value of an option due to the passage of time) is less in the first few years on a longer-dated option. It also means that we do not have to trade into falling markets. We can, instead, hold our position, and let the convexity described above reduce our equity exposure.

A small amount of S&P 500 Index futures are held in the portfolio to complement our call options. Futures provide liquidity, as well as the ability to adjust our exposure quickly and efficiently, and incur minimal transactions costs. They can prove extremely valuable in times of market duress, as they are among the most liquid securities traded in the world.

b) US government bonds and futures, which seek to preserve capital and provide downside protection.

About 80% of the MPS portfolio is held in US Treasuries (T-bills, notes and bonds) and Treasury futures. US Treasuries are "safe haven" assets intended to provide safety of principal, as well as liquidity, particularly during turbulent market conditions when investors flee risky assets for safer ones.

We actively manage the portfolio's sensitivity to changes in interest rates (blending the interest rate exposure of bonds with that of options, since options have negative embedded interest rate exposure), or duration risk, to balance the need for safety of principal with the generation of income. The use of US Treasuries allows us to provide daily liquidity and affords investors the ability to buy and sell positions when they need to, without extended redemption periods or lock-outs. We target the Bloomberg Barclays US Government Intermediate Bond Index as a proxy for our fixed income duration and return targets.

The combination of US Treasury futures with US Treasury holdings in the portfolio provides additional liquidity, minimizes transaction costs, and helps to efficiently adjust portfolio duration without having to trade bonds held in the portfolio.

CALL OPTIONS

*A **call option** allows the buyer the right—but not the obligation—to buy a certain amount of stock/index exposure at a specified (strike) price for a specific amount of time. The buyer can:*

- *Exercise or sell the option at any time*
- *Allow it to expire*

A call buyer seeks to make a profit when the price of the underlying stock/index rises. The call price will rise along with the price of the underlying instrument.

Options contracts can be priced using mathematical models such as the Black-Scholes or binomial pricing models. An option's price is primarily made up of two distinct parts: its intrinsic value and time value. Intrinsic value is a measure of an option's profitability based on the strike price vs. the stock's price in the market. Time value is based on the underlying asset's expected future volatility and the amount of time left until the option's expiration.

Multiple factors determine the value of a call option. These include the current stock price, strike price (intrinsic value), time to expiration (time value), implied volatility, interest rates, and cash dividends paid.

The most you can lose with a call option is the premium you invested, although as long as there is time until expiration, there is always some value in a call option.

Investment Process

PGIM Quantitative Solutions disciplined process allows us to actively adjust factor exposures (market, volatility and interest rates) in response to changing market conditions. We control risk systematically with our quantitative parameters. Along with our tactical views, this allows us to provide increasing upside participation in rising markets, while also limiting drawdowns in falling markets.

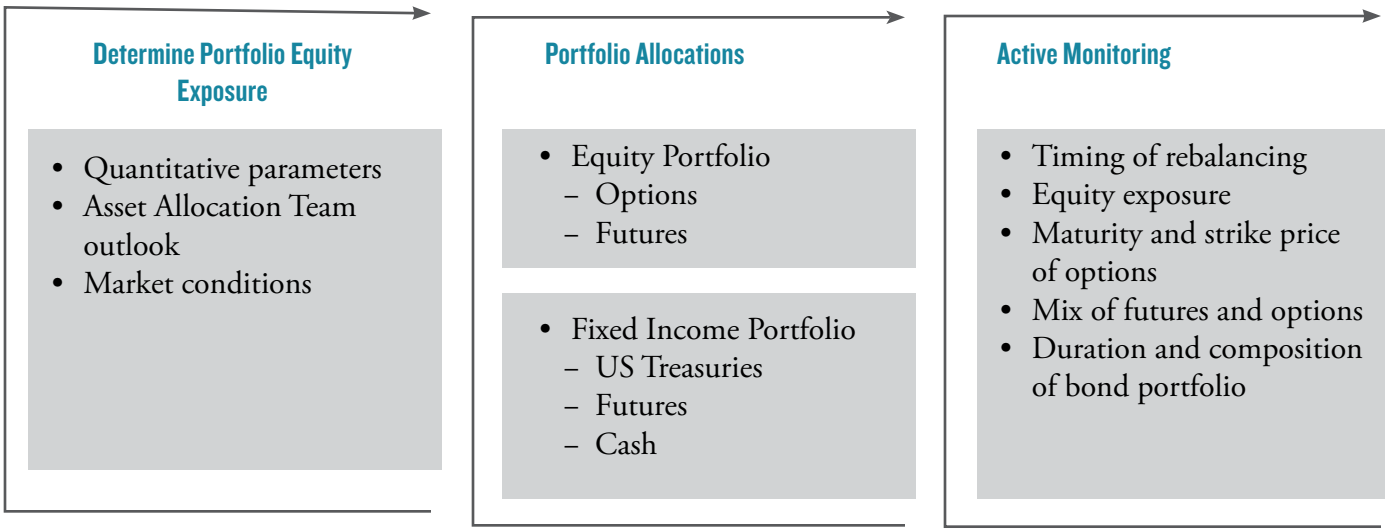
A benefit of MPS is that our experienced portfolio managers work together across investment teams, combining equity/options expertise with asset allocation experience in the application of tactical views to determine portfolio exposures. Portfolio managers take into account current market conditions, their overall economic outlook, and the liquidity available in the marketplace, along with the quantitative parameters used as a guide to reset equity exposures. They also actively manage portfolio allocations to meet the desired portfolio equity delta and fixed income duration.

