Building resilience: a framework for strategic asset allocation

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In this *Portfolio perspectives* publication, we introduce a new framework for our capital market assumptions and their use in strategic asset allocation.

Incorporating uncertainty and moving away from point return estimates are important steps for building resilient portfolios, in our view. We offer a new toolkit that can allow investors to plan for downside scenarios and adjust their asset allocation around individual needs and objectives – including time horizons.

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Summary

This publication introduces a modernised framework for the use of capital market assumptions in strategic asset allocation. This framework delivers an enhanced toolkit that allows investors to build resilient portfolios by bringing together the research and expertise from teams across BlackRock. We have revamped our capital market assumptions by designing a suite of models that explicitly reflect cross-asset and macroeconomic linkages. These models are the key input to inform our views on returns across asset classes, including new assumptions for private markets and equity style factors.

To build resilient portfolios, we have developed a few necessary building blocks. Central return assumptions are not enough on their own. We need to assess and account for the uncertainty around these return assumptions. To do so, we need to see how financial markets may evolve in different scenarios by looking at multiple potential return pathways – especially adverse ones. These pathways – from five years onwards – then allow us to tailor portfolios to specific points in time. With these elements in hand, we can fortify portfolios against potential losses through robust optimisation. Incorporating views on private markets and equity style factors add another layer to asset allocation by incorporating returns that go beyond traditional asset classes.

Our 10-year strategic asset allocation preferences are derived from bringing these building blocks together. Our strategic preferences are based on a specific desire to minimise potential losses from risks, such as a recession, through more diverse portfolios. We currently favour emerging market (EM) equities and government bonds at the expense of credit. This reflects favourable valuations in EM equities and our outlook for structurally low interest rates. It is also due to credit's lack of return compensation relative to the diversification benefits of government bonds. Our strategic preferences are also shaped by our view that we are entering the late phase of the US-led economic cycle. That is one reason why we have negative allocation tilts on US equities and credit assets. Yet our revamped approach to private markets leads to a higher overall allocation compared with our previous framework.

We believe the breadth, granularity and transparency of these return expectations are unique in the industry. We provide our asset return assumptions and uncertainty profiles for the US dollar and six other major currencies. See our refreshed interactive website highlighting these features. This paper also lays out concrete examples of how our portfolio construction framework can be put into action.

A new toolkit

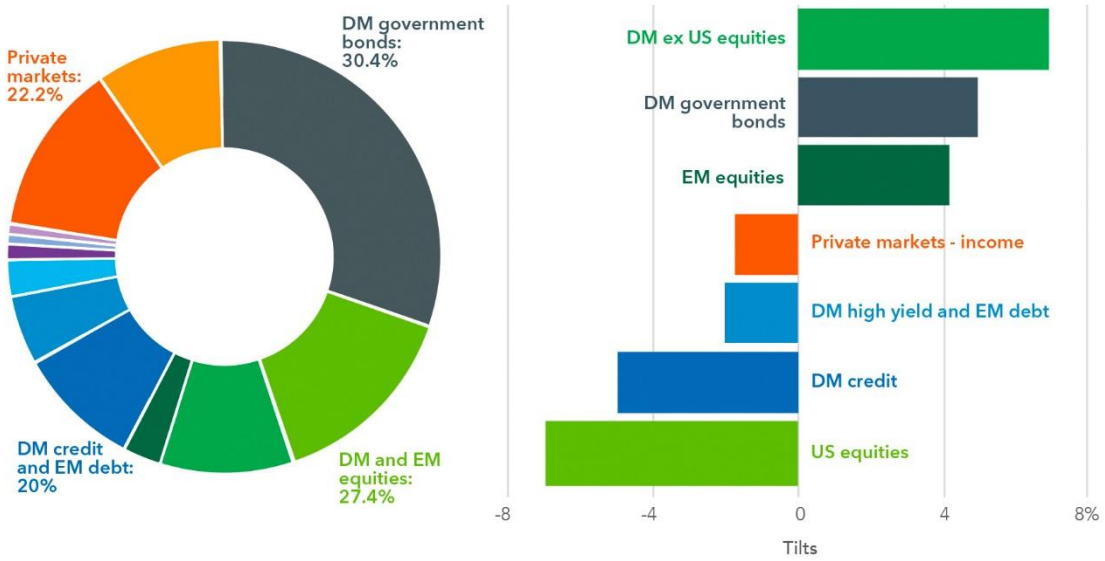
We believe the most important decision for any investor is determining the strategic asset allocation (SAA), the biggest driver of overall portfolio returns. The SAA process distils the answers to several questions into a single objective, such as: What is the blend of assets that may best achieve a return goal yet could cushion against negative shocks? This requires views on how the economic outlook and capital market returns might evolve. Yet we believe the standard industry approach to forming views and using them is incomplete for dealing with real-world complexities. A consistent approach that is cognisant of the large uncertainty shrouding these views and their interconnections is crucial. We outline what we see as an improved way of making critical portfolio decisions.

Heightened economic uncertainty coincides with widespread talk of the global expansion being late cycle. The need for building resilient portfolios is especially acute in this environment. Focusing on simple median estimates can lead investors astray: it is akin to having one foot in freezing water, one foot in boiling water – and on average feeling fine. Recessions are binary not average outcomes: they will or will not happen. Traditional portfolio optimisation techniques are highly sensitive to small changes in the assumed inputs, often forcing investors to place significant, subjective constraints around the optimisation process. That tries to fix the symptoms rather than the root problem, in our view. Our new capital market assumptions (CMAs) and portfolio construction toolkit seek to tackle these shortfalls head on. We offer an entire range of potential return paths across asset classes and factors, allowing for a fuller picture of uncertainty inherent within those expectations. A term structure of returns from five years to a long-term equilibrium lets investors map out what could occur over any time horizon. This fuller array of information allows investors to use robust optimisation techniques to try and limit the impact of potential drawdowns. This framework incorporates explicit connections between asset price behaviour through our new models. A change in the macroeconomic environment, such as a structural decline in real (inflation-adjusted) interest rates, *should* affect the expected returns of all assets. These linkages, combined with our varied return pathways, allow us to design portfolios that take into account downside risks and bring transparency to the drivers of portfolio construction. The components in our new approach – the incorporation of uncertainty in return estimates, the interconnected nature of our estimates, return term structures and robust optimisation – are essential features for building truly resilient portfolios, in our view.

We bring these components together as a tool to form our current strategic 10-year preferences below. Our preferences are not just determined by central return estimates but reflect our view that the US-led expansion is entering a late-cycle phase, so we focus on below-central outcomes. We currently favour emerging market (EM) equities and developed market (DM) government bonds at the expense of credit. This is due to favourable valuations in EM equities and our outlook for structurally low interest rates – but importantly credit's lack of return pickup to offset the diversification benefits of government bonds.

Fleshing out our asset allocation views

Our hypothetical, unconstrained long-term allocation vs our 10-year strategic asset preferences, December 2018



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

Sources: BlackRock Investment Institute, December 2018. Data as of 31 October 2018. Notes: These allocations represent unconstrained, long-only views and will be spelled out in the paper. Our long-term equilibrium is a hypothetical steady state economy – one represented by the mean value over multiple economic cycles and decades. Private markets income combines core real estate, real estate mezzanine debt, direct lending and infrastructure debt. Some individual asset classes are combined above. Equity indices are large cap unless otherwise noted. Indices are listed in the appendix. It is not possible to invest directly in an index.

