Portfolio insurance in times of higher interest rates

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Higher interest rates aid portfolio insurance (PI) strategies, as they serve to increase the size of the cushion and, hence, the size of the risk budget. This tends to translate into higher returns and Sharpe ratios, and may lead to lower implicit portfolio insurance costs. We analyze why a portfolio insurance strategy may be a viable alternative.

Portfolio insurance strategies aim to limit a portfolio risk over a specified period of time. Conventional financial theory connects risk with volatility. But for many, the expected maximum drawdown is more relevant. Broad diversification across asset classes, regions, industries and style factors can mitigate expected losses but doesn't explicitly target maximum drawdown. In this article, we analyze why a Portfolio Insurance strategy may be a viable alternative.

How portfolio insurance works

A portfolio insurance approach is an enhanced version of a conventional Constant Proportion Portfolio Insurance (CPPI) strategy. One main feature of CPPI is the so-called 'cushion' (C_t) which is the difference between the current portfolio value 'wealth' (W) and the net present value of the specified floor F_t.

(1) $C_t = W_t - NPV(F_T)$

To avoid losses in excess of the given floor over the predefined period, typically one calendar year, the maximum loss of the portfolio at time t should not exceed the cushion:

(2) $C_t \geq e_t \times W_t \times \text{MaxLoss}(\textit{risky asset})$

with e_t being the portfolio share of the risky asset and MaxLoss the risky asset's maximum loss (in %).

A portfolio insurance strategy dynamically adjusts the exposure to risky assets based on the risk forecast.

When interest rates are higher, one can risk more than the available risk budget.

Defining the risk exposure $E_t = e_t \times W_t$ and rearranging formula (2), this results in:

$$(3)\quad E_t \le \frac{C_t}{\text{MaxLoss}(\textit{risky asset})} = m \times C_t$$

with the multiplier m:

$$(4)\quad m := \frac{1}{\text{MaxLoss}(\textit{risky asset})}$$

The multiplier tells us how often the cushion can be invested in the risky portfolio, without losing more than the specified amount. In a CPPI strategy, this multiplier is constant over time and is usually derived from a realized maximum drawdown over a longer period. This results in lower investment exposures over time and may be regarded as extremely conservative.

In contrast, a portfolio insurance strategy dynamically adjusts the exposure to risky assets based on the risk forecast of the portfolio, with a variable multiplier:

$$(5)\quad E_t \le \frac{C_t}{\text{MaxLoss}_t(\textit{risky asset})} = m_t \times C_t$$

with the multiplier

$$(6)\quad m_t := \frac{1}{\text{ES}_t^{99\%}(\textit{risky asset})}$$

As there is no common guideline on how to set the multiplier, most practitioners use a tail risk estimate such as a Value-at-Risk (VaR) or an Expected Shortfall (ES). Here, we use the 99% daily Expected Shortfall for the risk estimate based on a t-GARCH Copula model. This addresses multiple shortcomings of traditional risk estimation: For instance, we do not need to assume normally distributed returns and work with time-varying correlations between assets.[1]

The PI strategy thus minimizes allocation to risky assets as needed to protect the floor but also allows upside potential when the specified floor is not in danger.

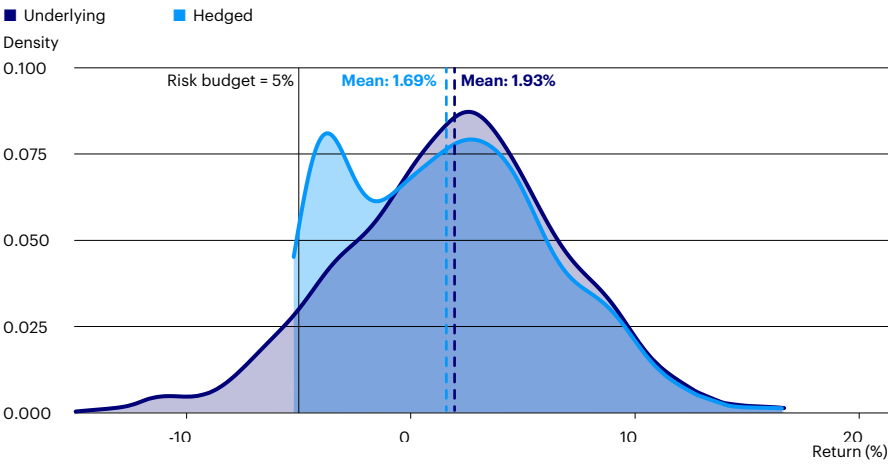
The effect of higher interest rates

As can be seen in formula (1), the cushion depends on the current portfolio value and the discounted value of the floor. The discount factor can be the yield of highly rated government bonds or of risk-free cash investments. With an increase in interest rates and associated risk-free returns, the NPV of the floor decreases so that the available cushion increases.