The ongoing management of the MPS portfolio is a three-step process, as shown in Figure 5 below:

Figure 5: MPS: Investment Process

Seeks to Provide Upside Equity Participation with Downside Protection

Our MPS investment process combines quantitative parameters with portfolio manager judgment to target desired equity and fixed income exposures. These exposures are actively monitored and rebalanced according to systematic parameters, and then tactically adjusted by portfolio managers based on their asset allocation outlook and liquidity in the markets. This periodic rebalancing seeks to capture upside gains while reducing downside losses.



Source: PGIM Quantitative Solutions. Shown for illustrative purposes only. There is no guarantee the objective will be achieved.,

Resetting Equity Exposures

Resetting equity exposures in MPS is key to both generating the expected return profile of the portfolio and providing risk management.[3] Rebalancing parameters are shown in the diagram below (Figure 6), and their purpose is illustrated in the following graph (Figure 7).

We normally buy an "at-the-money" option (strike price is equal or close to the price of the underlying stock/index) at rebalance, which provides increasing exposure as markets rise. As the option becomes more "in-the-money," equity exposure — or delta—increases. Similarly, this option provides decreasing exposure as the market falls. As the option becomes more "out-of-the-money," its delta decreases).

Our parameters allow for upside (and downside) moves, but only up to a point. Based on decades of experience and the desired return profile, we allow for delta moves of +/- 0.15 - 0.20 from the previous reset. When these parameters are met, the portfolio delta is normally reset back to the base delta of 0.60. These guidelines have served their purpose well since inception.

[3] No investment strategy or risk management technique can guarantee returns or eliminate risk in any market environment.

Figure 6: MPS: Resetting Equity Exposures

Combines Quantitative Parameters and Portfolio Management Judgment

- The strategy typically targets 60% equity exposure at reset
- Quantitative parameters (systematic):
  - Equity exposure changes 15%-20% from prior reset
  - Equity option weights change more than 10%
  - The maturity of the option portfolio approaches three years

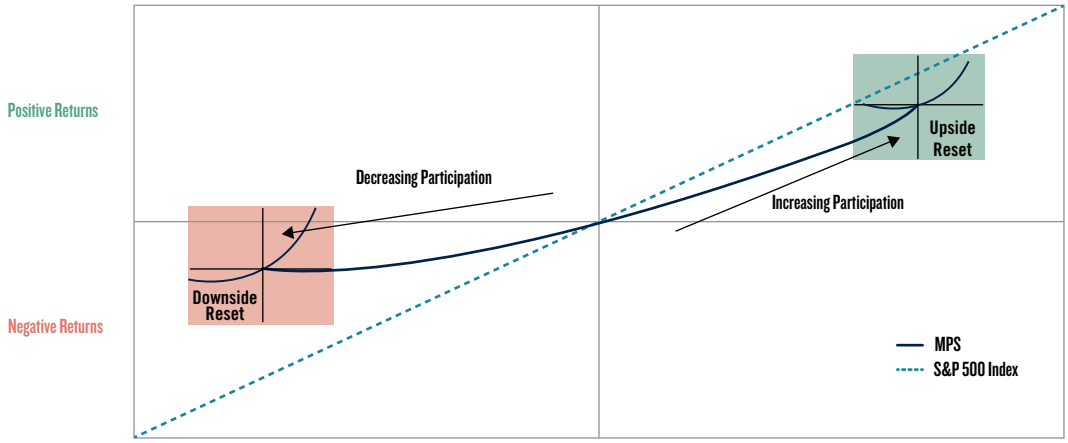
→

- Portfolio Manager judgment (tactical):
  - Asset Allocation Outlook
  - Liquidity in the markets
- To capture equity upside and provide downside protection, portfolio equity exposure typically ranges from 75% - 80% on the upside to 40% - 45% on the downside.
- It can range from as low as 10% to as high as 90% in certain circumstances.

