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MULTI-ASSET STRATEGIES

Portfolio Risk Mitigation without Bonds

Michael Stamos

Allianz Global Investors

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Michael Stamos

Dr. Michael Stamos, CFA, is leading the AllianzGI Multi Asset team's development of systematic investment strategies focusing on risk management, asset allocation, risk premia investing, portfolio construction. Michael specialized in the management of Dynamic Allocation, Managed Futures, Risk Premia, and Risk Parity Funds. Michael has 17 years of R&D experience and 13 years of portfolio management experience. Michael received a PhD (summa cum laude) in Finance and holds the Chartered Financial Analyst designation. Prior to joining the firm in 2007, Michael was a Research Assistant at Frankfurt University focusing on optimizing asset allocation and retirement solutions. He has published his work in top-tier journals such Review of Financial Studies, Journal of Banking and Finance, Journal of Portfolio Management, Journal of Risk and Insurance, Journal of Economic Dynamics and Control, Insurance Mathematics and Economics, and Journal of Pension Finance and Economics, and presented his work at many conferences.

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Michael Stamos

Michael Stamos
is director of research—
multi asset at
Allianz Global Investors
in Frankfurt, Germany.
michael.stamos@allianzgi
.com

KEY FINDINGS

- Static stock/bond portfolios dominated the portfolio risk management options by offering good risk mitigation at low opportunity cost since rates peaked in 1981. This is now different; bond-related opportunity costs will probably be higher going forward, whereas risk mitigation might be similar.

- We examine non-bond strategies that have the capacity to offset the size-wise huge bond problem. We find that these strategies offer, on average, a downside risk mitigation that is similar to that of a static 60/40 stock/bond portfolio, and hence may serve as an alternative.

- Prudent risk management dictates that one should take into account the differences regarding risk-management reliability, path dependency, duration-adjusted returns, and downside-risk-adjusted performance.

ABSTRACT

When it comes to financial market crises, times are always different. To make things worse, global government bonds worth trillions of dollars have yields close to zero, and in many cases below zero. What is left is maximum price downside and rather little upside. The traditional way of managing portfolio risks, by using government bonds as a crisis risk offset, seems—for the time being—no longer to be the straightforward option, rendering traditional stock/bond portfolios less appealing. So, the author asks the question of which risk management alternatives are left and tries to make a critical assessment of their opportunity cost and risk-reduction potential.

When it comes to financial market crises, times are always different. To make things worse, government bond yields worldwide are close to zero, and in many cases below zero. What is left is a large bond price downside and rather little upside. The traditional way of managing portfolio risks, by adding government bonds as a crisis offset, seems—for the time being—no longer to be the best option, rendering balanced stock/bond portfolios suboptimal. It seems reasonable to assume that future bond returns will be much lower than historical values because their performance was boosted by a huge drop in 10-year interest rates, from almost 16% to 0.9% at the end of 2020, which is not repeatable.

Hence, this article compares various systematic risk management approaches that could reasonably reduce portfolio risks and be chosen by those investors who believe that they need an alternative to bonds. We are not trying to predict the direction of bond markets. On the contrary, the considered approaches have no market prediction power; hence, they will lead to opportunity costs owing to the aim of

reducing risks. Being realistic is important in times of low expected long-term returns. Of course, in theory the best way to reduce the downside of an equity position is to perfectly predict market crises, which we believe is not possible for most human beings.

In what follows, we briefly describe the risk management strategies that we take into consideration and that we believe are large-scale, feasible strategies for millions of investors. At the time of this writing (April 12, 2021), the amount of negative-yielding bonds worldwide stands at $13.5 trillion. So, this problem is a big one. Hence, we only compare strategies that are extremely liquid and can be applied by most market participants, because almost all are facing the bond challenge. Thus, we rule out niche asset classes and niche alternatives-type strategies.

Our subsequent empirical analysis is going to look at the 30 years from January 1, 1991 to December 31, 2020; the timeframe is limited by the availability of data, especially for option-based strategies. One of the most important capital market variables, the US government 10-year rate, moved from 8.1% at the outset to 0.9% at the end of the timeframe. It is vital that results of historical simulations be handled with care and not overinterpreted, but we believe we can still learn about the behavior of risk management strategies. Hence, when assessing the strategies' performance, we are going to look at duration-adjusted returns to account for the fact that this 30-year period has seen an unrepeatable bond market rally. As with beta-adjusting returns, we remove the bond risk premium from all strategies. The primary goal of our analysis is to reassess the efficacy of the risk reduction relative to pure equities, including the latest Covid Crash, and to reassess the associated opportunity costs during times when the expected return for bonds is low.

RISK MANAGEMENT STRATEGIES

We consider seven alternative strategies that are deemed to reduce the downside risk versus a pure 100% equity portfolio. Furthermore, we focus on US equities (represented by the S&P 500 Index), which is by a wide margin the dominant equity market in the world today. We deliberately choose to keep the selected strategies plain vanilla and comparable in simplicity and hence resort to public strategy indexes from prominent index providers where possible. This is to avoid hindsight tuning and to keep their characteristic features—as well as to avoid overengineering—which may lead in practice to lower risk-mitigation potential. In real-world portfolio management, teams may specialize in one or a few strategies and fine-tune them. Our analysis is not about fine-tuning, but rather about comparison. The caveat is that none of the indexes include transaction costs. Because the selected strategies have very high liquidity, we believe that transaction costs play a role, albeit a rather minor one. The following strategies are considered:

1. **Equity plus bonds:** This is generally the most important risk reduction relative to equities to date. We set the allocation to the ubiquitous portfolio of 60% S&P 500 and 40% J.P. Morgan GBI US Index.
2. **Equity plus cash:** This is the easiest route for investors who are concerned about the bond-market risk. Instead of holding bonds as an offset, just hold cash, even if the yield is low. This is probably the trade that has the highest capacity. The allocation is 60% equities and 40% three-month government bonds.
3. **Equity plus gold:** This is the most interesting choice for investors who are concerned about inflation and about cash holdings losing value in real terms. We set the allocation to 60% equities and 40% gold. Above-ground gold is

reported to have a market capitalization of roughly $10 trillion,[1] so there is some capacity.

