BlackRock
Investment
Institute

PORTFOLIO PERSPECTIVES
SEPTEMBER 2019

Strategic asset allocation in an era of ultra-low interest rates

BlackRock

BIIM0919E-950283-1/16

Summary

A global protectionist push has brought about a dramatic shift in the market environment over the past year. Macro uncertainty is on the rise as the range of potential economic and market outcomes widens. See our *2019 Midyear investment outlook*. Escalating trade tensions and geopolitical frictions have injected significant uncertainty into business planning, threatening to weaken economic activity. The sharp about-face in central bank policy has accelerated the demand for duration, contributing to plunging bond yields. At the same time, these cyclical factors are dovetailing with secular forces driving interest rates lower, such as the global savings glut and the persistent bid for perceived safe assets. The shifting market dynamics underscore the importance of portfolio resilience – the backbone of our framework for strategic asset allocation that we have laid out over the past year. We believe our framework is positioned to tackle current market challenges. In this *Portfolio perspectives*, we show our process in action.

- **Even lower for even longer interest rates.** With global interest plunging towards zero or below, central banks are running out of monetary space to deal with the next downturn. An unprecedented response, likely involving getting money directly into the hands of public and private sector spenders will be needed, as we write in our August 2019 paper *Dealing with the next downturn*. The potential impact of such a policy – higher inflation expectations and bond yields - could be a world very different from the one today.

- The role of government bonds as portfolio ballast has come under scrutiny as the pool of sovereign bonds with negative yields burgeons. **We believe there remains an important role for global government bonds in portfolios as ballast; this allocation is about resilience and less about return. Yet the cushion they provide against risk-off episodes gets thinner as yields approach their perceived floor** – a phenomenon more acute with widespread negative yields in Europe, as highlighted by the relative underperformance of German bunds to U.S. Treasuries over the August 2019 equity selloff. Today's yield levels dim the appeal of holding Eurozone government bonds as ballast. We are still overweight government bonds in our unconstrained view, yet have cut allocations compared with the start of the year. We see equities and private markets driving returns on a strategic horizon.

- **Incorporating uncertainty in long-run return expectations is crucial in achieving portfolio resiliency.** Our capital market assumptions (CMAs) and robust optimization technique are built with this in mind. The framework we follow helps prevent investors from placing too much weight on average return expectations in making strategic asset allocation decisions, and take into account downside scenarios.

- **Investor-specific strategic asset allocations (SAAs).** We show how four distinct investor types might deploy our toolkit to design their SAAs around individual needs and objectives - including time horizons - and to plan for downside scenarios. The results are materially different, yet the process we follow is consistent for each, underscoring its scalability. We discuss four examples: A reserves manager investing globally in US dollars, a US public pension plan, a UK institutional multi-asset fund and an EMEA-based family office investing in US dollars. We plan to expand this list over time.

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Contents

How low can we go?

The recent dramatic plunge in bond yields is the latest episode in a decades-long move lower. The trend had already started to accelerate in the aftermath of the global financial crisis, forcing investors to adjust to a lower-for-longer environment. This is a particularly thorny challenge for institutions like insurers and pension funds that have liability-matching needs. Yet another pivot of global central banks towards easier monetary policy has exacerbated the move, as shown in the chart below. The collapse of long-term interest rates raises important questions. To what extent do negative yields challenge government bonds' role as the provider of resilience in portfolios? With the decline in rates dragging down expected returns across asset classes, where do investors go for returns in a low return world?

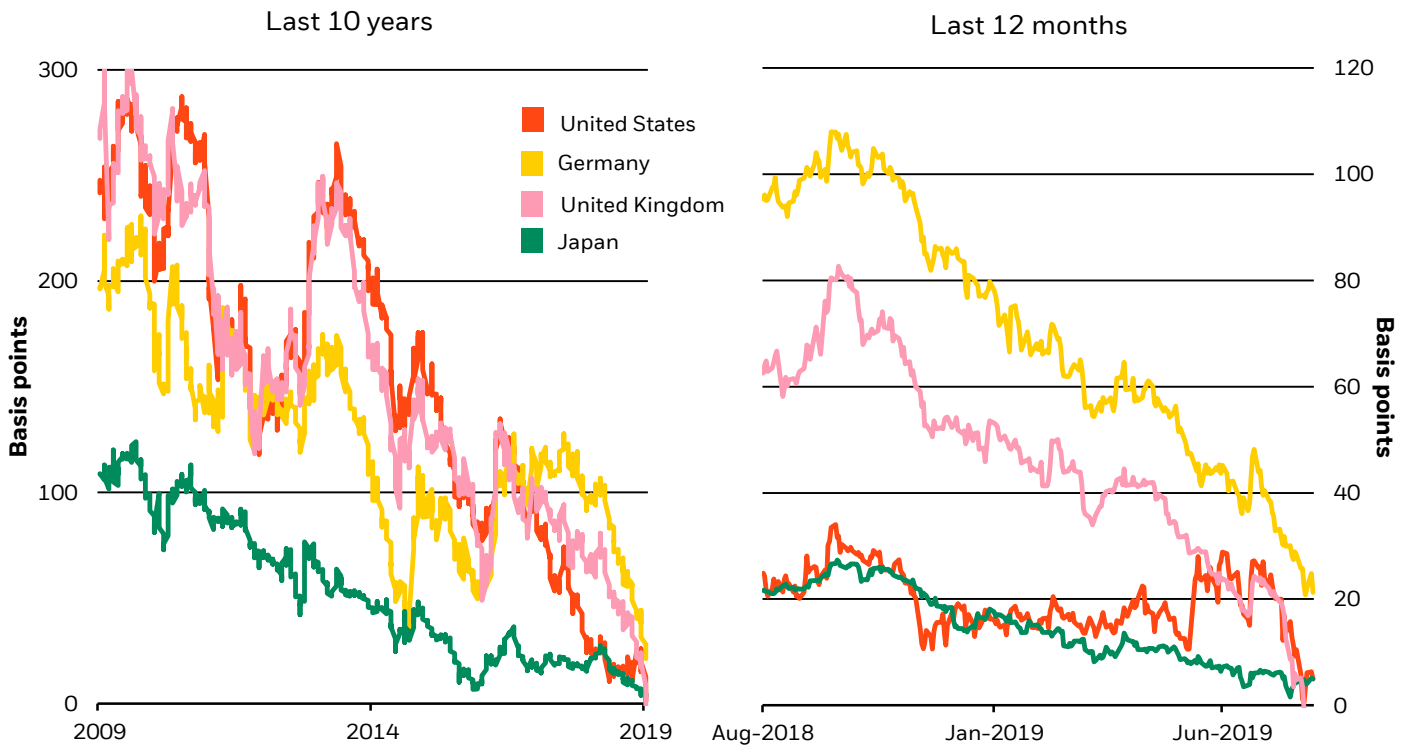
Our capital market assumptions (CMAs) are at the heart of our framework. Our central assumption is that government bond yields gradually rise, but to steady-state or equilibrium levels well below historic averages. Why? A confluence of structural and cyclical factors are suppressing interest rates. We expect slower potential growth, tepid inflation and strong demand for perceived safe haven assets weighing down neutral policy rates and term premia in the long-run. Our CMAs also account for the recent dovish policy tilt. Our projections for bond yields allow for rates being lower before they move higher.

How low could rates go? Lowering policy rates to provide economic stimulus is a fundamental tool in central bank policy. Some studies, including by Princeton professor Markus Brunnermeier, suggests there exists an effective lower bound (ELB) beyond which further rate cuts become contractionary rather than expansionary. The reason is that their detrimental effects on the banking sector outweigh the benefits. Brunnermeier estimated the eurozone's policy rate ELB at around -1% as of January 2019. Any estimate of the ELB is highly uncertain – one for bonds even more so than for policy rates. Assuming no arbitrage opportunities, one could potentially find a theoretical ELB estimate consistent across a term structure. Yet the impact of myriad regulatory and supply and demand factors that might be at play is likely to cloud such an estimate.

