Aligning Alternatives with Portfolio Objectives: A Framework for Integrated Portfolio Management

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Introduction

In the current low yield environment, investors are looking to improve returns while ensuring ample diversification across their portfolios. This dual focus, the quest for higher returns and true diversification makes alternative investments an attractive option for many.

The alternatives universe is a highly heterogeneous mix of asset classes. This is a function of the way in which the universe is defined; assets are typically labelled as 'alternative' based on the fact they are neither traditional publicly listed equities or fixed income investments, rather than their underlying characteristics and economic risk drivers, which are materially different for say private equity and infrastructure debt.

It is these underlying characteristics that are desirable, for their potential to diversify risk and enhance returns. However, they do not fit well within a traditional portfolio construction process. For instance, alternative investments may have a shorter history of returns or the availability of data may be more limited. Often this data tends to be stale and subject to smoothing. All these characteristics hamper modelling based on traditional asset allocation optimisation approaches.

We propose an asset allocation framework with a mix of quantitative and qualitative techniques to address these challenges. Our framework, summarised in Exhibit 1, outlines the steps that can be used to decide on an appropriate allocation to alternatives and identifies the differences and similarities between asset classes and their potential impact on a broader portfolio.

Our objective is to help investors assess the impact alternative investments will have on their portfolio and decide whether, on a risk adjusted basis, they significantly assist investors in meeting their specific objectives.

The power of our risk modelling approach lies in its ability to provide investors with a more complete picture of the risk exposures across

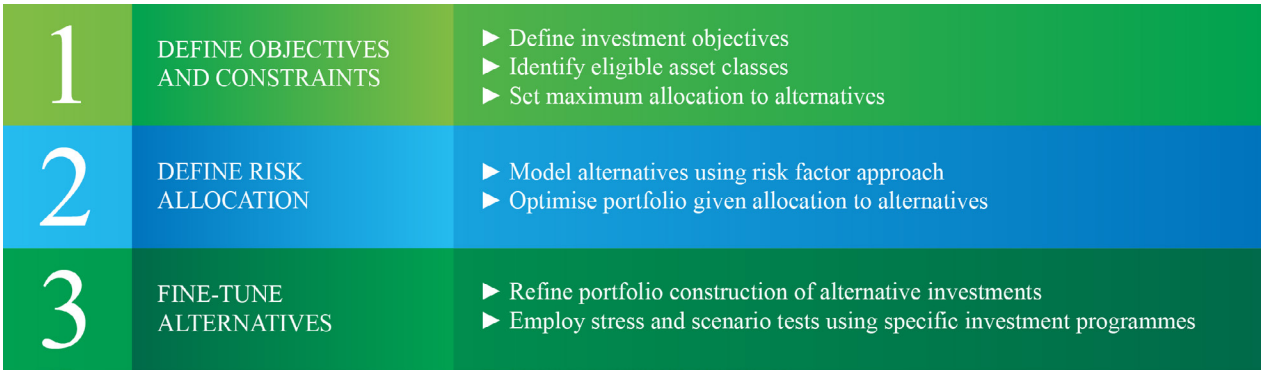

Exhibit 1:Framework For Incorporating Risk Modelling Into the Asset Allocation Process
Source: BlackRock, as of 31 December 2014

their portfolio containing both traditional and alternative assets. This can then be integrated with our scenario modelling so that adjustments to the liquid portion of the portfolio can be made in anticipation of large market events.

I. Define Objectives and Constraints

Step 1: Define Investment Objectives

The first step in incorporating alternative investments into the asset allocation process is to be clear about an investor's investment objectives. While alternative investments can add a variety of additional features to a portfolio, the attractiveness of a specific investment depends on what is desired from the alternative investment segment within a portfolio. The three primary objectives that investors are expecting to fulfill by allocating to alternatives are:

- **Return enhancement** - to what extent can they increase the portfolio's overall risk-adjusted return?
- **Risk diversification** - to what extent does an additional asset class help make a portfolio less dependent on the performance of just one or a few drivers?
- **Specific outcome focus** - to what extent can additional assets contribute to objectives other than risk or return, such as inflation hedging, liability matching and cashflow stability?

These objectives may not necessarily be of equal importance for every investor. This relative importance can be expressed in weights attached to these objectives, as in Exhibit 2 below. These weights are specific to the unique circumstances of an investor and the table is for illustrative purposes only.

Step 2: Identify Eligible Asset Classes

Having weighed their objectives, investors can then gauge how well each of the asset classes can fulfil these objectives and score each (between 1-5 with 1 being the least and 5 being the most attractive). Once the matrix has been completed, the scores can be aggregated for each asset class and used to rank the attractiveness of the various asset classes. The advantage of this scorecard is that it forces investors to apply a consistent framework to assess alternative investments and to exclude obviously unattractive asset classes before starting a more detailed analysis.