4. **Momentum managed allocation:** The way we compute performance is that exposure is reduced if stock market returns over the previous 120 days are negative. The exposure reduction is proportional to the size of the past negative log returns. The minimum and maximum equity exposures are set at 30% and 90%, respectively. The remainder goes into cash.[2] The equity allocation range is chosen to have some small degree of risk mitigation at all times but a large risk reduction when momentum is very negative.

5. **Volatility managed allocation:** The portfolio's equity allocation is inversely proportional to the trailing 60-day realized volatility of equities using a volatility cap of 12% and the same allocation bands as the momentum strategy described. Hence, the equity exposure is defined as

$$\text{Equity exposure} = \text{Volatility cap (12\%)}/\text{Trailing equity volatility with quity exposure truncated between 30\% and 90\%}$$

The remainder goes into cash.[3] Similar to the momentum strategy, the equity allocation range is chosen to have some small degree of risk mitigation at all times but a large risk reduction when volatility is very high.

6. **Minimum volatility stocks:** This is a stock selection strategy that aims to reduce investment risks by investing in stocks that have the lowest volatility. We use the S&P 500 Minimum Volatility Index to compute its performance; the exposure to stocks always remains 100%.[4]

7. **Equity plus rolling put:** Here capacity could be an issue if many investors do this. Option prices are driven by supply and demand. We use the CBOE S&P 500 5% Put Protection Index to compute the performance. The 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 put option as a hedge.[5]

RISK REDUCTION: A LOOK AT VOLATILITY

Let's set the scene by looking at the most straightforward risk measure: portfolio volatility. Whereas the pure S&P 500 portfolio has a volatility of 18.3%, all risk management strategies range between approximately 11% and 15%, with most around 12%. Most noteworthy is that the equity/bond strategy has the lowest realized volatility, at 10.7%. Other strategies that came close are equity/cash, volatility managed allocation, and momentum managed allocation. The equity/gold strategy, equity plus rolling put, and minimum volatility stocks have volatilities that are somewhat higher than the equity/bond strategy (Exhibit 1). Volatility does not capture asymmetry of returns, nor does it capture reliability of risk reduction; hence, we take a look at the downside risks.

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[1] See, for instance, https://www.goldeneaglecoin.com/Guide/value-of-all-the-gold-in-the-world.

[2] Moskowitz, Ooi, and Pedersen (2012) provided a good summary of the well-known time-series momentum patterns in asset classes.

[3] For a broad study detailing the risk and return benefits of volatility managed portfolios, see Moreira and Muir (2017) and Bollerslev et al. (2018).

[4] Frazzini and Pedersen (2014) showed abnormal returns of defensive strategies such as low volatility or low beta strategies, but also non–equity-related strategies.

[5] It is relatively well established that the costs of puts are high; Bondarenko (2014) even asked why put options are so expensive and found no explanation. We still want to include them to assess whether they become more attractive in the current low bond-yield scenario or whether the Covid Crash has changed their attractiveness.

EXHIBIT 1

Risk Reduction Relative to S&P 500: Volatility (%, annualized)
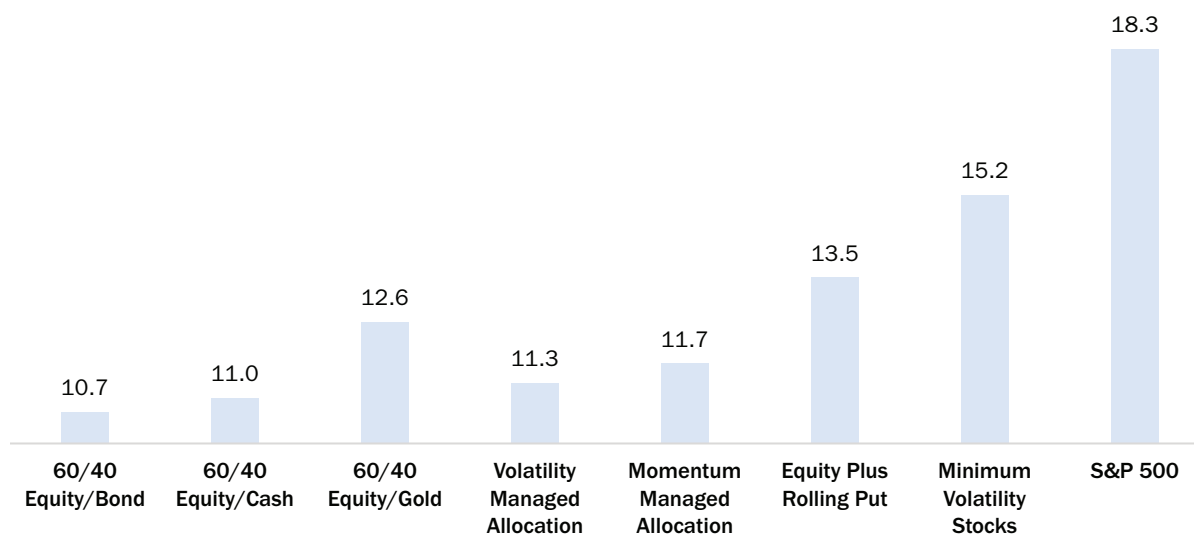
NOTES: The exhibit shows the volatility (%) of daily discrete returns of each strategy. The timeframe is 1991–2020.