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Incorporating pathways and uncertainty

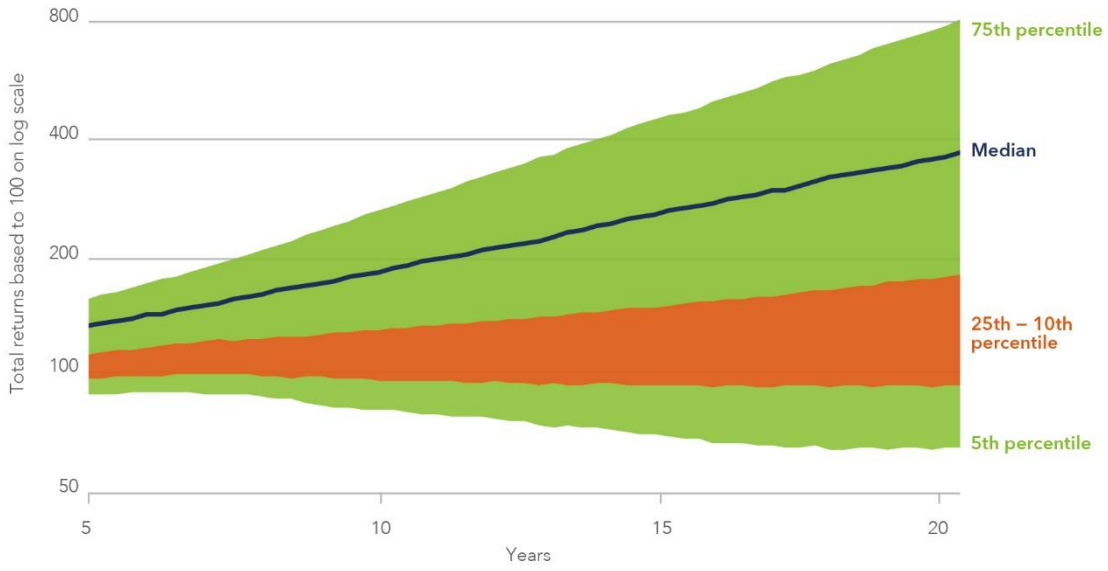
To create resilience within portfolios, we need to recognise that return assumptions are uncertain. Point estimates overstate the confidence any investor can have in the outlook for asset returns. Without constraints around the process, this can lead to overly concentrated allocations and leave portfolios vulnerable to potentially sharp drawdowns in those larger allocations. Recognising this inherent uncertainty in the central return expectation allows us to create portfolios that are more aware of the downside risks.

Our prior CMAs expressed return expectations as two point estimates – a five-year and a long-term view. We introduce two important changes. First, for any given time horizon, we generate a range of pathways around a central return expectation. Second, we map out asset class returns along a full spectrum from five years onwards, allowing investors to build time horizon-specific portfolios. Our potential return pathways are the result of a stochastic simulation – a random distribution of future returns informed by a combination of the distribution of historical returns, our central return expectations and our estimates of uncertainty. We anchor the simulation to our expectations of macro factors, such as economic growth and inflation, as well as asset-specific factors, such as earnings growth for equities. The *Emphasising the downside* chart shows how our approach can be used. From the myriad possible outcomes, investors can focus on a specific set most relevant to them. Investors worried about downside risk can select a subset of expected returns (orange band) below the median expectation (blue line). This subset of pathways could be any of the investor's choosing – even at the very bottom of the distribution – to fine tune their risk/return profile in ways that relying on point estimates alone cannot. The portfolio construction process allows for explicit choices on sacrificing some potential return to mitigate downside risks: there is no free lunch in building resilient portfolios. The approach is customisable for portfolios sensitive to specific time horizons and allows investors to express differing degrees of aversion to loss and uncertainty.

This goes well beyond traditional portfolio construction approaches. These methods construct asset allocations by balancing return and risk assumptions, yet they assume no uncertainty about central (median) return expectations. Robust optimisation improves on mean variance by directly incorporating the uncertainty inherent within our central return expectations – and helps determine the highest possible potential returns under negative scenarios in a fine-tuned way. We believe our systematic approach mitigates the need for ad-hoc fixes – such as forcing minimal allocations to an asset class – that investors typically use to counter the limitations of methods such as mean variance optimisation. The result? Portfolio allocations are more diverse and less vulnerable to changes in return estimates, as we show in our examples. This approach puts the trade-off between returns, volatility and downside risks at its core.

Emphasising the downside

Median and other pathways for total returns of our multi-asset allocation on 5- to 20- year horizon



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

Sources: BlackRock Investment Institute, December 2018. Data as of 31 October 2018. Notes: The chart shows a multi-asset total return profile on a log scale between five and 20 years and highlights downside pathways. The upper and lower bounds represent the 75th and 5th percentiles of the thousands of pathways generated by our stochastic generator, a way of building random scenarios tied to historical returns and our return assumptions. The orange band represents the 25th and 10th percentile to isolate downside pathways relative to the median in blue. The log (non-linear) scale makes it easier to visualise data with large variations.

Evolving our assumptions

Acknowledging uncertainty is an important pillar of our new approach to estimating return expectations. Yet we still want to generate the best possible central estimates for asset class returns. We have evolved our models for estimating returns across nearly all asset classes: they are based on bottom-up information within each asset class, build on the insights of asset class experts across BlackRock and rely on techniques grounded in academic literature. Our models were selected and validated by extensive backtesting work. A key enhancement in our approach is that models across assets are explicitly linked to reflect the interconnected nature of economic and market forces. Changes to real interest rates should not just impact the expected return on government bonds. They may have implications for the risk premia and valuations for equities or corporate bonds, and could influence the borrowing costs for leveraged private market assets. Making these interlinkages explicit can shed light on a portfolio's sensitivity to key variables, in our view.

Other enhancements: We also introduce new return assumptions on private markets and style factors. Along with beta return assumptions on asset classes, we offer alpha estimates for both public and private markets to compare them more directly. Costs – both from product fees and overall governance costs – are explicitly covered. As product fees are negotiable, they change over time and can vary greatly across different investors. Our framework assesses returns gross of fees. We bring representative fees into the portfolio optimisation process. The results of these models are just one input into our asset allocation views that are regularly reviewed and challenged by a committee of investment and risk experts from across BlackRock. More details of our retooled models are provided in the appendix.

Equity: We put estimates of the equity risk premium (ERP) at the heart of our approach to setting return expectations. Changes in equity valuations are driven by both expected cash flows – earnings and dividends – and the ERP. Forming expected returns by looking solely at valuations – typically the price-to-earnings ratio – can miss the full picture, in our view. Our work finds that linking expectations for future interest rates and the ERP can be more telling for expected returns rather than attempting to find a fair value for the price-to-earnings ratio alone. This allows us to incorporate our views of the structural drivers of interest rates into expected equity returns – as well as other asset class returns. We also use bottom-up analyst earnings forecasts and the relationship between margins and the economic cycle to formulate our earnings expectations. We find corporate profit margins not only converge to long-term averages but do so at a faster pace when an economy reaches full capacity. That suggests this cycle's rise in profit margins may not have been structural. The US economy has now reached full capacity, and this is one reason why we are strategically negative on US equities. The *Backtesting the equity model* chart shows how our new UK equity return assumptions would have performed relative to our previous model and the performance of the MSCI UK. Our new method more closely tracks actual equity returns.