$$(7)\quad NPV = \frac{F_t}{(1+r)^t}$$

In other words: When interest rates are higher, one can risk more than the available risk budget over the year without a rising probability of breaching the year-end floor limit. In times of positive interest rates all risky positions can be liquidated to allocate the full portfolio into money market securities with interest rates lifting the portfolio up above the predefined floor. In times of negative interest rates, on the other hand, one can lose less than the defined risk budget, as negative interest rates hurt a portfolio fully invested in money market securities. Of course, the risk budget only increases if a temporary breach of the floor is accepted and the portfolio insurance is evaluated at the end of each specified period.

Figure 1
Simulation for a risk-free rate of -50 bps



Density chart for 1,000 simulated return paths for a portfolio with 24% global equities, 60% 10-year global government bonds, 10% commodities and 6% money market instruments. Proxy for global equities: a mixture of Eurosotxx 50 future, S&P 500 future, Topix Future and FTSE 100 Future. Government bonds: Bloomberg 10-year German government index, Bloomberg 10-year Australian government bond index, Bloomberg 10-year UK government bond and Bloomberg 10-year Canadian government bond index. Commodities: Bloomberg Copper Subindex Total Return, S&P GSCI Crude Oil Total Return CME Index, S&P GSCI Gold Index Total Return CME. Money Market: Deutsche Bank 1-month Euribor Index. November 30, 2005 to December 31, 2022. PI risk budget of 5% p.a.
Source: Invesco calculations. **There is no guarantee that the simulated results will be achieved in the future.**

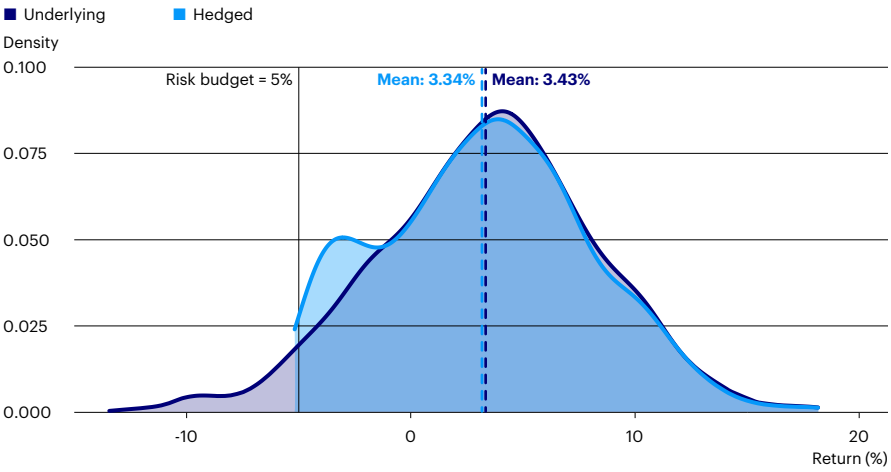
Simulations

We analyzed the effects of rising interest rates on a strategy by simulating 1,000 return paths with different assumptions for the discount rate. The underlying portfolio is a generic risk parity strategy, with 24% global equities, 60% 10-year global government bonds, 10% commodities and 6% money market instruments. The risk budget (i.e., the maximum loss at calendar year end) is set at 5% p.a. and the simulation – for the period from November 30, 2005 to December 31, 2022 – is based on historical returns, keeping realized correlation patterns while incorporating forward-looking capital market assumptions. The annual return assumptions are 450 bps above cash for equities, 50 bps above cash for bonds and 150 bps above cash for commodities. For the risk-free rate, we have iterated 5 variants: -50 bps, 0 bps, 100 bps, 200 bps and 300 bps p.a.

Table 1 shows the results for the -50 bps (figure 1), 100 bps (figure 2) and 300 bps (figure 3) and presents the result for all five iterations.