Another advantage of this approach is that it forces investors to formulate views and find evidence across several important dimensions, not just the obvious ones such as "commodities hedge against inflation." From Exhibit 2 the obvious conclusion would be to focus on the four asset classes that each scored 3.6, the highest number in the table. It is important to note that the

Illiquid		Return Enhancement	Risk Diversification	Outcome Focus	Score
Weighting		40%	40%	20%	
Real Estate Equity	Core	3	4	3	3.4
	Value-Add	4	4	2	3.6
Real Estate Debt		2	2	3	2.2
Private Equity	Buyout	4	4	2	3.6
	Venture Capital	5	2	1	3.0
Private Debt		3	3	3	3.0
Infrastructure Equity	Brownfield	3	4	4	3.6
	Greenfield	4	3	2	3.2
Infrastructure Debt		2	2	4	2.4
Hedge Funds	Relative Value	3	5	2	3.6
	Global Macro	3	4	2	3.2
Commodities		1	4	4	2.8

Exhibit 2: Illustrative Scorecard For Ranking Alternative Assets
Source: BlackRock, as of 31 December 2014
For illustrative purposes only.

weight placed on each of these three factors (return enhancement, risk diversification, and outcome focus) will vary for each investor. Furthermore, some investors may face additional regulatory requirements. For instance, European insurers may want to take into account Solvency II regulations when scoring the relative merits of assets. This may lead to certain types of assets being excluded from the outset. Thus, the total score will change based on a portfolio's objectives. It is worth stressing that the value of the table is not necessarily the scores but the way these scores are arrived at.

Step 3: Set Maximum Allocation to Illiquids

Having reduced the eligible investment universe to the key alternative asset classes that are likely to meet the investor's qualitative objectives, the next step is to understand investors' liquidity needs and how to incorporate these into the asset allocation framework. In this section we use private equity as the example asset class.

We define liquidity risk as the likelihood of a forced sale of illiquid assets due to insufficient capital available to make required payments from liquid assets. Liquidity risk increases in two ways: when it becomes challenging to find counterparties who are willing to buy the illiquid assets, requiring transactions to be completed at a discount to NAV (trading risk); and when drawdowns of committed capital impair a fund's ability to make liability payments or other spending requirements (funding risk).

Traditional asset allocation approaches do not account for the drawdown structure of many illiquid investments. Employing a stochastic modelling approach helps to incorporate the probabilistic nature of cash flow requirements and portfolio path dependency. Additionally, a static asset allocation is unlikely to be optimal given changing market dynamics and changing client needs.

The paper "Investing in Alternatives: Incorporating liquidity constraints into portfolio construction", published in June 2014, covers this topic in detail, but Exhibit 3 shows how including liquidity considerations changes the result of a traditional asset allocation approach.

It shows a representation of the efficient frontier, where for every level of risk, we calculate maximum expected return. The traditional approach, the blue solid line, does not allow for discounts applied to the value of illiquid investments in times of liquidity events nor does it account for the payout requirement of investors, for example, annual pension payments; our approach incorporates these constraints and consequently, the green line is always located below the blue solid line.

Another consequence of our modelling approach is that the allocations to illiquid assets in the higher risk/higher return areas of the efficient frontier tend to be lower. Since we assume private equity achieves a return premium compared to public equity, a lower allocation to this illiquid asset class will also lead to lower expected returns for the portfolio.

When factoring in liquidity considerations we apply a discount given that illiquid investments may have to be sold in times of distress. The size of the discount will vary depending on the availability and depth of secondary markets for each type of asset class.

The results are also dictated by the cashflow profile of the asset. To the extent cashflows are received early in the life of the alternative investment, the proposed allocation to alternatives will be greater than if the cashflows are skewed towards the late stages of the investment.

We can draw two principal conclusions from this analysis:

- As the annual spending requirement of an investor rises the optimal allocations to illiquid assets tends to fall. Therefore, incorporating probabilistic requirements into the asset allocation framework allows investors to better articulate their liabilities and plan their alternative investment allocations accordingly.
- For investors with low risk budgets the assumed timing of the distributions from their investments is an important variable. For investors with higher risk budgets, the size of the assumed return premium might be a more important factor to consider when deciding on their strategic allocation to illiquid alternative assets.