Backtesting the equity model

New and previous UK equity return assumptions compared with actual performance, 2009-2013

The figures shown relate to past performance. Past performance is not a reliable indicator of current or future results. Sources: BlackRock Investment Institute and MSCI, with data from Thomson Reuters, December 2018. Notes: The chart shows the annualised five-year return of the MSCI UK relative to the assumptions, with the first point in March 2009 representing the annualised forward five-year return between 2009-2013. We have used this period because UK equities have the longest track record in our CMAs. The actual performance of a strategy may vary significantly from our modelled CMAs due to transaction costs, liquidity or other market factors. This model was created with the benefit of hindsight and should not be relied upon for investment advice. Indices are unmanaged. It is not possible to invest directly in an index.

Credit: Like equity returns, credit spreads are cyclical. For that reason, we have tightened the links of our credit spread expectations to the economic cycle. We also believe it makes more sense to take a view on a risk premium in credit as with equity, tying it back to our interest rate expectations.

Interest rates: We map out the evolution of entire government yield curves between the short-term to a long-run equilibrium based on two key elements: the future short rate and term premia – the extra risk premia investors typically require to hold long-term bonds. These views are forward-looking; they are a blend of forward market pricing, long-run trends of economic growth and inflation shaping neutral rates, and our view of structural drivers of rates, such as global savings and demand for perceived safe assets. We construct yield curves using principal component analysis – a statistical means of determining the key underlying drivers.

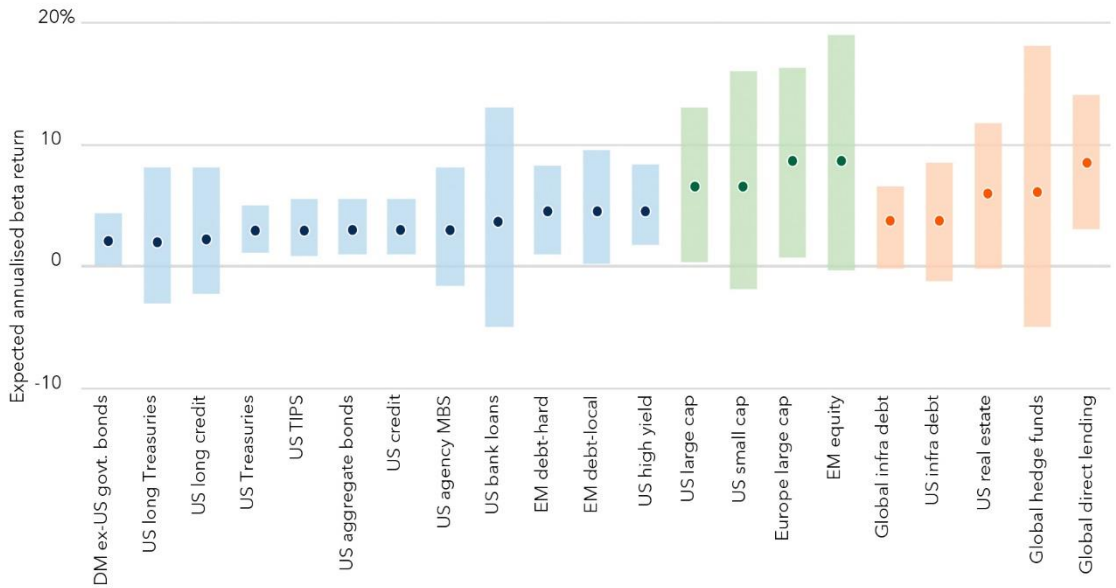
Private markets: Traditional approaches to estimating returns are not suitable or possible for private markets, largely due to data limitations. Even as private market investing has proliferated, return assumptions remain scant. We have built out our assumptions using external sources on deal-level and market-wide data. We believe our new approach to creating return assumptions is a step forward relative to traditional methods. We also account for fees, leverage and alpha generation. See the next page and appendix for details.

Style factors: We present a new addition to our CMAs: equity style factors – value, momentum, quality, size and min vol. Adding style factors to our CMA toolkit gives greater flexibility and granularity when designing equity allocations in the SAA. We put more weight on the time-varying, long-run mean of returns in our style factor assumptions because we determined it was more meaningful than valuations at longer horizons. We show an example of incorporating style factors on page nine and provide our factor definitions in the index.

How are these interconnected? Our view on structurally lower rates means our equity valuations are not as stretched as they might otherwise be, underpinning potential returns. Our private equity models use our macro views on GDP to imply future revenue growth while also taking advantage of our rate and credit spread expectations for views on what it means for leverage in the buyout space. These linkages allow us to simulate changes to the economy and see the effects. See our CMA website for details of our return assumptions.

Return assumptions and uncertainty

Our five year annualised US-dollar return assumptions and uncertainty bands across asset classes



This information is not intended as a recommendation to invest in any particular asset class or strategy or as a promise – or even an estimate - of future performance.
Sources: BlackRock Investment Institute , December 2018. Data as of 31 October 2018. Notes: We derive our return expectations from our CMAs. Return assumptions are total nominal returns. US dollar return expectations for all asset classes are shown in currency hedged terms for DM ex-US government bonds, global hedge funds and global large and small cap equities. Indices are for illustrative purposes only and do not represent any actual fund or strategy's performance. Indices are unmanaged. It is not possible to invest directly in an index. Referenced indices are listed in the appendix. The uncertainty bands represent the 25th and 75th percentiles of the potential return pathways generated by our stochastic simulation mentioned on page five.

Evolving our approach to private markets

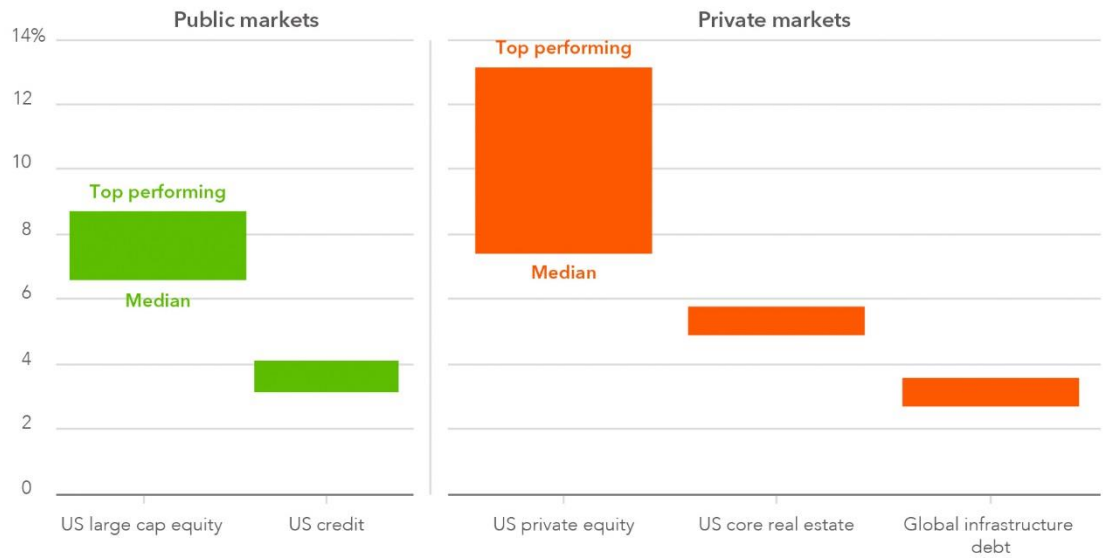
Building return expectations for private markets is difficult due to the dearth of information. Return and portfolio information is sparse and less standardised than the data from public markets. Such difficulties often result in simplistic return estimates: A typical industry approach is to apply static additions or subtractions to relevant public market return estimates to reflect the potential extra return (known as the private-public spread).