RELIABILITY OF CRISIS ALPHA

It is particularly important that the hedges work in times of extreme market stress, such as the Dot-Com Crash, the Great Financial Crisis (GFC), and the Covid Crash. Here we find relatively good reduction of risk for all strategies. Strategies have delivered an average 40% risk reduction in the large crises. Many of the strategies reached a risk mitigation similar to that of the equity/bond portfolio. The strategy with the biggest variation in risk mitigation effects was minimum volatility stocks, which delivered very little drawdown reduction during the GFC and Covid Crash, at 12% and 0.8% respectively. In addition, the equity plus rolling put has a wider deviation, with little risk mitigation during the Dot-Com Crash and GFC, but substantial risk mitigation in the 24-day Covid Crash, during which the S&P 500 lost 34%. In this scenario, the put-based strategy is supposed to deliver, and it did indeed produce the best drawdown reduction (Exhibit 2).

To dig deeper into the stability of risk migration, we look at all 13 US equity market drawdowns larger than 10% (Exhibit 3). All of these drawdowns unfolded very differently. For instance, some of them are very long, like the Dot-Com bubble burst, yet most are actually very quick and happen over very few days. The average drawdown mitigation across all strategies is around 30% to 40%, except for minimum volatility stocks, which have a reduction of 20% on average. The most consistent risk reduction has been achieved by static mix strategies that add cash, bonds, and especially gold, which have all considerably reduced the risk relative to equities. Volatility managed and momentum managed strategies exhibit path dependency; they depend on time-wise extended risk-off scenarios and hence work particularly well in longer-term down-markets, but less so in quick drawdowns. The equity plus put strategy has good reliability, except for one drawdown in 1999, during which the strategy actually slightly increased the downside. Minimum volatility stocks delivered the least risk mitigation, the degree of which varied considerably. In 1999 there was even a big increase in the drawdown.

EXHIBIT 2
Drawdown Reduction (%) in Big Three Crises
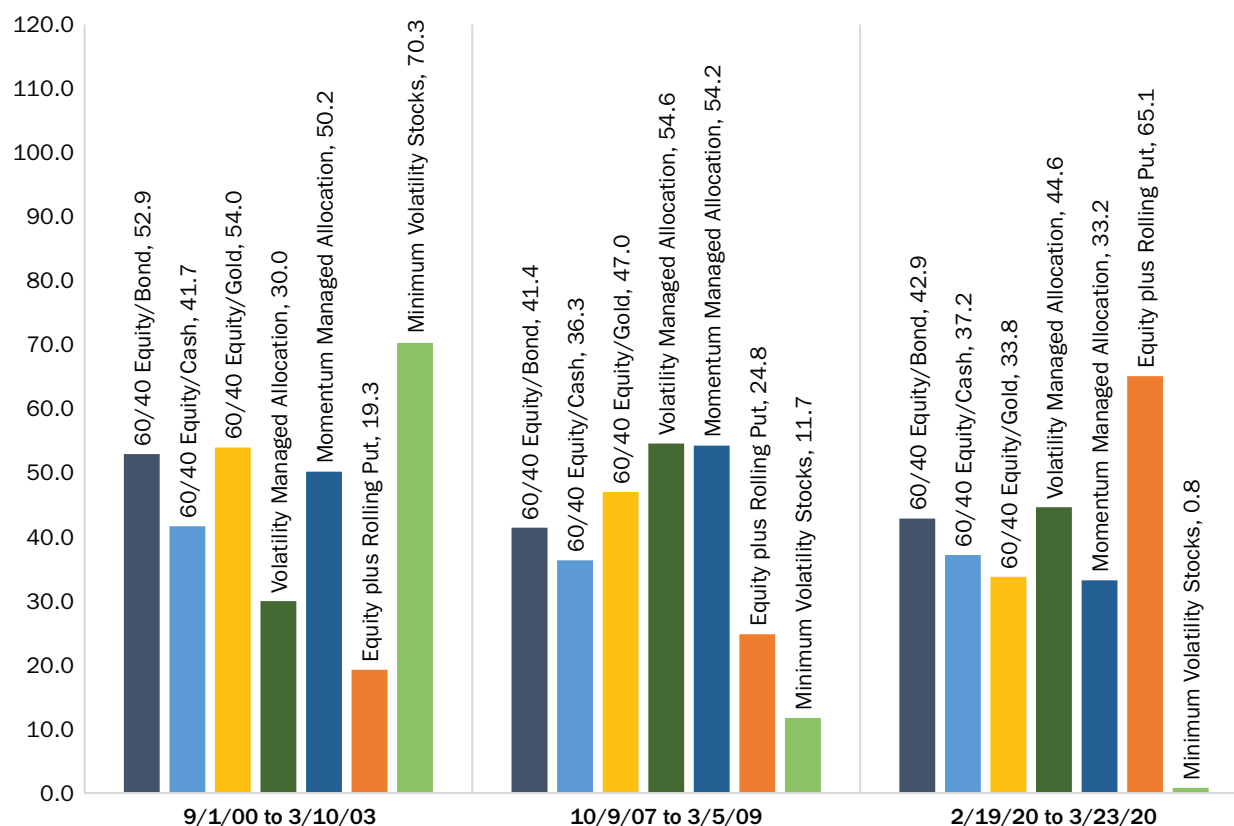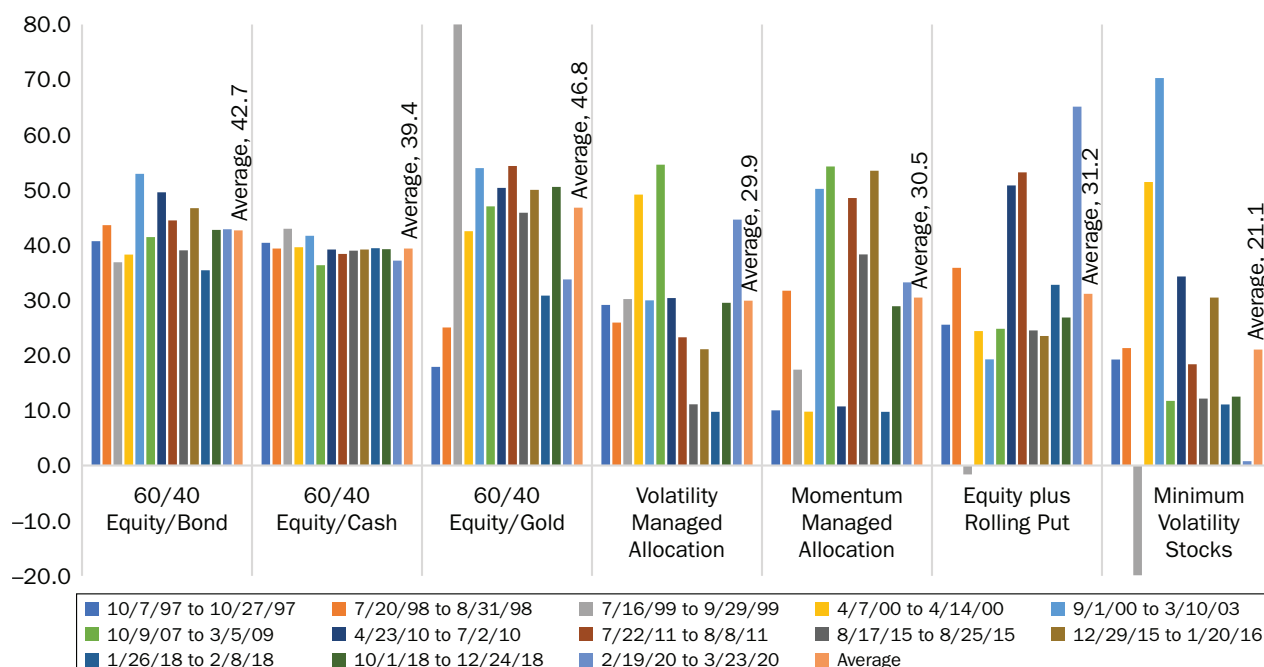