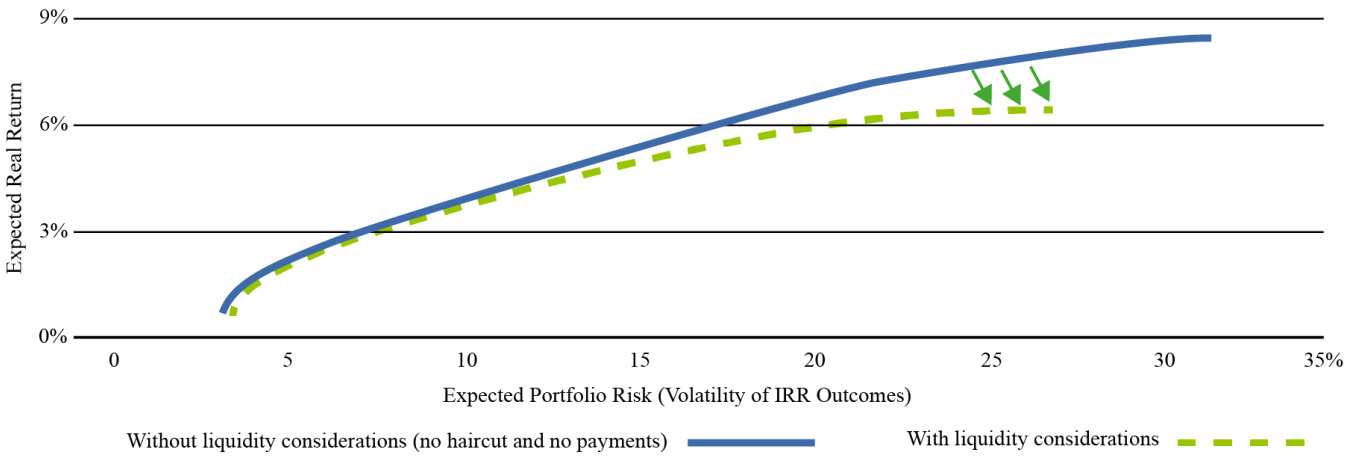

Exhibit 3: Efficient Frontier
Source: BlackRock, as of 31 December 2014
For illustrative purposes only

Risk Factors

	Equity	Rates (Govt bonds)	Spreads (Corporate)	Inflation	FX
Equity		-0.37	0.82	-0.16	-0.59
Rates			-0.41	0.87	0.17
Spread				-0.15	-0.60
Inflation					0.06
FX					

Asset Classes

	US Equity	EM Equity	Treasuries	Credit	High Yield
US Equity		.80	-0.22	0.51	0.70
EM Equity			-0.25	0.61	0.81
Treasuries				0.43	-0.17
Credit					0.66
High Yield					

Exhibit 4: Correlations Between Risk Factors and Asset Classes
Source: BlackRock, as of 31 December 2014
All correlations are based on 72 months of equally weighted data spanning from 31/12/2008 to 31/12/2014

II. Define Risk Allocation

Step 4: Model Alternatives With a Risk Factor Approach

Once we have arrived at an optimal allocation to alternatives that takes into account investors' objectives and their liquidity needs, we can then drill down into the allocations to various risk factors or economic drivers.

The use of risk factor investing has become more prominent as it enables investors to understand true sources of risk and return rather than relying on asset class diversification, which may not translate into risk factor diversification.

Exhibit 4 shows equity and corporate spreads to be highly correlated. This can be explained by the performance of both being reliant on the macroeconomic environment; when economic growth is strong equity prices tend to rise and credit defaults fall, at the same time interest rates often rise. This implies that a portfolio consisting of equity and spread dependent assets, such as high yield debt offers limited diversification. Decomposing asset classes into risk factors can help find and explain these underlying (though maybe hidden) relationships.

Using a risk factor approach during the portfolio construction process provides investors with a holistic view of ex-ante portfolio risk. While most sophisticated investors have adopted risk factor analysis with their traditional investment portfolios, many still struggle to apply this framework to the universe of alternative investments. This is because modelling alternatives provides several challenges, these include:

- **Imperfect information:** the availability of information from alternative investment managers varies considerably.
- **Attribution analysis:** internal rate of return (IRR) metrics are a money weighted approach while public equity returns are quoted using time weighted returns. Choosing an appropriate benchmark may also be an issue.
- **Return smoothing:** return and portfolio information is typically available on only a monthly or quarterly basis, while public markets price daily.
- **Unique factors:** traditional return and risk factors may not capture the attributes of an alternative asset class. For example adjustments related to financial leverage, biases in market capitalisation and industry exposure may be necessary to accurately capture private equity or hedge funds.

To counter these challenges, our approach focuses on economic risk, which seeks to provide a 'mark-to-market' view of the embedded economic risk in an investment, rather than accounting risk which is reflected in periodic valuations.

In addition, we aim to decompose the risks of alternatives into comparable public market exposures, while maintaining the unique characteristics of the alternative investment. From there, we map the granular risk factors into an integrated risk management system to understand how alternatives can complement a broader portfolio.

We now briefly discuss how we model some alternative investments in our approach:

Modelling Private Equity Funds

To account for the similarities and differences between private equity and public equity, we employ a comprehensive set of public equity risk factors where exposures to these factors are constructed to capture the attributes of private equity such as age-dependant leverage for buyout investments or capitalization risk for venture capital funds, as outlined in Exhibit 5.

Modelling Private Infrastructure Equity

We believe infrastructure can be modelled in the same way. Again our approach relies in part on the relationship with publicly traded factors after adjusting for the limitations of private infrastructure equity data. Similar to our private equity model, this model accounts for deal type, region, sector, project type and idiosyncratic risks.

Modelling Private Real Estate Funds

Private real estate can be modelled employing a similar approach. There is a strong relationship between private real estate and publicly listed real estate investment trusts (REITs), which increases over longer holding periods as illustrated by the light blue dashed line in Exhibit 6.