We believe our revised approach to return assumptions for private market returns marks a big step forward. We build from the latest academic research and tap the insights of BlackRock's private market specialists. We developed bottom-up return models for private equity buyout, core real estate and private credit markets that are driven by both public market risk factors and other metrics that can be empirically observed within private markets, such as occupancy rates in real estate. We believe such a bottom-up approach allows us to model an income statement for private equity buyout and real estate, making our return assumptions transparent and forward-looking rather than simply extrapolated from historic returns. By building return estimates directly from private market data, we can more meaningfully capture the spread between private and public market returns through our calculations rather than assuming it. Our new CMAs find higher potential returns across private markets, and as a result we have higher allocations in our unconstrained allocations than in our legacy framework.

This is still not enough, in our view. What does a return estimate for a "typical" private markets investment even mean? For public markets, the concept of a "typical" investment is clear because there are benchmark indices. In our CMAs, we assume investors access the index return (beta) through an index fund. If they opt for an alpha-seeking fund, they may achieve extra returns relative to an index (alpha). Private markets are different. There are either no indices or they are uninvestable, in our view. The market cannot yet be accessed via index funds. While "alpha" might not be the appropriate terminology given the lack of sufficient private market indices or benchmarks, the potential performance difference between good and average managers cannot be ignored. We believe this is a key factor in setting the appropriate allocation to private markets. We find US private equity offers greater return potential among top-performing managers relative to large cap equity – but the range of potential returns relative to the median manager shows there is also room to underperform. See the *Alpha expectations* chart below. We will publish more research on the role of private markets in portfolios in coming months.

Alpha expectations

Assumed returns including alpha by top-performing managers in public and private markets



This information is not intended as a recommendation to invest in any particular asset class or strategy or as a promise – or even an estimate - of future performance.
Sources: BlackRock Investment Institute, Morningstar and Preqin. December 2018. Data as of 31 October 2018. Notes: We apply our alpha estimates, based on the historical performance of top-quartile managers, to our return assumptions to arrive at the expected returns for top-performing managers. For assessing the top-quartile of manager performance in public markets, we looked at a sample of about 4,500 managers in the Morningstar database between 1997 and 2017. For public market fees, we use the Mercer Global Asset Manager Fee Survey 2017 described in the chart on the next page. For private markets, we use Preqin data of about 900 managers over a 30-year period to 2018. We look at returns net of fees. The range between median and top performance for global infrastructure debt is assumed the same as for US credit due to the lack of comparable data. For private market costs, we assume that fees on average can range from about 50 basis points for global infrastructure debt to 500 basis points for private equity buyout – these are the figures implicit in the median above. For all investors, fees can vary based on the size of investments and other factors. See the appendix for details.

Including style factor returns

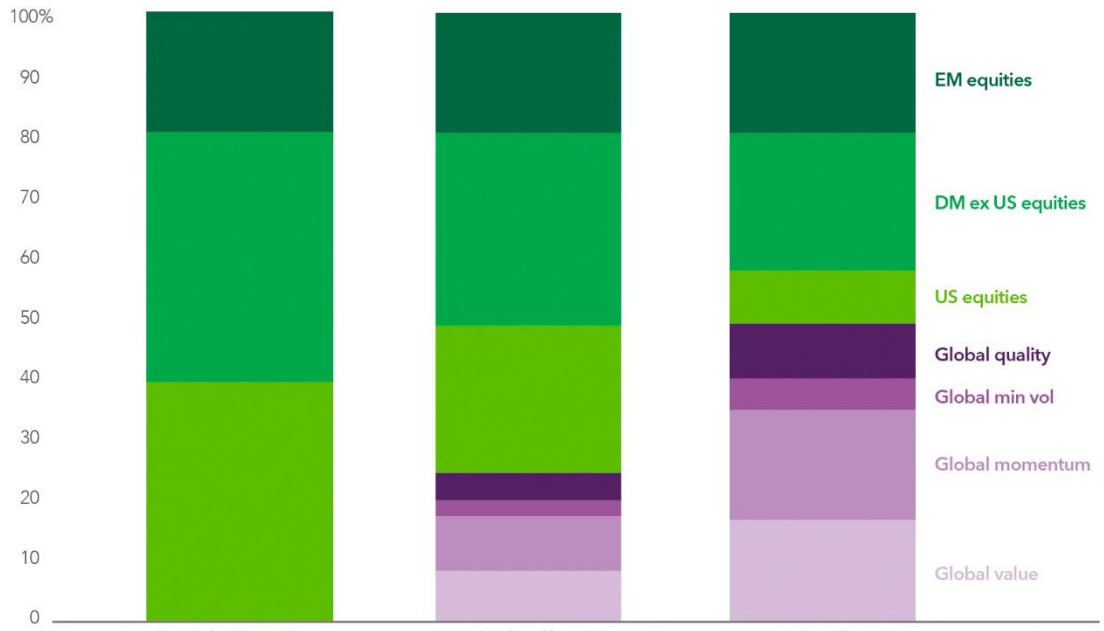
We believe investors need more than just asset class return assumptions to build resilient portfolios. The widespread adoption of factors has made them an essential component for designing the SAA. Exposure to factors can offer returns that straddle asset class boundaries and both indexing and alpha-seeking strategies. Factors are the broad, persistent drivers of returns that can be captured in a systematic and cost-efficient manner through indexing or factor strategies. Factors clearly need to be integrated into any investment framework, in our view. See our July 2018 paper *Blending alpha-seeking, factor and indexing strategies: a new framework*.

We differentiate macro factors – the drivers of returns across asset classes – from style factors, which explain returns within asset classes. Macro factors can often be captured by slow-moving, broad indices. Macro factor views are embedded in our long-term allocations. But to capture style factor returns, investors usually need to hold more dynamic portfolios. We use BlackRock's style factors defined in the paper above: value, carry, size, momentum, min vol and quality. We have expanded our CMAs to include return expectations for equity style factors, enabling investors to build them into the SAA. Our assumptions reflect our finding that the premium of style factors has changed over time, such as with the erosion of the value factor's premium since the late 1990s, but that we do not expect a further decline in that premium. Some investors may take a different view and allocate less of their risk budget towards style factors. We plan more work to build out the economic and behavioural drivers of style factors.

