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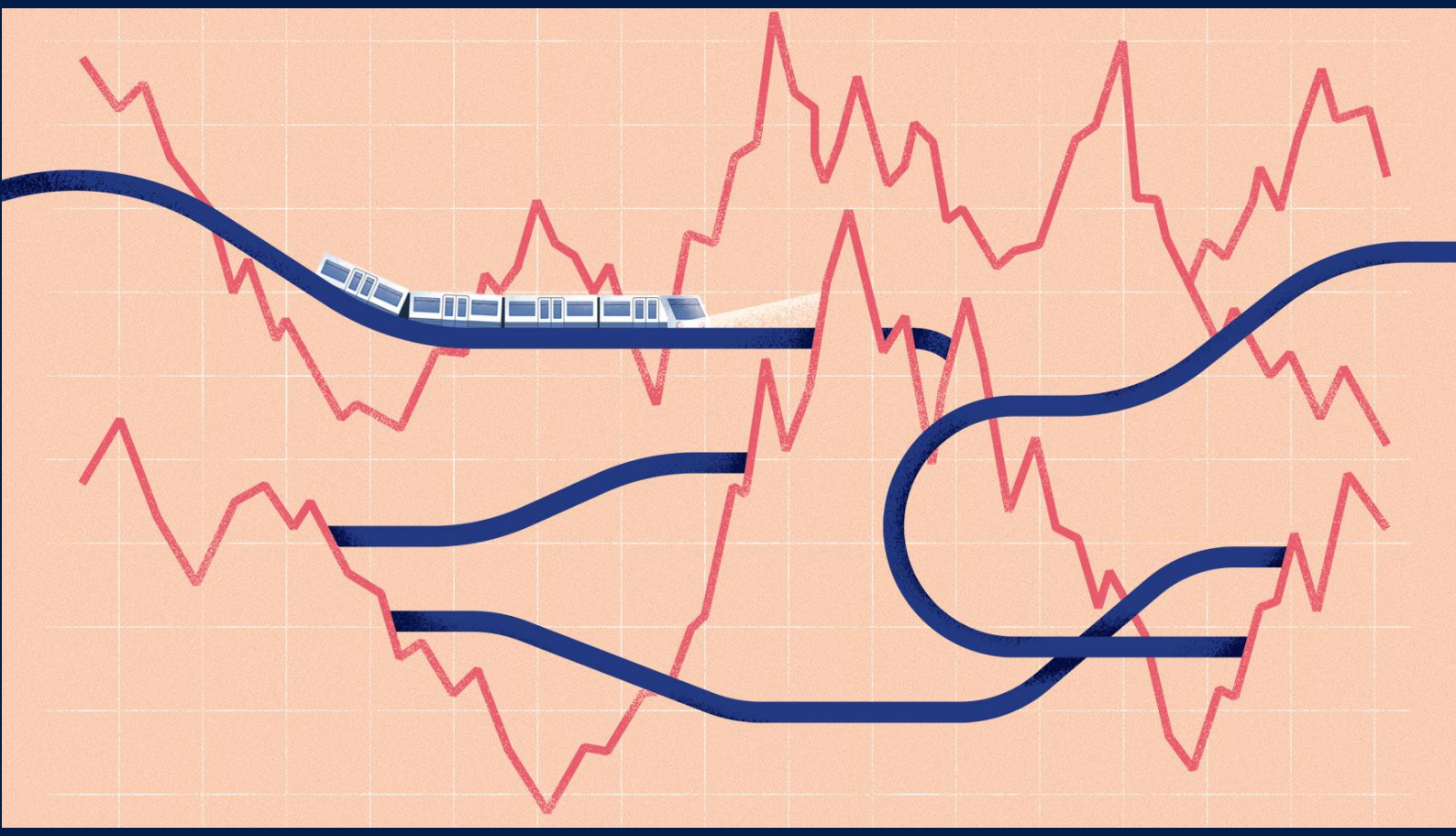

Building Balanced Portfolios for the Long Run

A New Framework for Incorporating Macro Resilience into Asset Allocation

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ABSTRACT

This paper by MSCI and GIC introduces an asset-allocation framework which aims to help long-horizon investors construct portfolios with greater resilience against continued macro uncertainties, while preserving investors' expected returns.

Introduction and summary

Long-term investors face two major shifts in the investment environment. One has been steadily building, while the other has materialised suddenly: We are witnessing the rise of private assets to the core of many asset allocations from a peripheral "alternative," and we have entered a new period of heightened macro uncertainty. Both could require a fundamental evolution of the asset-allocation process.

Decades of moderate inflation and falling interest rates have given way to higher inflation and interest rates. Other secular forces, such as climate change and deglobalisation, are also transforming the investment environment to one unlike any we have experienced before. These regime shifts suggest the need for a fundamentally forward-looking asset-allocation process.

Today's investors also face an investment universe that is quickly expanding beyond traditional public equity and bonds. Private assets have often promised investors higher returns and lower risk, but their opaque valuations and limited history have made them hard to evaluate and incorporate into the asset-allocation process alongside public markets.

In this paper, MSCI and GIC introduce an asset-allocation framework to help investors navigate a new regime. We start by moving away from short-term, backward-looking measures of risk to tools for understanding the macro risks that could dominate the coming decades, and how they may play into asset returns over long horizons. Some of these macro risks — including supply-driven inflation, a less-credible central bank, rising real rates and slowing productivity growth — were modest risks in recent decades but could significantly change the trajectory of the markets in the years ahead.

We use five potential macro scenarios to demonstrate a framework for constructing asset allocations aimed to be more robust to long-term risks. By putting less emphasis on reducing backward-looking, short-term risk, allocations can instead prioritise resilience to potential macro uncertainties, while preserving the same level of investors' long-run expected returns. In addition, placing public and private assets on the

same footing can help manage long-term risks and returns across the total portfolio.[1]

The macro-finance framework we use differs from traditional, statistically based risk measures in four main ways:

- First, a long-horizon view **aligns with many institutional investor mandates** — to meet liabilities and preserve wealth over the long run — instead of trading off short-term risk and return.
- Second, by relating investors' cash flows and discount rates to a common set of macro drivers, the macro framework provides an **intuitive and consistent view spanning all asset classes**.
- Third, the macro framework can project asset returns through a range of time horizons, making it potentially **useful for both strategic and tactical portfolio positioning**.
- Last, the framework may aid decision-making that **considers potential new macro environments** that may emerge, rather than optimising relative to the previous market regime.

This paper is organised as follows:

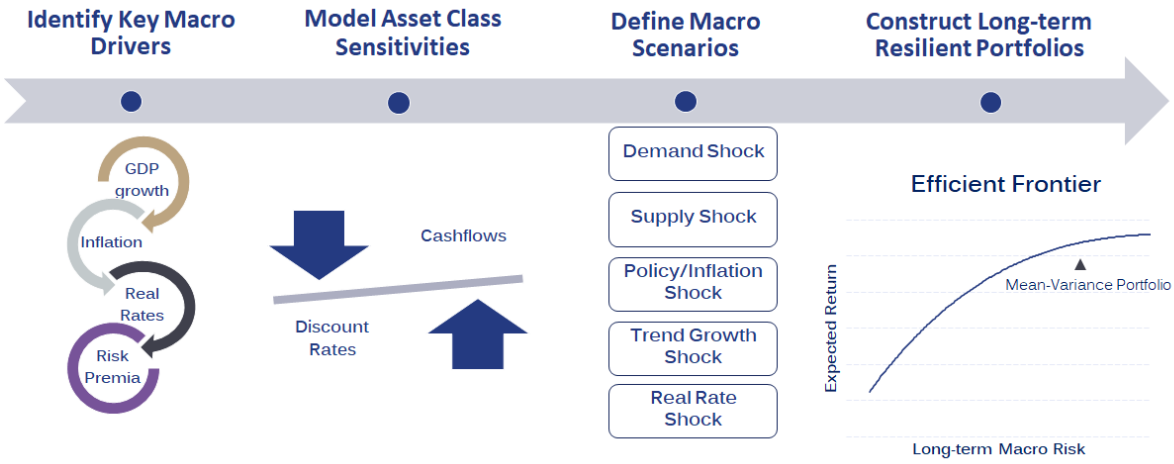
- First, we explain why a cash-flow-based, long-term view of risk may be useful for investors' strategic asset-allocation process, **describe new tools to estimate macro risk and introduce the five potential scenarios that may shape the macro regime in the decades ahead**: shocks to demand, supply, trend growth, central-bank policy and long-term real rates.
- Second, we analyse how these macro scenarios could play out across different asset classes and time horizons and highlight the key features of the investment landscape faced by long-term investors. We discuss how **discount-rate shocks, mean reversion, shocks to trend growth and regime shifts could have starkly**

[1] In practice, few investors have the luxury to be completely immune to short-term pressures. This framework focuses on the idealised, pure long-horizon investor, while recognising that, in practice, most long-term investors would likely seek some intermediate balance with short-term objectives. The aim of this note is not to recommend a particular asset allocation for long-term investors, but to introduce a new set of tools for these investors to use.

different effects for short-horizon versus long-horizon investors.