The problem of a looming ELB is most acute in Europe, where negative yields already prevail across several markets. Government bond yields are negative across the whole maturity spectrum in Germany, the Netherlands, and in Switzerland. Yet the pivot in market pricing and sentiment since the start of the year has been so drastic that asset allocators are also now mulling a scenario once considered unthinkable - the possibility of U.S. Treasury yields turning negative. The upshot? In a world where even long-term rates can undergo such a swift and significant turnaround, assuming any certainty around expected returns is foolhardy. We have consistently emphasized the need for portfolio resilience over the past year. To us, this means making portfolios resilient to the widening range of outcomes fostered by rising protectionism and macro uncertainty. Our scenario-based framework allows for many ways the world can evolve, beyond a central case.

What a difference a year makes

Spreads between 10-year and 2-year bonds, 2009-2019



Past performance is not a reliable indicator of current or future results.

Sources: BlackRock Investment Institute, with data from Refinitiv Datastream, September 2019. Notes: the chart shows the move in the spread, in basis points, between the 10-year and 2-year government bond for each respective sovereign over the past decade, and over the past year.

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Building resilience: bonds as ballast

Government bonds in a multi-asset portfolio are supposed to help cushion the overall portfolio impact of "risk-off" episodes. This has generally been the case since 1990, according to our study of U.S. and German government bonds, shown in the chart below. The hope is that bond prices rise when stocks fall. According to Bloomberg data, about 17 trillion dollars worth of sovereign bonds now have negative yields, putting their role as portfolio ballast under scrutiny.

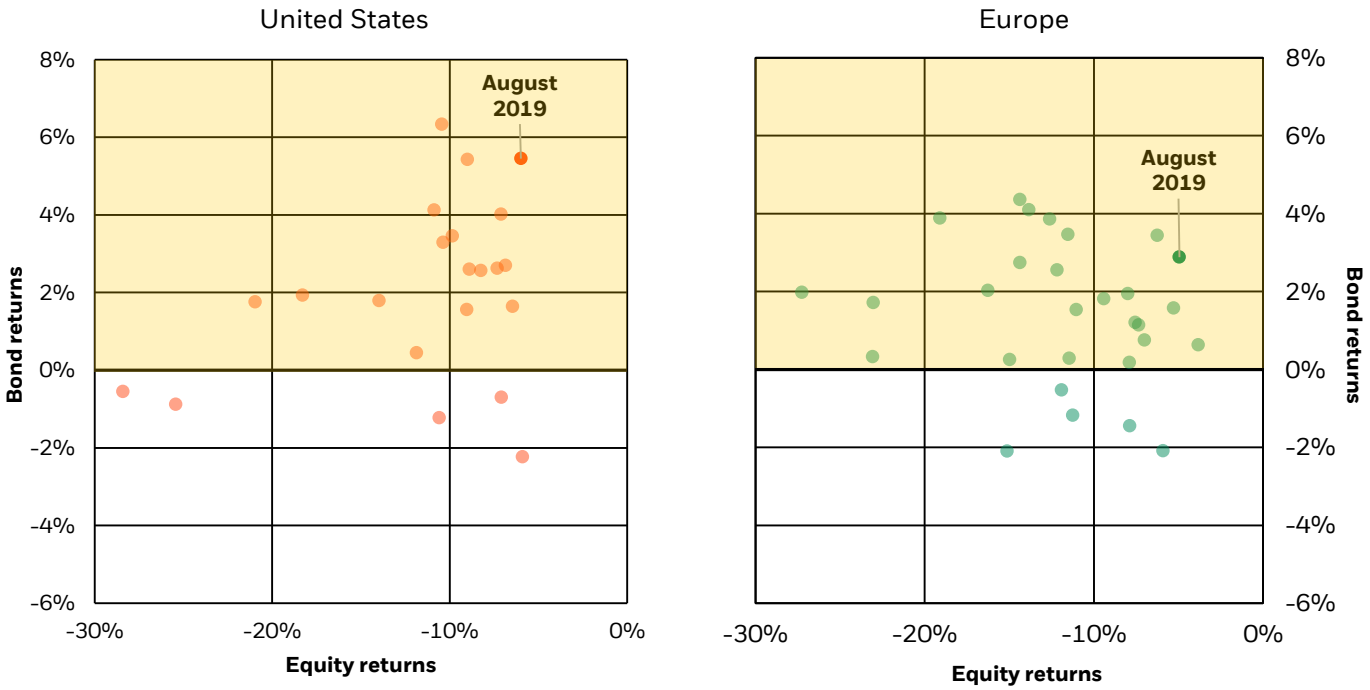
Government bonds performed their role as diversifiers in recent risk-off scenarios, such as the summer of 2019 and at the end of 2018. As discussed earlier, one worry for investors is that policy rates in the eurozone may be nearing an ELB. What matters most from an asset allocation perspective is the implication of this lower bound for longer maturity bonds, particularly the impact on correlations between key assets such as government bonds and equities –a key driver of resilient portfolios, in our view. If market participants thought rates could not go lower, falling equity values would no longer coincide with falling yields, curtailing bonds' diversification properties.

The strong performance of government bonds in the summer 2019 risk-off periods, marked in the charts below, should dispel any immediate concerns about their ability to defend against equity selloffs. We still see government bonds playing a crucial role in portfolios. Yet as shown in our unconstrained strategic tilts we have trimmed the size of our overweight relative to the start of the year, as our expected returns for fixed income are now materially lower. A further slide for yields from already ultra-low levels could well impact not just returns, but also the correlation government bonds with equities. The ability of government bonds to play the role of portfolio ballast is reduced as yields near the ELBs. This is underscored by the relative underperformance of German bunds relative to US treasuries through the August 2019 equity selloff. Holders of bunds should already consider diversifying holdings into other markets, such as US Treasuries and inflation-linked securities.

For European investors with liabilities, such as insurers, the structural advantage of euro area government bonds – such as the ability to hedge interest rates efficiently for liabilities and the comparatively favourable regulatory capital treatment - means the hurdle for a switch is greater. But it is still worthy of consideration, in our view. We see a more sizeable role for inflation-protected securities as we view higher inflation in the medium term as a possible consequence of accelerating deglobalisation. In such a supply-side shock, the ability of nominal government bonds to provide ballast is likely to be further diminished, in our view. Any potential shift in the monetary policy framework, as discussed on the following page, further underscores the need to incorporate uncertainty in expected returns.

Joining the dots

Monthly returns of government bond and stock returns during stock market selloffs, 1990-2019



Past performance is not a reliable indicator of current or future results.

Sources: BlackRock Investment Institute, with data from Refinitiv Datastream and Bloomberg, September 2019. Notes: The dots on the scatter plot represent stock returns and corresponding bond returns in the U.S. and Europe during stock market selloffs since 1990. Selloffs are defined as rolling four-week periods during which the equity market falls by 5% or more. The shaded areas mark positive bond returns. The indexes used are MSCI Europe, S&P500 and the Thomson Reuters Benchmark 10-year Government Bond Indexes for the U.S. and Germany. Returns are in local currency terms. Indices are unmanaged. It is not possible to invest directly in an index.