Source: PGIM Quantitative Solutions. Shown for illustrative purposes only. Holdings are subject to change.

When markets are rising and have increased toward our reset range (see green box in Figure 7 below), and portfolio delta has increased beyond 0.75 (but not past 0.80), we normally sell our "in-the-money" call options, and roll into new "at-the-money" calls, resetting the delta back to 0.60. This also resets the allocation between options and bonds close to their typical 20% in options and 80% in US Treasuries, as gains from options are "locked in" and reallocated back to these safe haven bonds.

Figure 7: MPS: Asymmetric Return Profile



Source: PGIM Quantitative Solutions. Shown for illustrative purposes only. ***Expected returns are not guaranteed and are subject to change.***

Similarly, during equity downturns, as options lose value along with the market and get into the "red zone" (see red box in Figure 7 above), and the portfolio delta falls below 0.45 (but not below 0.40), we normally roll these "out-of-the-money" calls into new "at-the-money" calls, increasing equity exposure and resetting the portfolio delta back up to the baseline 0.60.

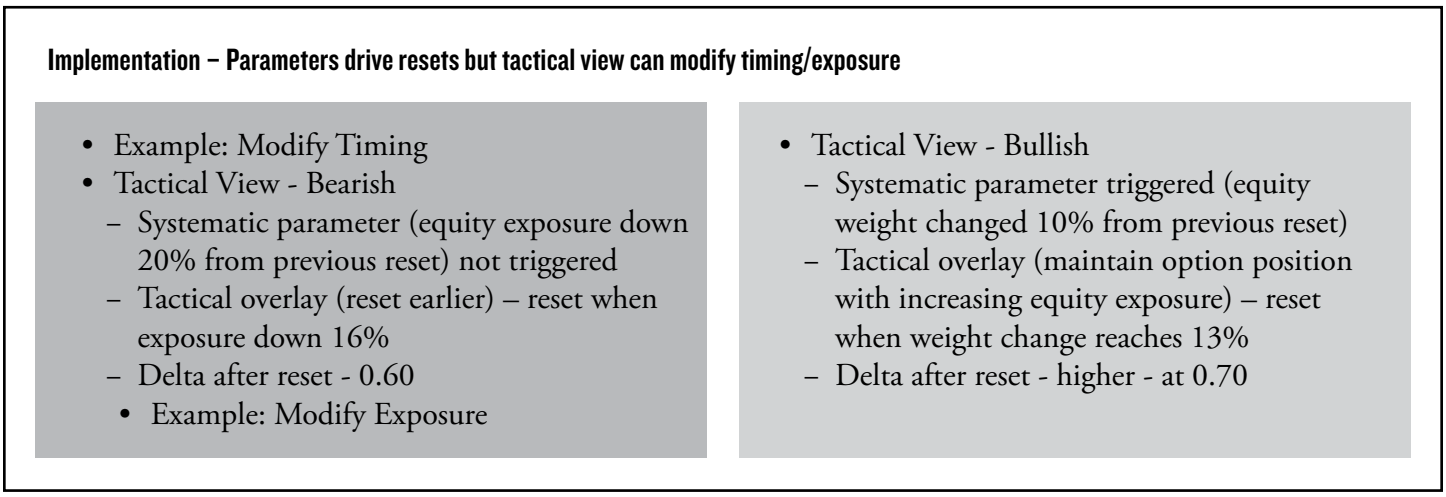
The convexity exhibited with market moves (as seen above in Figure 7) will, if unchecked, allow the portfolio delta to move towards a delta of one (1.0) on the upside, or conversely towards a delta of zero (0.0) on the downside. We established reset parameters precisely to avoid this as a form of risk control. Rebalancing keeps the strategy from getting overexposed to equities on the upside, and underexposed to equities on the downside.

In the vast majority of instances, our parameter-based resets serve the portfolio objectives well, by providing the increasing (or decreasing) equity exposure and limiting risk. Yet, there are times when the portfolio management team will choose to override these parameters, based on either current market conditions, their overall economic outlook, or liquidity issues.

For example, during the GFC and also during the recent COVID-19 crisis, the portfolio management team let the portfolio delta go past the lower bound of 0.40, because they had a meaningfully bearish outlook, and believed the market had more downside left. They did not reset the portfolio back to the baseline until the asset allocation view was that equities had become oversold and the market had stabilized.

The advantage of being "long" options (and volatility) is that the portfolio managers don't have to trade during turbulent markets. In fact, the exposure to equity decreases automatically along with the downturn, as can be seen in the red box in the above diagram.

Figure 8: MPS: Tactical Overlays



Source: PGIM Quantitative Solutions. Shown for illustrative purposes only. Holdings are subject to change.