- Last, we demonstrate a **systematic asset-allocation framework that incorporates a view of the long-horizon investment landscape, with a case study of asset allocations aiming to be more macro-resilient**. We illustrate some potential benefits and costs of replacing short-term volatility with such long-term risk measures, and explore the implications for long-term investors.

Exhibit 1: A toolkit for long-horizon asset allocation



A long-term asset-allocation framework can combine models for estimating the long-term macro sensitivity of asset classes with investors' macro views or capital-market assumptions to produce asset allocations aligned to long-term investors' objectives.

Redefining risk for long-term investors

Long-term investors aim to meet their liabilities and maintain the purchasing power of their wealth far into the future, but they have often made decisions based on the backward-looking, short-horizon behaviour of asset returns. Such a view tends to suggest that stocks are very risky, bonds behave like insurance and private assets are low-risk and mildly correlated. Allocations typically have followed accordingly, including large allocations to fixed income even as real yields went negative.

The outlook for long-horizon investors, however, may be very different from what conventional wisdom suggests. Although bonds tended to act as a hedge to equity when demand shocks were the dominant macro risk, bonds have typically moved down together with equity in response to supply shocks, when

the threat of inflation superseded the central bank's aim of fighting recession. Further, the low volatility and correlations of private assets are largely artifacts of their smooth valuations, rather than reflecting a lack of systematic risk.

Despite these challenges, significant opportunities may remain for long-horizon investors. Private assets are not uncorrelated over a long horizon, but their spectrum of exposures to macro risks may enable them to be used to help manage long-term risks across the total portfolio. In addition, while equity is highly volatile over a short horizon, volatility driven by fluctuating equity risk premia may be much milder for the long-horizon investor.

The use of backward-looking statistics may be increasingly ill-suited to the challenges facing long-term investors today, who need a framework to understand and manage the risks and return opportunities they face across all asset classes.

This paper introduces a framework to understand the long-horizon risks and returns of all asset classes by relating their prices to **uncertain future cash flows sensitive to the overall economy** and discounted with a combination of real rates and market-dependent premia. This view provides a direct connection between the assets in the portfolio and the long-horizon investor's objectives — sustained cash flows and spending power — and it enables projections into the new macroeconomic regimes that may prevail in the years ahead.

The macro view connects an ancient concept in finance — the discounted-cash-flow model — to a framework for understanding how assets' cash flows and discount rates may change with the macro regime.

Among a wide range of possible macro scenarios, we identify the key factors driving long-horizon risks and returns across asset classes, each represented by a downside scenario[2]:

- **Demand shocks:** Growth, inflation and real rates are driven down together by decreasing economic demand. Demand shocks were the primary source of market

[2] These factors were chosen to reflect the most important drivers of long-term returns across asset classes. Among many possible drivers of asset class returns, these were selected for their importance across asset classes, time horizons and market regimes. This paper focusses on a single downside for each of these factors, but the framework can incorporate a wide range of upside and downside scenarios for these factors and other macroeconomic scenarios.

volatility in most developed markets in the past two decades and were responsible for the negative correlation between equities and bonds.

- **Supply shocks:** Decreasing economic supply drives growth down while inflation and rates rise. Supply shocks drive equities and bonds down together, as in the stagflation period of the 1970s.
- **Productivity shocks:** Trend growth slows, moving the economy to a lower-growth path that persists for many years. Although growth slows only moderately in the short term, the cumulative effect of lower growth year after year is a much smaller economy and much smaller cash flows to growth-sensitive assets. Such a scenario could describe the end of Japan's explosive growth in the 1980s and, to a lesser degree, the aftermath of the 2008 global financial crisis. However, it may pose a significantly larger risk to the global economy than was the case during the economic boom that has taken place since the Second World War.
- **Policy shocks:** The central bank becomes less willing to cool the economy to control inflation and, in turn, becomes less credible. Weaker central-bank policy results in higher short-term growth, but the loss of credibility creates a cycle of higher inflation that lasts for years before eventually being brought under control with a Volcker-like recession. Nominal bonds suffer large real losses, while other assets suffer more mildly through the doldrum years, during which inflation is brought back under control.
- **Real-rate shocks**: The secular trend of decreasing real rates reverses. Immediate losses across asset classes are accompanied by higher expected returns, which ultimately benefit long-horizon investors.

The past decades were largely dominated by demand-shock volatility against a background of secularly declining real rates. In the future, however, any of the five macro scenarios could loom large, and each represents a different source of systematic risk to a long-term investor.

However, because the effects of these macro influences differ widely — across asset classes and time horizons, and compared to what has dominated in the past — they also represent an opportunity for long-horizon investors to balance risks across assets classes and to take advantage of their long horizon. We introduce a framework to model these long-horizon macro dynamics and account for them in the asset-allocation process.

Insights from a macro view

Long-term investors do not face the same investment landscape as the short-horizon investor, so the former may benefit by shifting their risk-return trade-offs to allocate away from risks that matter more to them, while taking on more of the return opportunities that are riskier to short-horizon investors.

We identify four market dynamics — particularly discount-rate shocks and mean reversion — for which a long investment horizon tends to be beneficial, as well as other dynamics to which long-horizon investors are more vulnerable — secular changes and regime shifts — and explore how different asset classes bring exposures to each.

Exhibit 2: Long- and short-term investors face different investment landscapes

	Short-term investors	Long-term investors
Discount-rate shocks		
Mean reversion		
Persistent slowdown		
Regime shifts		

Compared to short-term investors, long-term investors might be less vulnerable to rising discount rates and shocks to mean-reverting economic variables, but long-horizon investors are more at risk from a persistent economic slowdown or other regime shifts. Green, yellow and red denote typical good, moderate and bad effects, respectively.

Incorporating these long-term dynamics into the investment process requires understanding how the cash flows and discount rates of each asset class are exposed to the macro factors driving the long-horizon investment landscape. Rather than falling into simple growth/inflation buckets, such as equity

to growth or real assets to inflation protection, macro sensitivities cut across all asset classes. **Every asset class has a different degree of sensitivity to macro shocks of all kinds**.

The consequences of growth or inflation also depend critically on the underlying causes in supply, demand or productivity shocks, as well as on the response and credibility of the central bank. The positive rates-equity correlation that prevailed in recent decades can be understood as caused by the dominance of demand shocks in that era. A demand shock tends to drive growth and interest rates up or down together, but a return of supply shocks or degradation of central-bank credibility could take away the benevolent rates-equity correlation and undermine a key pillar of balanced asset allocations.

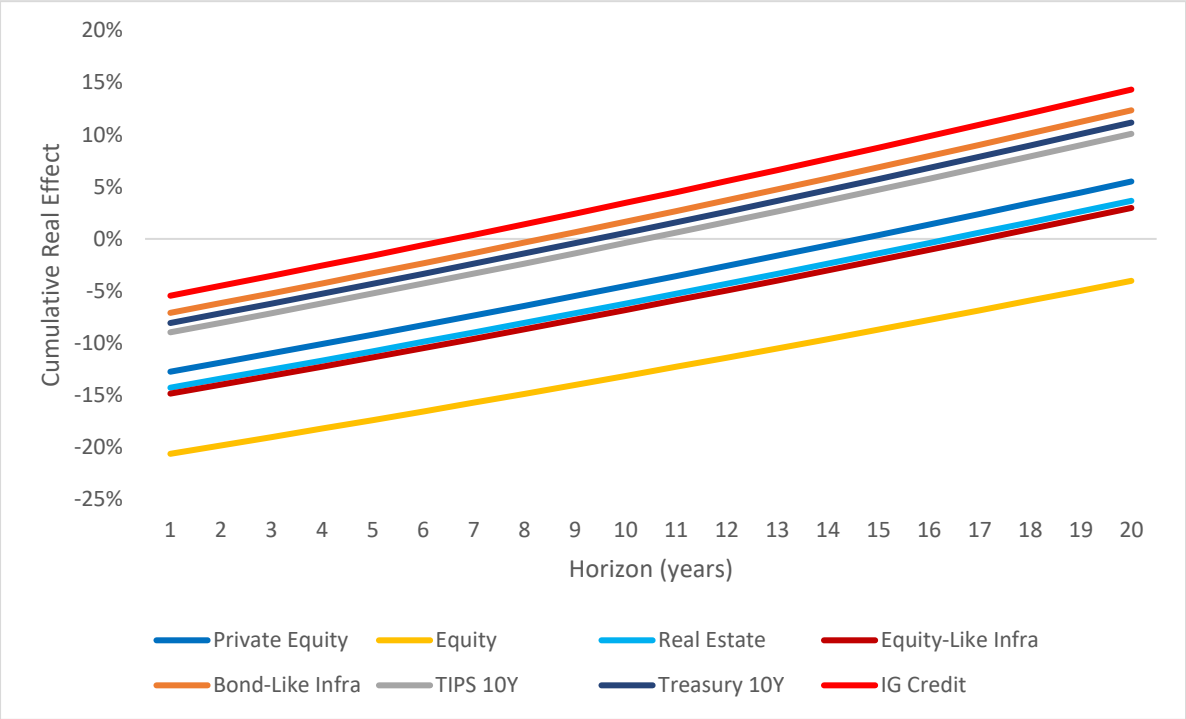
Exhibit 3: The correlation of bonds and equity has varied among different macro regimes

The correlation between equity and bonds was negative in recent decades, but has been positive in other macroeconomic regimes. The MSCI Macro-Finance Model explains this correlation as arising from the balance between supply shocks and demand shocks. Supply shocks have tended to drive equity and bonds up or down in the same direction, while demand shocks have driven them apart. Source: Provided by GIC from Robert Shiller and Global Financial Data. Used with permission.