This illustrates that there is no one-size-fits-all answer to these portfolio construction questions: the answers will depend on an investor's objectives and constraints. Different investors will also target different mixes of beta, style factor and alpha returns. Our CMAs reflect this and can accommodate explicit allocations to style factors as a way of spending the equity risk budget – improving potential returns for a limited increase in active risk, or volatility, relative to the original equity allocation. The *Making the most of style factors* chart shows the return impact we would expect from tilting a portion of our 10-year equity allocation towards style factors while maintaining the original equity beta stance. A view on style factors can result in a material changes to the equity allocation.

Making the most of style factors

Expected 10-year annualised returns from hypothetical equity allocations to style factors



	Initial allocation	25% style allocation	50% style allocation
Expected return	6.7%	6.83%	6.96%
Active risk	-	0.14%	0.28%

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Sources: BlackRock Investment Institute, December 2018. Data as of 31 October 2018. Notes: We show how different allocations to style factors change the return profile of the 30% equity portion of our hypothetical allocation. This allocation – and subsequent allocations – are optimised by maximising returns based on the below-median outcomes in the potential return pathways discussed earlier. The returns have been reduced to reflect fees that large investors typically pay. Fee data is from the Mercer Global Asset Manager Fee Survey 2017. Large investor fees used here and on pages 10 and 11 are based on investments of $500 million in the Mercer survey. The assumed fees range from 4-6 basis points for fixed income and DM equities to 75 basis points for EM equities. Different fees will have different results on performance. Indices are listed in the appendix. Style factors are hypothetical and are not investable portfolios. Style factors are proprietary to BlackRock and the definition of each style factor may differ from other firms.

A new framework

We can now pull together the different components of our framework. See the *Our framework in action* graphic below. The first building block: we generate CMAs using new asset return models. These models are interconnected due to their shared linkages between economic and asset behaviour, providing a consistent basis for portfolio construction. Yet strategic asset allocation is about more than just central return assumptions. The portfolio construction process should consider not just return variability around a median expectation but the uncertainty inherent in return estimates. The second building block: we have developed a method of producing potential return pathways around our mean return assumptions. This gives investors tools for assessing how their portfolios might perform in multiple situations, not just a central base case.

The final building block: we can take into account different degrees of risk aversion specific to each investor. We advocate a robust optimisation process because it explicitly accounts for the uncertainty in our return assumptions. The resulting portfolio is less sensitive to changes in central return assumptions: modest changes over time lead to modest changes in the portfolio rather than large switches between related assets. We believe certain investors care more about fortifying portfolios against potential losses, and we provide a process for doing so. Yet there is an explicit trade-off in making such decisions: a more risk-averse investor will give up more in potential returns

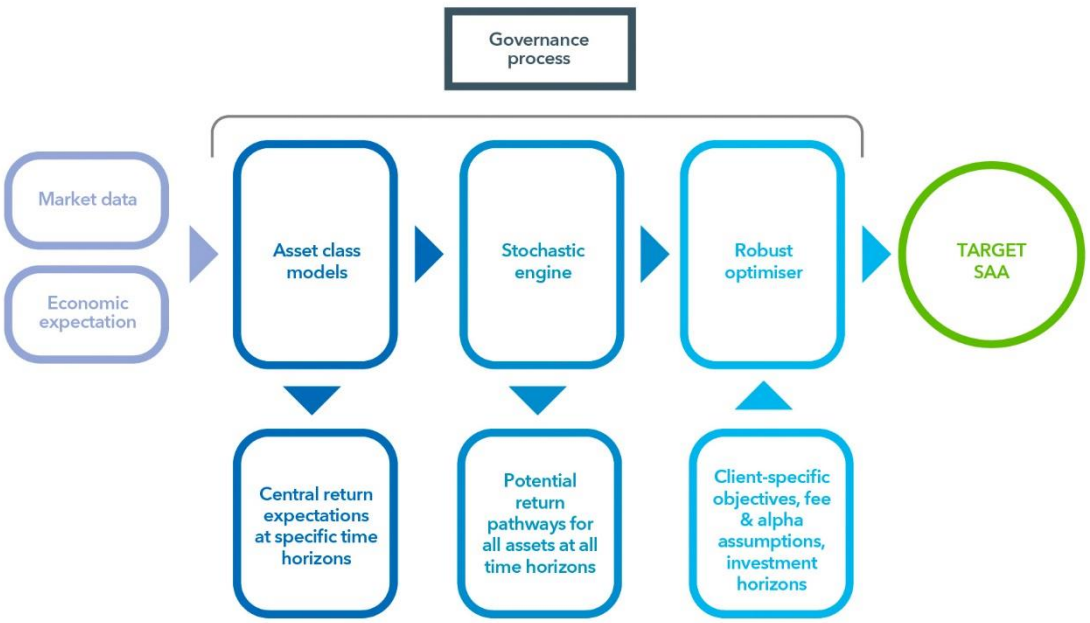
Our framework in action below summarises the steps in this process. This also highlights a few important aspects:

- **Bespoke design:** Every investor is different and has specific needs: regulatory constraints, time horizons, cash flow needs, the ability to access particular markets or product types, governance capacity and fee levels. These considerations – and many more – will guide investors towards different portfolios that may be better suited to their unique needs. Determining an objective function – how to maximise some measure of returns relative to risk – is a critical step. This helps investors determine how to trade off these needs against each other and help pilot a portfolio through an uncertain future.
- **Governance:** There is an overarching governance process at BlackRock that ensures that the inputs and outputs from each stage of our capital market assumptions receive appropriate scrutiny. We draw on portfolio construction experts across BlackRock to oversee and continually enhance the modelling of hypothetical economic and market outcomes. Client-level experts help ensure that the outputs from the process are appropriate for the multi-faceted constraints and requirements that investors face in their different contexts.

Following these steps leads to the target SAA – and in our case the strategic asset allocations. We provide examples over the next few pages. From this point, investors should still consider how best to achieve this SAA using alpha-seeking, factor and indexing strategies as laid out in our previously mentioned paper.

Our framework in action

BlackRock's portfolio construction design phase with our toolkit



Sources: BlackRock Investment Institute, December 2018. Notes: This graphic is for illustrative purposes only and subject to change without notice.