Unknown unknowns

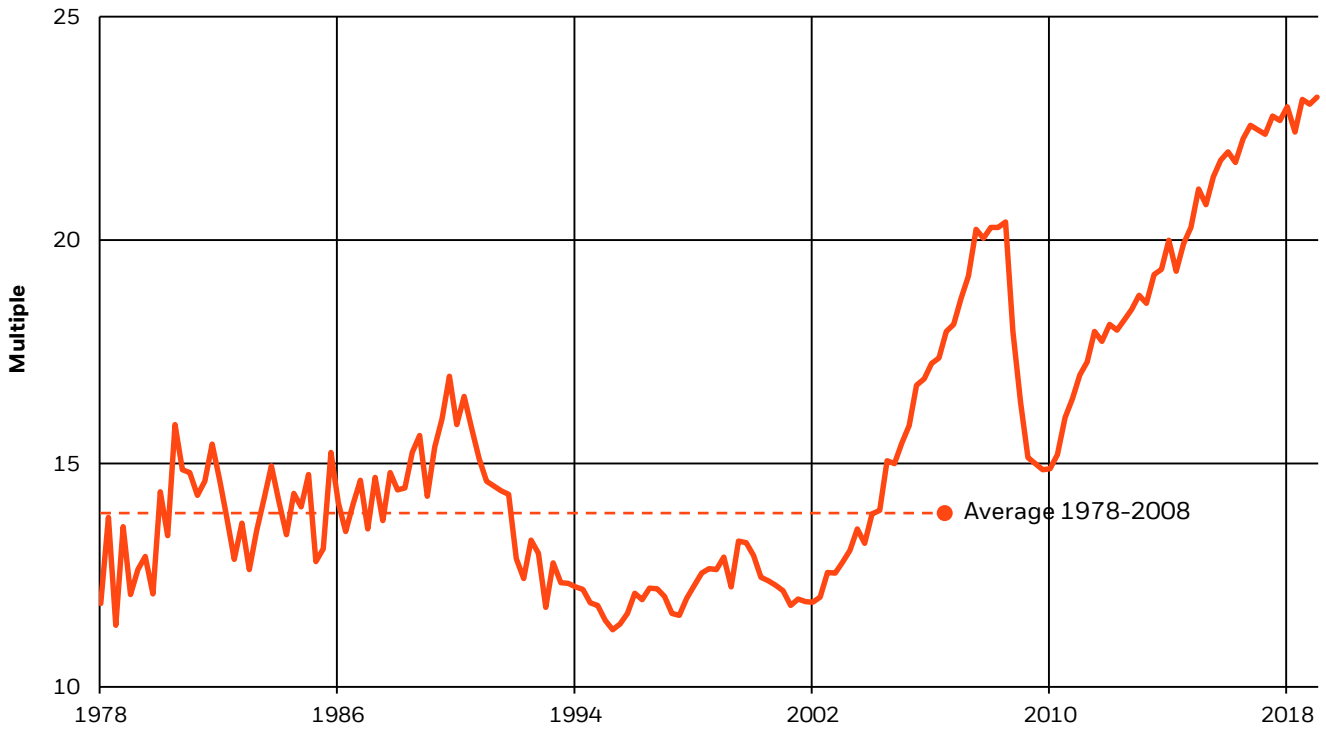
There is great uncertainty about how the world evolves over a strategic investment horizon of the next 10 years or more. For example, there is a possibility of negative US yields during the next downturn given structurally lower neutral rates and negative term premia. On the other hand, scenarios with materially higher nominal bond yields can also be envisaged. Fear that central banks are out of ammunition is contributing to recent market anxiety. Fighting the next downturn will likely require an unprecedented mix of monetary and fiscal coordination. One implication of such coordination, if successful, would likely be a pickup in inflation expectations, leading to rising long-term bond yields. Yet another tail risk scenario? A potential supply-side shock caused by de-globalisation could stoke higher medium-term inflation.

The implication of this high uncertainty is that strategic investors should build portfolios resilient to a range of scenarios, including ones that have no historic precedent. A common limitation of asset return models is they tend to anchor on assumptions of mean-reversion – that asset valuations will revert to their historic averages. This only allows for outcomes that have been observed historically. Yet we have seen constant structural changes to economies and financial markets, especially in just the past few decades. For instance, any estimate of US core real estate valuations in 2008 based on even long-term historical averages would have been significantly off the mark compared to reality, as the chart below shows. One reason: a failure to account for the impact of persistent ultra-low interest rates. Often mean-variance optimisation techniques are employed in building portfolios. These place too much certainty on one set of return assumptions that depict only one economic and market scenario, in our view. See our *Understanding uncertainty* paper for more.

A key belief underpinning our portfolio construction process: certainty around average, long-term expected returns can be misleading. We have consistently emphasised the need for making portfolios resilient to the widening range of potential economic and market outcomes. How do we do this? Our CMAs take a view on structural trends in the economy and markets. Rather than relying on point forecasts, we use Monte Carlo simulation to create thousands of return pathways for each asset class, representing the range of possible outcomes over a five- to 20-year time horizon. The simulation is informed by historical return distributions and centred on our expected returns. For more, see the appendix in our paper *Building resilience: a framework for strategic asset allocation*. Importantly, unlike classic stochastic scenario generation, we allow for uncertainty in the mean expected return around which the distribution of returns are simulated. In practice, it means we allow for a wider range of outcomes – including uncharted ones – such as negative US yields. We can also explicitly express an aversion to uncertainty in the process. Rather than mean variance, we use a robust optimisation process that considers the myriad pathways, and identifies portfolios that are resilient across the scenarios.

Keeping it real

US core real estate implied valuations, 1978-2018



Past performance is not a reliable indicator of current or future results.

Sources: BlackRock Investment Institute, with data from NCREIF, September 2019. Notes: the chart shows the implied valuation multiples for US core real estate based on the market value weighted capitalization rate calculated by the National Council of Real Estate Investment Fiduciaries. The capitalization rate is the ratio of annual net operating income generated by the asset to its value.

Bringing our framework to life

The current market environment is a challenging one – with low expected returns and high uncertainty. The standard industry disclaimer of "past performance is not a reliable indicator of current or future results" has never been more pertinent. How can investors navigate this maze? Our answer is to build portfolios employing an investment process grounded in the latest research and applicable across many different types of investment problems. A set of practical principles condenses our framework into a guide for investors.

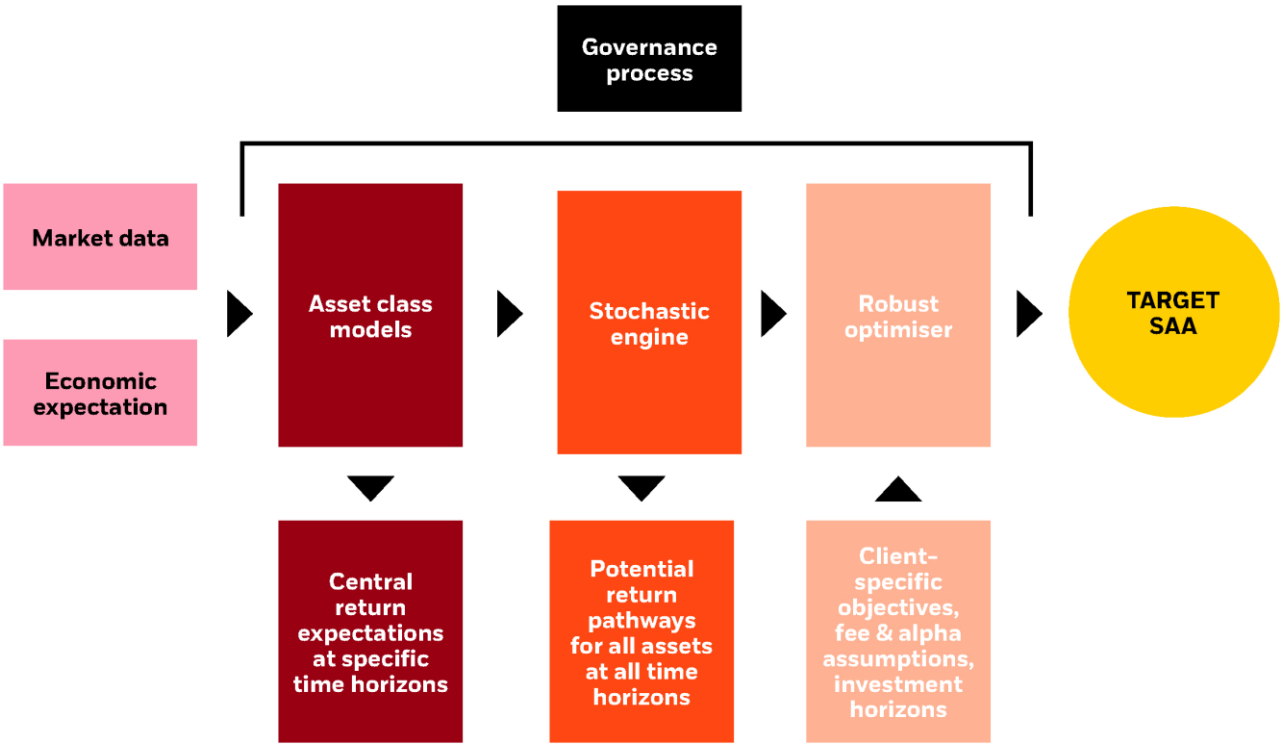
The inclusion of uncertainty in our CMAs means we can express sensitivity to a wider range of market outcomes when optimising. The result? SAAs that are more resilient to adverse market scenarios, in our view. We provide a term structure of returns allowing investors with different time horizons to fine-tune the process. This helps ensure that current valuations have less of an impact for long-term investors. Blending different return sources – alpha-seeking, factor and indexing strategies – is important. The blend will vary depending on risk and return requirements, as we explain in *Blending alpha-seeking, factor and indexing strategies: a new framework*. A low-return world brightens the appeal of private markets. Liquidity concerns tend to cloud private market allocations, and our paper on sizing private market allocations shows how investors can systematically think about the problem. Finally, we believe exchange rate hedging should be seen as a whole-portfolio decision rather than an asset-class-by-asset-class question.