		Definition	Stylised Impact
Required	Type	Investment Vehicle	Fund of funds will display lower idiosyncratic risk than holding a specific partnership
	Stage	Strategy (e.g. buyout)	Buyouts typically have greater financial leverage than public companies, which leads to higher beta and market risk
Optional	Sub-stage	Sub-strategy (e.g. early stage)	Early stage venture funds pursue investments in nascent companies, which leads to greater capitalisation risk
	Vintage Year	Fund inception (calendar year)	Buyout funds that launch in periods of excess liquidity (e.g.2006) will tend to employ greater leverage, which leads to higher beta and market risk
	Region or Country	Geographic breakdown	Holdings in regions outside of an investor's base currency will introduce geographic risk as well as currency risk since private equity is typically unhedged
	Sector	Sector breakdown	Venture Capital often focuses on information technology companies, which can introduce sector risk

Exhibit 5: Risk Model for Private Equity Funds
Source: BlackRock, as of 31 December 2014

While there are similarities between REITs and private real estate, our model also adjusts for the differences, including: leverage levels, property type composition and the short-term correlation to risky assets.

Modelling Hedge Funds

Hedge funds are not a distinct and homogenous asset class, but rather a diverse set of actively managed strategies that operate across a wide range of traditional assets. While hedge funds are mostly made up of traditional assets (equity and fixed income) managers often aim to limit market exposure and target secondary or idiosyncratic sources of risk. Thus, it is important to not only model commonly held risk factors which measure broad asset class performance and volatility but also hedge fund style factors such as merger arbitrage, trend-following, and currency carry trades.

Where we have detailed information of the positions in a hedge fund we can model hedge fund risk at this level. When we only have performance information available, we derive factor exposures using a multivariate regression analysis, customised for the hedge fund strategy.

Step 5: Optimise Portfolio Given Allocation to Alternatives

The alternatives portion of a portfolio needs to be embedded in the total portfolio and the conventional part of the portfolio needs to be adjusted so as to meet the overall objectives of the portfolio.

The conventional, more liquid part of the portfolio is easier to model and a stochastic optimisation might not be required. A traditional mean-variance optimisation (with the allocation to alternative investments, defined in step 2, fixed as a constraint) can be a sensible approach to design an appropriate portfolio.

Given the higher liquidity of the traditional portion of a portfolio it will generally be the portion that is changed to adapt to changing market environments, whereas the alternative part of the portfolio is more or less fixed and only changed infrequently. Our quarterly publication Strategic Perspectives, offers a model portfolio (currently comprising roughly 50% equities, 30% fixed income and 20% alternative investments) and describes its construction process and our current capital market assumptions in detail.

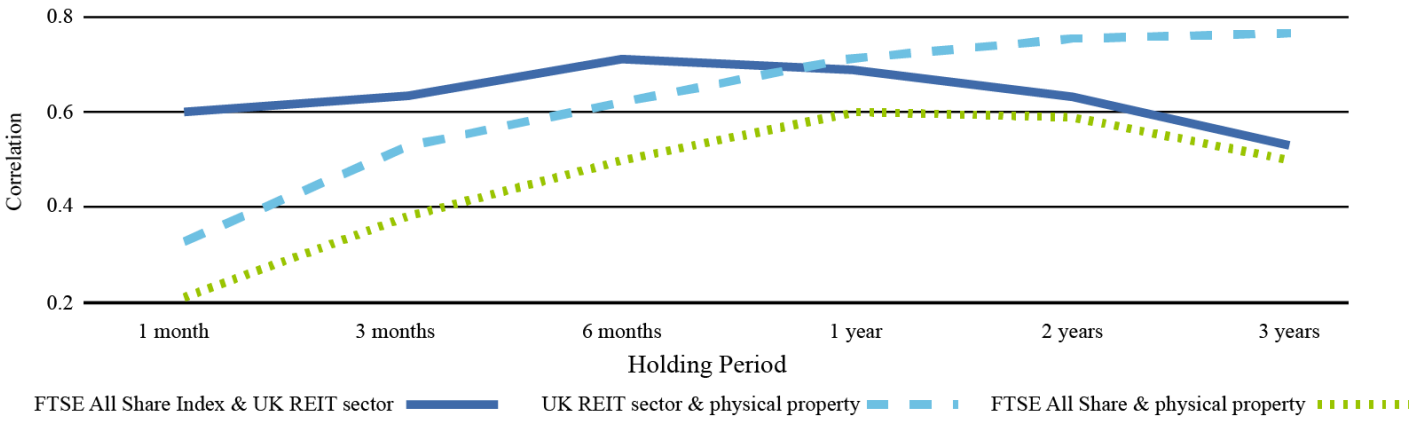

Exhibit 6: Correlation Between Equities, Reits and Private Real Estate
Source: BlackRock, Bloomberg, between 31 January 1990 to 31 January 2015
FTSE All Share Index, EPRA UK (UK REITS) and IPD 6 months forward (physical property)

