Capital Market Assumptions

WHITEPAPER

Influence tomorrow

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Table of contents

For Accredited Investors in Singapore.

Executive summary

At Barclays Private Bank, we help our clients to achieve their long-term investment goals through a structured and disciplined investment process. This journey starts with a deep understanding of our clients, their investment needs and objectives – such as liquidity, lifestyle and aspirational goals – as well as their risk tolerance and capacity.

Strategic Asset Allocation (SAA) is the bedrock of our investment process, and it represents the optimal long-term positioning in a range of asset classes. The SAA design is guided by our investment philosophy, which revolves around the principles of long-term investing, wealth preservation, international multi-asset class diversification and the optimal risk-return trade-off. According to some academic studies, 80-90% of a portfolio's performance can be attributed to the SAA[1]. Therefore, getting the long-term asset allocation policy right is important for successful investing.

Part of good asset allocation rests on reliable estimates of future return and risk. To this end, our Capital Market Assumptions (CMA) represent forward-looking estimates of expected returns, volatilities and correlations over the next five years for a number of asset classes, such as fixed income, equities, commodities, real estate, hedge funds, foreign exchange and private markets.

The CMA framework provides a strategic investment compass that helps clients to navigate the shifting landscapes of reward and risk in financial markets, avoiding a naive assumption that history will repeat itself exactly. The forward-looking nature of the CMA reflects the framework's attempt to integrate the macro-financial information, based on the current stage of the economic cycle, with the potential implications of secular trends and possible structural changes. Estimates are constructed using a building-block approach which decomposes expected returns into the key drivers: income, growth and valuation. The final results represent a robust blend of quantitative and fundamental expertise.

This whitepaper provides a non-technical overview of the CMA methodology at Barclays Private Bank. We hope that you find it insightful and use it as a guidebook for understanding the key return drivers across a spectrum of investment opportunities, as well as for informing your views regarding the attractiveness of various asset classes.

[1]See Brinson, Hood and Beebower (1986), Brinson, Singer and Beebower (1991), and Ibbotson and Kaplan (2000).

Introduction

The Capital Market Assumptions (CMAs) represent forward-looking estimates of expected returns, volatilities and correlations over the next five years for a range of (sub) asset classes in the investment universe. They include fixed income, equities, commodities, real estate, hedge funds, foreign exchange, and private markets.

For each asset class, the CMAs are produced in their respective local currencies. The exception to this rule is for indices that include geographically dispersed securities (such as, global or emerging market equities, global bonds or commodities). For such indices, the expected returns are produced in US dollars.

Both academic and industry research is used in establishing long-term returns and risk parameters. The methodology blends data-driven models and expert views for different asset classes, with macroeconomic projections for the next five years. As such, the current stage of the economic cycle provides an important anchor to the CMAs. However, investors should always keep in mind that forecasts are not a reliable indicator of future performance. The value of investments can fall as well as rise and you may get back less than you invested.

THE BUILDING-BLOCKS APPROACH FOR EXPECTED RETURNS

The methodology used in estimating expected returns is based on a simple framework – which has a strong foundation in financial economics and asset pricing theory – and breaks down the expected returns into three complementary building blocks: Income, growth and valuation (see table below).

This methodology can be applied to a wide range of asset classes: fixed income, equities and commodities. The exceptions to this rule are hedge funds and private markets, for which data is not as readily accessible and transparent as it is for public markets. However, alternative decomposition approaches and quantitative techniques are available for these asset classes.

THE BUILDING-BLOCKS APPROACH FOR EXPECTED RETURNS

Asset class	Building blocks of total returns					
	Income		Growth		Valuation	
Fixed income	Treasury yield	Credit spread	Roll return		Treasury yield curve adjustment	Credit spread adjustment
Equities and REITs*	Dividend yield	Net buyback Yield	Real earnings growth	Inflation	Multiple expansion	
Commodities	Collateral return		Roll return		Spot price adjustment	
Hedge funds	Quantitative approach					
Private markets	Public market benchmark			Illiquidity premium		

* REITs: Real Estate Investment Trusts
Source: Barclays Private Bank, March 2023

THE REGIME ANALYSIS FOR EXPECTED VOLATILITIES AND CORRELATIONS

The most common approach when computing long-term volatilities and correlations relies on historical estimates, given that risk parameters are relatively stable over longer investment horizons. However, average historical risk parameters do not incorporate any forward-looking information. To address this issue, estimations of expected volatilities and correlations are based on a two-step process.