Both cash-flow and discount-rate shocks hurt the short-term investor, but **a discount-rate shock is much less painful to the long-horizon investor**. Higher discount rates typically lead to lower asset prices in the near term, but by definition they subsequently lead to higher expected returns. A long-horizon

investor benefits by harvesting the higher returns and can eventually come out better off in the long run. Discount-rate risk therefore tends to be much more benign to a long-horizon investor than to a short-horizon investor — an example of the concept of "good beta/bad beta."[3]

Exhibit 4: Response to 100-basis-point real-rate shock



Upward shocks to the real interest rate tend to be bad for short-term investors, but they are also a classic example of "good beta" that is much less painful to long-term investors. Higher real rates initially drive asset prices down, but at the same time boost expected returns, which eventually benefit investors with a horizon longer than the real duration of the asset. Projections from the MSCI Macro-Finance Model.

Many macro-financial variables, including the equity risk premium, short-term growth, corporate-profit ratio and inflation,[4] have historically exhibited some tendency to mean-revert toward the neighbourhood of an equilibrium level. As a result, **shocks to mean-reverting variables tend to be short-lived**, contributing to short-term volatility much more than long-term risk. Mean reversion can also be the basis of systematic strategies that seek to profit as macro variables move back toward equilibrium.

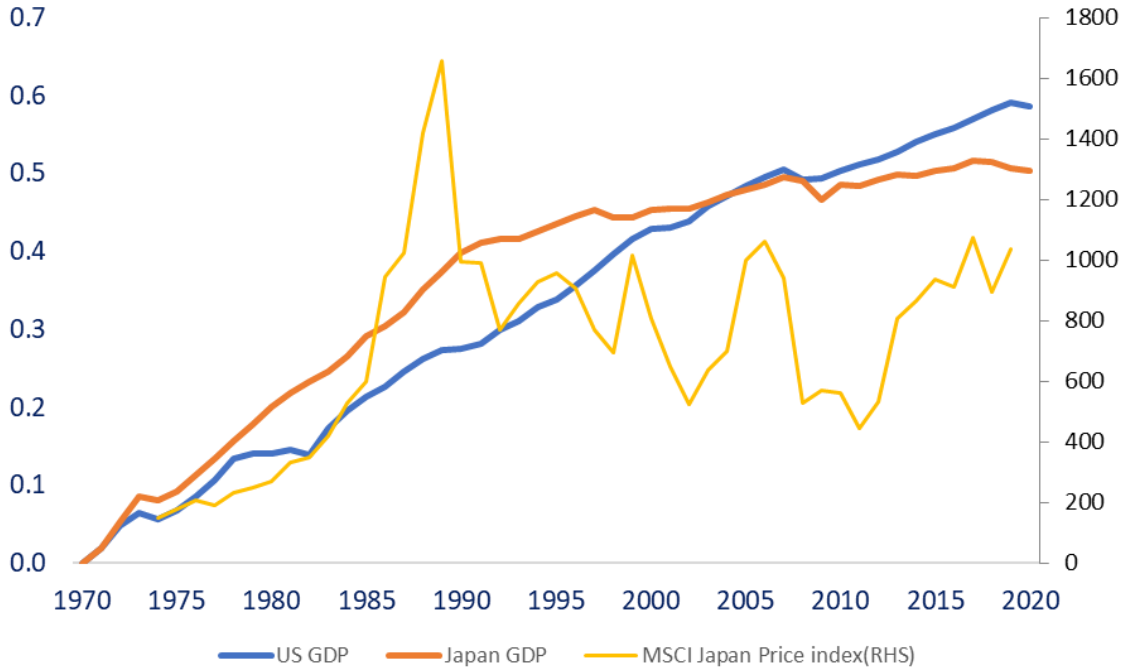
Notably, the equity risk premium may stand to benefit from both "good beta" and mean reversion, giving equity a very different

[3] Campbell, John Y., and Vuolteenaho, Tuomo (2004). "Bad Beta, Good Beta." *American Economic Review* 94, no. 5: 1249-1275.
[4] Mean reversion of inflation is much more tenuous than the other examples. In the MSCI model, described in the appendix, inflation is mean-reverting as long as the central bank is credible, but inflation can run away if that credibility breaks down.

risk profile for the long-horizon investor. Fluctuations in the equity premium drive short-term volatility, but long-term equity investors who are able to ride out large fluctuations in the equity markets may be able to harvest higher expected returns after premium-driven market crashes. Equity volatility does not always correspond to risk for long-term investors.

What matters much more for long-term equity investors is the long-term path of the economy.

Exhibit 5: Trend-growth shocks leading to persistent economic slowdown pose a large risk to long-term equity investors



The largest risk factor facing long-term equity investors is the possibility of a persistent decline to trend productivity growth, according to the macro model, such as what occurred in Japan in the late 1980s and, to a much lesser extent, the U.S. after the 2008 global financial crisis.

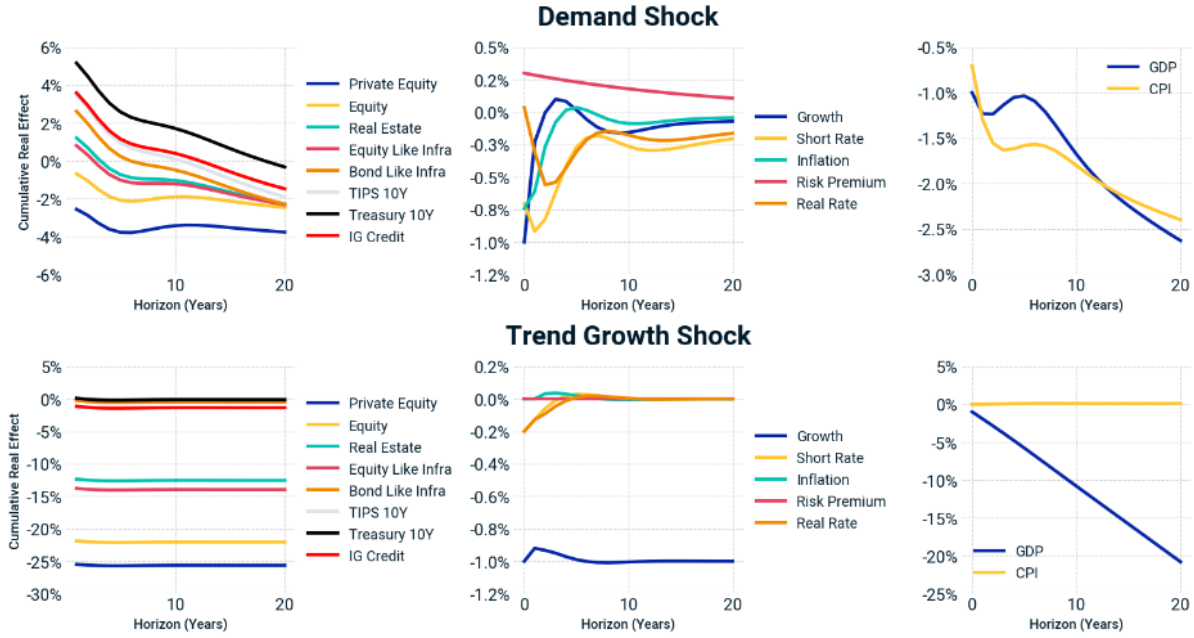
While a long horizon may help investors with the first two dynamics above (shocks to discount rates and mean-reverting macro variables), **long-term investors have greater exposure to the risk of a persistent economic slowdown — a trend-growth shock**. A persistent shock to growth may have only small, short-horizon effects, but can build up gradually to significantly impact the long-horizon investor.[5] Fluctuations in

[5] An important subtlety for trend shocks is that although the trend plays out over a long horizon, market expectations may change much more quickly. Our model distinguishes these with separate factors to reflect the long-term trend and changing market expectations about the trend. The latter can be a significant source of short-term volatility, as markets may quickly price in changes to long-term expectations.

the economy from quarter to quarter are very visible, but the risk of a persistent economic slowdown is a greater source of uncertainty. Such a slowdown occurred in Japan in the late 1980s and, more mildly, in the U.S. after the 2008 global financial crisis. Large shocks to trend growth were, however, remarkably rare during the "economic miracle" that took place in many economies for decades after the Second World War. If trend growth were projected to be as stable in the decades ahead as it has been in the past, then long-horizon investors could invest in equity with relatively low risk to their long-term spending power.

