A large, leafy tree in a brown pot, positioned on the right side of the page. The tree has a thick, gnarled trunk and dense green foliage. The pot is a simple, wide, brown ceramic style.

Asset Allocation at Barclays Wealth Management

White Paper

 **BARCLAYS** | Wealth
Management

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Introduction

Dear clients and colleagues,

Barclays Investment Philosophy is the cornerstone of our client offering. Based on our clients' needs, it is designed to provide personalised investment portfolios, delivering sustainable growth and risk management through diversified investments across multiple asset classes.

Why Asset Allocation?

Every investor has an asset allocation, whether they think in those terms or not. Holding nothing but cash is an asset allocation, or only individual equity investments is also an asset allocation, albeit a highly concentrated one with limited diversification benefits.

So, the question is not whether an investor has an asset allocation or not, but rather if the asset allocation is in line with the investor's needs and rewards adequately for the risks the investor is taking. We believe that a thoughtfully designed, diversified asset allocation is the best foundation for achieving an investor's long-term investment goals.

When we created the strategic asset allocation process that lies at the heart of our Investment Philosophy, we followed four basic principles: it must (1) meet client needs, (2) provide diversification to help manage risk, (3) comprise asset classes that are generally accessible to investors, and (4) incorporate our long-term market views, as well as our insights in quantitative finance.

Meeting Client Needs

To meet our clients' long-term investment needs, they must be able to invest in portfolios that align to their Risk Profile – determined by their Risk Capacity (as established by a review of total wealth) and their Risk Tolerance (measured by our Financial Personality Assessment™) – and be comfortable to hold this portfolio over a long time horizon.

To satisfy this requirement, we have developed five Strategic Asset Allocations (SAAs) from Low to High risk, considering how investors psychologically perceive risk, which tends to be more focused on poor outcomes than on volatility.

More generally, our SAA model portfolios reflect how we think financial markets work and they incorporate our long-term views on economic and market variables. We combine this to generate optimal long-term risk-return trade-offs for investors with different Risk Profiles.

Diversification

To benefit from diversification and enhance portfolio efficiency, an investment portfolio should include several asset classes and, ideally, go beyond the traditional set of stocks, bonds, and cash. The idea that introducing diversifying assets to a portfolio can both help decrease risk and enhance opportunities for return is well established in the academic literature and among investment managers. However, the concept has come under sporadic attack in the last few decades amidst several market crises characterised by most asset classes selling off at the same time. We believe such attacks are misplaced with regards to the role of diversification in mitigating risk.

Remember that for mainstream investment markets, close to every single sell-off has been rapidly retraced. In this context, we need to be wary of our ability to miss sharp sell-offs, even when diversified appropriately. The benefits from mixing and spreading your exposures can be seen as a more positive long-term influence in many ways. We are looking to enhance your savings' ability to participate in global growth and the productivity story therein.

To achieve diversification, we expand our range of asset classes to include the full universe of investible assets available to individual investors, including Commodities and Alternative Trading Strategies (ATS). We believe that absolute return funds and other alternative investment vehicles can play a variety of roles in a portfolio, including the generation of attractive risk-adjusted returns while also offering a low correlation with other asset classes.

To create diversified allocations, we use industry standard as well as internally developed risk measurement and management techniques to account for the fact that asset returns do not follow an abstract Normal (bell-shaped) distribution, tending instead to be asymmetrical and have 'fat tails'.¹

More generally, when analysing asset class returns, we are careful not to rely on a simplistic interpretation of data and avoid the assumption that the future will look like the past, a surprisingly common forecasting bias.

Accessibility

To make sure our clients are truly diversified, we have to provide an optimal portfolio that is also practically accessible. That is why we recommend broad categories of investible assets, both potentially attractive and accessible to all investors, rather than specific areas or products.

Incorporating Long-Term Views

Our final principle is that we seek to incorporate our long-term market views, as well as our insight in behavioural finance. We combine market data with our investment experts' views on economic trends. We also use behavioural finance to help us understand what is important to our clients, their perceptions of long-term risk and their preferences when balancing risk with expected returns. Using quantitative analysis, we combine our behavioural insights and understanding of clients with our market expertise, to best meet the long-term investment needs of our clients.

We are proud of our strategic asset allocation process and believe that it contains many significant improvements to past practices in the investment management industry. However, we continue to be focused on improving our process, which is why we regularly conduct a deep dive into our inputs and methodology, to maximise our chances of delivering strong long-term investment returns in line with our clients' goals.

Warmest regards,

William Hobbs
Chief Investment Officer

¹ Skewness describes the asymmetry of distributions and should be zero for symmetric distributions, such as the Normal distribution. Excess kurtosis measures the higher probability in the tails of a distribution (that is, the 'thickness' of the tails), and has a value of 0 for the Normal distribution.