In the first step, historical risk regimes are analysed. This helps to distinguish between 'risk-on' and 'risk-off' periods which are characterised by relatively low and high volatilities and correlations, respectively. Such analysis is particularly useful in understanding which asset classes might be best-placed to improve portfolio diversification during stressed periods in equity markets.

In the second step, based on the macroeconomic projections and other forward-looking inputs, the expected risk parameters for the next five years are estimated by appropriately mixing regime-specific risk inputs.

This approach allows views to be expressed regarding prospective investment risks.

CALIBRATING THE REAR-VIEW MIRROR

Although price indices can be used over shorter horizons, this does not hold for long-term investments because it is necessary to capture the transfer of value in the form of interim cash distributions. Therefore, total return indices are used in this analysis. The CMAs generally do not account for taxes, transaction costs, management fees and any other costs.

Given the five-year investment horizon, intra-daily, daily and weekly market moves are not an ideal match for the CMA analysis due to a large frequency gap. Using monthly or quarterly data for forecasting over economic cycles is a standard approach in the financial industry.

To this end, the data set consists of 22 years-worth of monthly observations, and index time series provide the required inputs for the implementation of the building blocks methodology (such as returns, yields, option-adjusted spreads, duration, dividends and buybacks). Most indices have sufficiently long histories. However, a backfilling algorithm is used for five indices which do not have a long enough data history. The backfilling process is further detailed in the last section of this paper. A 20-year timeframe is used for several reasons.

First, the sample spans various business cycles and therefore reflects different macroeconomic conditions, such as periods when markets were stressed (like the dot-com bubble, the Great Financial Crisis and the COVID-19 pandemic).

Second, the data does not extend back too far. The sample selection is a balancing act between the statistical benefits of using a longer time series, and the potential biases due to using data that reflects market regimes which seem unlikely over the next five years.

For data prior to 2001, there were several important changes around that time in the economic and financial landscape, such as the introduction of euro, inflation stabilisation, a lower equity-bond correlation, increased globalisation, shifting demographic trends and the growing importance of emerging markets.

Therefore, by design, the data set accounts for structural changes and secular trends on the basis of economic arguments. Nevertheless, it is long enough for correlation matrix estimation and analysis of risk regimes.

THERE IS NO SUCH THING AS PERFECT FORESIGHT

It is important to stress that – despite all the efforts involved in the forecasting of long-term returns and risks – the CMAs are not a guarantee of future performance. It is challenging to accurately predict all political, social, economic, financial, and other shocks that will materialise over the investment horizon of five years.

Uncertainty is an inherent characteristic of our world. One can only speak of returns and risks that can be reasonably expected in the future. The main purpose of the CMAs is to provide details around the underlying assumptions that trigger the decision-making process for an optimal asset allocation.

Accordingly, the primary goal is to build an internally consistent CMA framework which provides the expected returns and risks that seem appropriate for the economy and financial markets over the investment horizon.

The CMAs are constructed on an asset-class level, with a long-term investment horizon in view. No mention is made of specific products or investment vehicles. Moreover, the tactical asset allocation and instrument selection processes are completely separated from the CMAs, both in terms of the coverage (granularity) and the investment horizon (typically no longer than one year).

Therefore, the CMAs should be understood as a set of baseline expectations regarding the likely macroeconomic path, and the return and risk parameters for a broad spectrum of asset classes. While they do not try to model short-term market gyrations, uncertainty is a concern for the long run as well.

Macroeconomic backdrop

Each asset class in the investment universe has specific characteristics, a risk-return profile and serves a particular role in a portfolio context. However, all investments are ultimately exposed to the same underlying systematic risks, most notably the economic factors. The CMA framework accounts for this by linking the expected return and risk parameters to the projected paths for key macroeconomic variables.

Global economies are highly intertwined and form a complex system. There are many aspects that could be considered when forming a macroeconomic view, including economic output, consumer prices, labour markets, business conditions, monetary base, money supply, total public debt outstanding, government budget balance, trade balance and housing demand.

In terms of long-term forecasting, a single methodology is likely to fail, given that economic systems across the globe have vastly different sizes, population structures, natural resources, productivity, political stability and the like. Therefore, relying on a single model does not seem prudent, and combining information from different sources can add much value.

An effective way to build macroeconomic forecasts is to focus on key factors that encapsulate information about the current and expected state of the economy. Such factors can include real gross domestic product growth, inflation, short-term interest rates and unemployment rates.

ECONOMIC GROWTH

Gross domestic product (GDP) measures the monetary value of all final goods and services produced in an economy over a pre-specified period (typically quarterly or annually). A GDP figure provides a snapshot of the aggregate domestic production. Therefore, it is often interpreted as an indicator of a country's economic health.