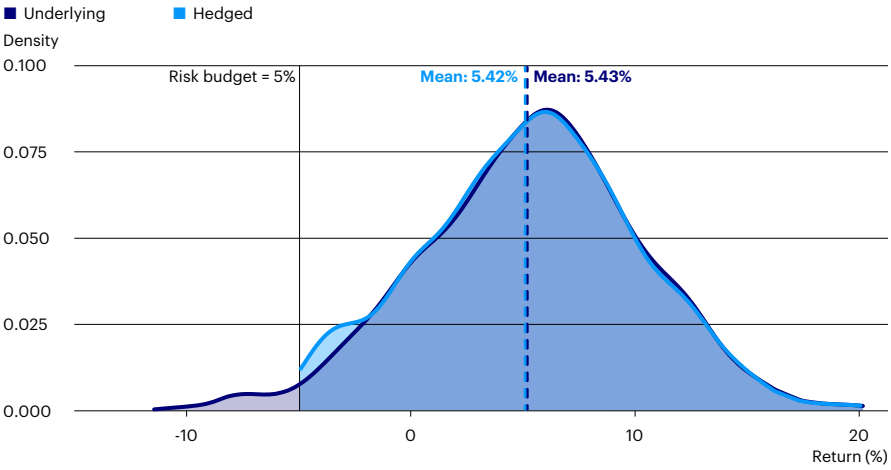
For a risk-free rate of -50 bps (figure 1), the portfolio return without PI is 1.93% p.a.; measured as the annualized return differential between the strategies with and without PI, the implicit insurance cost amounts to 24 bps p.a. Also, there are quite a few paths with a loss close to (but still above) the floor – as the blue hump in the distribution on the left-hand side shows. These observations result from the so-called 'cash-lock' situation. A cash-lock occurs when the portfolio value moves close to the floor, effectively reducing the

Figure 2
Simulation for a risk-free rate of 100 bps



Density chart for simulated return paths for a portfolio with 24% global equities, 60% 10-year global government bonds, 10% commodities and 6% money market instruments, November 30, 2005 to December 31, 2022. PI risk budget of 5% p.a.
Source: Invesco calculations. **There is no guarantee that the simulated results will be achieved in the future.**

Figure 3
Simulation for a risk-free rate of 300 bps



Density chart for 1,000 simulated return paths for a portfolio with 24% global equities, 60% 10-year global government bonds, 10% commodities and 6% money market instruments, November 30, 2005 to December 31, 2022. PI risk budget of 5% p.a.
Source: Invesco calculations. **There is no guarantee that the simulated results will be achieved in the future.**

Table 1
Simulation results in full

Risk-free interest rate		-50 bps	0 bps	100 bps	200 bps	300 bps	300 bps (scaled-up)
Portfolio insurance cost		24 bps	17 bps	9 bps	4 bps	1 bps	7 bps
Return p.a.	**without PI**	1.93%	2.43%	3.43%	4.43%	5.43%	5.90%
	with PI	1.69%	2.26%	3.34%	4.39%	5.42%	5.83%
Volatility p.a.	**without PI**	4.51%	4.51%	4.51%	4.51%	4.51%	5.41%
	with PI	3.90%	4.01%	4.15%	4.26%	4.33%	5.07%
Sharpe ratio	**without PI**	0.59	0.59	0.59	0.59	0.59	0.59
	with PI	0.44	0.47	0.51	0.54	0.56	0.53
Maximum drawdown (average over simulation period p.a.)	**without PI**	-4.86%	-4.72%	-4.47%	-4.26%	-4.07%	-4.98%
	with PI	-4.14%	-4.09%	-3.99%	-3.90%	-3.80%	-4.50%

Average results for 1,000 simulated return paths for a portfolio with 24% global equities, 60% 10-year global government bonds, 10% commodities and 6% money market instruments, November 30, 2005 to December 31, 2022. PI risk budget of 5% p.a.
Source: Invesco calculations. There is no guarantee that the simulated results will be achieved in the future.

> Higher interest rates not only reduce portfolio insurance costs, but also enhance the total return of the strategy.

cushion to almost zero and not allowing the strategy to build up any new exposure to risky assets.

As expected, some return potential may be forfeited, but this may be limited to the defined drawdown limit, offering an insurance-like payout profile.

For a higher risk-free rate of 100 bps, the picture changes somewhat (figure 2). The hump on the left-hand side is much smaller, and the implicit portfolio insurance cost amounts to just 9 bps (3.34% minus 3.43%). The overall return increases significantly due to the higher risk-free rate. In addition, the increase in volatility is offset by a higher return, leading to a better Sharpe ratio.