NOTES: Drawdown reduction (%) is defined relative to equities, meaning that a 50% drawdown reduction leads to a reduction of the downside by half. The analysis takes the top as its starting point and the bottom as its endpoint.

SHORT-TERM RISK MITIGATION AND CONVEXITY

Although it is important to look at the risk reduction during the full extent of a crisis, as we have just done, some investors may also look at the short-term risk mitigation potential. Hence, we look at all rolling 5-day losses in the following. Furthermore, because volatility as a risk measure cannot capture asymmetries in return profiles, we want to assess convexity (i.e., the larger the drawdown of equity markets, the better the drawdown reduction). The protective put has by far the strongest convexity; that is, it has a drawdown reduction of 20% for small losses and 70% for large losses. This is because the nonlinearity of the put option pay-off indeed results in an asymmetric profile of realized returns. Momentum and volatility managed allocation exhibit some convexity as well, owing to the dynamic exposure management, which helps if equities are trending down. The drawdown reduction is on average between 30% for small losses and around 50% for large equity losses. The static strategies based on bonds, gold, or cash have no convexity and reduce the drawdowns by roughly 40% (Exhibit 4). Thus, replacing bonds with gold or with cash has led to very similar risk mitigation. The minimum volatility stocks portfolio has the lowest risk mitigation in this analysis and has an anticonvex (i.e., concave) return profile, because drawdown reduction at 30% is high for small losses and at 10% is low for large equity drawdowns.
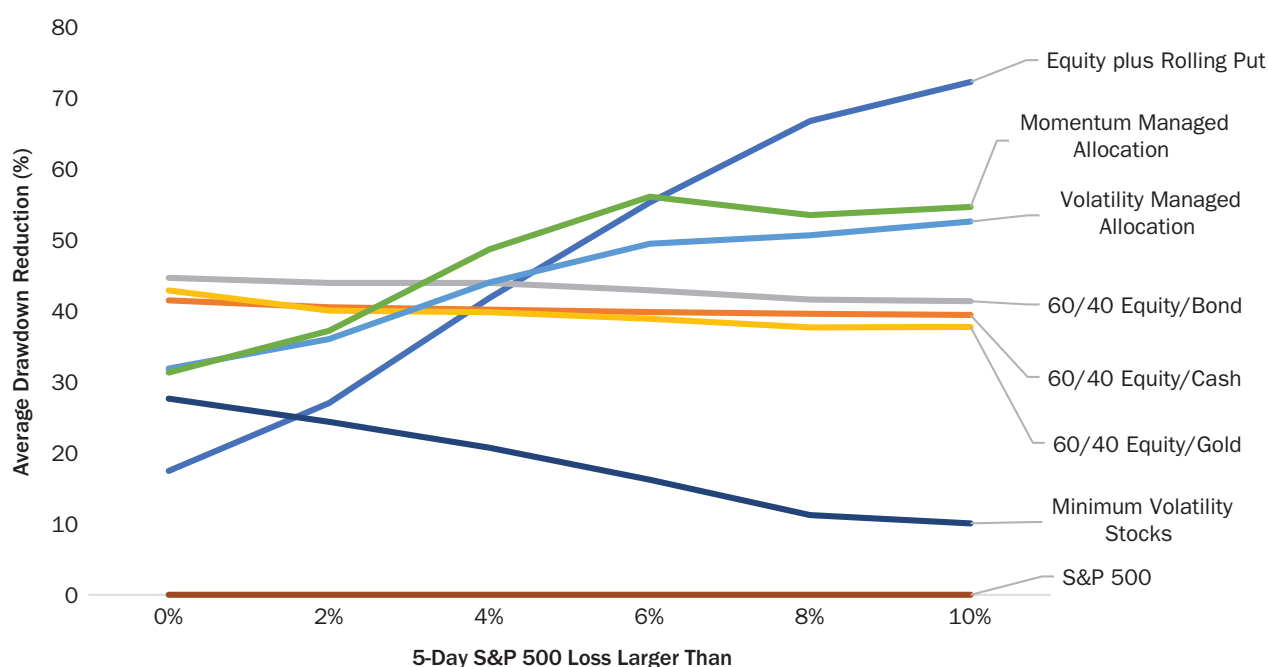
EXHIBIT 3