Unfortunately, there is no guarantee that growth will continue at the same rate, and trend growth is a primary risk facing long-term investors in equity and other growth-sensitive asset classes.

Exhibit 6: Demand shocks were the dominant source of volatility in recent decades, but trend growth shocks pose a larger risk to many asset classes



Projected responses to macro shocks from the MSCI Macro-Finance Model. Recent decades have been dominated by demand shocks, which tend to drive equity and other growth-sensitive asset classes down while driving bond prices up. Such shocks underlie the negative bond-equity correlations that have been the norm, and the backbone of many balanced asset allocations. With some exceptions, the period since the Second World War has sustained remarkably stable trend-growth rates, but equity investors risk a productivity shock that moves the economy onto a persistently lower trajectory.

Long-term investors are also more exposed to a fourth type of risk — regime shifts. As investors look to a longer horizon, it becomes increasingly important to consider a range of possible regimes beyond what is reflected in backward-looking data.[6]

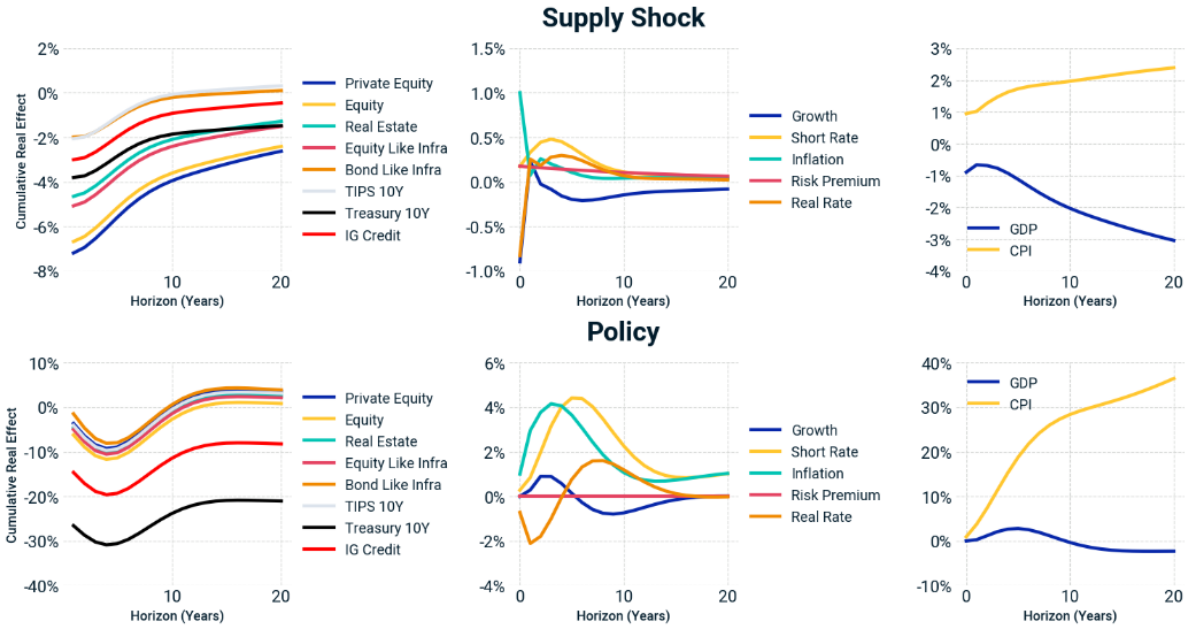
Today, potential regime shifts include the effects of deglobalisation and the decarbonisation of the economy, and many investors are considering the possibility that new levels of high inflation could persist and worsen into stagflation.

The high inflation of 2022 has been notable not only for its magnitude,[7] but for its origin in supply shocks, which tend to drive inflation higher and growth down, forcing the central bank to choose between controlling inflation and stimulating recovery. An initially slow policy response further led to doubts about central banks' commitment to stabilising inflation.

The consequences for investors could be wide-ranging. Central banks' primary mechanism for fighting inflation is to raise interest rates to cool the economy. A supply shock in the context of strong central-bank policy would typically hurt all asset classes through both higher discount rates and, more importantly for long-term investors, lower cash flows. If central banks instead accommodate higher inflation to avoid recession, they would run the risk of losing credibility, which could create a protracted period of high inflation and require even more painful measures to eventually control inflation. Either of these scenarios would likely lead to the end of the benevolent rates-equity correlation that has effectively provided a hedge between the bond and equity components of balanced portfolios.

[6] It is always possible to find ourselves in a fundamentally different economic or financial environment from one day to the next, but each day usually looks more like the previous. As we look to longer and longer horizons, however, the likelihood of a regime shift increases, and we would be surprised if the next decade is not significantly different from the previous.
[7] In contrast to 2022, the inflation observed in 2021 was likely mostly demand-driven, a byproduct of the high growth that came with the pent-up demand released as pandemic restrictions eased and stimulus took effect. This was largely consistent with the macro environment that prevailed in the preceding decades.

Exhibit 7: Inflation driven by supply shocks tends to hurt all asset classes and tends to be much more painful if central-bank policy loses credibility



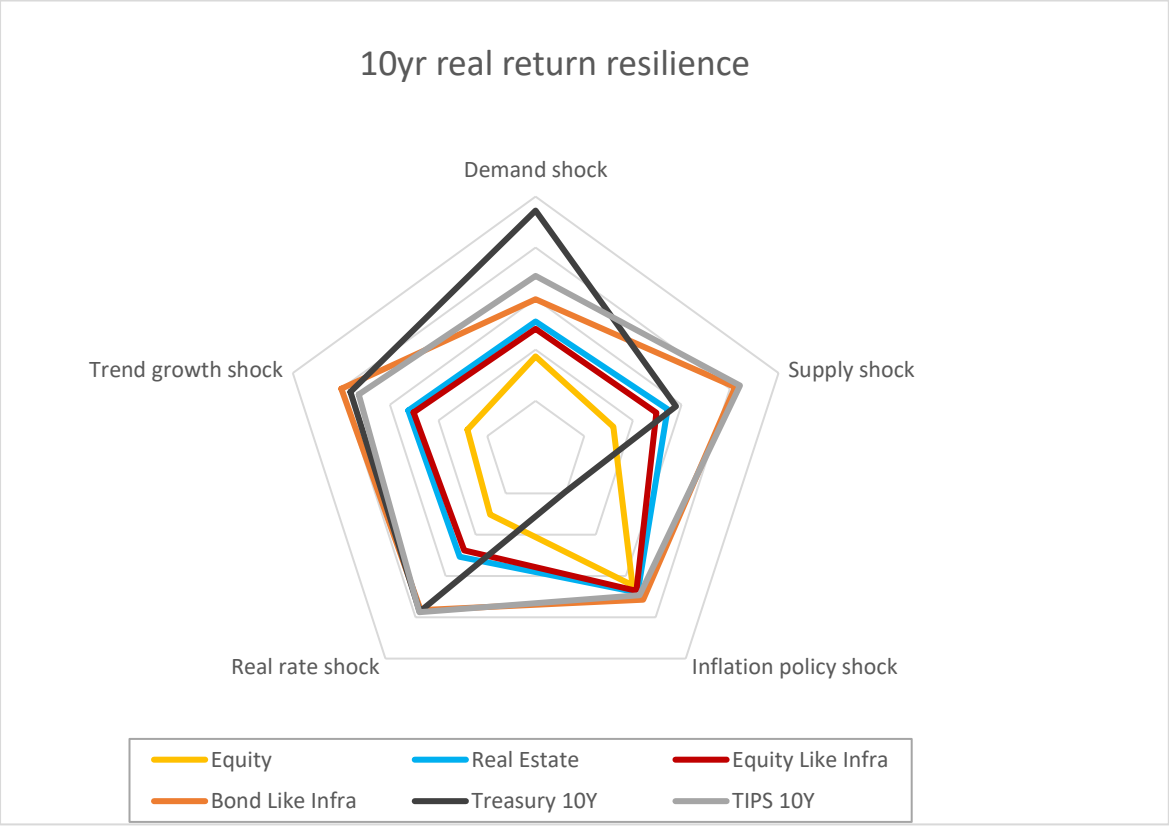
Projected responses to macro shocks from the MSCI Macro-Finance Model. The consequences of higher inflation depend heavily on its origin and on the response of the central bank. In contrast with inflation caused by surging demand, supply-driven inflation tends to coincide with economic slowdown and forces the central bank to make difficult decisions to trade off price stability for economic growth. A central bank that retreats from a hawkish inflation-fighting policy may trade off higher short-term growth for weaker credibility and a much longer period of high inflation.

Together, various sources of mean reversion, good beta, trend shocks and regime shifts shape a long-horizon investment landscape that is fundamentally different from the risks reflected in short-term volatility.

Rather than being simply more or less “risky,” different asset classes demonstrate a wide range of sensitivities to the various drivers of risk and return over different horizons. Traditional market beta can be understood as a short-horizon average of these scenarios, weighted only according to their frequency over a past dominated by demand shocks and declining real rates. There is little reason to expect or assume the other scenarios could not play larger roles in the years ahead.