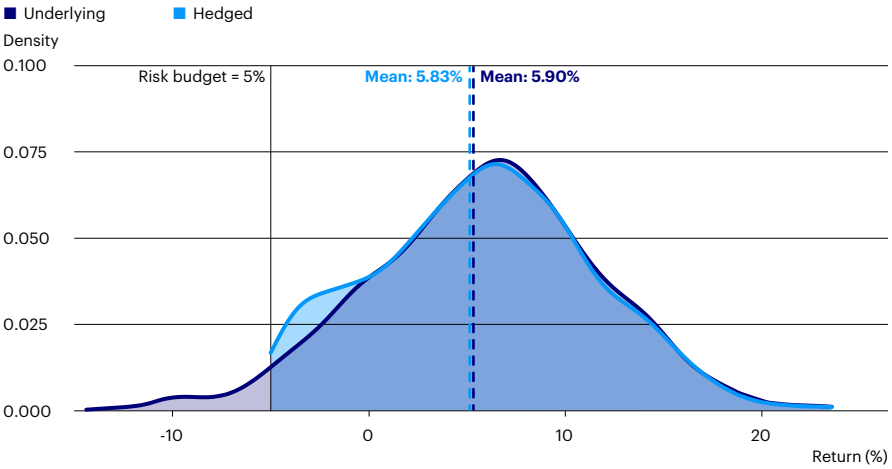
Finally, at a rate close to the current cash market rate of 300 bps, there are almost no portfolio insurance costs (figure 3). The return without DPPI is 5.43%, whereas an insured strategy yielded 5.42%.

Table 1 summarizes the results for all five interest rate assumptions (and the 'scaled-up' version, which we will discuss later). Higher interest rates not only reduce portfolio insurance costs, but also enhance the total return of the strategy more or less linearly (since we assumed constant risk premia for all asset classes). As for the maximum drawdown, a similar observation can be made: With a higher yielding risk free investment, the drawdowns for the DPPI strategies are reduced. As expected, our risk-managed version additionally reduces the average yearly drawdown compared to a non-risk-managed strategy.

Do higher interest rates enable higher risk exposures?

Next, we examine whether it is possible to increase overall portfolio risk when interest rates rise and still achieve satisfactory results after PI. To this end, we have scaled up the portfolio by 20% so that portfolio shares become: 29% for equities, 72% for bonds and 12% for commodities, introducing a small degree of leverage. Figure 4 shows the results for a risk-free rate of 300 bps.

Figure 4
Simulation for a risk-free rate of 300 bps (scaled-up)



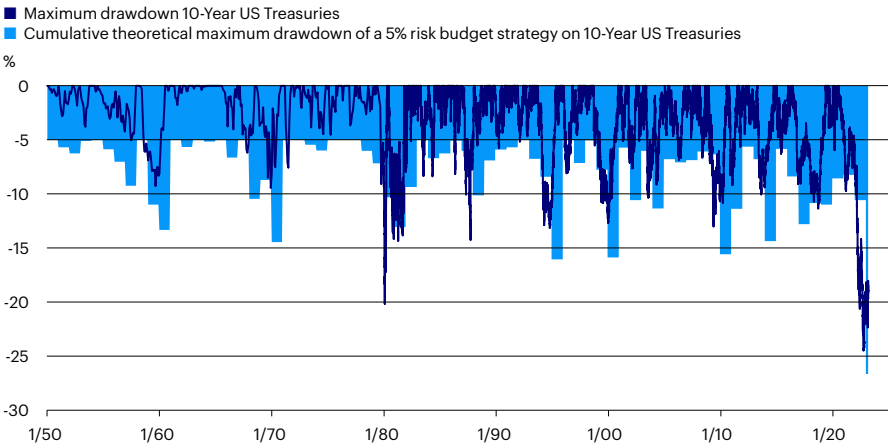
Density chart for 1,000 simulated return paths for a portfolio with 29% global equities, 72% 10-year global government bonds, and 12% commodities, November 30, 2005 to December 31, 2022. PI risk budget of 5% p.a.
Source: Invesco calculations. **There is no guarantee that the simulated results will be achieved in the future.**

As expected, the implicit portfolio insurance costs have risen – in this case from 1 bp to 7 bps, but the total return has also increased – to 5.90% without and 5.83% with PI. For a less risk-averse appoach, the higher insurance fee may seem appropriate; it is expected to remain in the single digits while the total return increases by more than 40 bps.