We launch four, investor-specific SAAs that take into account our lower expected returns across asset classes, and each investor type's typical objectives and constraints. These hypothetical SAAs are intended to show how our portfolio construction process applies to individual risk budgets, goals and limitations. Our resulting SAAs differ materially from one another, yet underpinning them is a consistent, scalable process, shown in the schematic below, seeks to limit the need for subjective fixes.

We study four broad client types: U.S. public pension plans, EMEA-based family offices investing globally in U.S. dollars, UK institutional multi-asset clients and reserve managers. We highlight the expected performance of each in the bottom 50th percentile of our return pathways to emphasize our focus on downside-aware SAAs. We will update these SAAs every quarter alongside our asset class views and expected returns. We plan to expand the list of client segments over time.

Building blocks

BlackRock's portfolio construction toolkit showing one consistent process with investor oversight at each stage, 2019



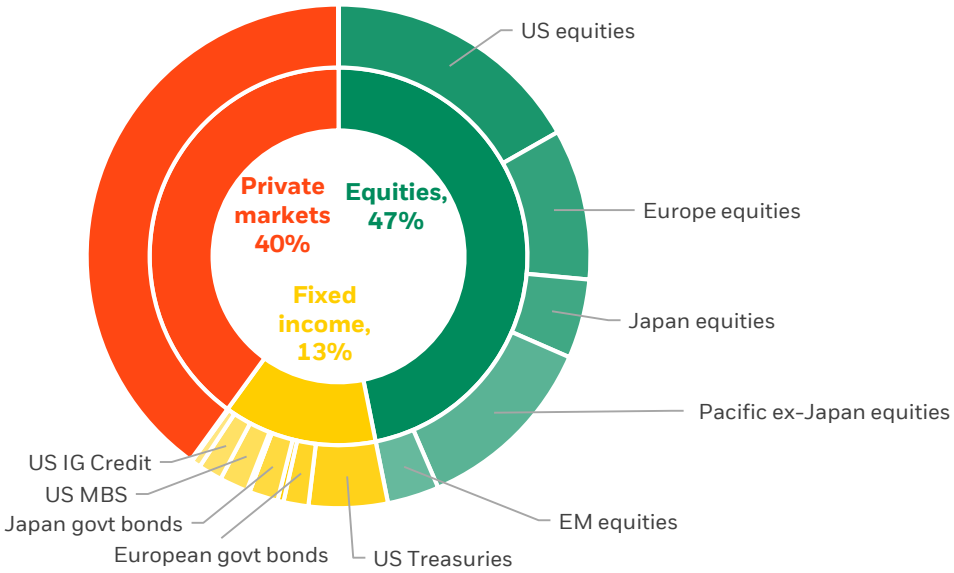
Sources: BlackRock Investment Institute, September 2019. This schematic is for illustrative purposes only and subject to change without notice.

EMEA Family Office

Family offices typically have long investment horizons, high risk tolerance and low liquidity needs, and tend to hold large private market and equity allocations.

Criteria	Description
Base currency	US dollars
Investment objective	Maximise return for sizeable risk budget, while being downside aware
Risk target	12% volatility
Investment opportunity set	Long-only, global. Assets with holding periods of more than 10 years excluded.
Investment horizon:	10 years

Hypothetical BlackRock SAA for US dollar-denominated EMEA-based family office, 2019



Parameter	Value
Expected SAA return range excluding alpha, net of fees	5.3-9.5%; Central return estimate: 7.4%
Contribution from net alpha	0.0-0.6%
Expected SAA return range including alpha, net of fees	5.3-10.1%
Return estimate assuming bottom half of outcomes	3.4%

Past performance is not a reliable indicator of current or future results. This information is not intended as a recommendation to invest in any particular asset class or strategy or as a promise - or even estimate - of future performance. Sources: BlackRock Investment Institute, with data from Refinitiv Datastream and Bloomberg, September 2019. Notes: The chart shows a hypothetical SAA for an EMEA-based family office, based on the metrics provided in the tables. Net asset return expectations are as of 30 June, 2019. Index proxies and fee assumptions are listed in the appendix on pages 11-13 and on our CMA website. The expected returns range is based on the 25th and 75th percentile of our simulated return pathways as detailed here. For assets without indices (private markets), we have assumed top-quartile performance. 'Contribution from net alpha' in the table relates to the alpha opportunity in public market assets only, according to the definitions and methodology detailed in our paper on blending returns. The allocation shown above does not represent any existing portfolio, and as such, is not an investible product. The construction of the hypothetical asset allocation is based on criteria applied with the benefit of hindsight and knowledge of factors that may have positively affected it's performance, and cannot account for risk factors that may affect the actual portfolio's performance. The actual performance may vary significantly from our modelled CMAs due to transaction costs, liquidity or other market factors. Indexes are unmanaged, do not account for management fees and one cannot invest directly in an index.

Our view: The SAA above would deliver a 0.4% higher return for lower risk, excluding any alpha potential, than a stylized peer group over the investor's time horizon, in a central scenario assuming asset returns as per our CMAs detailed in the appendix. The hypothetical peer group is described on page 14. Broadly, we still see government bonds playing a core role in SAAs even at ultra-low yields, yet prefer US Treasuries over German bunds. Key differentiators from the peer group include:

More private credit: Aversion to the asset class for EMEA-based family offices often arises due to fear of adverse tax implications, in our view. Yet even in stress tests assuming investment income being taxed at 30% higher than capital gains - a higher differential than that observed in many regions - our models show only modest changes. Exposure to private credit is balanced by exposure to government bonds.

More public equity: Our favourable view on equities, particularly in developed markets, over a strategic time horizon suggests the asset class should be an important source of growth.