Asset Class	Allocation	Stand-Alone Risk	Risk contr. (bps*)	Risk Contr. (%)
US Equity	40%	1533	589	72%
EM Equity	10%	1800	155	19%
Treasuries	30%	399	-2	0%
Credit	20%	538	77	9%
Total	100%			100%

Asset Class	Allocation	Stand-Alone Risk	Risk contr. (bps)	Risk Contr. (%)
US Equity	35%	1533	521	57%
EM Equity	5%	1800	78	9%
Treasuries	25%	399	-9	-1%
Credit	15%	538	55	6%
Private Equity	5%	2630	119	13%
Infrastructure	5%	1313	58	6%
Hedge Funds	5%	599	23	2%
Real Estate	5%	1799	69	8%
Total	100%			100%

Exhibit 7: Risk Contribution as Asset Allocation Changes
Source: BlackRock, as of 31 December 2014
* Risk contribution is adjusted for correlations across asset classes
For illustrative purposes only.

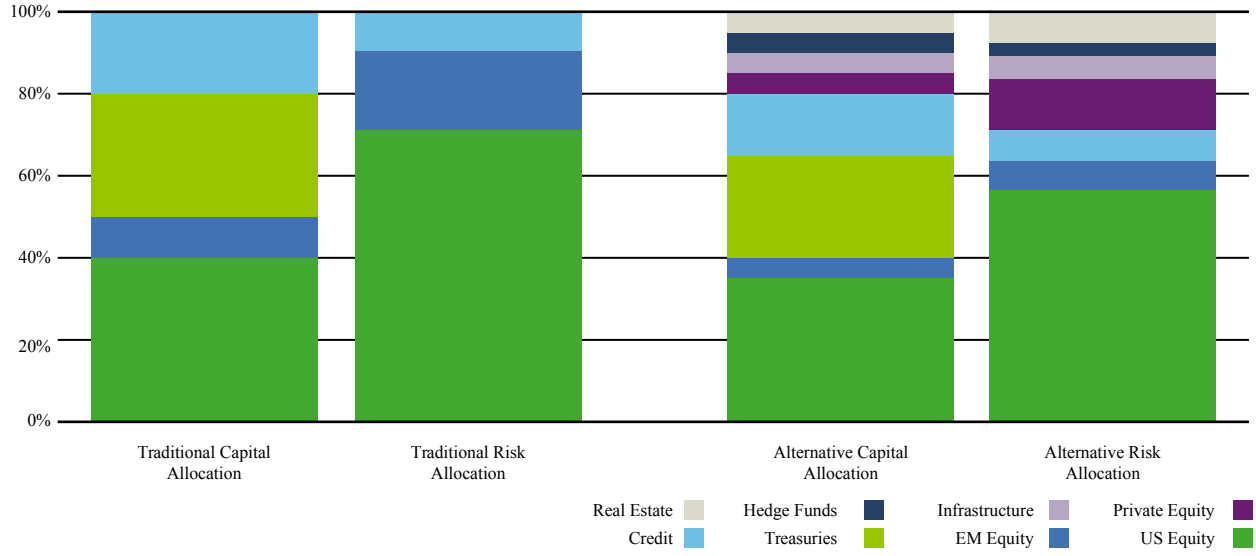

Exhibit 8: Comparison of a Traditional and Alternatives Portfolios and Risk Allocation
Source: BlackRock, as of 31 December 2014
For illustrative purposes only.

III. Fine-tune Alternatives

Step 6: Refine Portfolio Construction of Alternative Investments

In this section, the model portfolio is used to illustrate how the inclusion of alternative investment can enhance the portfolio and which analytics can be employed using a risk factor approach.

Starting from a balanced portfolio comprising 50% equity and 50% fixed income, we assume that an investor decided, based on the analysis described in previous sections, to reduce the allocations to fixed income and equity by 10% each, and invest 20% in alternative investments.

Going back to Exhibit 2 on page 48 our hypothetical investor rated four of the asset classes within alternatives as the most likely to achieve the return enhancement, risk diversification and outcomes objectives they have for their portfolio: value-add real estate, private equity buyout, brownfield infrastructure and relative-value hedge funds. The next step is to decide, how to fill the 20% alternative investment allocation with these four building blocks.

In light of the difficulties described earlier in incorporating alternatives investments in a mean variance approach, this is typically done employing an iterative process built on the risk factor approach: given the allocation to conventional asset classes, how would different allocations to the specific alternative investments in the alternatives bucket change the risk and return profile of the total portfolio? For the purpose of this section, we have assumed the result of such an iterative process was to allocate 5% to each of the four alternative asset classes. Exhibit 7, which contains the traditional allocation (left) and the allocation with alternatives included (right), displays the standalone risk, or predicted volatility, of each asset class as well as risk contribution, which takes account of the effects of diversification.