To build economic growth projections, nominal GDP growth is broken down into inflation and real growth components. Since inflation projections are constructed separately in the CMA framework, attention is focused on real economic growth.

As with return projections, in-house expert views on economic growth are drawn on and combined with a quantitative approach that enhances modelling for long-term structural anchors with external short-term expectations. The further out the forecast, the more weight is attached to the structural model. By contrast, the early years are entirely dictated by in-house expert views and averaged external projections.

The reason behind this weighting is that the models cannot capture near-future expected events like a government spending programme or an energy price shock. Instead, they operate with structural parameters that determine the potential output of an economy (like population, the labour-force participation rate or the amount of capital invested) and therefore produce estimates that are indifferent of the typical economic cycle.

Conversely, qualitative approaches to determine growth in five or more years' time are less powerful because of the lack of useful qualitative inputs at such a distant point, as well as the growing dependency on intermediate forecasts. This makes projecting a non-cyclical measure such as potential output more sensible for the longer term (a period of at least five years).

POTENTIAL GROWTH

As such, it is implicitly assumed that in the long run, there is no economic cycle and the economy evolves according to a stable so-called "steady state". This is a standard approach in both academic and industry literature.

For an extensive overview of potential output modelling approaches, see World Bank (2018). The chosen structural model combines the elegance of a standard Cobb-Douglas production function, with the insights gained from a cohort-based labour force participation rate model, as well as the flexibility offered by a non-standard, state-of-the-art model for productivity growth.

The productivity model incorporates effects from climate-risk related carbon taxation. Finally, a widely used quadratic damage function is applied, with parameters according to the metastudy by Nordhaus and Moffat (2017), to reflect physical risks from climate change. Since the estimated physical damages are global, we rely on a distribution key derived from a study into the consequences of climate change by the OECD (2015) to produce country-specific damage estimates.

The general structure of the potential growth estimate is heavily inspired by Alestra et al. (2020), who propose a system which integrates the transition risk of combatting climate change by estimating productivity growth. In the most widely used OECD production function methodology, productivity is determined residually from the production function and then filtered to produce a non-eventful forecast. Alestra et al., however, find several determinants of productivity, such as education and the relative prices of energy and investments to derive long-term projections from a panel estimate. A panel approach is followed too, combining nine developed market countries (Australia, Canada, Switzerland, France Germany, Spain, Italy, Japan, United Kingdom and the United States of America).

This approach to productivity estimation requires projections for carbon taxation as well as future energy usage. In-house climate change experts provide appropriate scenarios for energy as well as global warming projections, selecting scenarios from the scenario database of the Network for Greening the Financial System (NGFS) and attributing weights for likelihood of occurrence.

One important aspect outside of productivity and capital is the rate at which populations (in this particular case, adults between the ages of 15 and 74) participate in the labour market. The concept, which is common in pension liability modelling and borrowed from Grigoli et al. (2018), is to estimate a participation rate effect for every birth cohort (in five-year groups like 1940-1944) and age bracket (for example, 25 to 29 year olds). This model is enriched with cyclical factors to capture swings in participation across the economic cycle, as well as structural factors to capture changes in education levels. One system of seemingly unrelated equations is estimated per sex and country.

Most parameters for potential growth estimates are derived from the OECD Economic Outlook Database. Population projections are taken from the United Nations Population Division (medium scenario). Historical educational attainment data is sourced from Barro and Lee (2013, updated 2018). Historical energy and fixed investment price indices are sourced from local statistics offices via Datastream by Refinitiv. Climate scenario-related projections are derived from the NGFS Phase 3 Database (2022) hosted by the International Institute for Applied Systems Analysis (see Richters et al. 2022).

INFLATION

Inflation represents the rate of change in prices in an economy over a given period of time, as reflected in the consumer price index (CPI). It is often used to assess shifts in the cost of living and to gauge the purchasing power of a country's currency.

Naturally, inflation impacts all asset classes. However, some of them are more sensitive to changes in the inflation rate. For example, real assets like commodities and real estate are typically considered as good inflation hedges. Inflation-linked bonds are designed specifically to provide protection against unexpected inflation, which is otherwise not embedded in nominal bonds. Additionally, commodity-related stocks and commodity-producing countries exhibit higher correlation with inflation.

The approach followed when forecasting inflation is motivated by two streams of academic research. First, the findings of Banerjee and Marcellino (2003) and Kapetanios, Labhard and Price (2008), which demonstrate that pooling different predictions is a powerful and robust tool for inflation forecasting. Second, in their influential paper, Ang, Bekaert and Wei (2007) demonstrated that survey-based models exhibit superior performance.