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Section 1: Overview

A brief tour of our asset allocation methodology.

Asset allocation – the appropriate mix of cash, bonds, and equities - is the cornerstone of how Barclays builds client portfolios. The objective of asset allocation is to have a framework that maximises client satisfaction from their portfolio for a given level of risk. Simply maximising portfolio returns is not sufficient if the client is unable or unwilling to maintain their portfolio holdings during times of market volatility.

Crafting the right allocation for any investor calls upon all the skills we possess as investment professionals: finance theory, economic analysis, market savvy and psychological insight. To design our approach to asset allocation, we have drawn upon the many facets of our organisation.

Getting asset allocation right can be a difficult business. In this white paper, we let these challenges guide the explanation of our processes. Our solutions highlight how our approach to asset allocation is distinct from our competitors.

Which asset classes should be included in a client portfolio?

Diversification and investment accessibility are the broad themes that underpin our decisions on which asset classes should be included in a client portfolio.

In Section 2, we explain the principles that guide our selection and why we believe that the following eight asset classes are appropriate for most portfolios: Cash and Short-Maturity Bonds, Developed Government Bonds, Investment Grade Bonds, High Yield and Emerging Markets Bonds, Developed Markets Equities, Emerging Markets Equities, Commodities, and Alternative Trading Strategies (ATS).

How should a portfolio be divided between these assets?

The answer depends on individual client circumstances, needs and preferences. We start from one of our core Strategic Asset Allocations, which are designed to deliver the best long-term risk-adjusted returns for a given investor's long-term objectives.

Section 3 explains our SAA methodology in detail. We begin by forecasting the average returns for each asset class, using a blend of objective estimates implied by market data, and subjective projections made by our investment strategists.

Then, we acknowledge the uncertainty of the future by simulating many different possible paths for each asset class. In determining what we consider an 'optimal' portfolio, we maximise the subjective value an investor in each Risk Profile would attach to the outcomes of those simulations.

Our measure of subjective value puts more weight on poor outcomes – as is sensible, and not the case in the commonly-used measure of risk known as volatility. This means the portfolios we consider to be optimal have less exposure to those asset classes with a tendency to fall sharply in value.

The SAAs created through this process offer a baseline mix of assets that, if held on average over the long term, will in our view provide a desirable risk/return trade-off for an investor's Risk Profile.²

What makes our asset allocation process unique?

The simulation of asset class returns is standard industry practice, but just randomly drawing from past return observations has a significant drawback: these simulated returns will show little clustering of high volatility observations. High volatility periods are usually associated with financial crashes, and they are an important characteristic of financial returns. To address this, we make use of the latest statistical techniques by inserting some short-term memory in our simulations. This ensures that the simulations display volatility clustering like what we observe in real-life financial data.

The second point which we would like to highlight is that it is impossible to measure model inputs without error and there is also a chance that our model does not capture all the relevant characteristics of financial markets. We acknowledge that the use of models, however sophisticated they may be, has limitations. That is why we pull the most extreme outcomes from our optimisation slightly towards a maximum diversification allocation.

Finally, we don't target a specific level of risk, regardless of the market outlook. Instead, in conjunction with our future views of expected returns, we strive to achieve the best balance of risk and return, i.e. we will only take on risk to the extent that we think it will be rewarded.

Whether it's how we measure risk, or how we avoid solely using the past to predict the future – at every stage, we've designed our SAAs from our clients' perspective.

² By aiming for the best risk-adjusted returns, i.e., the highest expected returns over and above the return that each investor requires to compensate them for the risk they take.

Section 2: Roster of Asset Classes

Why we think investors should consider holding a range of asset classes in their portfolio.

Asset classes are broadly defined as a collection of financial assets (such as equities or bonds) that exhibit similar risk-return characteristics and are driven by similar economic forces. Constituents of an asset class should in principle be very similar. Investing in a range of asset classes spreads the risk across different types of assets which lowers the risk (volatility) of a portfolio therefore improving risk-adjusted returns.³

When determining the number of asset classes to include in our SAA, we deploy a range of techniques. We consider historical data (e.g. risk, return and correlations) as well as economic reasoning (what exactly is the source of the risk premium), complemented with statistical methods such as cluster analysis and principal component analysis. That said, the final outcome of an eight asset class portfolio is not set in stone as the number of components of each asset class varies (for example, are Developed and Emerging Market Equities two separate asset classes? Or traditional government bonds and inflation-linked government bonds?).

To summarise, an asset class is a good candidate for routine inclusion in an investment portfolio to the extent that:

- It is likely to improve the portfolio's risk-adjusted returns, and
- It offers unique risk or return characteristics, and
- It is efficiently accessible by retail investors, and
- Adding this asset class does not unnecessarily complicate the overall portfolio.