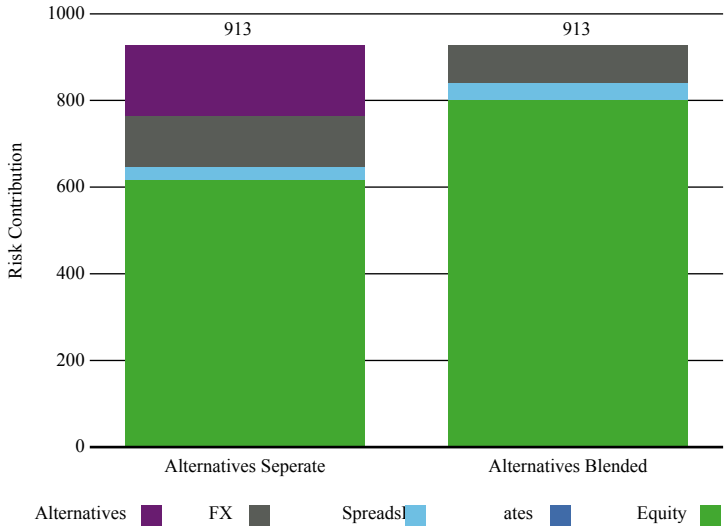

Exhibit 9: Seperate and Blended Risk Contributions
Source: BlackRock, as of 31 December 2014
For illustrative purposes only.

Scenario	Description	Scenario calibration
Regional contagion grexit	Greece defaults on its debt and exits the European Monetary Union after a breakdown in negotiations. The contagion, however, is limited to the European periphery.	MSCI World: -5.0% Greece ASE: -50% ESP 10y: +100bps GRD 5y: +1000 bps EU Corp Greece: +300bps EUR/USD: -5% VSTOXX: +50%
European deflation	European Central Bank easing measures fail to impact the real economy. Weaker-than-expected growth and persistent global deflationary pressure leads Europe into recession, while the European Central Bank fails to intervene with anzy meaningful action.	10 Year Bund yields: -20bps 10 Year Italian sovereign yields: +5 bps EU IG credit spreads: +20 bps EUR/USD: +1% 10 Year euro inflation: +45 bps EMEA equity volatility factor: -3.75%
Fed policy error	The Fed moves abruptly towards multiple rate hikes leading equity and fixed income markets to sell-off in tandem. Risky asset moves are calibrated to the movements observed in the 'Taper tantrum' during May/ June 2013.	S&P500: -7.5% MSCI Europe: -12.5% US Credit IG: +25 bps, EUR/USD: -5% 2 Year Treasury yields: +75bps 5 Year Treasury yields: +50bps 10 Year Treasury yields: +25bps
New tech bubble pop	'New tech' companies diverge from the fundamental performance of the underlying businesses and investors are make speculative bets that rapid growth and abundance of low-cost capital will continue to drive up valuations, creating a bubble.	Internet & software services: -12.9% Software: -10.8% Biotechnology: -13.5% Momentum: -3.7% Volatility: -5.04%
Chinese stimulus	Declining economic indicators suggest an economic slowdown, pushing Chinese policy makers toward additional stimulus measures including cutting the benchmark rate and reserve requirement ratio later in the year.	China Shenzen SE: +16% MSCI emerging markets: +5% Copper CMX 1 Month: +10% 3 Month CNY yields: -30bps China credit HY: -100bps CNH/USD: -2%
Japan QE	The Bank of Japan decides to augment its easing programme, in the face of market headwinds that prevent the Bank of Japan from attaining inflation targets. Japanese equities rally and market euphoria leads to some spill over into global markets.	10 Year Treasury yields: -10 bps 10 Year JGB yields: -15 bps AUD/USD: +5% MXN/USD: +5% MSCI World: +5% MSCI Japan: +15%

Exhibit 10: Scenario Analysis
Source: BlackRock, as of 31 March 2015

The most basic application of the risk factor approach is to identify the ex-ante risk of each asset class in a portfolio. Exhibit 8 below highlights the difference between the capital and risk allocation. This analysis will help investors answer the question –

"How does my capital allocation correspond to risk allocation?"

Often portfolios that hold a diversified set of asset classes are actually taking concentrated bets from a risk factor perspective.

In the traditional allocation, equity market risk represents about 90% of the risk in the portfolio against a 50% capital allocation, due to the low risk weighting of US treasuries and the close correlations between US and emerging market equities.

By comparison, in the new asset portfolio the risk allocation for public equities has fallen to just over 60% against a 40% capital allocation. This is the result of adding the alternatives. While each asset class has a 5% capital allocation, they contribute a differing percentage of the risk allocation.

The next stage is to look at the economic sources of the risks in the portfolio. Exhibit 9 graph, examines the same portfolio, but from a risk factor point of view. There are two ways of doing this:

1. **Separate view** – which sees alternatives as constituting a risk category of their own.
2. **Blended view** – where the alternatives allocation is broken down into 'traditional' and unique 'alternative' risk factors to understand the types of economic risk that the alternative allocation is adding to the portfolio.