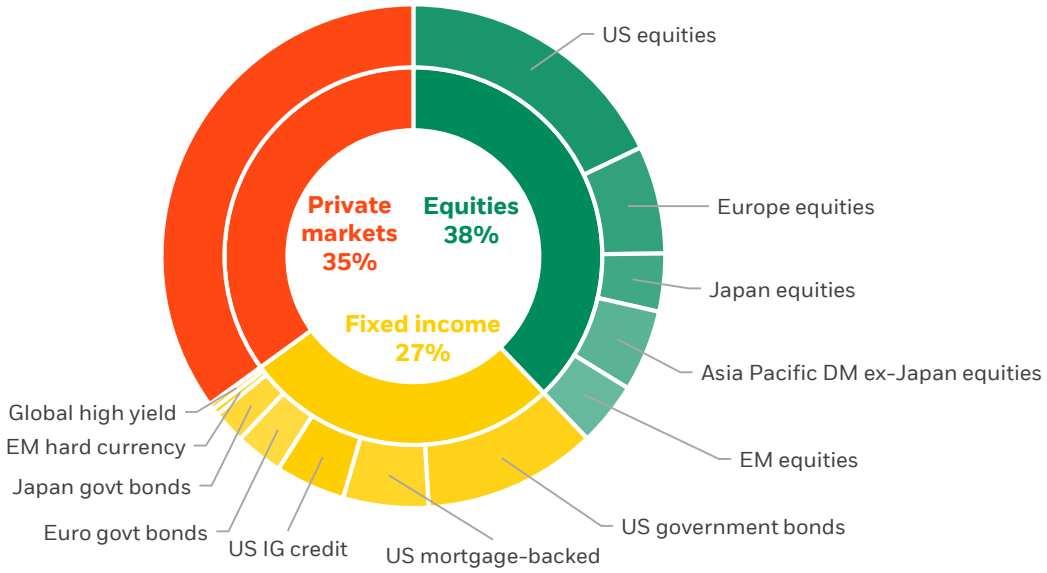
Currency hedging: We find many family offices leave currency exposure unhedged. The decision to hedge exchange rate exposure should be based on the contribution to overall risk and return. In this SAA, we fully hedge all overseas developed currency, besides the yen. The reason – yen exposure reduces overall risk through its diversification benefit, in our view.

US public pension fund

A typical US public pension plan invests globally on a long-only basis with an absolute return target.

Criteria	Description
Base currency	US dollars
Investment objective	Absolute return target in the range of 7-7.3%
Risk target	9.6% volatility
Investment opportunity set	Long-only, global. Maximum allocation to private markets constrained by liquidity considerations to 35%
Investment horizon:	20 years

Hypothetical BlackRock strategic asset allocation for USD-denominated US public pension plan, 2019



Parameter	Value
Expected SAA return range excluding alpha, net of fees	5.6%-8.8%; Central return estimate: 7.2%
Contribution from net alpha	0-0.6%
Expected SAA return range including alpha, net of fees	5.6-9.4%
Return estimate assuming bottom half of outcomes	4.6%

Past performance is not a reliable indicator of current or future results. This information is not intended as a recommendation to invest in any particular asset class or strategy or as a promise - or even estimate - of future performance. Sources: BlackRock Investment Institute, with data from Refinitiv Datastream and Bloomberg, September 2019. Notes: The chart shows a hypothetical SAA for a US public pension plan, based on the metrics provided in the tables. Net asset return expectations are as of 30 June, 2019. Index proxies and fee assumptions are listed in the appendix on pages 11-13 and on our CMA website. The expected returns range is based on the 25th and 75th percentile of our simulated return pathways as detailed here. For assets without indices (private markets), we have assumed top-quartile performance. 'Contribution from net alpha' in the table relates to the alpha opportunity in public market assets only, according to the definitions and methodology detailed in our paper on blending returns. The allocation shown above does not represent any existing portfolio, and as such, is not an investible product. The construction of the hypothetical asset allocation is based on criteria applied with the benefit of hindsight and knowledge of factors that may have positively affected it's performance, and cannot account for risk factors that may affect the actual portfolio's performance. The actual performance may vary significantly from our modelled CMAs due to transaction costs, liquidity or other market factors. Indexes are unmanaged, do not account for management fees and one cannot invest directly in an index.

Our view: The SAA above would deliver a 0.1% higher return for less risk, excluding any alpha potential, than a stylized peer group over the investor's time horizon, in a central scenario assuming asset returns as per our CMAs detailed in the appendix. The hypothetical peer group is described in the appendix on page 14. Our SAA also shows better downside scenario performance, assuming the bottom half of outcomes. We still see government bonds playing a core role in SAAs even at ultra-low yields. We prefer US Treasuries over German bunds. Key differentiators from typical allocations include:

Less public equity and more private credit: We expect private credit to offer equity-like returns with less risk over the given time horizon. We limit the overall private markets allocation to 35% for liquidity reasons.

More private markets: Based on our liquidity analysis detailed in our paper on the *role of private markets*, investors with 5% net cash outflows each year can afford up to 35% of their total portfolio in illiquid assets, often higher than observed allocations.

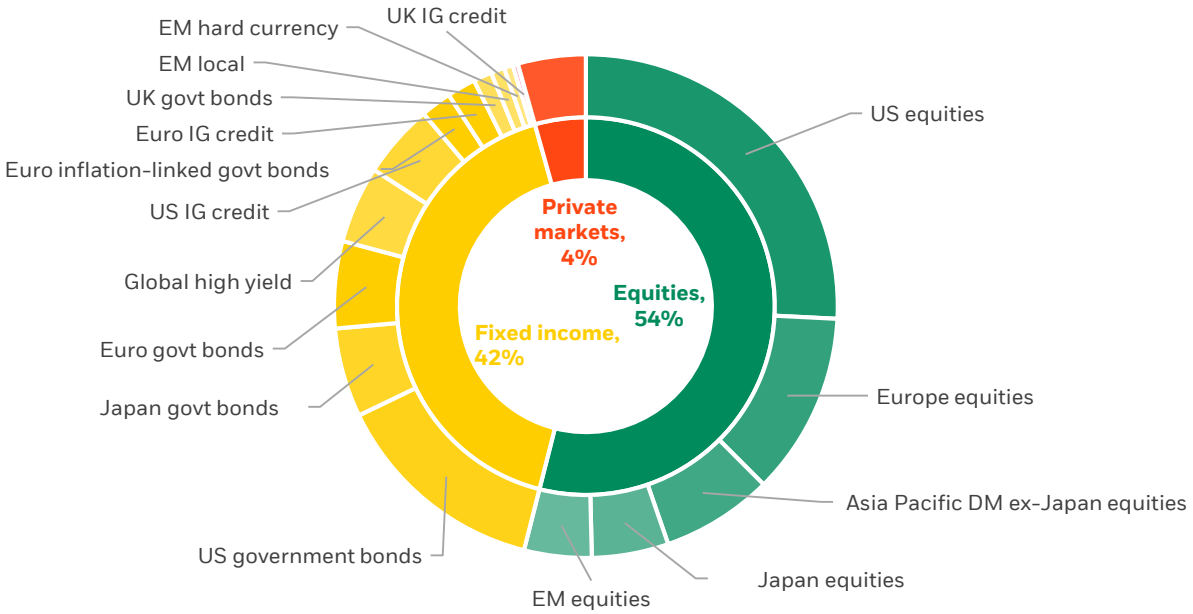
More international fixed income: Even though interest rates in other developed market economies are currently lower than in the US, currency hedging allows investors to benefit from steeper yield curves in these markets.

UK institutional multi-asset

This client type typically invests globally on a long-only basis, often with an absolute or 'cash plus' return objective.