After analysing a broad range of candidates, we concluded that, unless there is a good reason to do otherwise, investors should hold some combination of the following eight asset classes in their portfolios. We explain our approach and the rationale behind each asset class below.

Cash and Short-Maturity Bonds

Cash and Short-Maturity Bonds are the least risky asset of our eight asset classes. When we say Cash, we are referring to cash equivalent and cash-like products, a slightly broader

definition. We do not mean cash as money in its physical form, but rather deposits, money market funds, and Short-Maturity Bonds.

The objective of this asset class is to represent the asset class with the lowest capital risk. Cash deposits secured by the Financial Services Compensation Scheme (FSCS) in the UK are considered safe, but we also include some highly-rated short-term bonds to add a small amount of extra return at a negligible amount of extra risk.

Although the asset class has the advantage of immediate or near immediate access to withdrawals, as an investment it does have a low expected return. Over longer time horizons there is a risk that inflation might be higher than the asset class return and thus investors might experience a decrease in their spending power.

Another risk of this asset class is currency risk. Cash-like products are denominated in a currency, which could depreciate against other currencies. This would reduce the investor's spending power when buying goods and services denominated in foreign currencies.

Developed Government Bonds

Bonds are like a loan from the investor to the borrower. A borrower promises to repay the money borrowed as well as to pay periodic interest payments. Because there is a wide range of different bonds, we have created separate asset classes to capture certain risk/return characteristics within this set of investment opportunities.

The Developed Government Bonds asset class objective is to capture interest rate risk while having only minimal exposure to credit and foreign exchange (FX) risk. Interest rate risk is the exposure of the bond price to fluctuations in the interest rate. For example, if interest rates increase bond prices tend to fall. Generally, the longer the maturity of the bond, the greater the exposure to interest rate movements. To capture interest rate risk, we only include longer duration bonds in this asset class.

³ Note that even a diversified portfolio can fall in value, and the portfolio may end up with less money than initially invested.

To minimise credit risk, these bonds must have a high-quality credit rating and be issued by governments. Even ignoring credit ratings, governments are perceived to have less credit risk than a public or limited company because of their ability to raise taxes.

Developed country bonds are exposed to exchange rate risk between currencies. To capture the essence of interest rate risk, we hedge out the exchange rate risk. This can be done in a cost-effective way as there is a liquid market for currency pairs of developed countries.

Finally, investors in nominal government bonds are also exposed to inflation risk as higher than expected inflation decreases the real return of these investments. Inflation-indexed government bonds offer protection against unexpected inflation. As we have seen in 2022, inflation can rise unexpectedly and suddenly. Therefore, we construct the developed government asset class by allocating 60% to nominal government bonds and 40% to inflation-linked government bonds. Both types carry interest rate risk in line with the respective sovereign.

Investment Grade Bonds

We define our Investment Grade Bonds as bonds which have an investment grade rating (BBB- or better) but that are not already included in either the Cash and Short-Maturity Bonds or Developed Government Bonds asset classes.

The objective of this asset class is to introduce exposure to credit risk in exchange for additional yield. Over time, a borrower's financial situation might deteriorate, increasing investors' doubts in the borrower's ability to fulfil its payment obligations. This will increase the yield investors require to hold the bond, causing the bond price to fall. Credit risk is the risk that a borrower's credit worthiness will deteriorate.

Investors are compensated for taking on this additional risk which, in turn, increases the expected return of their portfolio. Credit risk is not taken in isolation as bonds are still

exposed to interest rate risk and foreign denominated bonds will also have FX risk.

At the extreme, default risk is the risk that the borrower will not or cannot repay the bond. The Investment Grade Bond asset class tries to keep this risk low by only including bonds rated BBB- or better. However, this is not guaranteed as Investment Grade Bonds have, in the past, defaulted during stressed market conditions.

High Yield and Emerging Market Bonds

This asset class includes bonds not yet included in the previously introduced asset classes and is a combination of High Yield Bonds and Emerging Market Bonds.

We define high yield bonds as fixed income instruments issued by companies with low credit ratings (BB+ or worse). Emerging Market Bonds refer to fixed income instruments issued by emerging market sovereigns, government-related agencies and corporations denominated in either major currencies (US dollar, Euro, Yen, or Sterling) or local currencies.