We prefer to use the blended view as we believe it gives a more complete understanding of where risks are concentrated. We know, for instance that, a large proportion of alternative risk can be explained by public equity market factors. However, there are also specific factors. Therefore, only the proportion of the risk which is not attributable to traditional risk factors, is then labelled as 'private equity' risk.

Similarly, we blend rates, spreads, and foreign exchange related alternative factors into their respective risk groups. The residual 'alternative' risk that remains in the blended view is deal specific, idiosyncratic risk from illiquid investments and highly specific hedge fund style factors that are not easily grouped into traditional risk groups.

The value of the blended view is to highlight that even though investments are labelled as alternative, a large proportion of risk can come from conventional factors and the diversification benefits might be more muted than initially envisaged.

This transparency can also help address how to best fund an allocation to alternative investments. For instance, if the characteristics of private equity can to a large extent be explained by public equity and if the desire is to add new risk factors to a portfolio, the most natural funding source would be public equity. A well-designed switch from public to private equity can keep the equity exposure more or less constant while adding new exposures to the mix, which the investor expects to increase the diversification or return potential of the portfolio.

This approach allows investors to understand whether their portfolio is truly diversified and to weigh the risk characteristics of their portfolio against the return expectations of their investments.

Step 7: Employ Scenario Analysis Using Specific Investment Programmes

Investors often struggle to quantify how their portfolio would perform should market conditions change rapidly. Given a portfolio with an allocation to alternatives, this can be even more difficult unless a holistic approach to risk analysis is available. Modelling alternative and conventional investments in a risk factor framework focused on economic risk provides a mechanism to run scenario analysis on a portfolio consisting of both traditional investments and alternatives.

Scenario analysis typically focuses on market events and how portfolios behave under different conditions. Analysing the performance of portfolios under different environments or regimes can help mitigate the disadvantages of portfolio construction approaches which assume normally distributed returns. To help understand the potential impact of large market shocks and geopolitical stresses, we have developed a series of Market-Driven scenarios to facilitate discussions about the potential impact on portfolios.

In Exhibit 10, we outline some of the scenarios investors might have been concerned about at the end of March 2015 as well as our model's forecasts of how markets might perform. Taking this analysis further Exhibit 11 illustrates how our portfolio, with a 20% allocation to alternatives, might perform in each of these scenarios.

This analysis is unique in that it provides an economic sense of performance under various market conditions which may not be reflected by periodic valuations as they are often smoothed and managed. Furthermore, this analysis decomposes performance of a market event into risk factors which can provide insights as to how an investor might wish to adjust the liquid portion of their portfolios in anticipation of large market events.

Applying the risk modelling, illustrated in Exhibit 9, we can compare scenario analysis under the blended and separate view as shown in Exhibit 11. There is no performance associated with the alternative factor block under the blended view as these factors have been blended into the traditional risk factor blocks, equity, rates, spreads, and foreign exchange. Equity factors will tend to drive the majority of predicted performance in these scenarios, so investors may choose to decrease their exposure to public equities, for example, if they are concerned about the risks associated with the Fed turning unexpectedly hawkish. While the new tech bubble pop scenario exemplifies the importance of the blended view as it highlights the hidden equity exposure embedded in the portfolio's alternative allocation.

Creating More Efficient Portfolios

Alternative investments can provide many benefits to investors, ranging from potentially higher returns to lower risk and better diversification than may be available from a traditional portfolio. In addition, several alternative asset classes offer the prospect of more secure cashflows, inflation hedging or other benefits investors may value. However, investors often find it hard to assess the precise impact of an alternatives allocation on their overall portfolio goals. Many are also concerned about the associated risks, with illiquidity being the top of the list.