Time horizons matter

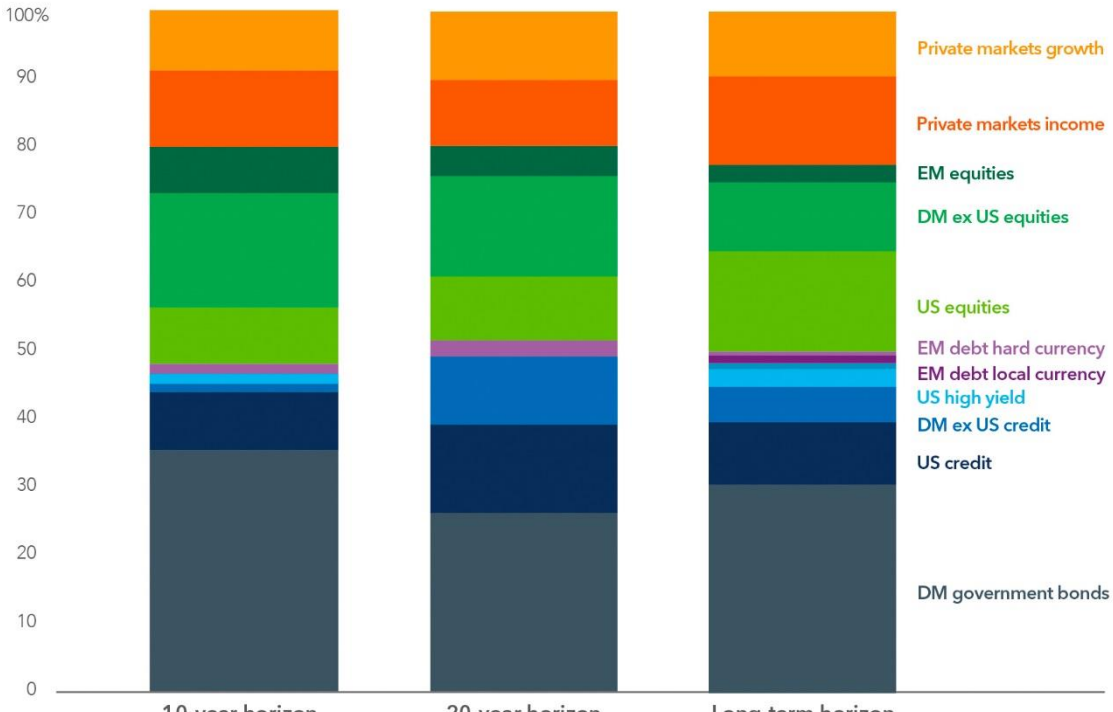
Our new CMAs give a view of returns over an entire horizon – a term structure. We show returns from five years and beyond. Such a detailed view of potential returns over time allows investors to think about the future in a more realistic way that could not be achieved with a few point estimates. Investors can tailor their asset allocations and see how different scenarios affect specific points in time when cash flow considerations, such as redemptions or liability payments, may be paramount. If an investor has specific needs at a seven- or 15-year horizon, those can now be accommodated. An investor can then easily visualize the different paths a portfolio's returns might take along the way to these points – especially downside scenarios – by using our potential return pathways.

Why does this matter? Investors with different time horizons for maximising returns relative to risk can end up with different portfolios. See the chart below. Multi-asset portfolios with similar risk and volatility objectives can look very different when assessed on 10- or 20-year horizons. Equities play a greater role in the long-term allocation – effectively the portfolio leans towards a broader array of macro factors for the same targeted return and expected volatility. We present here our strategic allocations on these horizons. The long-term equilibrium allocation is our benchmark against which our strategic preferences – as presented earlier – are determined. We can build portfolios purely based on our long-term views, yet we can also adapt them to any investment horizon. Allocations will change more at shorter horizons than longer ones as market conditions change.

These portfolios incorporate a greater aversion to downside risk by having been optimised on the potential return pathways below the median outcome. The bottom-half outcomes figures below show how those returns compare to the annualised expected return based on all outcomes from our return pathways. We explain how to assess recession and downside risks in more detail on the next page.

How multi-asset portfolios differ at different snapshots

Annualised return profiles of our hypothetical 10–, 20-year and long-term allocations, December 2018



	10-year horizon	20-year horizon	Long-term horizon
Expected return	6.4%	6.7%	6.8%
Return - bottom half outcomes	2.1%	2.3%	3.3%

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BlackRock Investment Institute, December 2018. Data as of 31 October 2018. Notes: This chart shows the annualised expected return and the expected return in the bottom half of outcomes (below-median) our potential return pathways for our hypothetical allocations at different time horizons. In all our allocations, DM government bonds, DM ex-US credit and DM ex-US equities are currency hedged. EM equity and private markets are not currency hedged. Private markets growth combines private equity, hedge funds and infrastructure equity. Fees are incorporated as described on page 8 and 9, and expected returns net of fees are used in the portfolio optimisation process. Indices are listed in the index. It is not possible to invest in an index.

Dealing with recession risk

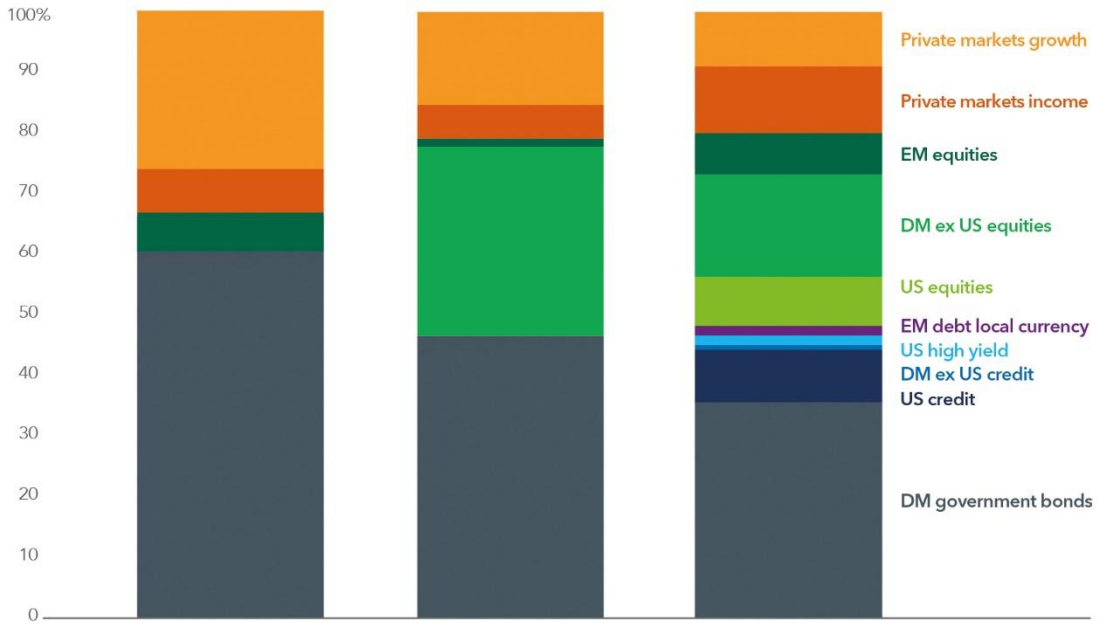
Our framework allows us to consider how an investor might construct a portfolio differently based on views of the economic cycle. If the investor sees a higher recession risk in the next few years, we can pick a subset of the potential return pathways that reflect this view. We can then optimise over this subset of pathways and see how allocations shift. Classic optimisation methods assume no uncertainty in expected returns, trading off that expected return with the volatility of actual returns. The only way to express a view of heightened recession risk is to trim the expected return. Yet expected returns are not enough, in our view: average numbers cannot inform portfolio decisions on binary risks such as recessions that can result in starkly different outcomes relative to an "average". A simulation-based framework and optimisation process offers many more choices.

The *Bracing for a bear market* chart compares the approach of different investors to the risk of a negative market shock. On the left we have an extremely risk averse investor – the "bear-scenario obsessed" – who is certain that a sharp risk asset selloff is looming. The result? A portfolio heavily concentrated in government bonds (grey) and private markets (orange). This portfolio performs the best in our bear market scenario and does well in the median outcome of our return pathways – that is, where the portfolio stands at the end of year 10. Yet it does the worst in the bottom-half outcomes situation – where expected returns are somewhere below the median but not as bad as this investor feared. The "close your eyes" investor has no conviction on calling a bear market: this portfolio does best in the central outcome – exactly what it has been optimised for. But this portfolio is also not very diverse: while the overall expected return looks better, its bottom-half of expected return outcomes is also low. This is a portfolio that also may not fare well if the future is only slightly worse than a median outcome.