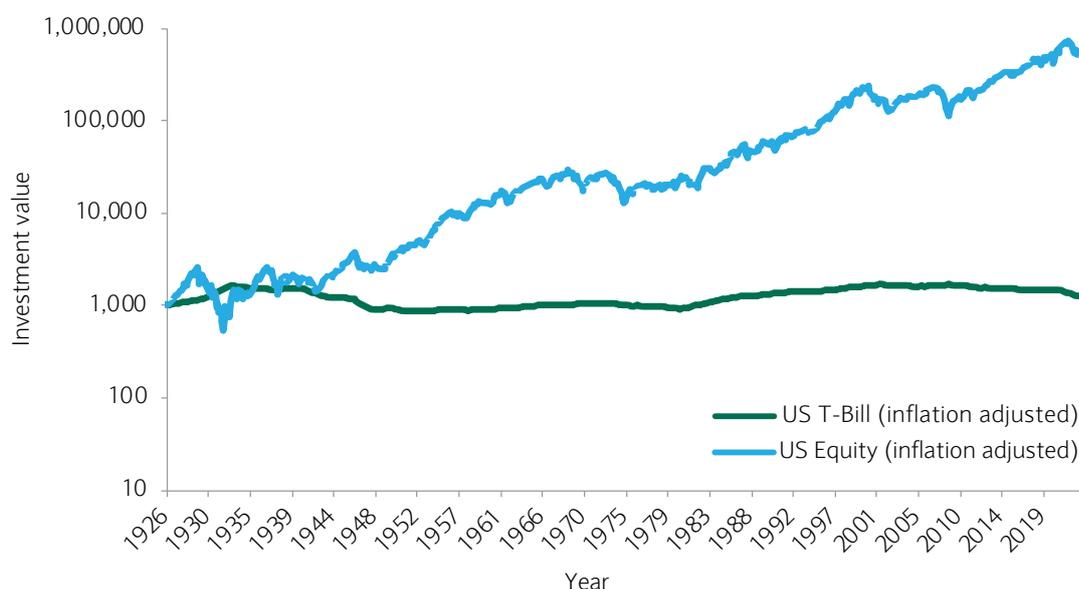
High Yield and Emerging Market Bonds have been grouped together for three reasons. First, they both share higher credit and default risks than the previous asset classes. Second, the market for these bonds is far smaller than that for the other bond asset classes. Third, while in the short term they may have different risk-adjusted returns, in the long term, they show similar risk-return characteristics.

Developed Market Equities⁴

Equities, also known as stocks and shares, are one of the largest and most publicised asset classes. A company's share price performance will find more media attention than a company's bond price performance. The value creation through equities over the last century has been enormous and far outpaced that of cash/short-term bonds (see Figure 1).

⁴ As defined by their inclusion in the MSCI World Index.

Figure 1: Long term inflation-adjusted returns



Source: Kenneth R. French website and FactSet, as of March 2023

Equities represent partial ownership of companies. This ownership generally gives the right to receive the company's dividends and (in most cases but not all) to vote on the running of the company. In a company's capital structure, equities are at the bottom so that in the event of a liquidation, equity holders are the last group to receive their share. This special risk/return characteristic makes equities a unique asset class.

Country and credit ratings were used to partition bonds into asset classes. With globalisation, industry sectors could potentially be used to partition equities, however, this would create tens of asset classes, more than is required. So, as we did with bonds, we partition equities by region into developed and emerging markets.

Developed Market Equities are, as the name indicates, equity markets that are the most developed. These are generally the countries with a high GDP per capita, but just as important, they also need to be open to foreign ownership. We highlight that Developed Market Equities means more than just the investor's domestic equity market, but rather a global approach.

Measured by the MSCI World Index, the UK represents less than 5% (March 2023) of the developed market capitalisation. So, treating Developed Market Equities as just the FTSE 100 substantially limits the investable universe.

Emerging Market Equities⁵

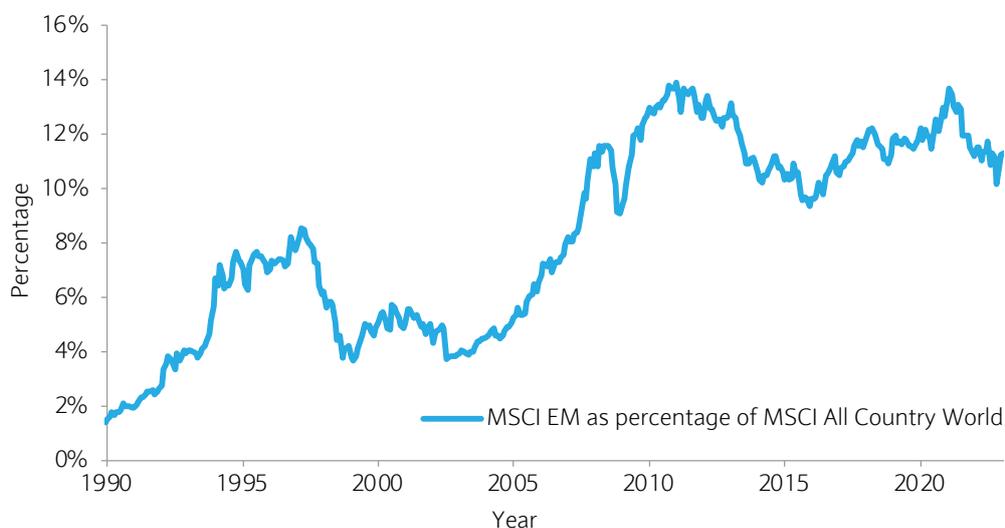
No two emerging markets are the same and so sweeping statements will not be true in every situation. Although opportunities may be greater in emerging markets, these markets are also perceived riskier than Developed Market Equities.