Drawdown Reduction (%) in Larger than 10% Equity Market Drops

NOTES: Drawdown reduction (%) is defined relative to equities, meaning that a 50% drawdown reduction leads to a reduction of the downside by half. The analysis looks at all US equity drawdown periods larger than 10%. In the case of the longer Dot-Com and GFC crises, there were multiple 10% drawdowns that we have combined in the longer timeframe instead of listing them separately. For the other crisis we have taken the shortest time window that led to the 10% drop—the drops often happen in very short periods—instead of seeking the market top that may be long gone. This is to capture the fact that corrections happen very quickly, which does not allow investors to react in time.
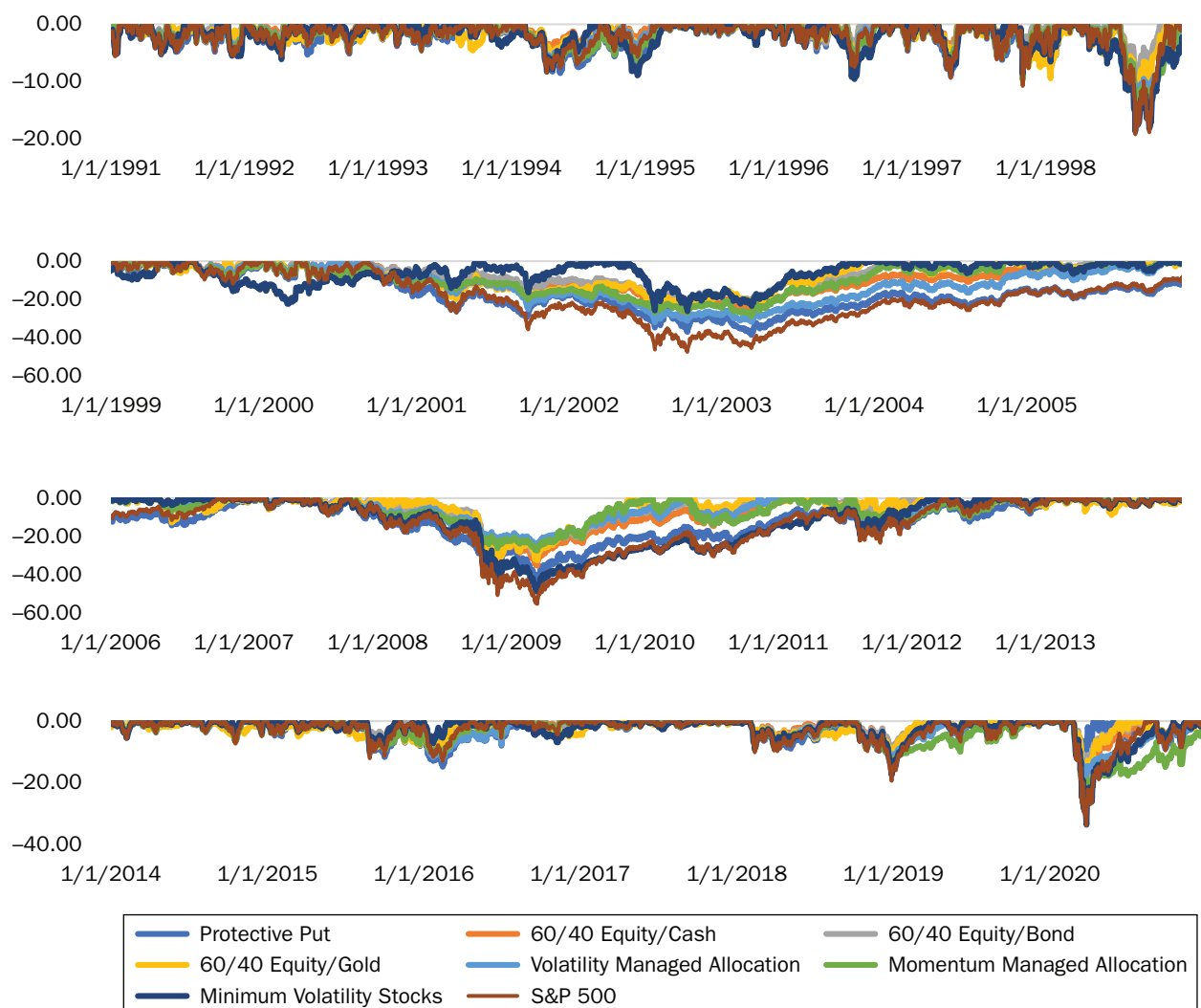
EXHIBIT 4

Drawdown Reduction Depending on Size of Equity Market Drawdown

NOTES: Drawdown reduction (%) is defined relative to equities, meaning a 50% drawdown reduction leads to a reduction of the downside by half. The analysis takes into consideration all daily rolling five-day returns between 1991 and 2020.