The "downside-aware" portfolio shows the risk/return trade-off in action: an expected return that is slightly below the "close your eyes" portfolio yet with a higher bottom-half outcomes return, even with a lower bear market return. This shows the diversification benefits of incorporating uncertainty and building portfolios in a robust way.

Bracing for a bear market

Annualised returns of hypothetical 10-year portfolios under a downside scenario, December 2018



Expected return	Bear-scenario obsessed	Close your eyes	Downside-aware
All scenarios	6.6%	7.1%	6.6%
Bottom half outcomes	-1.4%	0.9%	2.2%
Bear market outcomes	5.2%	4.9%	4.6%

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

Sources: BlackRock Investment Institute, December 2018. Data from end-October 2018. The bars show the expected returns under a hypothetical bear market scenario within three-five years. The "bear-scenario obsessed" shows the allocation of an investor assuming a market drawdown is certain. The "close your eyes" is the allocation who takes no view on uncertainty. The "downside-aware" shows the allocation of an investor who wants to optimise returns in return for some reduced risk from a potential drawdown. The bear market outcome returns are based on a subset of pathways that experienced peak-to-trough market drawdowns that were similar to the average of the 1991 and 1987 drawdowns. We exclude 2008 due to the severity of the recession and equity market drawdown and 2001 because it was an equity-specific event. Fees are incorporated as described on pages 8 and 9. Indices are listed in the index. It is not possible to invest in an index.

Pulling it all together

We now apply this framework to generate our strategic asset allocation tilts on a 10-year horizon relative to the long-term equilibrium. The chart below summarises our current tilts. This is based on an unconstrained US dollar-portfolio with a long-only bias.

On equities, we currently prefer EM over DM given stronger expected earnings growth and better starting valuations. We also prefer DM equities outside the US relative to the US – also a valuations story. Within fixed income, we prefer DM government bonds over credit, reflecting the view that the diversification benefits of government debt are preferable – in an overall portfolio context – to the marginally higher returns from the credit assets. Even with the occasional, short-term breakdown in that negative correlation (equities up and bonds down), we expect the correlation to hold over a strategic time horizon.

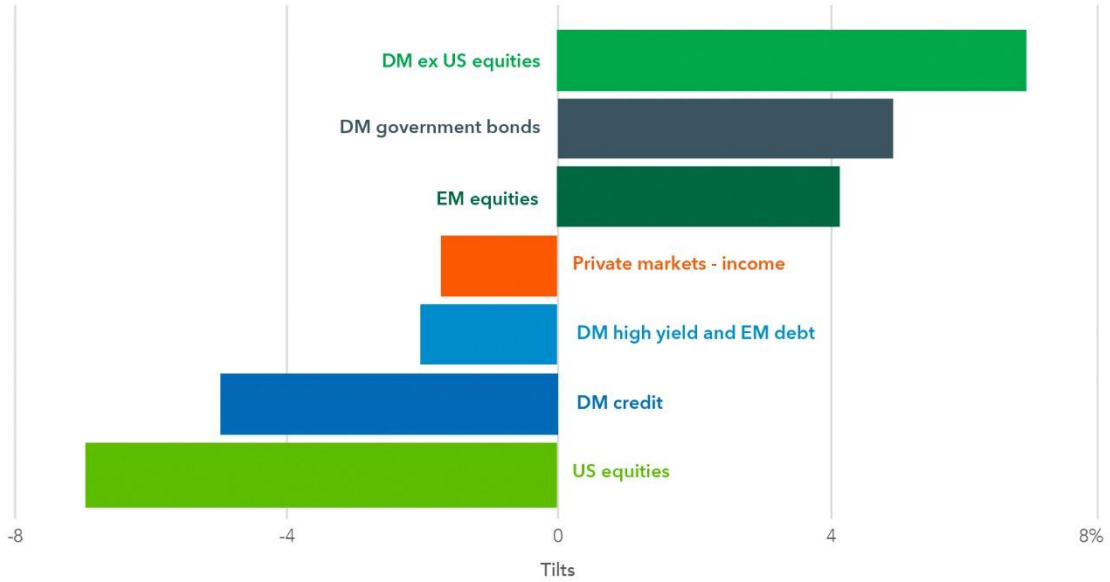
On private markets, we are modestly underweight private market income assets. Yet our overall strategic allocation to private markets is higher than in our previous allocations, reflecting the better risk/reward potential relative to some public market assets, especially credit. We believe private markets can offer greater potential alpha reward available if investors can select good managers. We use the principles underpinning our alpha, factors and indexing framework to help identify allocations to private equity where we see the most evidence of systematically higher alpha potential relative to public market equivalents if good managers are chosen. The strategic tilt to private market growth assets is broadly neutral.

These strategic horizon, multi-year views need not chime directly with our tactical views on horizons less than a year. Our negative strategic view on US equities is balanced against a tactical overweight to this asset class based on the near-term growth and earnings outlook (as of end-October). The reverse is true for European equities. This reflects the relative importance of underlying return drivers at different time horizons. Shorter-term factors – such as sentiment and momentum (currently positive for US stocks and negative for European) – and the prevailing political climate can be significant for a near term return returns outlook. Yet these are not necessarily systemic drivers of longer-term returns where more fundamental factors – interest rates, structural growth trends -- predominate.

How to combine these views? This depends partly on the conviction an investor holds in each. But as outlined in our alpha, factors and indexing framework from July 2018, a more systematic approach is possible. We believe tactical asset allocation is a key source of alpha potential and can be blended with strategic tilts, indexing and factor strategies in a consistent manner.

How our asset allocation views tilt

Our strategic 10-year asset allocation preferences, December 2018



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

Sources: BlackRock Investment Institute, December 2018. Data as of 31 October 2018. Notes: These allocations represent unconstrained, long-only views and will be spelled out in the paper. Our long-term equilibrium is a hypothetical steady state economy – one represented by the mean value over multiple economic cycles and decades. Private markets income combines core real estate, real estate mezzanine debt, direct lending and infrastructure debt. Some individual asset classes are combined above. Equity indices are large cap unless otherwise noted. Indices are listed in the appendix. It is not possible to invest directly in an index.

Appendix and references

Methodology

Uncertainty and optimisation: Expected returns and asset price volatility are difficult to predict. We believe any technique that builds portfolios should incorporate this inherent uncertainty (Ceria et al. 2006). We consider both long- and short-term drivers of return. In the long run, we expect a relatively small number of macroeconomic drivers – economic growth, rates, inflation, credit and currencies – to determine an asset's returns. In the short-run, other factors can overpower the structural drivers causing wider fluctuations from an asset's fair value. Valuations can be helpful in estimating short-term returns. We combine contributions from the long- and short-term return drivers to produce a final set of return expectations with a range of uncertainty around each.

The next step is to use this set of return expectations in an optimisation engine that seeks out the best return without breaching an investors' risk limit. Mean variance optimisation would produce a portfolio that maximises expected return under one base scenario with a given level of risk. In contrast, we look to build a "least-worst" portfolio – one that maximises returns for an investors' target risk levels across the worst outcomes, say for the bottom 50% of the distribution, from a set of stochastically generated scenarios (cf. Tütüncü et al. 2004 and Garlappi et al. 2006). This helps ensure the portfolio is not overly reliant on just the median return. This process seeks to produce a portfolio that is robust to small changes in the central return estimates (Scherer, 2006).