Risks can include greater political instability, greater currency volatility, less developed infrastructure, less market liquidity, less strict accounting standards, and harder to enforce legal rights for foreign investors. The risk/return profile is sufficiently different to classify Emerging Market Equities as a separate asset class. Also, Emerging Market Equities have become more important for investors as their share of total global equities has been increasing over the last 30 years (see Figure 2).

A country's classification as a developed or emerging market is not static as countries can change over time (for example, China's capital market is very different today from what it was 20 years ago). Our implementation of this asset class follows the classification of MSCI, which in turn is regularly updated.

⁵ As defined by their inclusion in the MSCI Emerging Markets Index.

Figure 2: Emerging market's share of total global equities



Source: FactSet

Commodities

Commodities are diverse, ranging from precious metals to grains, from energy to livestock. Commodities, in their physical form, can be considered 'real assets' as opposed to financial assets. Commodities tend to rise with inflation and thus offer some weak form of inflation protection. Investing in physical commodities is not practical for most investors as it would require storing these assets. To participate in the price movements of commodities investors can buy future contracts, which are an agreement to buy the underlying asset at a future date at a fixed price. These contracts can be sold before expiry or settled in cash to avoid physical delivery of the underlying asset.

Even though commodities do not offer any income, there is empirical and theoretical evidence that, when implemented through futures, commodities exposure provides a positive long-term risk premium. According to the academic literature, this is linked to the fact that the convenience yield of most commodities is higher than the sum of storage and financing costs.⁶ The convenience yield is the benefit of holding the physical asset and is a compensation for inventory risk.

We highlight that it is important to implement this asset class with a diversified mix of commodities and avoid being concentrated in just a select few of them (for example, being invested mostly in oil). This will ensure that the full risk premium is accessed.

⁶ The return of a futures contract on a commodity can be decomposed into the spot price return and the so-called interest rate adjusted carry, which is the convenience yield of holding the physical asset minus the storage cost and financing cost. Empirical studies have shown that, in the long term, interest rate adjusted carry is positive.

Alternative Trading Strategies (ATS)

Also known as absolute return funds, the objective of this asset class is to generate investment returns that are uncorrelated to the above-mentioned asset classes. Strategies can include, but are not limited to, having long and short positions in a wide range of markets, using leverage, and exploiting market inefficiencies.

The return driver of this asset class is mainly the investment manager's skill in exploiting market inefficiencies and running statistical models to enhance risk-adjusted performance. ATS fund managers can provide diversifying returns by using a wide range of techniques. Some examples of typical strategies and their sources of returns are:

- Credit Arbitrage – Taking opportunities along the corporate credit structure, both senior and subordinate credit, with ideally little or no broad credit market exposure.
- Merger Arbitrage – Taking long and short positions in companies that are currently engaged in merger transactions.
- Active Trading – Taking short-term positions in financial instruments. Typically results in high turnover and use of leverage. Reacting more quickly to news than the market.

- Systematic Diversified – Typically running mathematical and statistical models that seek to find predictable patterns in market prices and subsequently exploiting these patterns.

A Note on Currency Hedging

Currency risk is the risk of negative investment returns due to adverse movements in foreign exchange rates. There is little evidence that exposure to foreign currency fluctuations carries a risk premium, however, hedging this risk may not be practical for all asset classes. Our approach is to hedge currency risk for all fixed income asset classes (Cash & Short-Maturity Bonds, Developed Government Bonds, Investment Grade Bonds, High Yield & Emerging Market Bonds⁷) as otherwise the return on these assets would be dominated by the exchange rate return, which tends to be significantly more volatile than fixed income returns.

We do not hedge currency risk for the equity asset classes as their volatility is considerably higher than that of the respective currency markets. Furthermore, large capitalisation equities are usually multinational companies, which can be dual, or triple listed, making it difficult to choose the appropriate currency pair for hedging.

⁷ Excluding emerging market local currency bonds as the rationale for holding local currency bonds is to participate in any emerging market currency appreciations as their economies mature.

Section 3: How Much of Each

The ways in which we've made the conventional approach to asset allocation better – and why we generate five portfolios.

