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BlackRock. Building Better Portfolios

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Building a house requires a clear process allowing you to build a strong **foundation**, **partner** with the best providers and **budget** accordingly.

Portfolio construction is no different . . .

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Macro trends, industry trends and investor demands are re-shaping portfolio construction



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Follow a thoughtful, well-documented process for portfolio construction

01	Benchmark Translating investor outcomes	Set the foundation of the portfolio – aligned closely with the client objective
02	Budget Evaluating risks and opportunities	Decide where you want to incur costs and take risk
03	Invest Identifying cost-effective and efficient holdings	Determine the most appropriate vehicles to implement your strategy
04	Monitor Keeping a "hand on the wheel"	Regularly measure success and rebalance with discipline

Demystifying "Factors"

Risk Factors as the driver of risk and return

Risk Factors: The Building Blocks of Risk and Return



*Percent Daily Values are based on a 2,000 calorie diet. Source: BlackRock, 12/2016. For illustrative purposes only.

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Risk drives returns over the long term

Macro Risks

- Economic
- Credit
- Inflation
- Real Rates
- Liquidity
- Emerging Markets

Style Risks

- Value
- Momentum
- Quality
- Size
- Low Volatility
- Carry
- Curve

Active Risks

Security selection

- Country and industry selection
- Market and factor timing

Portfolio Returns

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What is a Risk Factor?

A risk factor is a measurable characteristic or element that can help explain the risk and return behavior of investments

	Equity	Fixed Income	Alternative	Foreign Exchange	Other
Risk Factor Categories	 Market Country Sector Style Specific 	 Rates Spreads			

Risk Factor	Consumer	Italian 10Y spread	Merger Arbitrage	EUR/USD	Implied Volatility
	Size	USD 5Y Treasury Rate	Wheat	Etc	Etc
	Momentum	High Yield Corp Spread	Gold		
	Etc	3m LIBOR Spread	Etc		
		Etc			
Source: BlackRock. For illustrative purposes only.					

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Why focus on risk?



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The Equity Factor Model: An Example – Apple

Common Factor Risk

Observable characteristics based on industry, accounting, fundamental or price metrics

- Technology / Computers & peripherals
- Large Cap
- High Profitability

Specific Risk

Idiosyncratic events unrelated to markets or other companies (news, management, M&A activities)

- Death of Steve Jobs
- EU ruling on €14bn tax deal
- Popularity of new iPhone

Country Risk/Currency Risk

Stocks incur risks related to their base country and are subject to currency fluctuations when traded outside their base currency.

- US Country Risk for a global fund manger
- USD/AUD Currency Risk for an Aussie investor

Example shown for illustrative purposes only and show not be construed as a recommendation of any security.

Market Risk

Stocks incur broad global equity market beta exposure, systematic risk

• Apple is an equity and has market risk exposure

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Let's take Apple as an example

Risk factors can be thought of as building blocks to deconstruct risk into components. When the risk of the factors are combined, they can be additive or offset each other.



AAPL - Risk Factor Decomposition



Source: BlackRock, 31/07/2019. Risk Factor Decomposition from proprietary Aladdin model. Example for illustrative purposes only and should not be construed as a recommendation of any security. In order to calculate the ex-ante risk, the Aladdin portfolio risk model uses over 2,200 distinct risk factors across equity, fixed income, currencies and alternative investments. A risk factor is defined as a measurable characteristic of a security or asset that can influence the risk/return behavior of that security / asset. Risk factors can be fundamental characteristics such as financial ratios, technical analysis attributes such as price behavior or liquidity, and / or specific attributes of a given security / asset such as yield, geographic domicile and currency exposure. The Aladdin portfolio risk model is a proprietary multi-factor model which can be applied across multiple asset classes to analyze the impact of different characteristics of securities on their behaviors in the marketplace. In analyzing risk factors, the Aladdin portfolio risk model attempts to capture and monitor these attributes that can influence the risk / return behavior of a particular security / asset.

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Uncertainty is the only certainty

Benchmark: Incorporating Uncertainty in to Capital Market Assumptions

Asset Allocation can account for >90% of portfolio risk



0.2% Mean active return, after cost, over benchmark *

50% Of variation in active return is attributable to factors *

SOURCE: * A REVIEW OF NORGES BANK'S ACTIVE MANAGEMENT OF THE GOVERNMENT PENSION FUND GLOBAL. MAGNUS DAHLQUIST, BERNT ARNE ØDEGAARD, 5 JANUARY 2018.

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We employ capital market assumptions which incorporate uncertainty



Our five year annualized AUD return assumptions and uncertainty bands across asset classes

Source: BlackRock Investment Institute, April 2019. Data as of 28 February, 2019. 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, hedge funds, and global ex-US large cap equities. Our CMAs generate market, or beta, geometric return expectations. Asset return expectations are gross of fees. For representative indices used, see Appendix. 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. The bands around our mean return expectation are based on the 25th and 75th percentile of expected return outcomes - the interguartile range. 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.