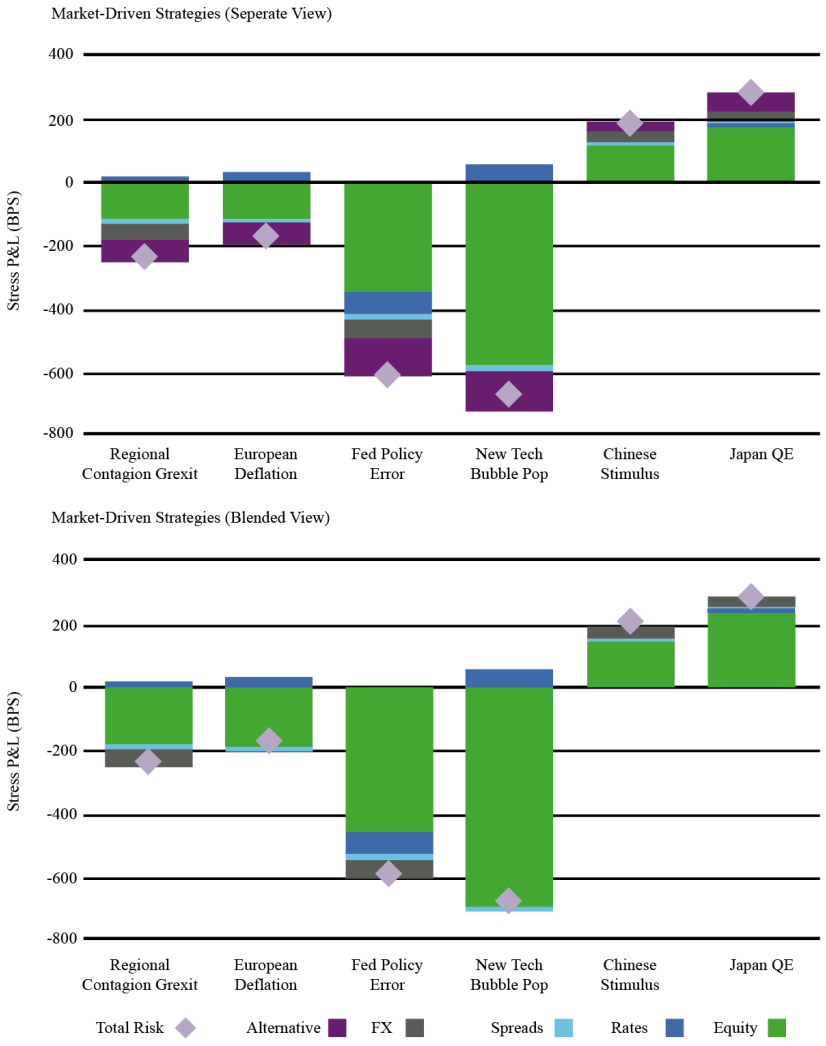

Exhibit 11: Market-Driven Scenarios - Seperate and Blended View
Source: BlackRock, as of 31 March 2015

The answer we believe is a systematic, risk-based approach that uses a common methodology across all asset classes. As a first step, investors need to define their objectives and to assess which asset classes, and in what proportion, are most likely to help them achieve these objectives. This involves the use of scorecards, but also stochastic modelling to ensure liquidity needs are really taken into account.

In a second stage, we apply a risk factor analysis across the universe to ensure appropriate diversification, given many alternatives assets will be driven by the same economic factors as traditional asset classes.

As a final step, we use scenario analysis to understand the likely impact of major market events investors may be concerned about. This in turn may lead to suggested asset allocation adjustments to the liquid portion of the portfolio. This analysis can be continuously updated as new information becomes available.

In summary, we believe our proposed framework provides a roadmap to build and manage a diversified portfolio of alternative and traditional assets that is aligned with investors' objectives and combines greater transparency with the potential for stronger risk-adjusted returns.

Authors' Bios

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Stephan Meschenmoser, CFA, Managing Director, is a member of the Strategy and Market Views function of the Client Solutions group within BlackRock Solutions. The Client Solutions team provides complex solutions support for the firm's largest institutional clients. The team has a broad set of investment experience across fixed income, equity, alternatives and a wide range of specialised investment strategies. It also focuses on outcome-oriented investing solutions, taking into account liabilities, capital and other drivers of investment strategy.

Mr. Meschenmoser service with the firm dates back to 2002, including his years with Merrill Lynch Investment Managers (MLIM), which merged with BlackRock in 2006.

Mr. Meschenmoser earned an MS degree in business from the University of Wisconsin, Madison in 1999, and a "Diplom-Volkswirt" degree in economics from the University of Mannheim, Germany, in 2002.

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Julia Wittlin, CFA, CAIA, FRM, Director, is a member of the BlackRock Private Equity Partners group within BlackRock Alternative Investors. Prior to joining the BlackRock Private Equity Partners group, Ms. Wittlin was a member of the Risk & Quantitative Analysis group at BlackRock focusing on Fiduciary Risk Management for Multi Asset Class Product and BlackRock Alternative Investors Products. As the lead risk manager for the Global Allocation multi-asset mandate and private equity and infrastructure equity assets she was responsible for assessing and managing risk in addition to developing risk analytics and performing quantitative analysis. Ms. Wittlin began her career in 2007 as an analyst in the Performance Analytics group within RQA. In that role, she supported analytical reporting for portfolio managers across the equity and alternative asset platforms. Additionally, she worked with the BlackRock Treasury group on proprietary risk reporting for the seed capital portfolio and other firm-wide balance sheet risk items. Ms. Wittlin earned a BA degree in Economics with a citation in Finance from the University of Rochester in 2006. She also completed a Certificate in Mathematical Modeling in Economics and Political Science and a Management Studies Certificate.

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Jonathan Callan, CAIA, Associate, is a member of BlackRock's Alternative Solutions Group, a team responsible for developing and managing multi-alternative portfolios. He focuses on Alternative Solutions' research initiatives and is responsible for risk analysis of opportunistic investments. Additional responsibilities include developing relative-value allocation models that aid in the portfolio construction process.

Mr. Callan began his career with BlackRock in 2012 as an analyst in the Risk and Quantitative Analysis group, where he was responsible for risk management and research across a variety of BlackRock's alternative funds including private equity fund of funds, infrastructure, and REITs portfolios.

Mr. Callan graduated with a BS degree in Commerce and a BA degree in Mathematics from the University of Virginia.