EXHIBIT 5
Drawdowns from Trailing Top

NOTES: The drawdown at each point in time is computed as: 100 × (Current portfolio value/Trailing maximum portfolio value − 1). The timeframe is 1991–2020. We split the exhibit into multiple subperiods to make it more visible when single strategies underperform.

ALL DRAWDOWNS

So far, we have only looked at periods during which equity markets dropped, yet it may well be possible that the strategies drop while equity markets actually rise. To get the full picture of all drawdowns, we look at Exhibit 5, which shows the rolling drawdowns from trailing tops. First of all, the exhibit confirms the risk reduction during the massive Dot-Com, GFC, and Covid Crash crises. Second, in times of normal equity market volatility, there can be periods during which the risk-management strategies lose more money than stocks (e.g., the gold market dips during 1993, 1998, 2013, and 2018 led to some losses, as did the duration sensitivity of minimum volatility stocks in 1994, 1996, 1999, 2000, and 2016). Third, it becomes apparent that loss recovery may sometimes take longer; for example, momentum-managed strategies show this behavior during 2019 and 2020 and volatility-managed strategies during 2016. All of this confirms our point that the considered strategies may well lead to opportunity cost (i.e., risk management costs in some periods). More light is shed on potential long-run opportunity costs in the next section.

EXHIBIT 6
Historical Returns and Duration-Adjusted Returns (%)
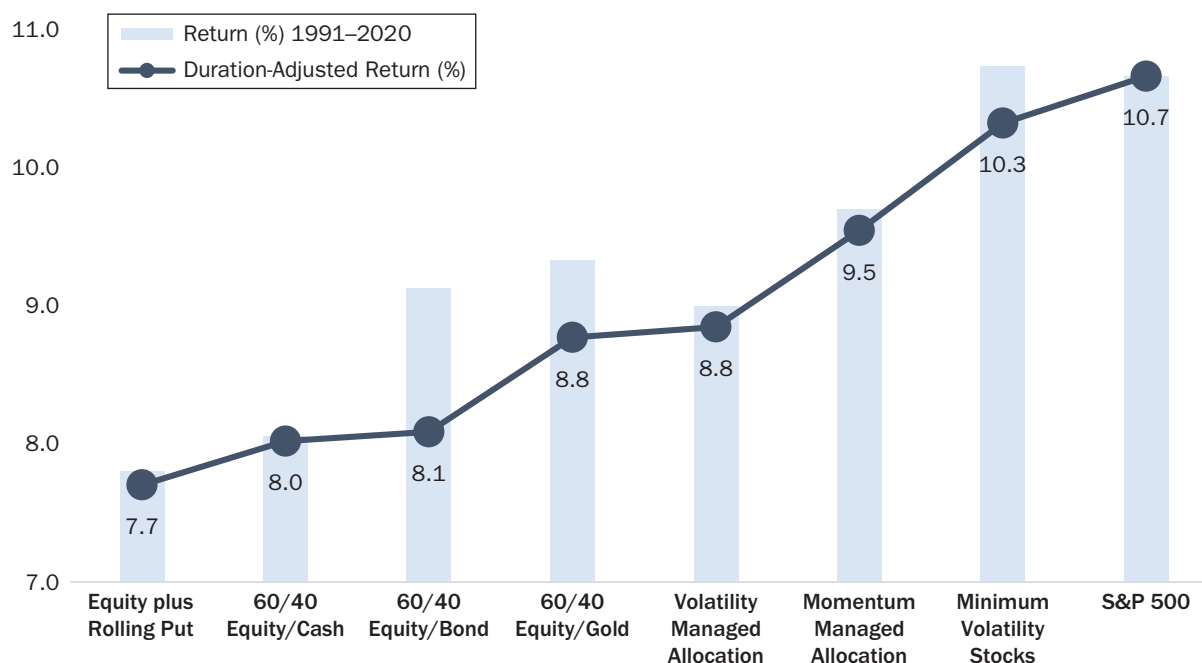
NOTES: Return (%) is the geometric return per annum. We wanted to capture the extent to which the geometric return profits from lower volatility or lower downside. The duration-adjusted return is defined analogous to a beta-adjusted return. The idea is to strip out the part of performance that is explained by the duration risk factor. We subtract the historical risk premium of bonds from the strategy returns. The duration loading is based on a full-sample regression using rolling five-day returns to handle daily pricing discrepancies. We do this as regression-based to capture the duration loading of gold and minimum volatility stocks. The timeframe is 1991–2020.

WHAT IS THE COST?

The risk management strategies' reduction of losses during equity market corrections has been between 20% and 40%. This risk reduction has to come with a cost, on the assumption that capital market returns are driven by risk-taking. We compute two types of return: the simple historical return and the duration-adjusted return (Exhibit 6). The duration-adjusted return is equal to the historical return minus the bond-beta times the historical bond risk premium; hence it estimates the strategies' return if bonds no longer deliver a risk premium above cash. This seems to be a sensible scenario for the foreseeable future, if rates stay lower for longer.