PGIM Quantitative Solutions tactical views are incorporated into the portfolio as an overlay to our systematic parameters, implemented by modifying the timing and magnitude of our equity exposure and duration resets – two key levers driving portfolio performance (see Figure 8). The application of our tactical views sets PGIM Quantitative Solutions offering apart. We call upon decades of investment experience to help us actively manage our exposures to achieve MPS' objectives.

Managing Portfolio Duration

Approximately 80% of the MPS portfolio is invested in US Treasuries (and US Treasury futures), so managing duration is an important aspect of the portfolio management process. Additionally, it is important to note that total portfolio duration for MPS is a combination of the weighted bond and option portfolio durations. Bonds have positive duration and options have embedded negative duration. Interestingly, while a change in equity markets can meaningfully impact the weight of the options in the portfolio (the delta of the option changes as it moves in- or out-of-the-money), it can also change portfolio duration as the option weight in the portfolio changes.

Market moves (both equity and interest rates) impact duration almost continuously, so we are generally comfortable when the duration is within certain target ranges. When we want to actively change duration, we can do so in multiple ways: (a) trading Treasuries or Treasury futures, (b) making shorter- term, minor adjustments of the mix of bonds/options/futures/cash, and (c) resetting the option/bond mix by rolling the S&P 500 Index call options. (When we reset, we reduce/increase equity exposure based on our reset process. This changes the option maturity and weight of the options in the portfolio, and thus it impacts portfolio duration).

The objective of our US Treasury bond portfolio in MPS is to reduce risk and preserve capital. We build this portfolio based on our interest rate and asset allocation outlook, and target and manage both the bond and portfolio duration accordingly.

MPS Compared to Other Risk Mitigation Strategies (RMS)

Here we look at MPS vs. options-based strategies, low volatility strategies and equity hedge RMS:

1. MPS vs. Options-Based Strategies

While there are many options-based strategies, two are most popular in the realm of RMS. The first is covered call writing (also known as buy-write) and the other is a protective put strategy.

Covered-Call

While both MPS and covered call strategies have similar objectives—upside participation with reduced volatility—there are some key differences:

- MPS has potentially unlimited upside capture potential and limited downside risk. (In a market correction, the most you can lose is the option premium, while US Treasuries should perform well). A covered call (long the underlying index and writing (selling) an "at-the-money" or "out-of-the-money" call) has limited upside profit potential, but losses can be significant in a severe equity drawdown, since they are cushioned only by the premium received for writing the call.
- MPS is long volatility (it buys and holds call options), while a covered call strategy is short volatility (it sells call options).
- MPS does well in volatile markets. It will increasingly participate in rising markets, and decrease participation in falling markets. A covered call strategy does well in less-volatile markets, when the market either moves sideways or rises steadily (but less than the call strike prior to call maturity).
- Call premiums that provide income for covered calls can diminish during falling markets.

Protective Put

MPS and protective put strategies also have similar goals—upside participation and reduced downside risk— again with some key differences.

- Both MPS and protective put strategies have potentially unlimited upside potential, but downside protection will vary.
- Buying a put during periods of high volatility can be expensive. The benefits that come from option protection can often be swamped by the cost of the insurance premium, so tactical trading strategies using options are best when the market has not fully priced in the cost of the risk (options are cheapest when markets are calm and rallying), or when they are only used for limited time periods.
- In case of an extended equity market downturn, puts may have to be rolled at regular intervals, and put premiums may become increasingly expensive.

Among MPS' advantages, the strategy does not have to transact during falling markets when volatility is elevated, as it holds long-term options, unlike either covered-call or protective put strategies, which typically use one-month options that are rolled every month.

2. MPS vs. Low Volatility Strategies

Similar to MPS, low volatility (low vol) strategies aim for market-like returns with significantly lower risk, which may be defined as portfolio volatility either in absolute terms or relative to a cap-weighted index. Risk is the primary measure for most low vol investors. While low vol strategies are not necessarily static in terms of volatility reduction, they do not attempt to keep up with rising markets.

A key difference is that low vol strategies are based on stock selection, unlike options-based strategies like MPS.

The S&P 500 Low Volatility Index (SP5LVIT) measures the performance of the 100 least volatile stocks in the S&P 500 Index. Constituents are weighted relative to the inverse of their corresponding volatility, with the least-volatile stocks receiving the highest weights. Normally, the beta of the SP5LVIT is around 0.7. While the SP5LVIT has outperformed MPS since inception of MPS (1/1/1992), as well as the S&P 500 Index over various time periods, it has done so with higher volatility than MPS. (See Figure 9). Low volatility strategies, (if they have a similar risk/return profile as the SP5LVIT index) may be worthy RMS, but given their higher beta, they may not provide as much downside protection.