The Big Picture

We take a top-down approach to decide what asset allocations clients should hold today to maximise their future satisfaction from their portfolio. The future is unknown with certainty, but we use our combined experience and skill to create an investment framework with what we know.

Time horizon: The SAA is designed as a mix of asset classes that an investor should hold over a long period of time. The idea, at the strategic stage, is to avoid any attempts to time the markets. The asset allocation is meant to be held during expansions and recessions, in other words, it should be held through a complete market cycle. The markets are volatile, and tomorrow's returns are unknown today, but over longer time periods human ingenuity of creating new products and services, and finding better ways of using what we have, creates wealth. The aim of the strategic asset allocation is to benefit from this wealth creation.

The SAA is not a static process, as assets perform differently over time so that the client portfolio weights will drift away from the starting SAA. Regularly rebalancing the client portfolio will return the asset allocation weights back to the SAA. Effectively selling assets with a high valuation and buying assets with a low valuation.

Further, the strategic asset allocation is periodically reviewed to ensure it remains up to date and relevant. Views on the asset classes' long-term expected returns are reviewed regularly and, if needed, revised.

Stay Invested: The journey is as important as the destination. Basically, don't be a forced seller. There is no guarantee that the future will be smooth and predictable. Unfortunately, there will be times when markets become volatile and fall. In the cold light of day, it may be easy to agree, but in those periods, some clients may find it hard to stay invested as the value of their portfolio continues to fall. Yet, selling during a market crash is extremely detrimental to long-run portfolio returns. The SAA is designed to be held during market downturns. More risk-averse investors can opt for a lower risk profile allocation.

Diversification: In the previous section, we introduced different asset classes, which display distinct risk/return characteristics. As the returns of these asset classes are

not perfectly correlated, the investor can benefit from a diversification effect when combining these assets. This diversification effect results in a more favourable risk/return profile for the client's portfolio. More specifically, it allows us to build portfolios that have the same level of risk as any single asset class but offer a higher expected return. Diversification allows us to build portfolios with the most efficient risk-return trade-off, thus allowing the investor to choose a desired level of risk.

The Asset Allocation Process

Once we've identified a suitable set of asset classes, we need to map them to investable indices. Then we will make use of our proprietary quantitative financial models. Using a model in the asset allocation process allows us to explicitly account for inputs and assumptions and the uncertainty around them. The optimal asset allocation depends on expected asset class returns, risk, and how strongly asset classes move together. A model makes these assumptions explicit, and we can incorporate their estimation uncertainty into the optimisation process.

Asset Class Indices

We will proxy each asset with a market index. For example, we have chosen the MSCI World Index to represent Developed Market Equities. The objective is to have an idea of the historical risk-return trade-off of each asset class and their correlation with each other. We are acutely aware that past performance may not be indicative of future returns.

We obtain 30 years of historical monthly returns for each asset class. Over such a long time frame we have to make some adjustments to ensure that the index, at the time, is the best representation of the corresponding asset class. Also, over some periods, our asset classes may be represented by a weighted average of two or more market indices to ensure a close representation of the respective asset class.

In addition to monthly returns, we also obtain the market capitalisation of the underlying indices.

Equilibrium Returns

For some financial instruments, it is possible to work out the market implied expected return given the price of that instrument and making use of assumptions. For example, given a bond price and making some basic assumptions, the redemption yield can be derived. We employ a similar technique to derive the implied market return for our chosen asset classes. These implied returns are called 'equilibrium returns' and they depend on only one parameter, which represents the market implied risk aversion.

The Capital Asset Pricing Model (CAPM), developed more than 50 years ago by Jack Treynor and William Sharpe, starts with the observation that every asset in the market must be owned by someone at all times. Therefore, unless there is a good reason to expect otherwise, the expected relative returns on different investments will tend toward their equilibrium values. The equilibrium expectation for any asset is the relative level of return that investors demand – given how risky that investment is and how returns on that investment relate to returns on other assets – to induce them to hold the total market value of the asset.

Equilibrium returns are not without their challenges. The views are dependent on the methodology used to derive them. The model uses historical monthly returns to calculate historical variances and covariances, and we know that past performance is not a reliable indicator of future returns. Historical variance is dependent upon the length and frequency of the time series of returns. Variances calculated over a longer time period will be more stable, but less applicable to today's markets. The CAPM assumes frictionless capital markets (no taxes, no transaction costs, unlimited lending and borrowing at the risk-free interest rate), which, in the real world, is violated to some extent.

Further, an input into the calculation is the asset class market capitalisations. For equities and bonds this is straightforward, but for Commodities and ATS that is not the case. For this reason, we do not derive equilibrium returns for Commodities and ATS. Even for those asset classes where reliable data are available, the notion of solely using total market capitalisation at a single point in time as a basis for advice regarding multi-year investment strategies seems problematic.