Criteria	Description
Base currency	GBP
Investment objective	Absolute return target of LIBOR +3-4% with a moderate risk target
Risk target	8% volatility
Investment opportunity set	Long-only investments across global public and private markets. Liquidity requirements limit the size of private market allocations.
Investment horizon:	10 years

Hypothetical BlackRock SAA for sterling-denominated UK multi-asset investor, 2019



Parameter	Value
Expected SAA return range excluding alpha, net of fees	2.8%-5.2%; Central return estimate: 4%
Contribution from net alpha	0-0.8%
Expected SAA return range including alpha, net of fees	2.8%-6.0%
Return estimate assuming bottom half of outcomes	1.5%

Past performance is not a reliable indicator of current or future results. This information is not intended as a recommendation to invest in any particular asset class or strategy or as a promise - or even estimate - of future performance. Sources: BlackRock Investment Institute, with data from Refinitiv Datastream and Bloomberg, September 2019. Notes: The chart shows a hypothetical SAA for a UK-based institutional multi-asset investor, based on the metrics provided in the tables. Net asset return expectations are as of 30 June, 2019. Index proxies and fee assumptions are listed in the appendix on pages 11-13 and on our CMA website. The expected returns range is based on the 25th and 75th percentile of our simulated return pathways as detailed here. For assets without indices (private markets), we have assumed top-quartile performance. 'Contribution from net alpha' in the table relates to the alpha opportunity in public market assets only, according to the definitions and methodology detailed in our paper on blending returns. The allocation shown above does not represent any existing portfolio, and as such, is not an investible product. The construction of the hypothetical asset allocation is based on criteria applied with the benefit of hindsight and knowledge of factors that may have positively affected it's performance, and cannot account for risk factors that may affect the actual portfolio's performance. The actual performance may vary significantly from our modelled CMAs due to transaction costs, liquidity or other market factors. Indexes are unmanaged, do not account for management fees and one cannot invest directly in an index.

Our view: The SAA above would deliver a 0.2% higher return for less risk, excluding any alpha potential, than a stylized peer group over the investor's time horizon, in a central scenario assuming asset returns as per our CMAs detailed in the appendix The hypothetical peer group is described on page 14. We still see government bonds playing a core role in SAAs even at ultra-low yields. We prefer US Treasuries over German bunds. Key differentiators from the peer group average include:

Currency hedging: Exchange rate risk is often overlooked in the portfolio construction phase, in our view. Our SAA has more than 90% overseas exposure. We determine the currency hedge ratio at the whole portfolio level, based on risk and return contribution. We fully hedge all overseas developed market currency exposure, except US dollars and yen. US dollar exposure is hedged at 70% and exposure to yen is left unhedged, as we believe maintaining some exposure provides a diversification benefit. Also, due to interest rate differentials, we expect US dollar hedging to be a drag over a strategic investment horizon.

Avoiding home bias: According to a BlackRock study, many UK multi-asset investors display significant home bias by investing in domestic markets to reduce exchange rate risks and due to perceived informational advantages. Yet the UK makes up only about 5% of global equity and government bond markets. We prefer to weigh the opportunity of UK assets against global peers. In our SAA, we stay close to neutral on UK assets given elevated political and economic uncertainty.

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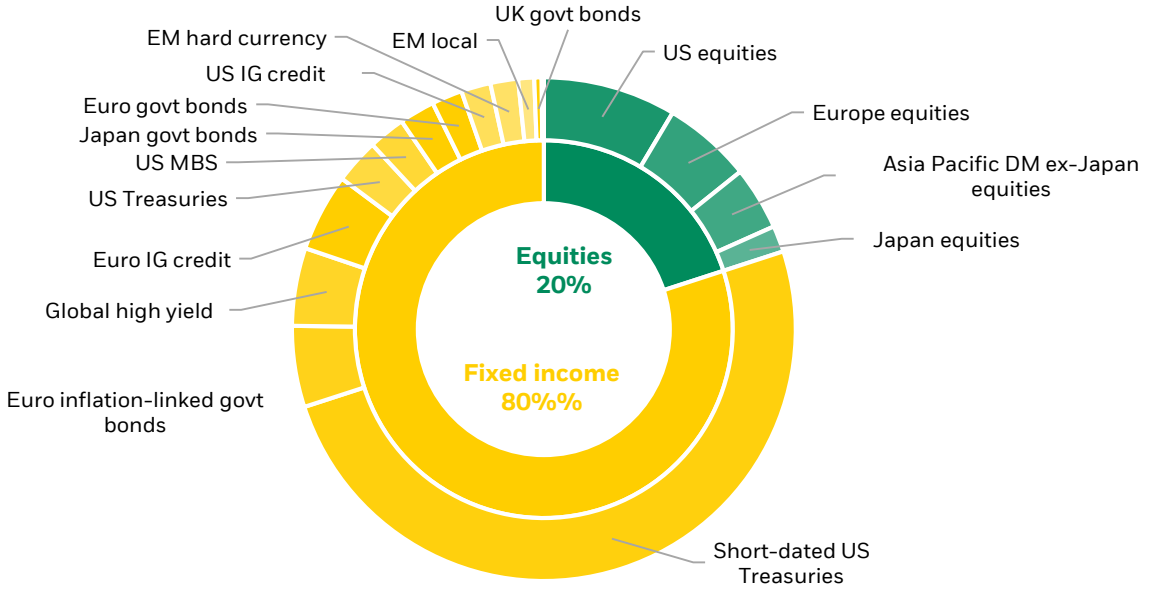
Reserve manager

Capital preservation, liquidity and return have historically driven official reserve managers' investment decisions.

Criteria	Description
Base currency	US dollars
Investment objective	Maximise returns for given level of risk, subject to achieving material liquidity
Risk target	3.5% volatility
Investment opportunity set	Relatively restricted, yet less so than typical reserve managers
Investment horizon:	10 years

Hypothetical BlackRock SAA for USD-denominated reserve manager, 2019



Parameter	Value
Expected SAA return range excluding alpha, net of fees	2.5-4.1%; Central return estimate: 3.3%
Contribution from net alpha (embedded in total return)	0.0%
Expected SAA return range including alpha, net of fees	2.5-4.1%
Return estimate assuming bottom half of outcomes	2.0%

Past performance is not a reliable indicator of current or future results. This information is not intended as a recommendation to invest in any particular asset class or strategy or as a promise - or even estimate - of future performance. Sources: BlackRock Investment Institute, with data from Refinitiv Datastream and Bloomberg, September 2019. Notes: The chart shows a hypothetical SAA for a reserve manager, based on the metrics provided in the tables. Net asset return expectations are as of 30 June, 2019. Index proxies and fee assumptions are listed in the appendix on pages 11-13 and on our CMA website. The expected returns range is based on the 25th and 75th percentile of our simulated return pathways as detailed here. For assets without indices (private markets), we have assumed top-quartile performance. 'Contribution from net alpha' in the table relates to the alpha opportunity in public market assets only, according to the definitions and methodology detailed in our paper on blending returns. The allocation shown above does not represent any existing portfolio, and as such, is not an investible product. The construction of the hypothetical asset allocation is based on criteria applied with the benefit of hindsight and knowledge of factors that may have positively affected it's performance, and cannot account for risk factors that may affect the actual portfolio's performance. The actual performance may vary significantly from our modelled CMAs due to transaction costs, liquidity or other market factors. Indexes are unmanaged, do not account for management fees and one cannot invest directly in an index.

Our view: The SAA above would deliver a 0.9% higher return for equivalent risk than a stylized peer group over the investor's time horizon, in a central scenario assuming asset returns as per our CMAs detailed in the appendix. The hypothetical peer group is described in the appendix on page 14. Downside performance – an important criteria for this investor type – is also better. We still see government bonds playing a core role, yet see prefer US Treasuries over German bunds. Key differentiators from typical allocations include**:**

Equity allocation: Our returns are higher in the reserve manager portfolio than the peer group average, driven by a broader asset universe and the increased allocation towards equities – an asset class reserve managers typically do not consider. Equities provide an attractive risk return trade-off for reserve managers, in our view, particularly as they sit alongside a portfolio of highly liquid fixed income assets.