Few investors have the luxury to completely ignore the short term, but those with a long investment horizon may benefit from looking beyond the short term and putting more weight on a long-horizon view. In the following section, we introduce a case study demonstrating an asset-allocation framework that applies these measures of macro risk to position the portfolio for a long horizon.

Exhibit 8: 10-year real-return resilience across asset classes



Macro scenarios pose different degrees of long-term risk to each asset class (greater resilience corresponds to lower risk). Real asset classes fall roughly on a spectrum spanning inflation-protected bonds to equity based on different degrees of growth sensitivity. Nominal bonds bring a high degree of resilience to the demand shocks that dominated recent decades but are much less resilient to the supply- and policy-driven scenarios that are now greater concerns.

Case study — Building robust portfolios for a long horizon

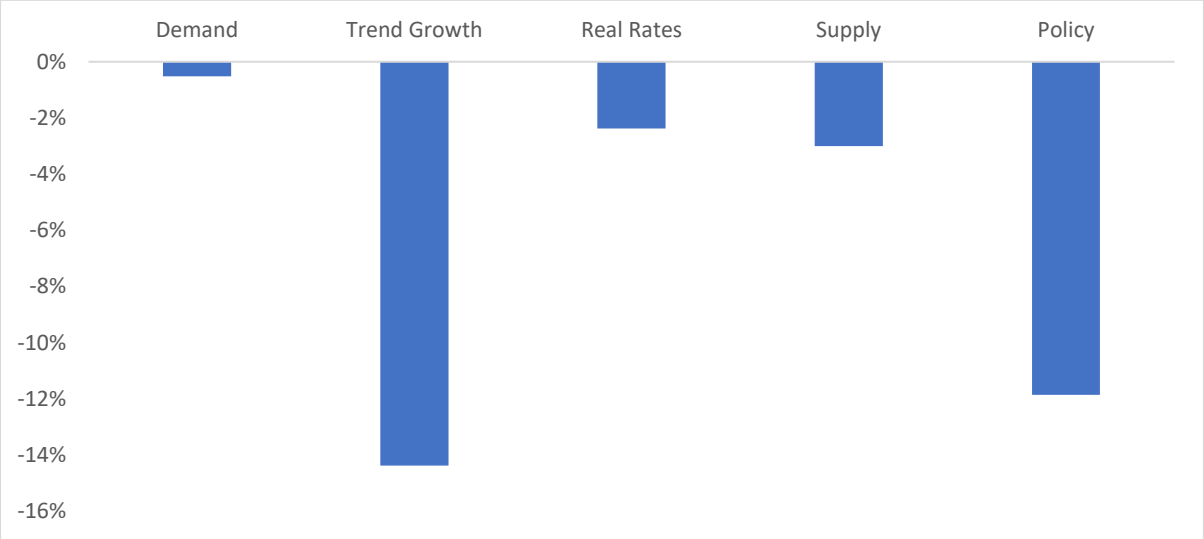
Many approaches to asset allocation have aimed to reduce short-term fluctuations in the value of the portfolio, rather than long-term risk. Whether through qualitative approaches or quantitative optimisation, the result has often been portfolios positioned to diversify or hedge against volatility.

For investors with a longer investment horizon, a focus on volatility could come at the expense of managing important long-term risks and could lead to sacrificing potential upside, such as exposure to the equity risk premium. We explore how a new understanding of the risks facing long-horizon investors can be incorporated into the asset-allocation process.

Looking beyond demand shocks, a 60-40 allocation is no longer balanced

We begin by looking at a traditional 60-40 portfolio through the lens of the five key scenarios introduced above. A portfolio consisting of 60% public equity and 40% nominal bonds has been a common allocation among institutional investors, as explained by Exhibit 9.[8] In an era dominated by demand shocks, government and investment-grade bonds have acted as a hedge for equity, typically rising in value as interest rates and equity fall in response to weaker demand. The combined effect left a 60-40 portfolio well-balanced relative to demand shocks, suffering only mild losses in the downside of the prevailing source of volatility over the past few decades.

Exhibit 9: The 60-40 portfolio's 10-year real-return impact from the five key scenarios



60-40 allocations tended to be well-balanced relative to the demand shocks that dominated recent decades, due to offsetting gains and losses between the equity and bond components of the portfolio. However, the model suggests they may be significantly less robust when faced with other macro environments.

Although well-balanced relative to demand shocks, the 60-40 portfolio might not be as resilient to other macro scenarios that may play a larger role in the future. Supply shocks, a weaker central-bank policy, a decline in productivity growth or a long-term real-rate shock could all have a large and sustained adverse impact on a 60-40 portfolio. Long-term investors may want tools to explore allocations that could be more robust

[8] In practice, the components of 60-40 allocations are comprised of a variety of equity and bond allocations. For simplicity, this example uses global equity and U.S. Treasurys. The projected sensitivities would be similar for other representations of 60-40.

against a range of possible other macro environments that may arise in the years ahead.

Expanding the opportunity set and enhancing macro resilience

Going beyond 60-40, one common step for long-term investors to benefit from their horizon is to add allocations to private assets. Many private asset classes have outperformed their public-market counterparts, possibly due to an illiquidity or complexity premium, general-partner management skills and potential benefits of managing portfolio companies for a long horizon.

Long-horizon investors have also made allocations to private assets for risk reduction, though sometimes not for the right reasons. Their smooth valuations might make many private assets appear to have lower volatility and lower correlations with other assets. Nonetheless, a lot of private assets have highly uncertain future values and are potentially exposed to the same systematic risk factors accumulating in the rest of the portfolio. Some investors have conflated reduced short-term volatility for reduced risk, which it is not. The long-term value dispersion of private assets is typically much higher than their observed volatility, and their long-term market beta even higher compared with what is visible at the quarterly frequency of valuations. Private assets may play an important role in diversifying long-term risk, but doing so requires putting private assets on the same footing as the rest of the portfolio and understanding the range of macro exposures they add to the portfolio.

To start the case study, we explore expanding the opportunity set by introducing private asset classes into the allocation, represented by broad private equity, core real estate and private infrastructure. To reflect the heterogeneity of infrastructure, it is divided between equity-like infrastructure (unregulated and greenfield assets with more growth-sensitive cashflows) and bond-like infrastructure (comprising regulated and brownfield assets with more stable cashflows). We also include 10-year Treasury Inflation Protected Securities (TIPS) and investment-grade bonds, although this case study does not result in any allocation to the latter.

We first build a baseline allocation by constructing a mean-variance optimal portfolio from the expanded opportunity set.

The portfolio maximises the assumed expected return subject to the same volatility as the 60-40 portfolio and an illiquid-asset constraint of 60%. Importantly, variance and covariance are estimated using a risk model that corrects for the smoothness of private-asset valuations, to avoid exaggerating the benefits of private assets.[9]

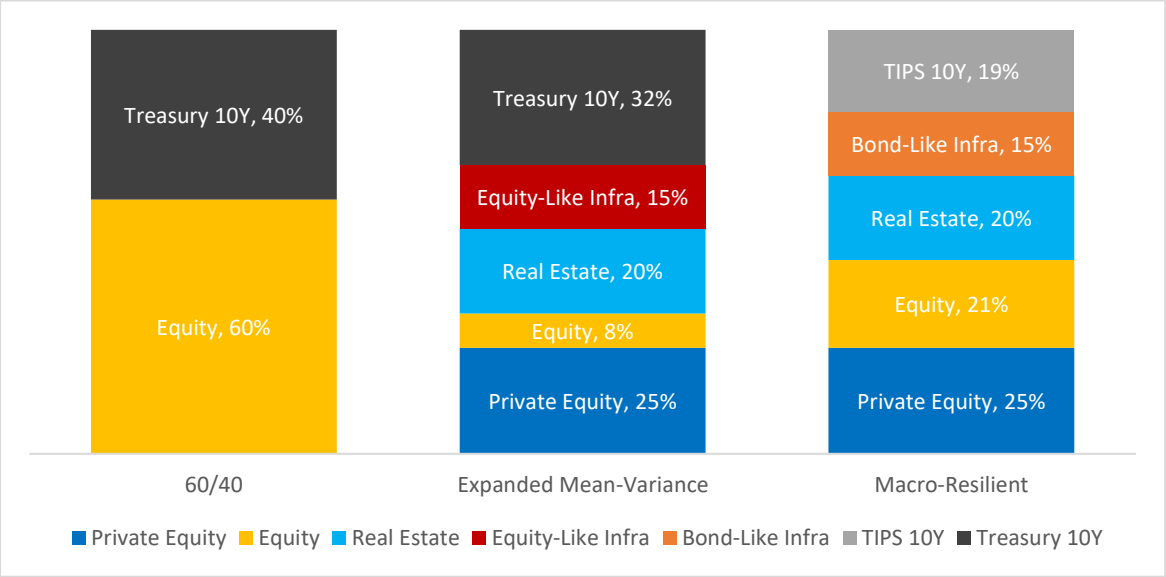
Compared with a 60-40 allocation, the expanded mean-variance portfolio substitutes public equity for equity-like private assets (private equity and equity-like infrastructure). Government bonds continue to play the role of portfolio diversifier, even though a portion of bonds are replaced by real estate.