From a risk-adjusted return perspective, MPS has better Sharpe, maximum drawdown and Sortino ratios compared to the SP5LVIT since inception, as well as throughout other shorter time periods, as can be seen in Figure 10. As a result, MPS performed significantly better in two of the three big drawdowns (GFC and COVID-19 crisis) over the last 28 years since MPS' inception.

3. MPS vs. Hedged Equity Strategies

Adding a hedge fund allocation to a typical balanced 60% stock/40% bond portfolio is designed to decrease total portfolio standard deviation, while increasing Sharpe and Sortino ratios. It also frequently decreases maximum drawdown in the combined portfolio. The allocation to hedge funds acts as both a risk-adjusted return enhancer and a diversifier for the traditional stock/bond portfolio.

To compare MPS to a hedge fund strategy, it seems most relevant to consider the Equity Hedge category. We looked at the HFRI Equity Hedge Index (HFRXEH) as representative of this universe. The category is defined by HFRI as follows:

> Equity Hedge: Investment managers who maintain positions both long and short in primarily equity and equity derivative securities. A wide variety of investment processes can be employed to arrive at an investment decision, including both quantitative and fundamental techniques. Strategies can be broadly diversified or narrowly focused on specific sectors, and can range broadly in terms of levels of net exposure, leverage employed, holding period, concentrations of market capitalizations and valuation ranges of typical portfolios. Equity hedge managers typically maintain at least 50% in equities, and may in some cases be substantially or entirely invested in equities, both long and short.

MPS and the HFRXEH have an average (monthly 7-year rolling) equity beta to the S&P 500 Index of 0.37 since January 1998 (the inception of HFRXEH). Both strategies aim to decrease volatility, while increasing risk-adjusted returns and reducing drawdowns.

MPS has provided superior risk-adjusted returns (net) and lower maximum drawdowns when compared to the HFRI Equity Hedge Index.

MPS Competitive Analysis

MPS vs. Peers

As discussed in our comparisons of MPS and other RMS, each strategy has its unique properties and characteristics along with their relative strengths and weaknesses. In the table below (Figure 9) we look at the relevant risk/return statistics for options-based, low vol and equity hedge strategies vs. MPS for the longest history available to all strategies, starting with the inception of HFRXEH, in January 1998.

Figure 9: MPS Compared to Other RMS

Long-Term Periodic Performance as of 12/31/2020:

As of 12/31/2020	MPS (Gross)	MPS (Net)	BXM	PPUT	SP5LVIT	HFRXEH	SPTR
3 year							
Annualized Return	**12.6%**	**12.3%**	2.3%	15.9%	8.3%	1.6%	14.2%
Standard Deviation	**10.6%**	**10.6%**	14.7%	13.0%	14.8%	9.3%	18.8%
Sharpe Ratio	**1.03**	**1.00**	0.12	1.09	0.51	0.05	0.72
Max. Drawdown	**-9.1%**	**-9.1%**	-22.2%	-10.5%	-21.4%	-15.9%	-19.6%
Sortino Ratio	**1.91**	**1.85**	0.05	2.00	0.47	0.00	0.97
5 year							
Annualized Return	**11.4%**	**11.0%**	5.3%	14.9%	10.5%	2.9%	15.2%
Standard Deviation	**8.7%**	**8.7%**	11.7%	10.9%	12.4%	7.9%	15.3%
Sharpe Ratio	**1.14**	**1.11**	0.40	1.23	0.78	0.26	0.93
Max. Drawdown	**-9.1%**	**-9.1%**	-22.2%	-10.5%	-21.4%	-15.9%	-19.6%
Sortino Ratio	**1.78**	**1.69**	0.29	1.83	0.78	0.22	1.12
15 year							
Annualized Return	**8.1%**	**7.7%**	5.0%	8.0%	9.8%	0.7%	9.9%
Standard Deviation	**7.8%**	**7.8%**	11.4%	11.4%	11.4%	7.8%	15.1%
Sharpe Ratio	**0.89**	**0.84**	0.39	0.63	0.77	-0.01	0.62
Max. Drawdown	**-11.7%**	**-12.5%**	-35.8%	-38.9%	-35.4%	-29.5%	-50.9%
Sortino Ratio	**1.49**	**1.40**	0.32	0.84	0.84	-0.06	0.72
23 year							
Annualized Return	**7.1%**	**6.7%**	5.7%	5.8%	9.0%	4.8%	8.1%
Standard Deviation	**8.8%**	**8.8%**	11.5%	11.9%	11.7%	8.0%	15.4%
Sharpe Ratio	**0.61**	**0.56**	0.38	0.38	0.63	0.39	0.46
Max. Drawdown	**-19.0%**	**-19.8%**	-35.8%	-38.9%	-35.4%	-29.5%	-50.9%
Sortino Ratio	**0.90**	**0.82**	0.32	0.48	0.74	0.44	0.53

Source: PGIM Quantitative Solutions. As of 12/31/2020. ***Past performance is not a guarantee or reliable indicator of future results.***
BXM – CBOE S&P 500 BuyWrite Index, PPUT – CBOE S&P 500 5% Put Protection Index, SP5LVIT – S&P 500 Low Volatility Index, HFRXEH – HFRI Equity Hedge Index, SPTR – S&P 500 Total Return Index.
Detailed descriptions for each strategy are listed in the Appendix.