The takeaway from this section is that relying exclusively on equilibrium returns has its problems which is why we also model the uncertainty around the equilibrium views.

Capital Market Assumptions (CMAs)

Equilibrium views are only based on historical data. What we now do is involve our investment strategists to obtain their views of the future with the aim to improve upon the equilibrium views.

We start the development of our subjective views on future returns for each asset class by eliciting the input of a wide range of research and investment professionals across Barclays. Our process then uses a top-down approach in which the building blocks for each asset class include key macroeconomic variables as well as the price, valuation, and market fundamentals relevant to their performance. This helps keep views across asset classes grounded and consistent.

For example, for fixed income asset classes we consider the current yield of the representative benchmark and make small adjustments based on the current yield curve and expected default rates. For equity, we consider the aggregated earnings yield and buyback yield, amongst other things. By periodically updating the SAAs with new views, we ensure that our long-term asset allocations are positioned intelligently regarding prevailing return levels.

Black-Litterman Model & Blended Returns

The approach we take to estimating future returns begins with standard industry best practice – the Black-Litterman model. This involves creating a blend of market implied equilibrium return estimates and the subjective views of our investment strategists.

Recall that for the majority of asset classes, we have two views: the market implied equilibrium views and the subjective views from our investment strategists. If these two views were known with certainty, then a weighted average would generate a blended return. However, both views have a level of uncertainty. Rather than just adding two expected returns together we also need to combine their different levels of uncertainty.

Indeed, the Black-Litterman model does not assume that the world is always in equilibrium, but rather that when expected returns move away from it, imbalances in markets will tend to push them back. Investors can therefore profit by combining their views about returns in different markets with the information contained in equilibrium prices and returns. Equilibrium returns can be seen as a 'centre of gravity' for expected returns; views determine the extent of the deviations from equilibrium.

Using Bayesian updating, we combine our long-term views with the equilibrium estimates to create our forward-looking

blended returns. As a result, assets deemed to be expensive will have lower expected returns, and therefore smaller weights in our portfolios, than historical returns might suggest.

Financial Market Simulations

Our SAA model exists within the bank's Model Risk Management framework. The model is reviewed annually and challenged by the Independent Validation Unit. There are multiple ways to model financial markets and we have developed challenger models to give comfort that our implemented approach incorporates our best thinking.

We all know market returns don't follow a perfect bell shape normal distribution. Recent crises have proven this. To address this, we base our simulations on resampled historical data which we align with our forward-looking blended returns.

Our SAA Model uses a statistical technique called Bootstrapping. This method creates new samples of returns based on the 30-year time series of historical returns. To preserve the characteristics of financial data as much as possible, we employ the following modifications. First, we sample the returns of all the asset classes in one draw (instead of sampling them separately), which preserves their correlation structure, i.e., one draw will contain the returns of all eight asset classes instead of just one asset class. Second, we sample blocks of returns, i.e. not just one month of returns but several months at a time, to better capture clusters of volatility and stock market crises.

An advantage of bootstrapping is that no parameters need to be estimated or calibrated. The distribution of the monthly returns can remain unknown. The larger than expected negative returns characteristic of asset classes is maintained in the simulations.

Maximising Client Utility

Once we have generated a set of simulated return paths for each asset class, we are ready to solve for the optimal asset allocation weights, i.e. to determine the portfolio that offers the best trade-off between risk and return. But how should we define risk?

The use of volatility as a risk measure is widely used across the investment management industry. However, volatility is problematic: it penalises positive deviations from the average as much as it does negative ones, and it is concerned with the bumpiness of the journey, not the outcome. This is not what 'risk' means to most investors.

So, instead of considering risk and return separately, we translate simulated final portfolio values into the subjective value that an investor of each risk profile would attach to them. This can be done using what's known as a 'utility function'.

The function we use encodes two key investor preferences: the first is intuitive – more wealth is preferred to less wealth. The second needs a little more explanation and states that the relationship between returns and investor utility is not symmetric around zero, i.e. the increase in utility of a positive return is smaller than the decrease in utility of a negative return of the same magnitude. Also, positive returns provide diminishing returns to scale, i.e. the value of an extra amount of return decreases as the level of return increases.

There are a number of substantial advantages to this approach:

1. it accounts for 'fat tail' events and asymmetry of asset returns, which can't be accommodated in the standard risk measures.
2. it can be personalised for each Risk Profile, so that the 'beauty' of a portfolio is in the eye of the beholder.
3. it emphasises the trade-off between risk and return, not an arbitrary, fixed level of volatility, and hence only takes on risk to the extent that it is expected to be rewarded.