For the same level of volatility as in a 60-40 portfolio, the expanded mean-variance portfolio has a much higher expected return (4.8% annual real return versus 3.1% for the 60-40), predominantly driven by the assumed private-asset returns. But it is still largely a barbell portfolio, loading up high-risk, high-return asset classes and using government bonds to reduce volatility.

As a second step, we redesign the portfolio-construction process to favour long-term macro-resilience. The macro-resilient allocation in Exhibit 10 is constructed to have the same expected return as the expanded mean-variance portfolio while minimising long-term macro risk rather than volatility. In this example, we measure long-term macro risk as the real-return impact at the 10-year horizon, averaged over the five key macro scenarios. Investors can choose a different time horizon to align with their mandate or assign different weightings among the macro scenarios to reflect a view of their likelihood and importance.

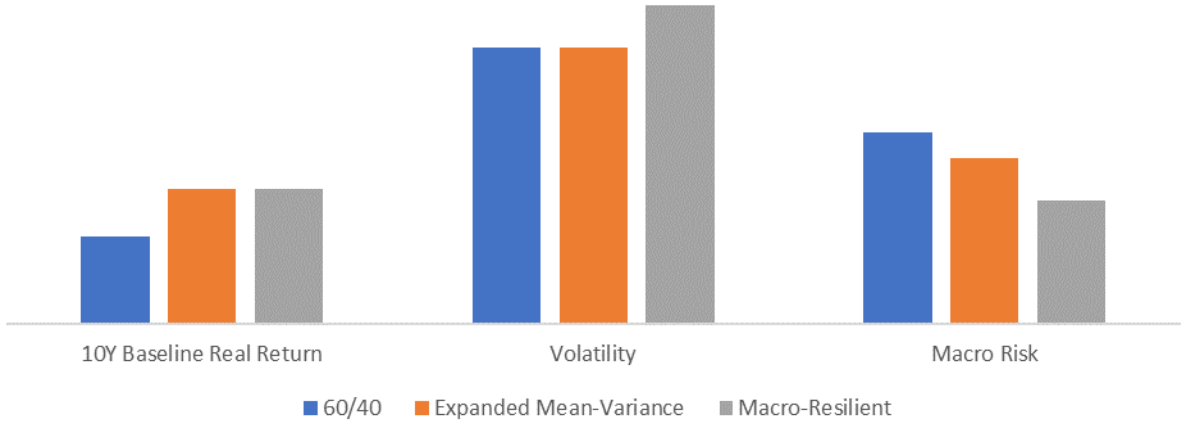
[9] The long-term capital-market assumptions used in this paper are taken from the MSCI Macro-Finance Model, which combines macro assumptions and market prices to back into market-implied asset returns. See the appendix for more detail. For simplicity, we represent an overall liquidity constraint a fund may have with a constraint on the total allocation to private assets to be no more than 60% and impose maximum capacity constraints of 25% on private equity and real estate and 15% for infrastructure. In practice, investors' illiquidity limit depends on their total fund liquidity supply and demand. Please refer to the Journal of Portfolio Management paper "Asset Allocation and Private Market Investing" for more details. The covariance matrix for the mean-variance optimisation uses the MSCI Multi-Asset Class Factor Model. Shepard, Peter, Demond, Andrew, Xiao, Limin, Zhou, Chenlu, and Ahlport, Jennifer (2020). "The MSCI Multi Asset Class Factor Model." *MSCI Model Insight.*

Exhibit 10: The asset allocations of three representative portfolios



The expanded mean-variance portfolio incorporates a broader opportunity set of private assets while targeting the same volatility as that of the 60-40 portfolio (represented here as a simple combination of Treasurys and global equity). The macro-resilient portfolio takes on somewhat more volatility and exposure to equity-like assets, while reducing exposure to a range of potential future macro risks.

Exhibit 11: Risk and return characteristics of the three representative portfolios



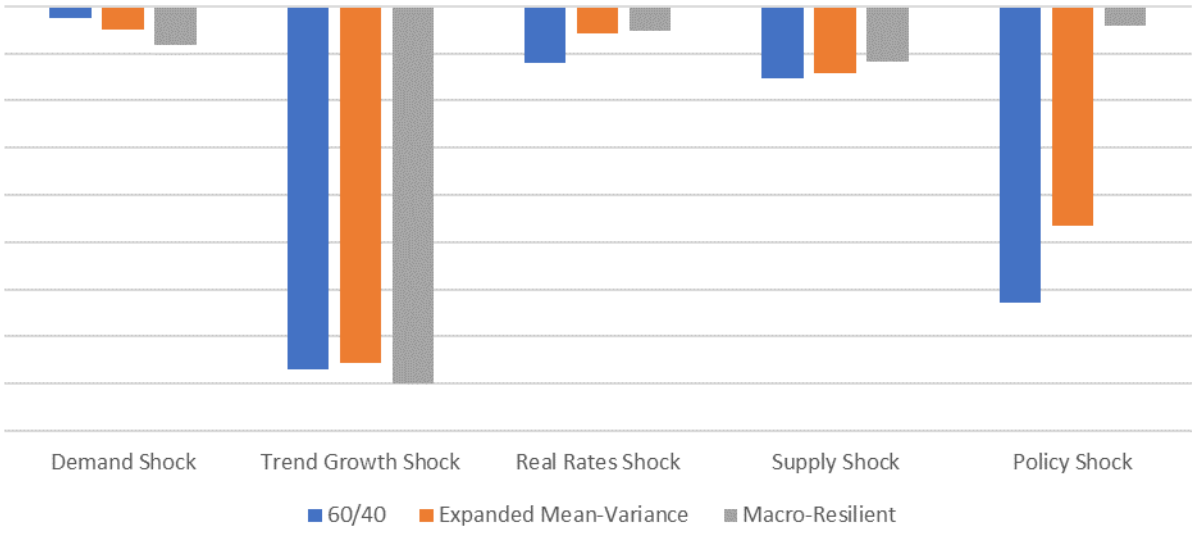
Expanding the investment opportunity set enables allocations with the same estimated volatility but higher investor expected return, and shifting the objective to a long-horizon risk may reduce macro risk while taking on more volatility. The example baseline real return is from the model's capital-market assumptions, for demonstration.

The asset mix of the macro-resilient portfolio has shifted out of nominal bonds and into bond-like infrastructure and TIPS, two asset classes projected to be more resilient across a range of macro scenarios. Allocations to nominal bonds reduce volatility in a regime dominated by demand shocks and a highly credible central bank, but they carry much higher risk in scenarios where their real value is degraded by inflation. The macro-resilient

portfolio also takes a higher allocation to public equity compared with the expanded mean-variance portfolio. While equity is highly volatile over a short horizon, the effects of volatility driven by fluctuating equity risk premia are milder for the long-horizon investor.

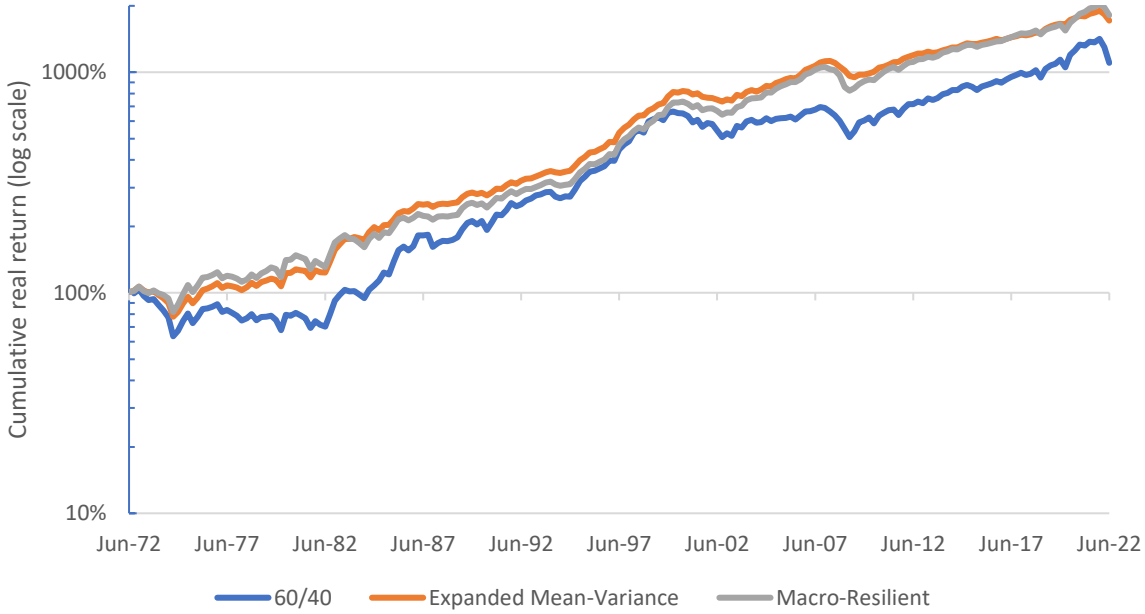
Exhibit 12 compares the three sample portfolios' macro resilience under the five key scenarios. By sacrificing some volatility, the macro-resilient portfolio has a more well-rounded macro-risk profile. Long-term macro risk is reduced by a third, driven by improved resilience to policy, supply and real-rate shocks.