On average, the return reduction relative to the S&P 500 Index is 1.5% per year across all strategies. It is not surprising that the protective put strategy has the highest opportunity cost—about 3% per year—because it delivered the best short-term crash protection and convexity. The balanced solutions equity plus cash, equity plus bonds, and equity plus gold have a cost of 2% to 3%. The costs of volatility or momentum managed allocations are between 1% and 2%. The lowest cost was generated by minimum volatility, also not a surprise because these strategies offer the most uncertain risk mitigation profile.

RISK AND RETURN BALANCE

As investors are seeking to optimize the balance of risk and return, subject to restrictions related to both, it is helpful to look at Exhibit 7, which shows the trade-offs

EXHIBIT 7
Risk- and Duration-Adjusted-Return
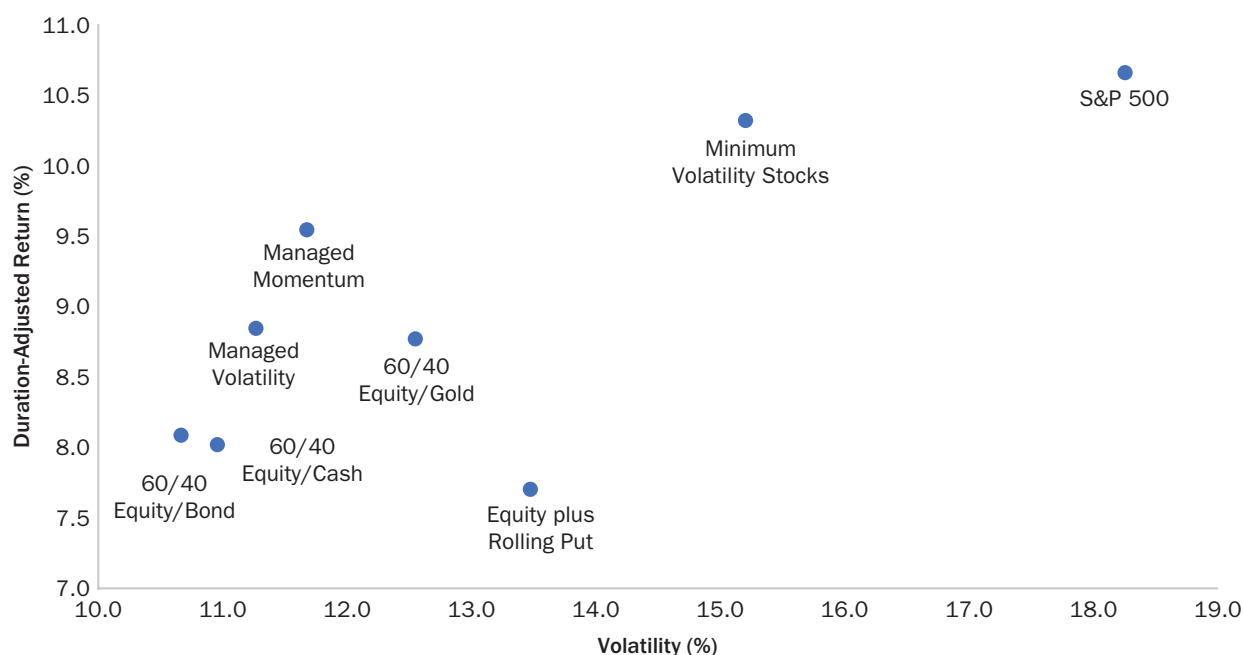
NOTES: Duration-adjusted return (%) is defined as similar to a beta-adjusted return. We subtract from the daily strategy returns the expected daily risk premium of bonds. The duration loading is based on a regression using rolling five-day returns to handle daily pricing discrepancies. We then compute the geometric return per annum, based on the duration-adjusted daily returns. The timeframe is 1991–2020.

for all strategies. Most appear to be relatively close to a perceived efficient frontier. Only equity plus rolling put shows a large deviation from the efficient area, owing a low return paired with higher volatility than some other strategies. The crash protection cost in the puts is so high that investors must have a strong crash protection preference to be willing to pay this much. Both managed momentum and managed volatility have such a favorable risk–return combination that they dominated the equity/gold combination.

In Exhibit 8 we look at the duration-adjusted Sharpe ratio, which is the duration-adjusted return minus cash divided by the volatility, and at the crisis Sortino ratio, which is defined as duration-adjusted return minus cash divided by crisis volatility if equity markets drop more than 2%. The latter is our choice to highlight the need for volatility reduction in days with large drawdowns.

Overall, it is interesting that all but one of the risk management strategies deliver the same or slightly better risk-adjusted performance compared to the S&P 500 index. The best outcome was achieved by momentum, volatility cap, and minimum volatility, which balance out return and risk in the best way. The static strategies equity plus cash/bond/gold all have similar risk-adjusted ratios that are slightly better than pure equities. Only the protective put leads to a reduction of risk-adjusted performance, even when looking at the crisis Sortino ratio. Overall, the crisis Sortino strategy ranking is almost the same as the Sharpe ratio–based ranking.