MPS has, in fact, delivered on its objective of reducing volatility as well as limiting maximum drawdowns over the various periods shown. MPS particularly shines during significant drawdowns over this 23-year period: Tech Bubble burst, the Global Financial Crisis (GFC), and, most recently, during the sharp correction of the ongoing COVID-19 crisis. (See Figure 10).

Figure 10: Performance During Large Drawdowns

As of 12/31/2020	MPS (Gross)	MPS (Net)	BXM	PPUT	SP5LVIT	HFRXEH	SPTR
Large Drawdowns							
Tech Bubble Burst (9/2000–9/2002)	**–17.0%**	**–17.5%**	–30.2%	–32.3%	9.0%	11.0%	–44.7%
Global Fin. Crisis (11/2007–2/2009)	**–10.0%**	**–10.4%**	–35.8%	–38.2%	–33.5%	–29.5%	–50.9%
Covid-19 Crisis (1/2020–3/2020)	**–4.0%**	**–4.1%**	–22.2%	0.0%	–19.0%	–13.3%	–19.6%

Source: PGIM Quantitative Solutions. As of 12/31/2020. ***Past performance is not a guarantee or reliable indicator of future results.***

While some strategies have done better in one or other of the three biggest drawdowns of the past 23-years, MPS has been the most consistent. This speaks to MPS' strength as a true downside protection strategy during times of significant crises. Longer-term performance shows that MPS provides upside participation during rising markets, as well.

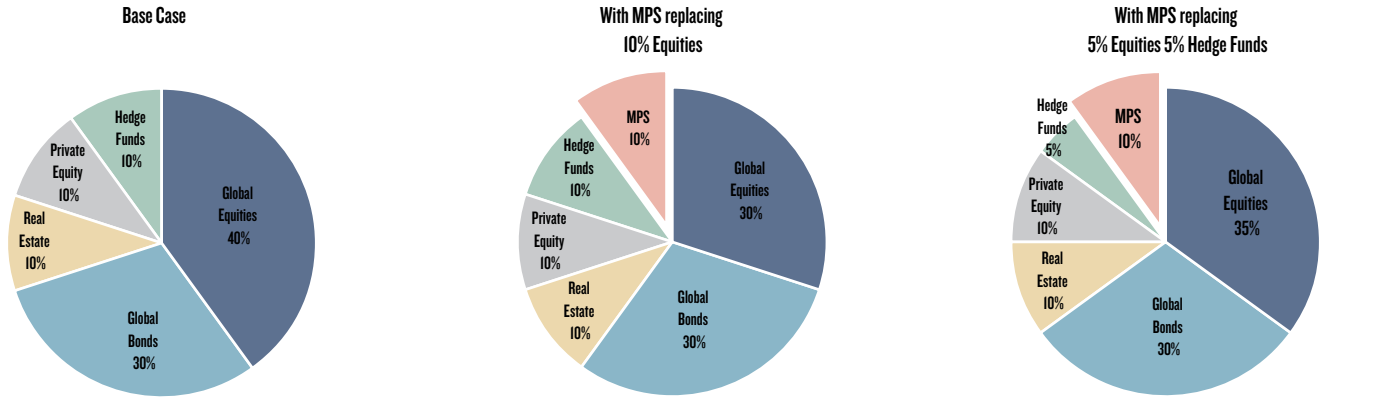
Evaluating and Implementing an RMS

Selecting the appropriate downside protection strategies and determining their ideal weights within your allocation model is key, in our estimation. Correct RMS implementation can improve stability and limit drawdowns, thus "smoothing" the bumps along the way to meeting your investment goals.

We believe that adding MPS to a modern institutional multi-asset portfolio could be beneficial as a way to add value over time, while reducing volatility along the way. MPS could be considered an equity replacement (the defensive equity or tail risk component of a RMS), a component of a risk mitigation bucket, or an alternative investments allocation – either alongside, or instead of, certain equity hedge funds.

In the analysis below (see Figure 11), we examine the effects of adding MPS to a hypothetical institutional multi-asset portfolio: 40% global public equities, 30% global bonds, 10% private equity, 10% real estate and 10% hedge funds – rebalanced annually.