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The optimization process allows for investors to focus on their areas of greatest concern

A given asset allocation has:

- An expected return, which is uncertain; and
- An expected volatility

The simulated paths for this allocation have:

- Volatility along each path (similar to expected volatility)
- Median cumulative return (close to expected return)
- <u>Dispersion</u> of returns: Range of cumulative returns whose width is determined by the return uncertainty AND the return volatility

Robust optimization:

From the myriad of possible outcomes, investors can focus on a specific set most relevant to them. Investors worried about downside risk can select a subset of expected return below the median expectation. Among allocations with a given expected volatility, seek portfolio with highest average return in the selected set of outcomes. *Hypothetical illustration:* Median and other pathways for total returns of a hypothetical multi-asset allocation on 5 year to 20 year horizon



Source: BlackRock Investment Institute. For illustrative and discussion purposes only.

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Results of optimization based on relevant market outcomes



Hypothetical allocations, based on downside preferences

Depending on investor views, portfolios can be optimized with different subsets of the potential return pathways

- **Bear market focus:** Optimizes using scenarios where risk assets perform poorly, leading to an allocation that is primarily fixed income. *Performs best in a bear market only.*
- **Central path:** Investor has no conviction in calling a bear market so they optimize using the central path. *The expected return is high, but the return in the bottom half of outcomes is low.*
- **Downside aware:** Maximizes the expected return in the bottom half of outcomes. The expected return is slightly below "close your eyes", but it is *expected to perform better* across a range of downside outcomes

Note: 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 "central path" is the allocation who takes no view on uncertainty. The "downside-aware" shows the allocation of an investor who wants to optimize 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 slide 11. Indices are listed in the appendix. It is not possible to invest in an index.

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It's not one or t'other – blending strategies

Budgeting & Investing: Index, Factor, Alpha

There is no such thing as a passive decision in investing



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Asset Allocation

Choice of asset mix

Dynamic Management

Reacting to macro events and adjusting long term views

Manager/Security Selection

Choosing the best funds for your objectives

Implementation

Implementing in the right way to solve for objectives



All are active decisions

Efficient, index based solutions help solve these

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An Alpha and Index Framework

1	 • Allocates risk efficiently – Uses all elements of the risk budget • Avoids drift – Sticks with objectives through time
2	 Know what you are buying – Focus on alpha, not active return See the full picture – Understand that "active in X, passive in Y" is too simplistic Time is money – Recognise finding alpha takes time, incurring governance costs
3	 Not "active vs passive" – A blend of return drivers What does it look like? No "one-size-fits-all" – different for every investor situation More efficient portfolios – A higher information ratio

The views expressed do not constitute investment or any other advice and are subject to change.

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Blend strategies by recognising different return sources

Return Drivers



1. Alpha can be generated by market timing using index products, such as ETFs.

Source: BlackRock Investment Institute as of July 2018

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We start with a Reference Portfolio

We take the following approach to develop the proposed strategic asset allocation portfolio:

- 1. Construct the Reference Portfolio using a two-asset model to define the overall risk appetite
- 2. After determining appropriate risk range, conduct a second optimization using a broader set of asset classes

Converting a Reference Portfolio to a Strategic Portfolio



Source: BlackRock. For illustrative purposes only

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We incorporate factor insights to determine our asset allocation and portfolio design



A factor lens brings additional insights into design

Diagnose portfolio risks and understand stress scenarios



Illustrative stress test analysis



Source: BlackRock. For illustrative purposes only. There is no guarantee that every solution managed will achieve the same level of diversification as shown above. Each solution's allocation strategies and targets depend on a variety of factors, including prevailing market conditions and investment availability. There is no guarantee that they will be achieved and any particular investment may not meet the target criteria. For illustrative purpose, given the limited information, we have conducted the analysis purely from the asset only perspective. With more information on the liability profile, we could also conduct similar analysis from the asset-liability matching perspective. See appendix for stress test scenario definitions.

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A combination of exposures lets you solve for risk, return and cost



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In a nutshell

To summarise:



- Follow a well documented process for portfolio construction
- Robust risk governance can help potentially lead to better outcomes
- Incorporate uncertainty in to capital market assumptions
- Consider portfolio implementation in the dimension of index, factor and alpha

Appendix

List of representative indexes

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

Broad market continued: 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

CMA Methodology

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.

CMA Methodology

Methodology

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.

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 terturns 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 tash 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.

CMA Methodology

Methodology

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 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 (Doskel and Stromberg, 2018).

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