Are bonds an alternative?

It is prudent to frequently weigh the benefits and drawbacks of a diversified, risk-budgeted multi-asset strategy against an allocation to bonds. Figure 5 compares the maximum drawdown of US 10-year Treasuries without PI to the theoretical maximum drawdowns of a PI-based US Treasury allocation with 5% annual risk budget.

Figure 5
Maximum drawdowns of US Treasuries – with and without PI



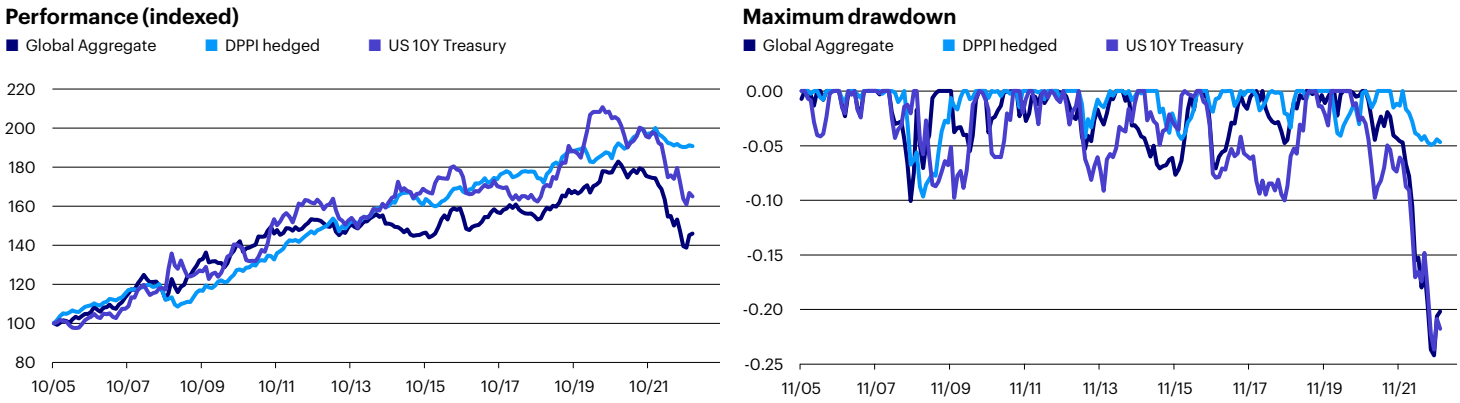
Source: Invesco. Data from January 31, 1950 to March 21, 2023. DPPI risk budget of 5% p.a. **There is no guarantee that the simulated results will be achieved in the future.** Backtested data.

Table 2
Return patterns of PI and US Treasury strategies in comparison

	Return			Return comparison		Maximum drawdown per calendar year end		
	PI	US 10Y Treasury	Global Aggregate	Difference (PI vs US Treasury)	Difference (PI vs Global Agg)	PI	US 10Y Treasury	Global Aggregate
2005*	3.7%	1.8%	0.3%	2.0%	3.4%	-0.2%	-0.3%	-0.7%
2006	5.5%	1.3%	6.6%	4.1%	-1.2%	-1.0%	-1.8%	-1.8%
2007	7.3%	9.7%	9.5%	-2.4%	-2.2%	-0.4%	-1.0%	-1.4%
2008	-3.4%	20.1%	4.8%	-23.5%	-8.2%	-6.5%	-1.4%	-2.4%
2009	4.5%	-9.8%	6.9%	14.2%	-2.5%	-1.3%	-10.2%	-3.9%
2010	8.6%	8.0%	5.5%	0.6%	3.1%	-0.6%	-6.7%	-3.7%
2011	7.5%	17.2%	5.6%	-9.7%	1.8%	0.0%	-0.6%	-2.8%
2012	7.3%	4.1%	4.3%	3.1%	2.9%	0.0%	-1.7%	-0.7%
2013	2.1%	-7.8%	-2.6%	9.9%	4.7%	-2.0%	-9.5%	-2.6%
2014	6.8%	10.7%	0.6%	-3.9%	6.3%	-0.5%	-0.8%	-4.1%
2015	-0.8%	0.9%	-3.2%	-1.7%	2.4%	-5.2%	-3.6%	-3.7%
2016	5.0%	-0.2%	2.1%	5.2%	2.9%	-0.9%	-8.6%	-7.8%
2017	5.6%	2.1%	7.4%	3.5%	-1.8%	-0.1%	-2.4%	-0.9%
2018	-3.3%	0.0%	-1.2%	-3.3%	-2.1%	-3.7%	0.0%	-2.8%
2019	10.0%	8.9%	6.8%	1.1%	3.2%	-0.6%	-3.6%	-0.8%
2020	1.6%	10.6%	9.2%	-9.0%	-7.6%	-0.1%	-3.2%	0.0%
2021	4.1%	-3.6%	-4.7%	7.6%	8.8%	-0.2%	-3.6%	-4.9%
2022	-4.7%	-16.3%	-16.2%	11.7%	11.6%	-4.6%	-15.2%	-15.9%
Total simulation period (11/30/05 – 12/31/22)								
Return (p.a.)	3.83%	2.96%	2.23%					
Volatility	3.81%	7.21%	5.83%					
Sharpe Ratio	0.71	0.26	0.19					