Focus on downside management: The average return in the bottom–half of outcomes for our SAA is higher than that of the peer group average, and our SAA also has a 0.4% lower maximum drawdown over a one-year period. We have preserved short duration US Treasuries a liquidity buffer.

Currency hedging: The decision to hedge currency exposure is based on the contribution to total portfolio risk and return. In this relatively low risk SAA, we find fully hedging DM currency exposure gives the best return-risk outcome.

Appendix

Indices

US TIPS = Bloomberg Barclays US Government Inflation-Linked Index

US aggregate bonds = Bloomberg Barclays US Aggregate Total Return Index

US Treasuries = Bloomberg Barclays US Aggregate Government Index

US long Treasuries = Bloomberg Barclays U.S. Long Treasury Index

US short Treasuries = Bloomberg Barclays U.S. Short Treasury Index

US long credit = Bloomberg Barclays U.S. Long Credit Index

US high yield = Bloomberg Barclays U.S. High Yield Index

US IG credit = Bloomberg Barclays U.S. Investment Grade Index

US agency MBS = Bloomberg Barclays US MBS Index

European government bonds = Bloomberg Barclays Global Aggregate Euro Treasury index

Japan government bonds = ICE BofA-ML Japanese Governments

UK government bonds = FTSE Actuaries UK Conventional Gilts All Stocks index

UK inflation-linked government bonds = FTSE Actuaries UK Index-linked Gilts (over 5 years) index

UK IG credit = ICE BofA-ML Sterling Corporate Securities index

European inflation-linked government bonds = ICE BofA-ML EMU Direct Government Inflation Linked index

Euro IG credit = ICE BofA-ML Euro Corporate index

Global high yield = Bloomberg Barclays Global High Yield index

US large cap equities = MSCI USA Index

US small cap equities = MSCI USA Small Cap Return Index

DM ex US large cap equities = MSCI World ex-US Index

DM high yield = Bloomberg Barclays Global High Yield Total Return Index

DM government bonds = Bloomberg Barclays Global Aggregate Treasuries

DM ex US government bonds = Bloomberg Barclays Global Aggregate Treasury Index ex US

DM ex US credit = Bloomberg Barclays Global ex-USD Credit Index

Europe large-cap equity = MSCI Europe Index

Asia Pacific DM ex-Japan equity = MSCI Developed Asia Pacific ex-Japan index

Japan equity = MSCI Japan index

EM debt - hard currency = JP Morgan EMBI Global Diversified Total Return Index

EM debt - local currency = JP Morgan GBI-EM Total Return Index

EM equity = MSCI Emerging Markets Index

Global infrastructure debt = 50% Bloomberg Barclays European Infrastructure EUR Index/50% Bloomberg Barclays US Corporate 10+ Baa3-A3 Utility

Hedge funds (global) = HFRI Composite Index

US infrastructure debt = BlackRock proxy*

US real estate = BlackRock proxy*

Global core real estate = BlackRock proxy*

Global direct lending= BlackRock proxy*

US private equity (buyout) = BlackRock proxy*

Mezzanine debt = BlackRock proxy*

*We use BlackRock proxies for selected private markets because of lack of sufficient data. These proxies represent the mix of risk factor exposures that we believe represents the economic sensitivity of the given asset class.

Fee assumptions

	Index or beta	Alpha-seeking
Equities	0.15%-0.5%	0.4%-0.8%
Government bonds	0.15%-0.3%	0.2%-0.25%
Investment grade credit	0.1%-0.3%	0.2%-0.25%
Sub-investment grade credit	0.4%-0.5%	0.4%-0.5%
Private markets	N/A	0.5%-5.0%

Sources: Mercer Global Asset Manager Fee Survey 2017, Morningstar, BlackRock estimates. Note: Fee assumptions are given as ranges given the wide range of asset classes, currencies and datasets we consider in our calculations.

BIIM0919E-950283-11/16

Capital market assumptions – US dollar

Asset	Return expectations (geometric, gross of fees)				Long-term expected volatility	Long-term correlation	
	5-year	10-year	15-year	20-year		Global equities	Global government bonds
Short-dated US Treasuries	1.6%	1.9%	2.1%	2.3%	2.3%	-44.9%	62.4%
US government (10+ years)	-0.4%	0.3%	1.0%	1.4%	14.2%	-30%	77%
US credit (10+ years)	0.6%	1.9%	3.2%	4.1%	12.1%	24%	55%
Global ex-US government bonds	1.1%	1.6%	2.0%	2.3%	3.3%	-22%	100%
US inflation-linked government bonds	1.3%	1.7%	2.1%	2.4%	5.7%	-1%	49%
US government bonds (all maturities)	1.4%	1.7%	2.1%	2.3%	5.0%	-38%	77%
US aggregate bonds	1.6%	2.0%	2.4%	2.7%	4.0%	-16%	76%
US credit (all maturities)	1.6%	2.3%	3.0%	3.4%	5.8%	15%	61%
US agency MBS	1.6%	2.0%	2.2%	2.4%	2.1%	-25%	57%
US cash	1.8%	2.1%	2.3%	2.4%	0.0%	0%	0%
Local currency EM debt	2.7%	3.0%	3.2%	3.3%	12.2%	52%	7%
USD EM debt	2.9%	3.5%	4.1%	4.5%	9.1%	36%	35%
US high yield	4.5%	4.7%	4.9%	5.1%	7.8%	62%	-6%
Japanese government bonds	0.1%	0.7%	1.3%	1.7%	10.5%	-31.2%	44.2%
Euro government bonds	0.2%	0.8%	1.5%	1.9%	11.0%	12.4%	43.8%
Emerging large cap equities	5.5%	6.4%	7.3%	7.9%	22.4%	80%	-13%
US large cap equities	5.5%	6.0%	6.5%	6.8%	16.0%	88%	-18%
Europe large cap equities	5.7%	6.2%	6.7%	7.1%	18.3%	89%	-15%
US small cap equities	5.8%	6.3%	6.8%	7.1%	19.2%	87%	-19%
Japan large-cap equities	5.9%	6.0%	6.1%	6.1%	16.1%	71.2%	-11.0%
Asia Pacific ex-Japan equities	7.1%	7.2%	7.2%	7.2%	21.7%	80.1%	-11.1%
Global ex-US large cap equities	5.9%	6.4%	6.7%	7.0%	16.4%	91%	-15%
Developed infrastructure debt	2.3%	3.1%	3.8%	4.2%	8.5%	25%	47%
US Infrastructure debt	4.0%	4.7%	5.3%	5.7%	9.6%	20%	49%
Real estate mezzanine debt	4.9%	5.3%	5.8%	6.1%	10.9%	61%	5%
US core real estate	5.1%	5.3%	5.4%	5.5%	14.6%	43%	6%
Hedge funds (global)	5.5%	5.8%	6.1%	6.2%	7.1%	80%	-27%
Global infrastructure equity	6.9%	7.1%	7.3%	7.4%	17.8%	63%	2%
Global direct lending	7.3%	7.7%	8.0%	8.2%	13.4%	74%	-22%
US private equity (buyout)	13.1%	13.2%	13.2%	13.1%	30.0%	80%	-24%

This information is not intended as a recommendation to invest in any particular asset class or strategy or as a promise - or even estimate - of future performance.

Source: BlackRock Investment Institute, September 2019. Data as of 28 June, 2019.

Notes: Return assumptions are total nominal returns. US dollar return expectations for all asset classes are shown in unhedged terms, with the exception of global ex-US Treasuries and hedge funds. Our CMAs generate market, or beta, geometric return expectations. Asset return expectations are gross of fees. Forecasted future performance is not a reliable indicator of future results. We use long-term volatility and correlation expectations. We break down each asset class into factor exposures and analyse those factors' historical volatilities and correlations over the past 18 years. Correlations with global equities and bonds are based on global measures excluding domestic equities and bonds. We combine the historical volatilities with the current factor makeup of each asset class to arrive at our assumptions. This approach takes into account how asset classes evolve over time. Example: Some fixed income indices are of shorter or longer duration than they were in the past. Our expectations reflect these changes, whereas a volatility calculation based only on historical monthly index returns would fail to capture the shifts. Indices are unmanaged and used for illustrative purposes only. They are not intended to be indicative of any fund or strategy's performance. It is not possible to invest directly in an index.