Consequently, with this more realistic and personalised measure of value, the investor should feel more comfortable with their portfolio.

Robust by Design

Risk and return isn't the only trade-off to consider there is also a tug of war between maximising expected investor value and the robustness of a portfolio. For example, the optimiser's 'best' ex-ante allocation may include only two or three asset classes. This allocation may not maximise the investor's utility ex-post as this outcome may have been the result of measurement error in the input data or of wrong model assumptions.

A diversified portfolio is more robust to modelling errors, as it avoids the risks of being highly concentrated in just a few assets (i.e. it minimises the risk of overfitting the data). We therefore nudge the allocation from the first optimisation step towards a maximum diversification portfolio. When working out the maximum diversification allocation we take the correlations between asset classes into account, so that more highly correlated assets get less weight.

Also, instead of pulling all risk profile portfolios towards one maximum diversification allocation, we create tailor-made maximum diversification portfolios for each risk profile. This helps us manage the impact on expected investor utility and ensures that the nudge towards more diversification is small. Our SAAs target the low-hanging fruit, but no more.

Summary

Throughout the SAA process, we have tried to keep the methods as simple as possible and as complex as necessary. Financial data is notoriously noisy so that higher complexity does not always lead to more accurate outcomes. In fact, as model complexity increases the risk of overfitting the data increases as well. It is always about finding the right balance and we are confident that our methods achieve just that.

To summarise, the results of this process – using the Black-Litterman model to integrate our views on forward-looking returns; generating a multitude of possible outcomes through resampling; optimising with a personalised, natural measure of investor value; building in a preference for robustness – are our recommended SAAs for a range of investor Risk Profiles.

Section 4: From Asset Allocations to Customised Portfolios

How we tailor asset allocations to suit individual investor needs and incorporate tactical adjustments to portfolios.

So far, we have derived SAAs for five different risk profiles. These SAAs are intended as average, long-term holdings for generic investors. They are not our recommendation for every investor at every point in time. Two more steps are necessary to further tailor our investment advice.

First, we recognise that the optimal long-term allocation is not necessarily optimal at every point in time. In the short term, market sentiment and fundamentals can shift quickly, which creates opportunities that can be exploited through a tactical positioning of the portfolio. We thereby lean on the insights of one of the pioneers of investing, Benjamin Graham, who stated that in the short run the market is like a voting machine, tallying up which investments are popular and unpopular. In the long run, however, the market is like a weighing machine, assessing the investment's long-term ability to create value. We capture the long-term concept with our SAA and implement our short-term views in the tactical asset allocation. This will be of interest to many, but not all investors, as we shall see below.

Second, the SAA needs to be customised to reflect two aspects of an investor's specific circumstances: (a) their financial situation, and (b) their financial personality. SAAs are optimised according to the long-term risk-return preferences of five different Risk Profiles, but otherwise assume that investors do not have any other financial constraints, have no plans to spend the money in their portfolio, have no income requirements, and are concerned only with long-term financial efficiency. This allows our SAAs to have the broadest possible application to meet long-term investment needs, but there are aspects of individual investors' circumstances which may require some customisation of these portfolios.

Section 5: What's Different?

At the start of this white paper, we laid down the four basic principles at the heart of our asset allocation process: meeting client needs, portfolio diversification, accessibility of investments, and incorporating our long-term market views as well as leveraging our expertise in behavioural and quantitative finance.

Our asset allocation process is the result of years of innovation and refinements, which enable us to address each of these principles.

We have focused on:

- Having a broad range of asset classes with distinct risk/return characteristics, which include Commodities and ATS
- An investor's total wealth, which results in many investors with a low Risk Profile holding more in Cash and short-term bonds than advocated in conventional strategic asset allocations
- Improving the standard Black-Litterman asset allocation process by using advanced statistical techniques that allow us to incorporate uncertainty around the risk-return estimates and to increase the robustness of the optimised portfolios

- Enhancing the standard re-sampling techniques used in the industry by inserting 'memory' and thereby making the re-sampled financial returns more realistic
- Measuring and seeking to mitigate risk in a way that is consistent with what matters to investors: the chance of bad outcomes. Characteristics of financial returns, such as fat tails and asymmetries, are then accounted for
- Reducing the sensitivity to measurement errors and model risk by slightly tilting the allocation towards the maximum diversification weighting
- An integrated research and strategy department, so that our views on future macroeconomic developments feed seamlessly into our investment recommendations

Our approach to strategic asset allocation at Barclays is one important part of our overall Investment Philosophy. It is a component of the advice we provide to clients, but not the whole package. The latter includes substantial tailoring of the implementation to help meet the specific needs of individual clients, both financial and emotional, as well as providing tactical recommendations to take advantage of short-term investment opportunities in the market.

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