Data from November 30, 2005 to December 31, 2022; return for 2005 since November 30. Drawdown is defined as the drawdown during the specified year based on year-end prices. 'PI' refers to the multi-asset strategy, a risk budget of 5% p.a and a risk free rate of 5% p.a and actual historical risk-free rates.
Source: Invesco, Bloomberg. **There is no guarantee that the simulated results will be achieved in the future.**

Figure 6
Performance and maximum drawdown over time



Data from November 2, 2005 to December 31, 2022. **Past performance is not a guarantee of future results.**
Sources: Invesco, Bloomberg.

> US Treasuries have frequently experienced significant drawdowns.

> The portfolio looks well-equipped to deliver a diversified return in different economic environments.

Despite their safe-haven characteristics and extremely low default probability, US Treasuries have frequently experienced significant drawdowns. The most severe episodes, exceeding 20%, occurred in 1980 and 2022, when the Fed swiftly raised interest rates to bring down inflation. This highlights a potential pitfall of a pure bond allocation – its lack of diversification. Bonds suffer during periods of growth and inflation.[2] An annual risk budget of 5%, as in our PI-based simulations, is exceeded numerous times.

For comparison: Over the historical backtest period from November 30, 2005 to December 31, 2022, using historical interest rates, the multi-asset strategy experienced maximum drawdowns of 14.4% without and 11.0% with PI (table 2), whereas US Treasuries saw maximum drawdowns of 25.1% (even with PI) at a much higher level of volatility.

Increasing diversification by using a broader Global Aggregate Bond index that invests in multi-currency investment grade debt from treasuries, government-related or corporates, volatility can be reduced, while providing a nearly identical drawdown profile compared to US Treasuries. Contrasting those drawdown figures, it becomes apparent that both diversification and the portfolio insurance mechanism can help mitigating drawdowns.

As table 2 and figure 5 show, the multi-asset PI approach produced overall higher returns and lower volatility than US Treasuries – and consequently much better risk-adjusted performance. Especially in times of rising rates, the US Treasury strategy is prone to substantial negative returns. (For completeness, we have also calculated result for a Global Aggregate strategy, which essentially show a similar pattern.)

By its multi-asset nature, the underlying portfolio looks well-equipped to deliver a diversified return in different economic environments. Equities help in times of non-inflationary growth, bonds work as a safe haven asset in recessionary environments and commodities constitute a viable hedge against unexpected inflation.

Conclusion

In an environment of higher interest rates, a balanced multi-asset strategy with different macro sources of return looks well positioned to harvest these successfully through its underlying strategic allocation. Coupled with a drawdown-limiting mechanism, a second line of defense is introduced which controls the maximum possible loss over a calendar year. Higher short-term rates function like a backwind for those strategies, providing it with the opportunity to bear higher risks without increasing the likelihood of breaching the predefined floor. A multi-asset strategy may provide a stable stream of returns compared to a pure fixed income allocation, as it has more diversified sources of return compared to traditional options.

Notes
1 e.g., Happersberger, Lohre and Nolte (2020); Pfaff (2010); Kolrep, Lohre and Happersberger (2017).
2 cf. Lohre, Hixon, Raol et al. (2020).

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Data as of June 30, 2023 unless otherwise stated.

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