CONCLUSIONS

Crises never unfold in the same way and hence are different each time. The fact that yields are at zero changes everything. On one hand, investors have been climbing

EXHIBIT 8

Risk-Adjusted Performance
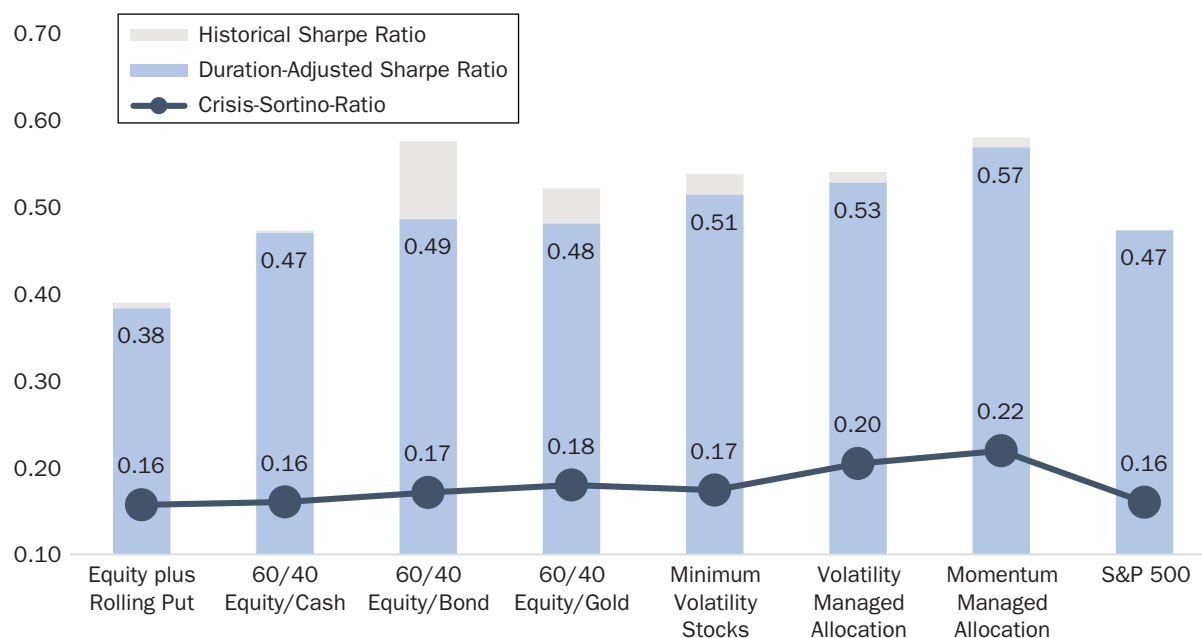
NOTES: Duration-Adjusted Sharpe Ratio is the Sharpe Ratio computed with duration-adjusted return. The Crisis-Sortino-Ratio is the same as the Duration-Adjusted Sharpe Ratio, except that the volatility is replaced by a crisis volatility that uses only the days when equity markets drop more than 2% to reflect times of real market stress. The timeframe is 1991–2020.

up the risk ladder; and on the other, they are looking for risk management alternatives to bonds. Regarding our analysis of risk management strategies, it should be noted there is potential hindsight bias in the strategies tested. We tried to manage hindsight by resorting to official simple indexes and to simple momentum and volatility cap rules. Of course, in practice each of the tested strategies may be subject to optimization and fine-tuning, but we decided to keep them comparable in both simplicity and degree of risk mitigation.

The first result is that the strategies discussed, and hence combinations of them, may have a good chance of reducing the investor downside. Most delivered some degree of risk mitigation, on average around 30% to 40% of the equity market risk, which is comparable to that of the ubiquitous 60/40 equity/bond portfolio. Hence, they offer viable alternatives to the traditional equity/bond portfolio. In terms of risk-adjusted returns the strategies are comparable, and in some cases better.

In terms of strategy ranking, it gets more difficult to make forward-looking performance statements. Hence, we rely on the following more qualitative statements, and application may then depend rather on investor preference. The most traditional risk management is the static mix case, which is to reduce the equity allocation in favor of bonds, gold, or cash. All three alternatives had very similar return and risk statistics, when adjusting returns by historical nonrepeatable bond premiums. Furthermore, all three cases had very stable risk mitigation patterns in all drawdowns larger than 10%, independent of the length of the drawdown, so they have low path dependency. In the current scenario, it is sensible to reduce bonds for gold or even cash to reduce duration risk, which may result in downside reduction similar to that delivered by bonds up to now.

Dynamic asset allocation strategies such as momentum managed and volatility managed portfolios can also replace 60/40 portfolios, because they have delivered

good risk mitigation, especially in times of extended losses. They are somewhat path dependent; to be effective, they require market drawdowns to be extended. If markets are trending, they also offer some additional return convexity, as the risk mitigation is then better than that of a static mix portfolio.

If the investor prefers not to reduce the equity allocation from 100% but to reduce the risk anyway, the minimum volatility stocks strategy might be an interesting option. One needs to take into account that the risk-reduction effectiveness was weakest overall, and it has some duration loading. The historically good Sharpe ratio is well documented, and because it is behaviorally founded it may persist.

The protective put is the strategy that had the best convexity and hence crash protection. This is probably the reason that this must be paid for. Therefore, investors who do not need short-term crash protection and have rather long-term goals might prefer the other options.

In any case, it is difficult to predict whether the past 30-year pattern of risk reduction, and especially that of opportunity costs, will stay the same for the next 30 years. Still, we hope that the above analyses can help investors to select appropriate risk management strategies or combinations of them.

REFERENCES

Bollerslev, T., B. Hood, J. Huss, and L. Pedersen. 2018. "Risk Everywhere: Modeling and Managing Volatility." *The Review of Financial Studies* 31 (7): 2729–2773.

Bondarenko, O. 2014. "Why Are Put Options So Expensive?" *Quarterly Journal of Finance* 4 (3): 1–50.

Frazzini, A., and L. Pedersen. 2014. "Betting Against Beta." *Journal of Financial Economics* 111 (1): 1–25.

Moreira, A., and T. Muir. 2017. "Volatility-Managed Portfolios." *The Journal of Finance* 72 (4): 1611–1644.

Moskowitz, T., Y. Ooi, and L. Pedersen. 2012. "Time Series Momentum." *Journal of Financial Economics* 104 (2): 228–250.