Exhibit 12: Three representative portfolios' risk under the five key macro scenarios



The 60-40 and expanded mean-variance portfolios are well-balanced relative to the demand-shock scenarios that dominated recent decades, but they have large exposure to other possible macro scenarios. The macro-resilient portfolio aims for more balanced resilience across a range of possible macro environments.

Exhibit 13: Backtesting the example portfolios

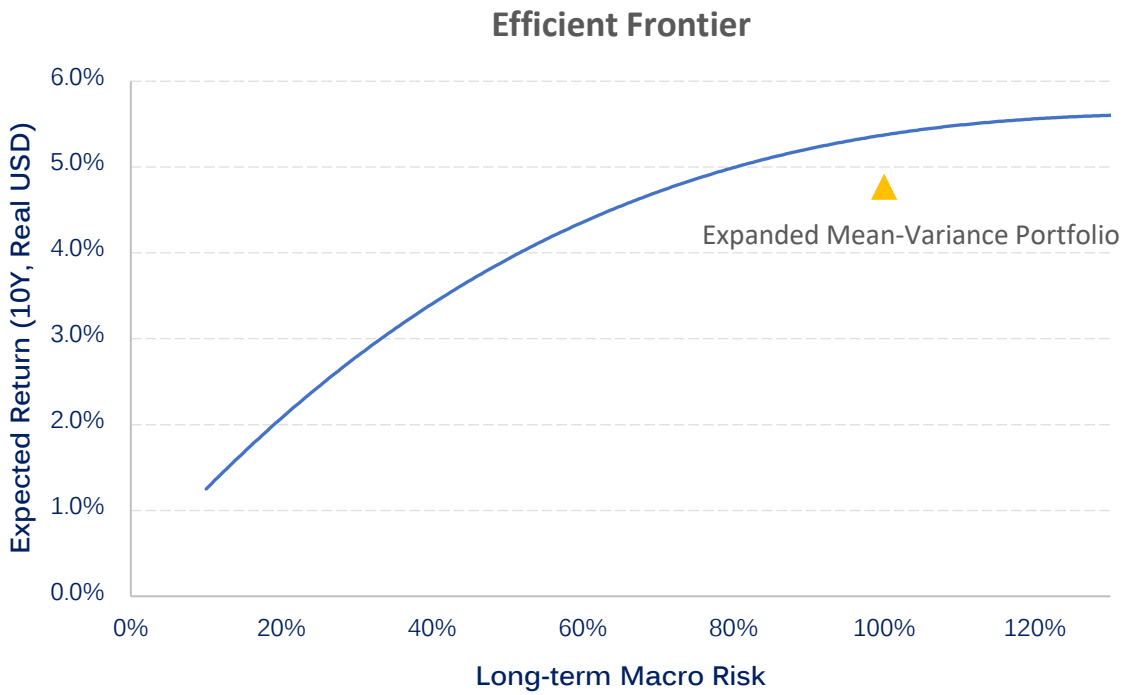


A comparison of backtested performance of the three example allocations. Asset-class returns are proxied prior to inception of data.

The macro-resilient efficient frontier

The example macro-resilient portfolio — chosen to have the same expected return as the expanded mean-variance portfolio — is just one point along an efficient frontier of different risk-return trade-offs. Each point on the new frontier represents a portfolio with the highest return achievable at different levels of macro risk.

Exhibit 14: The macro-resilient efficient frontier



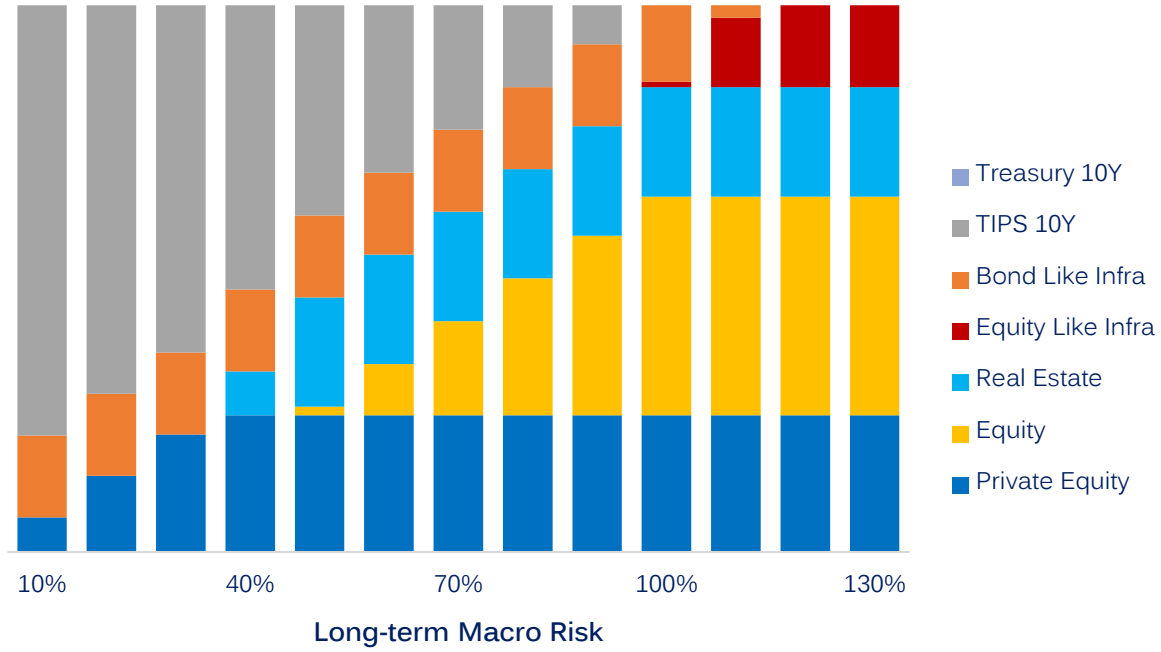
An efficient frontier spans a range of portfolio allocations with different trade-offs between investors' expected return and estimated long-term macro risk. Compared with the expanded mean-variance portfolio, the frontier has moved to portfolios with higher short-term volatility but lower estimated macro risk or higher investor expected return. Here the scale of macro risk is measured relative to the macro risk of the expanded mean-variance portfolio, which is defined to have a macro risk level of 100%. The expected returns shown here are those of the capital-market assumptions of the above use case.

The macro-resilient efficient frontier lies above the expanded mean-variance portfolio: For the same expected return, there are portfolios with lower macro risk and portfolios with higher expected return at the same macro-risk level. The efficient frontier is relatively flat, so it tends to be easier to reduce risk than to increase returns. It's also notably inefficient from the perspective of the short-horizon investor, taking on higher volatility for each unit of expected return.

As seen in Exhibit 15, the asset allocations along the macro-resilient efficient frontier tend to replace Treasurys with TIPS and bond-like infrastructure and take on greater allocation to equity. More macro-risk-averse portfolios tend to take on more exposure to TIPS and bond-like infrastructure, the two most macro-resilient assets. More risk-tolerant allocations seek higher return from exposure to equity-like assets, such as private and public equity, equity-like infrastructure and real estate.

Overall, the macro-resilient efficient frontier offers a range of allocations to align with long-horizon investment mandates.

Exhibit 15: Asset allocations along the macro-resilient efficient frontier



In the example use case, asset allocations varied along the macro-resilient efficient frontier with the level of macro risk. Here the scale of macro risk is measured relative to the expanded mean-variance portfolio, which is defined to have a macro risk level of 100%.

Conclusion

This paper introduces an asset-allocation framework to help long-term investors align their allocation process with their investment mandate and understand the long-horizon investment landscape, including the benevolent effects of mean reversion, a broader opportunity set of private assets and the risks posed by potential regime shifts in the macro environment.

We mapped out five potential macro scenarios for the decades ahead, including demand, supply, trend growth, policy and real-rate shocks, which provide a view of risk that may help inform long-term asset-allocation decisions.

By placing less emphasis on backward-looking, short-term risk, long-horizon investors may be able to construct portfolios with greater resilience against continued macro uncertainties, while preserving investors' expected returns. Further, by putting public and private assets on the same footing, long-term risk and return may be systematically managed across the total portfolio.

We started by exploring the potential limitations of backward-looking, statistical measures for understanding the range of potential risks facing long-term investors today. We introduced risk measures based on model-derived projections of asset returns over a long horizon and into macro regimes that haven't been seen before. These long-term projections are enabled by relating asset cash flows and discount rates to their underlying macroeconomic drivers.