Figure 11: Effects of Partially Replacing Global Equity or Hedge Fund allocation with MPS, 1/1/1998 to 12/31/2020



Institutional Asset Allocation			
	Base Case	MPS replacing 10% Equities	MPS replacing 5% Equities, 5% HF
Annualized Return	7.6%	7.6%	7.8%
Standard Deviation	9.8%	8.9%	9.4%
Maximum Drawdown	-35.7%	-31.3%	-32.9%
Sharpe Ratio	0.61	0.66	0.64
Large Drawdowns			
Dot Com Bust (9/2000–9/2002)	–12.2%	–8.9%	–12.2%
GFC (11/2007–2/2009)	–35.7%	–31.3%	–32.9%
COVID-19 Crisis (1/2020–3/2020)	–14.3%	–12.6%	–13.3%

Source: PGIM Quantitative Solutions. As of 12/31/2020. Using monthly returns.
Past performance, including hypothetical past performance, is not a guarantee or reliable indicator of future results. Actual results may vary, based on market conditions or other risk factors.
For the hypothetical multi-asset portfolios shown above, MPS is shown net of fees. Returns for global public equities reflect the MSCI World Index, returns for global bonds reflect the Bloomberg Barclays Global Aggregate Bond Index, returns for real estate reflect the FTSE NAREIT (All) Index, returns for private equity reflect the Thomson Reuters PE Buyout Index, and returns for hedge funds reflect the HFRX Global Hedge Fund Index.

The hypothetical results show that partially replacing a 100% passive global equity or hedge fund exposure with MPS yields greater asset growth over time with reduced volatility. Additionally, during significant market drawdowns, MPS really proves its mettle in the allocation mix, as shown in the tables above (Figure 11).

MPS can also work as a growth asset for corporate pension plans, with lower volatility than most other growth options, since it is highly liquid and can help minimize surplus volatility. Thanks to the limited downside features built into the strategy, MPS can serve as a crisis risk offset (CRO) vehicle, as well. The strategy would represent the growth asset, and could comprise much of an institutional CRO allocation.

In all cases, we believe that MPS is a liquid, cost-effective solution that can help mitigate risk in market downturns, while remaining invested in the markets to help maximize returns when market conditions return to normal.

MPS Benefits

There are many reasons why we believe MPS is unique among risk mitigation strategies in the marketplace:

1. MPS has a 29-year track record, meeting the objective of equity-like returns over the long term with reduced volatility and reduced downside risk, as measured by both standard deviation and maximum drawdowns.

2. MPS is managed by an experienced portfolio management team with no turnover since inception (1/1/1992).

3. The key philosophy and process for MPS remains unchanged – to provide increasing upside in "up" markets, while reducing volatility and limiting drawdowns in downturns.

4. By following this process, MPS has consistently proven its reliability since inception, having successfully navigated three big drawdowns - Tech Bubble burst, the GFC, and most recently, the COVID-19 crisis.

5. MPS is "long" options and thus "long" volatility – important during turbulent and volatile markets.

6. There is no need to trade at all during highly volatile, low liquidity environments that are typical during large equity drawdowns.

7. MPS provides liquidity when you need it most. MPS averages an 80% holding in US Treasuries and Treasury futures, which have been among the most liquid securities in the world. They remain "safe haven" assets and have proven their mettle during every crisis. MPS has never had a liquidity issue. Clients have been able to redeem or invest assets (some on a daily basis), even during a market crisis.

8. MPS has much lower fees compared to most RMS and other alternative investment strategies. We charge a flat, asset based management fee, without no carried interest or performance-based fees.

Conclusion

The importance of asset allocation cannot be overstated. A diversified multi-asset portfolio that meets investors' goals, targeting long-run returns based on their desired investment horizon and risk tolerance is essential — especially in volatile markets.

Risk mitigation strategies should be part of a well designed strategic asset allocation framework. With its proven 29-year track record, MPS has met its objective of decreasing total portfolio standard deviation while increasing Sharpe and Sortino ratios (and also lowering maximum drawdown) in the combined portfolio for clients over several market cycles.

Our analysis shows that MPS has performed well over the long term, but especially during severe market downturns. It compares favorably to other RMS/alternatives in complementing stock/bond/private equity/real estate/hedge fund allocations for a typical institutional multi-asset portfolio.

Appendix

BXM – CBOE S&P 500 BuyWrite Index

The CBOE S&P 500 BuyWrite Index (BXM) is a benchmark index designed to track the performance of a hypothetical buy-write strategy on the S&P 500 Index.