Stochastic engine: We use Monte Carlo simulation to create random distributions informed by historical return distributions and centred on our expected returns. The engine simulates thousands of return pathways for each asset, representing the range of possible outcomes over a five- to 20-year time horizon. We leverage BlackRock's risk models to help ensure that assets generate similar returns, to the extent that they have common drivers . The range of scenarios incorporate our work on incorporating uncertainty in return expectations. We use an extension of the Black-Litterman model (1990) – a well-known model for portfolio allocation that combines equilibrium returns and medium-term views in a single-period setting. Our model uses a Kalman filter (1960) – an algorithm that extracts insights about return paths by bringing together a number of uncertain inputs - to extend Black-Litterman into a multi-period setting. This allows us to capture the variation of expected returns over time under various scenarios – from economy-related to market sentiment driven. A large part of these variations is not predictable. Constructing portfolios that are robust to, or can exploit, these variations is a major challenge for investors. The ability to calibrate the engine with asset class views with uncertainty at arbitrary time horizons, and to evolve this uncertainty stochastically, drives the dispersion of return outcomes. Highlighting the uncertainty that investors face when building portfolios helps ensure ostensibly precise return expectations do not lead investors to concentrated portfolios.

Simulated return paths support a broader range of applications, such as asset-liability modelling. We believe stochastically generated return scenarios enable investors to move with ease beyond mean-variance and optimise portfolios against their individual needs. Investors can place more emphasis on the tails of the distribution or focus on the path of returns rather than just the total return. They can incorporate flows in or out of the portfolio over the course of the investor's time horizon or place more emphasis on scenarios that are challenging for the investor's business beyond their portfolio. Investors with complex asset-liability matching requirements, such as insurers, typically rely on stochastic simulations of returns to assess and construct portfolios.

Interest Rates: Our model provides a way to chart the yield curve at multiple time horizons in the future. We base this on our estimates of: (1) the short rate and (2) model implied term premia. We base our estimates of short rates on market data in the near term and on macro-informed data in the long term. We assume investors' views about long run inflation and real growth, coupled with changing preferences as to savings and risk aversion, will ultimately determine their expectations for short rates (the "long run short rate"). We use an affine term structure model - a type of model that assumes bond yields as a linear function of a small set of parameters (Piazzesi, 2010) – to compute model-implied term premia. In our implementation, we represent the yield curve using the first five principal components of yield, as laid out by Adrian et al. (2013). We then blend the model implied term premia from the affine term structure model with market implied term premia, with the relative weights dependent on the relevant time horizon.

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Equities: Expectations of cash flows and discount rates can help explain the variability in equity returns as shown by Campbell (1990). We have used this insight to develop a discounted cash flow (DCF) model, with a few key innovative features. Most academic research focuses on the question of whether stock returns are predictable at all. We are concerned with making the best estimates that we can. We make two additional contributions. First, the baseline DCF model estimates earnings by leveraging analyst earnings estimates in the near term as discussed by Li et al (2013) to derive the implied cost of capital. The common assumption in implied cost of capital (ICC) studies is that earnings growth implied by analyst earnings estimates in the near term should trend towards GDP growth in the long-term. This can introduce an unintended assumption of continued expansion of profit margins. We have introduced a modification to account for late economic cycle dynamics. We allow for corporate profit margins to revert to trend (the median over a rolling 10-year history) as margins typically peak late-cycle. The standard ICC approach typically tests for equity returns using linear regression tests. For our DCF model, we take the desired time horizon as an input (number of years) and we estimate the appropriate discount rate for the specific time horizon using our aggregate implied cost of capital. This way, we account for both key sources of variability in equity returns, namely changes in cash flows and changes in the discount rate.

Credit: Our model for credit asset (excess) returns is anchored on two key elements: 1) our estimate of credit spread at a given horizon and 2) our estimated loss due to defaults and downgrades over the horizon. The first component is projected in a consistent manner with our view of real GDP growth and the link between credit spreads and equity volatility. Our approach helps explain the behaviour of credit spreads using a limited number of predictive variables. Yet, as validated by tests against more complex methods, it retains the ability to help explain a high proportion of the variance in credit spreads. The second component is estimated based on our outlook for spreads, the duration of the asset and an assumed transition matrix which captures migrations and defaults across multiple credit cycles. We currently base our transition matrix on Moody's long-run transition data. We aim to further develop our model by directly modelling transitions based on macroeconomic conditions in order to better capture cycle dynamics and the respective variation in losses due to credit events. In addition to making our estimates of credit spreads consistent with our macroeconomic views, our new credit (excess) return model allows greater flexibility of calibrating our expected returns to different credit rating compositions which may prevail over the entire time horizon.

Private Markets: The private market return models can be grouped into two categories – equity and debt. The equity models – relevant for core real estate and private equity buyouts – are based on an accounting statement framework. We estimate earnings growth and future valuations of underlying assets, which are used in conjunction with observable market data (current valuations, financing cost, leverage, etc.) to model the evolution of the capital structure over time and infer equity returns. Estimated earnings growth and future valuations are linked to components of our public market return expectations for equity, rates, and credit spreads. Crucially, they also consider the unique dynamics of each asset class, such as the changing occupancy rates for real estate. Returns for private market debt – infrastructure debt and direct lending – are estimated using a build-up approach. The total return is a build-up of underlying public market returns (risk-free rates, corporate credit spreads) and private-market specific return drivers such as the public-private spread, losses due to default and downgrades, leverage and borrowing costs. Unlike most public debt markets, infrastructure debt and direct lending are modelled as buy-and-hold investments, in line with how investors access these asset classes. External data sources include S&P Capital IQ for deals and Preqin and S&P Capital IQ for market-wide and aggregate data.

Accounting for fees in private equity can be challenging, partly due to a wide variety of clauses that allow funds to adjust fees over time and the variety of fees involved (management, carried interest, fund expenses, transaction costs) (Phalippou, 2018). We use the academic literature and professional surveys that have started to track the limited partnership agreements (LPAs) of private equity funds. We use Preqin data on deal cash flows to and from funds to simulate the fees charged by typical LPAs. We add fee estimates to this cash flow data to calculate our data on gross-of-fees returns. The average fee estimates are in line with the most recent academic research on this topic (Doskeland and Stromberg, 2018).

BlackRock's definitions of macro and style factors

Source: BlackRock Investment Institute, December 2018. Notes: This graphic shows BlackRock's definitions of macro and style factors. It is for illustrative purposes only.

Indices

Broad market:

US cash = Citigroup 3-Month Treasury Bill Index
US credit = Bloomberg Barclays U.S. Credit Index
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 long credit = Bloomberg Barclays U.S. Long Credit Index
US high yield = Bloomberg Barclays U.S. High Yield Index
US bank loans = S&P/LSTA Leveraged Loan Index
US agency MBS = Bloomberg Barclays US MBS 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
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

Equity style:

Global momentum = MSCI ACWI Momentum Index
Global min vol = MSCI ACWI Minimum Volatility Index
Global quality = MSCI ACWI Quality Index
Global value = MSCI World Enhanced Value Index

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