The long-horizon view allows asset-allocation decisions to more closely align with investors' mandates to meet liabilities and preserve wealth over the long run. The underlying macroeconomic drivers provide a common lens to view all assets consistently and intuitively, allowing comparisons and trade-offs across public and private markets. The multi-horizon nature of the framework also enables decision-making over different time horizons, potentially facilitating strategic and tactical positioning.

We then integrated macro risk into a long-horizon asset-allocation framework spanning public and private assets. In our case study, we introduced the macro-resilient portfolio, which mitigates long-term macro risks while maintaining the same level of expected returns as a portfolio optimised to a shorter horizon. The macro-resilient portfolio reduces exposure to nominal bonds, while increasing exposures to real assets and the equity risk premium.

Finally, we generated a macro-resilient efficient frontier, demonstrating how asset allocations may vary according to the level of tolerance for long-term macro risks. The new frontier lies above the expanded mean-variance frontier, suggesting that by accepting more short-term volatility, long-horizon investors may be able to better allocate their portfolios to be more aligned with their long-horizon objectives.

Appendix: The MSCI Macro-Finance Model

To understand the drivers of long-term asset returns, the MSCI Macro-Finance Model[10] relates asset cash flows and discount rates to their underlying macroeconomic drivers and models how these macro variables interact and evolve.

The goal of the model is finance, not macroeconomics. It aims to understand how macro shocks propagate across asset classes and through time, not to produce precise predictions about the macroeconomy. The question is not “what will inflation be next quarter?” but rather “if inflation is higher than markets have priced in, how could that affect rates and growth over the years ahead, and therefore change valuations and return expectations across asset classes and time horizons?”

The model can also be applied in the other direction. Given market prices and a baseline macro scenario, what are the market-implied return expectations? Similar to the way bond yields translate bond prices and expected cash flows to ex-ante returns, this view provides a framework for thinking about ex-ante returns for equity and other growth-sensitive asset classes. The market-implied return expectations provide a baseline for thinking about how return expectations change with the macro and market environments, and our studies show them to have been more accurate than extrapolating ex-post returns forward.

The main macroeconomic drivers of all asset classes are **real growth, real interest rates, inflation and risk premia**. For each of these, the model projects a term structure into the future based on the initial state and dynamics among macro variables, and then relates these term structures to each asset’s projected **cashflows and discount rates**. Last, the model identifies the primary shocks driving the macro variables, including the **supply and demand shocks** that have had different prominence in different regimes, and explain the changing rates-equity correlation over the past seven decades.

Beginning at the bottom level of assets, the first step is to formulate discounted cash flow models for each asset class and relate the expected cashflows and discount rates to GDP, inflation and discount rates. The primary challenge is the econometrics of understanding cash-flow sensitivities to GDP. Using time-series regressions of cashflows against GDP would pick up sensitivity to short-term growth volatility, but would miss the critical sensitivity to long-term trend growth.[11] Instead, we use long-term data on the corporate-profit ratio to understand public-asset cash-flow sensitivities, and other data sets and econometric techniques to

[10] For further detail on the model, see: Shepard, Peter, et al. "The MSCI Macro-Finance Model." *MSCI Model Insight*, forthcoming.

[11] What matters most is how cashflows vary relative to the ensemble of different economic trajectories, not how much they have reacted to each bump in the road along the particular trajectory we can observe. The stickiness of short-term cashflows tends to dampen their sensitivity to short-term growth volatility, even when there is large sensitivity to the longer-term path of the economy. For example, a company may not immediately cut its dividend in a recession, but a persistent economic slowdown is likely to significantly reduce the long-term cashflows.

understand private assets. Together, these asset-pricing models relate projections of the macroeconomic term structure to asset prices and return projections.

The next level is to model the macroeconomic term structure, which we do by combining standard macroeconomic models with standard tools for modeling interest-rate term structures. The basic idea is to start with models describing the evolution of state variables from one period to the next and to chain these together to create a full term structure of expectations, generalising how a long-term yield curve can be related to expectations of future short-term interest rates.

Crucially, our single-period macro models include not only the short-term macro variables (growth, policy rates, inflation etc.), but also state variables that influence their long-term dynamics (e.g., the trend-growth rate, long-term real interest rate or long-term target inflation rate). Since asset prices reflect the present value of cash flows stretching far into the future, these longer-term variables play a critical role. These macroeconomic dynamics are described in further detail below.

The final step is to further understand what drives the macro variables. For example, inflation shocks have very different effects depending on whether they are supply- or demand-driven, in addition to whether the central bank remains credible.

Higher or lower economic demand tends to drive inflation and growth up and down in the same direction and also lead to relatively straightforward central-bank policy. These include raising rates after a positive demand shock to prevent the economy from overheating or lowering rates after a negative demand shock to stimulate growth. Demand shocks also tend to drive the equity risk premium to amplify the changing cash-flow expectations; lower demand tends to coincide with higher risk premia and lower equity prices. Altogether, demand shocks tend to drive stock and bond prices in opposite directions and have been the main driver of their negative correlations over the first two decades of the 2000s.

Supply shocks are much more difficult. A reduction in supply, such as a reduced supply of energy or a contraction of the labour force, tends to drive inflation higher and growth lower and forces the central bank to balance between competing pressures: raise rates to fight inflation or lower them to stabilise growth. Paul Volcker responded to the supply-driven stagflation of the late 1970s by boldly raising interest rates, even in the face of the ensuing recession. Doing so established the credibility of the central bank to fight inflation, and the resulting expectations of stable inflation made it much easier for subsequent policymakers to keep inflation in check. However, doing so required stiff resolve to push the economy deeper into recession until inflation was reined in. There is always the risk that other policymakers may be unwilling to take such harsh action, resulting in more protracted inflationary cycles. Higher inflation, combined with a weakening of the strength and credibility of the central bank, forms the basis of our policy scenario.

Overall, we identified five central scenarios — shocks to supply, demand, policy, trend growth and real rates — which drive the most significant risks across asset classes and the primary shifts in market regimes that have occurred over the past half century.

Macro dynamics

The core pillars of the MSCI Macro-Finance Model are growth, inflation, interest rates and risk premia, which interact with each other as well as other macro variables, such as foreign-exchange rates and energy prices. The main dynamics of the core variables are summarised below.

Short-term **real growth** is influenced by:

- **Short-term shocks:** The source of most growth volatility, though only a modest contributor to macro risk for most growth-sensitive assets.
- **Short-term persistence:** Higher-than-average growth one year is more likely to be followed by somewhat higher growth the following year.
- **The midterm economic cycle:** Cycles of above or below trend growth are apparent over a two-to-three-year horizon. Market expectations for the midterm economic cycle are apparent in the shape of the yield curve, whose short end has tended to exhibit a downward slope in anticipation of a recession or a steep upward slope in anticipation of a boom.
- **Long-term trend growth:** The largest source of long-term macro risk for equity and other growth-sensitive assets is a persistent slowdown in growth, lasting many years or decades.
- **Real interest rates:** Low real rates (compared to the long-term or equilibrium real rate) tend to stimulate economic activity, while higher real rates tend to cool the economy. Changing interest rates is the primary lever used by the central bank to control inflation by cooling the economy.

Short-term interest rates are described by a generalised Taylor Rule[12] describing how central-bank policy responds to the economic environment:

- **Inflation:** The central bank tends to raise rates when inflation is above its long-term target.
- **Growth:** The central bank tends to raise rates when growth is above the long-term trend growth.

[12] Taylor, John B. (1993). "Discretion versus policy rules in practice," *Carnegie-Rochester Conference Series on Public Policy, Elsevier*, vol. 39(1), pages 195-214, December.

- **Short-term persistence:** The central bank tends to change rates incrementally, with a series of smaller changes anchored to the previous rate, even when economic conditions alone may call for larger changes.
- **Policy strength:** The central bank's response to conditions can vary with its resolve to fight inflation. Paul Volcker notably initiated a regime of hawkish policy, in which the Federal Reserve and many other central banks aggressively raised rates to fight inflationary pressure.
- **Short-term shocks**: The central bank can surprise us by being more or less aggressive in its policy than the mechanical Taylor-like rule would imply.
- **Long-term real rates and inflation:** The baseline relative to which the policy rate is set is determined by the long-term interest rate, which can change as long-term real rates and inflation targets evolve.

The evolution of inflation is described through the interplay of inflationary pressure, the central-bank's response to it and how central bank credibility and inflation expectations influence realised inflation.

- **Growth:** Higher real growth tends to be inflationary, while inflation is controlled by raising rates to cool the economy.
- **Central-bank credibility and persistence:** When a central bank is highly credible, short-term inflation surprises tend to reverse even before a strong central-bank response, because expectations of stable inflation tend to be self-fulfilling. Conversely, if a central bank is less credible, short-term inflation shocks tend to persist and accumulate until brought under control by much more severe economic policy.
- **Long-term inflation:** The target or equilibrium inflation level has evolved over time, hovering around 2% in many developed markets in recent decades, after a previous expectation of closer to 5%, for example.
- **Foreign exchange:** If the domestic price of a basket of goods is below the global price (after adjusting for per capita GDP), domestic prices tend to rise.

The term structures of **risk premia** are modelled with mean-reverting short-rate models.

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