The BXM is a passive total return index based on (1) buying an S&P 500 stock index portfolio, and (2) "writing" (or selling) the near-term S&P 500 Index «covered» call option, generally on the third Friday of each month. The SPX call written will have about one month remaining to expiration, with an exercise price just above the prevailing index level (i.e., slightly out of the money). The SPX call is held until expiration and cash settlement, at which time a new one-month, near-the-money call is written.

We consider the BXM a passive proxy and benchmark for a covered call strategy.

HFRXEH - The HFRI Equity Hedge Index

Equity Hedge strategies maintain positions both long and short in primarily equity and equity derivative securities. A wide variety of investment processes can be employed to arrive at an investment decision, including both quantitative and fundamental techniques; strategies can be broadly diversified or narrowly focused on specific sectors and can range broadly in terms of levels of net exposure, leverage employed, holding period, concentrations of market capitalizations and valuation ranges of typical portfolios. Equity Hedge managers would typically maintain at least 50%, and may in some cases be substantially entirely invested in equities, both long and short. Hedge Fund Research, Inc. (HFR) utilizes a UCITSIII compliant methodology to construct the HFRX Hedge Fund Indices. The methodology is based on defined and predetermined rules and objective criteria to select and rebalance components to maximize representation of the Hedge Fund Universe. HFRX Indices utilize state-of-the-art quantitative techniques and analysis; multi-level screening, cluster analysis, Monte-Carlo simulations and optimization techniques ensure that each Index is a pure representation of its corresponding investment focus.

PPUT – CBOE S&P 500 5% Put Protection Index

The CBOE S&P 500 5% Put Protection Index is designed to track the performance of a hypothetical strategy that holds a long position indexed to the S&P 500 Index and buys a monthly 5% "out-of-the-money" S&P 500 Index (SPX) put option as a hedge. The PPUT Index rolls on a monthly basis, typically every third Friday of the month.

S&P 500 Index

The benchmark for the US Market Participation Strategy composite is the S&P 500 Index. The S&P 500 Index is an unmanaged index of 500 common stocks, weighted by market capitalization, representing approximately 75% of the New York Stock Exchange. Dividend income is reinvested. Source of the S&P 500 Index: S&P Dow Jones Indices LLC. Copyright 2020, Standard & Poor's, a division of The McGraw-Hill Companies, Inc. Standard & Poor's including its subsidiary corporations ("S&P") is a division of The McGraw-Hill Companies, Inc. S&P and/or its third party licensors have exclusive proprietary rights in S&P data. S&P data may only be used internally for business purposes and shall not be used for any unlawful or unauthorized purposes. Dissemination, distribution or reproduction of S&P data in any form is strictly prohibited except with the prior written permission of S&P. S&P does not guarantee the accuracy, adequacy, completeness or availability of any information and is not responsible for any errors or omissions or for the results obtained from the use of such information.

SP5LVIT – S&P 500 Low Volatility Index

The S&P 500 Low Volatility Index measures the performance of the 100 least volatile stocks in the S&P 500 Index. The index benchmarks low volatility or low variance strategies for the US stock market. Constituents are weighted relative to the inverse of their corresponding volatility, with the least volatile stocks receiving the highest weights.

SPTR – S&P 500 Total Return Index

The S&P 500 Index is an unmanaged index that is widely regarded as the standard for measuring large-cap US stock market performance. The total return includes the price return plus dividends reinvested in the index.

MPS Composite Annual Returns (%)

	1992*	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Gross	5.91	10.26	–2.07	32.34	20.41	30.60	29.45	10.48	0.12	–7.89	–2.63	7.11	7.88	2.65
Net	5.38	9.71	–2.56	31.70	19.82	29.96	28.82	9.93	–0.38	-8.35	–3.12	6.58	7.34	2.13
S&P 500 Index	7.61	10.08	1.32	37.59	22.96	33.38	28.58	21.04	–9.11	–11.89	–22.10	28.69	10.88	4.91

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Gross	9.70	13.99	–7.64	2.28	8.64	3.86	2.55	26.75	11.45	–2.85	6.13	12.98	–2.97	21.28
Net	9.16	13.43	–8.10	1.78	8.10	3.35	2.24	26.38	11.12	–3.14	5.81	12.64	–3.26	20.92
S&P 500 Index	15.80	5.49	–37.00	26.46	15.06	2.11	16.00	32.39	13.69	1.38	11.96	21.83	–4.38	31.49

	2020
Gross	21.39
Net	21.03
S&P 500 Index	18.40

*Inception 1/1/1992. ***Past performance is not a guarantee or a reliable indicator of future results.***

Notes to Disclosure

For Professional Investors only. All investments involve risk, including the possible loss of capital. Past performance is not a guarantee or a reliable indicator of future results. Diversification does not assure a profit or protect against loss in declining markets.

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