Capital market assumptions – sterling

Asset	Return expectations (geometric, gross of fees)				Long-term expected volatility	Long-term correlation	
	5-year	10-year	15-year	20-year		Global equities	Global government bonds
UK government bonds (15+ years)	-3.4%	-1.8%	-0.2%	0.8%	12.1%	-16%	70%
UK corporate bonds (10+ years)	-1.6%	0.0%	1.6%	2.6%	10.3%	19%	47%
UK government bonds (all maturities)	-1.4%	-0.3%	0.7%	1.4%	7.1%	-20%	75%
UK index-linked gilts (5+ year)	-0.7%	0.2%	1.0%	1.5%	11.3%	5%	47%
Global ex-UK government bonds	0.2%	0.8%	1.4%	1.8%	3.7%	-30%	100%
Global aggregate bonds	0.4%	1.1%	1.7%	2.1%	3.3%	-13%	95%
UK cash	0.8%	1.2%	1.6%	1.9%	0.0%	0%	0%
Local currency EM debt	1.6%	2.1%	2.5%	2.7%	11.5%	35%	17%
USD EM debt	1.6%	2.5%	3.3%	3.8%	9.1%	39%	36%
Global high yield bonds	2.7%	3.3%	3.8%	4.2%	7.7%	65%	-5%
UK large cap equities	4.0%	4.8%	5.6%	6.1%	14.6%	85%	-23%
Emerging large cap equities	4.4%	5.5%	6.6%	7.3%	20.7%	75%	-15%
US large cap equities	4.4%	5.2%	5.8%	6.2%	16.0%	84%	-19%
Europe large cap equities	4.6%	5.3%	6.0%	6.5%	15.8%	86%	-17%
Global small cap equities	4.6%	5.3%	5.9%	6.3%	17.1%	96%	-30%
Global ex-UK large cap equities	4.7%	5.3%	5.8%	6.1%	14.8%	100%	-30%
Developed infrastructure debt	1.3%	2.2%	3.1%	3.7%	8.6%	0%	66%
Global core real estate	2.4%	3.2%	4.0%	4.5%	13.4%	39%	13%
Real estate mezzanine debt	3.8%	4.5%	5.1%	5.5%	10.5%	44%	14%
US core real estate	4.0%	4.4%	4.7%	4.9%	15.5%	31%	10%
Hedge funds (global)	4.2%	4.7%	5.2%	5.5%	7.1%	83%	-36%
Global infrastructure equity	5.8%	6.2%	6.6%	6.8%	16.0%	55%	6%
Global direct lending	6.2%	6.8%	7.3%	7.6%	12.6%	65%	-20%
Global private equity (buyout)	10.9%	11.5%	12.1%	12.4%	27.5%	84%	-27%

This information is not intended as a recommendation to invest in any particular asset class or strategy or as a promise- or even estimate - of future performance.

Source: BlackRock Investment Institute, September 2019. Data as of 28 June, 2019.

Notes: Return assumptions are total nominal returns. Sterling return expectations for all asset classes are shown in hedged terms, with the exception of regional equity markets, local-currency EM debt and private markets other than hedge funds. Our CMAs generate market, or beta, geometric return expectations. Asset return expectations are gross of fees. Forecasted future performance is not a reliable indicator of future results. We use long-term volatility and correlation expectations. We break down each asset class into factor exposures and analyse those factors' historical volatilities and correlations over the past 18 years. Correlations with global equities and bonds are based on global measures excluding domestic equities and bonds. We combine the historical volatilities with the current factor makeup of each asset class to arrive at our assumptions. This approach takes into account how asset classes evolve over time. Example: Some fixed income indices are of shorter or longer duration than they were in the past. Our expectations reflect these changes, whereas a volatility calculation based only on historical monthly index returns would fail to capture the shifts. Indices are unmanaged and used for illustrative purposes only. They are not intended to be indicative of any fund or strategy's performance. It is not possible to invest directly in an index

Peer groups for investor-specific SAAs

We derive the peer groups for our SAAs from a variety of sources listed below. These peer groups are purely illustrative, intended to be an approximate guide of average industry practice. They do not represent any actual portfolio. We apply our CMAs and robust optimization techniques to these allocations using the same assumptions as our SAAs. We do not assume any alpha in the expected returns for peer groups as we have no visibility into what blend of returns (index, factors and alpha-seeking) various investors in our data sets use, their ability to pick top-quartile managers or their fees and governance costs.

EMEA Family Office

Peer group derived from: UBS/Campden Wealth Family Office report, 2018
Assumed asset class breakdown: Fixed income (17%), Equities (30%), Private markets and hedge funds (44%), Cash (7%), Commodities (2%)

Expected return range excluding alpha, net of fees	4.1% - 9.9%; Central return estimate: 7%
Risk target	13.1% volatility
Return estimate assuming bottom half of outcomes	2.1%
Maximum drawdown	21.4%

US public pension plan

Peer group derived from: Average asset allocation of the top 100 US public pension plan as of latest publicly available data
Assumed asset class breakdown: Fixed income (23.5%), Equities (49%), Private markets and hedge funds (27.5%),

Expected return range excluding alpha, net of fees	5.4% - 8.8%; Central return estimate: 7.1%
Risk target	11.9% volatility
Return estimate assuming bottom half of outcomes	4.0%
Maximum drawdown	23.0%

UK institutional multi-asset

Peer group derived from: "Moderate risk" UK multi-asset portfolio included in BlackRock Portfolio Insights Study
Assumed asset class breakdown: Fixed income (22%), Equities (49%), Private markets and hedge funds (17%), Cash (9%), Commodities (3%)

Expected return range excluding alpha, net of fees	2.4% - 5.2%; Central return estimate: 3.8%
Risk target	8.7% volatility
Return estimate assuming bottom half of outcomes	1.0%
Maximum drawdown	16.2%

Reserve manager

Peer group derived from: Average allocations based on reserve manager data at the IMF, BIS, industry surveys and BlackRock estimates
Assumed asset class breakdown: Fixed income (81%), Equities (7%), Private markets and hedge funds (1%), Commodities (11%)

Expected return range alpha, net of fees	1.2% - 3.6%; Central return estimate: 2.4%
Risk target	3.6% volatility
Return estimate assuming bottom half of outcomes	0.8%
Maximum drawdown	7.1%

Past performance is not a reliable indicator of current or future results. This information is not intended as a recommendation to invest in any particular asset class or strategy or as a promise - or even estimate - of future performance. Sources: BlackRock Investment Institute, with data from Refinitiv Datastream and Bloomberg, September 2019. Notes: The tables show hypothetical SAA and certain performance metrics for the peer groups used in our analysis. Net asset return expectations are as of 30 June, 2019. Index proxies and fee assumptions are listed in the appendix and on our CMA website. The expected returns range is based on the 25th and 75th percentile of expected return outcomes as detailed here. Peer groups return ranges do not include alpha potential. Hedge fund allocations are included in private markets for peer groups. For assets without indices (private markets), we have assumed top-quartile performance. The allocation shown above does not represent any existing portfolio, and as such, is not an investible product. The construction of the hypothetical asset allocation is based on criteria applied with the benefit of hindsight and knowledge of factors that may have positively affected it's performance, and cannot account for risk factors that may affect the actual portfolio's performance. The actual performance may vary significantly from our modelled CMAs due to transaction costs, liquidity or other market factors. Indexes are unmanaged, do not account for management fees and one cannot invest directly in an index.

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