The inflation forecasts adopted in the CMA follow a pooled, survey-based approach: (a) The Bloomberg economic consensus data for the next two years, (b) The International Monetary Fund (IMF) long-term inflation projections, (c) Central bank conditional inflation forecasts and (d) central bank inflation targets.

SHORT-TERM INTEREST RATES

Treasury bills are government debt obligations with maturities of up to one year. Interest rates on Treasuries reflect a government's short-term cost of borrowing. Following the industry standard, three-month Treasuries are considered as a proxy for short-term debt in the CMA framework.

Short-term interest rates are intricately linked to the policy rates of central bank. Their relationship is remarkably stable across different monetary regimes due to central banks' control of the money supply via open market operations. For example, if the economy is struggling, central banks typically reduce interest rates and add liquidity to the market, possibly by buying Treasury securities. Lower policy rates make loans more affordable, which in turn should help to boost credit creation and economic activity. This is often referred to as expansionary monetary policy.

Monetary policy is the key determinant of future short-term interest rates. This has been particularly pronounced after the Global Financial Crisis (GFC). On the basis of their assessment of the economy and with their mandates in mind, central banks use forward guidance to communicate the anticipated path of monetary policy, effectively anchoring the market's expectations. In addition to traditional monetary policy instruments, central banks have liberally explored unconventional tools, such as quantitative easing (large scale asset purchases), since the GFC. With currently elevated levels of inflation, the future of quantitative easing is unclear and the focus is back on the central bank policy rate – our main anchor for short-term interest rates.

Short-term projections for policy rates are very difficult to make as central banks are performing a balancing act on inflation and economic activity without having a clear indication of a) the effect of their decisions on future inflation, b) the effect of their decisions on future economic activity and c) even the current level of economic activity.

Hence, like with economic growth, short-term projections rely on forecasts from (a) The Bloomberg economic consensus data that aggregates information from almost 70 different global banks, (b) The official target ranges for central bank policy rates, and (c) Historical policy rates in the post-GFC period. The adopted survey-based approach is motivated by extensive academic research, as seen in Chun (2011), Wright (2011), Kim and Orphanides (2012), and Bauer and Rudebusch (2020).

That said, in the long term, central bank policy rates become less of a balancing act, since economies are assumed to grow at the rate of potential output and inflation is assumed to be in line with central bank targets. This allows the use of models that estimate the neutral rate of interest (NROI), which is the policy rate a central bank will set when the economy grows at its potential rate (full capacity usage) and inflation neither decelerates nor accelerates. To estimate the NROI, a neoclassical formulation, derived from a Ramsey-Cass-Koopmans model as presented in Mendes (2014), is adopted. The model revolves around estimating the compensation for saving required by the households in a steady state for each country separately.

As for GDP growth, more weight is attached to the survey-based approach early on in the forecast horizon, while fully anchoring the policy rate estimates around the structural long-term projections from year five onwards.

Expected returns methodology

FIXED INCOME

A fixed income security represents a financial obligation of the debtor who promises to pay a specific amount of money on a pre-defined payment schedule to the creditor. The debtor borrows the money by issuing a bond, and repays the principal (the face value) at the maturity. The interest on the debt is typically paid in regular instalments (coupons) during the term of the bond.

THE LARGEST PIECE OF PIE

There are many different types of bond issuances, such as government, municipality, agency and corporation. Bond investors benefit from a stable income stream and high likelihood of repayment of their initial investment. In a portfolio context, fixed income is one of the core asset classes. In addition to their income-generating feature, bonds can help to diversify portfolios and, in so doing, might provide some protection when equity markets tank.

This is particularly true for fixed income instruments with the highest credit ratings, like government bonds.

IT'S ALL ABOUT INTEREST RATES

If the bond is held to maturity, the investor is exposed to the reinvestment risk, or the risk that they will have to reinvest coupons at an interest rate below the yield to maturity at the time of investment. If the bond is sold in the secondary market prior to the maturity, the investor is exposed to the interest rate risk, or the risk that they will sell the bond at a price lower than the initial/purchase price due to interest rate movements, and therefore they will realise a capital loss.

By construction, bonds are sensitive to changes in interest rates. If interest rates rise (fall) the bond price decreases (increases). This fundamental result is merely a special case of the inverse relationship between the present value of a stream of cash flows, and the discount rates. The degree of a bond's price exposure to the interest rate risk depends on several factors: maturity, coupon, yield, and embedded options.

BUILDING BLOCKS FOR GOVERNMENT BONDS

The three pillars of expected returns for government bonds are:

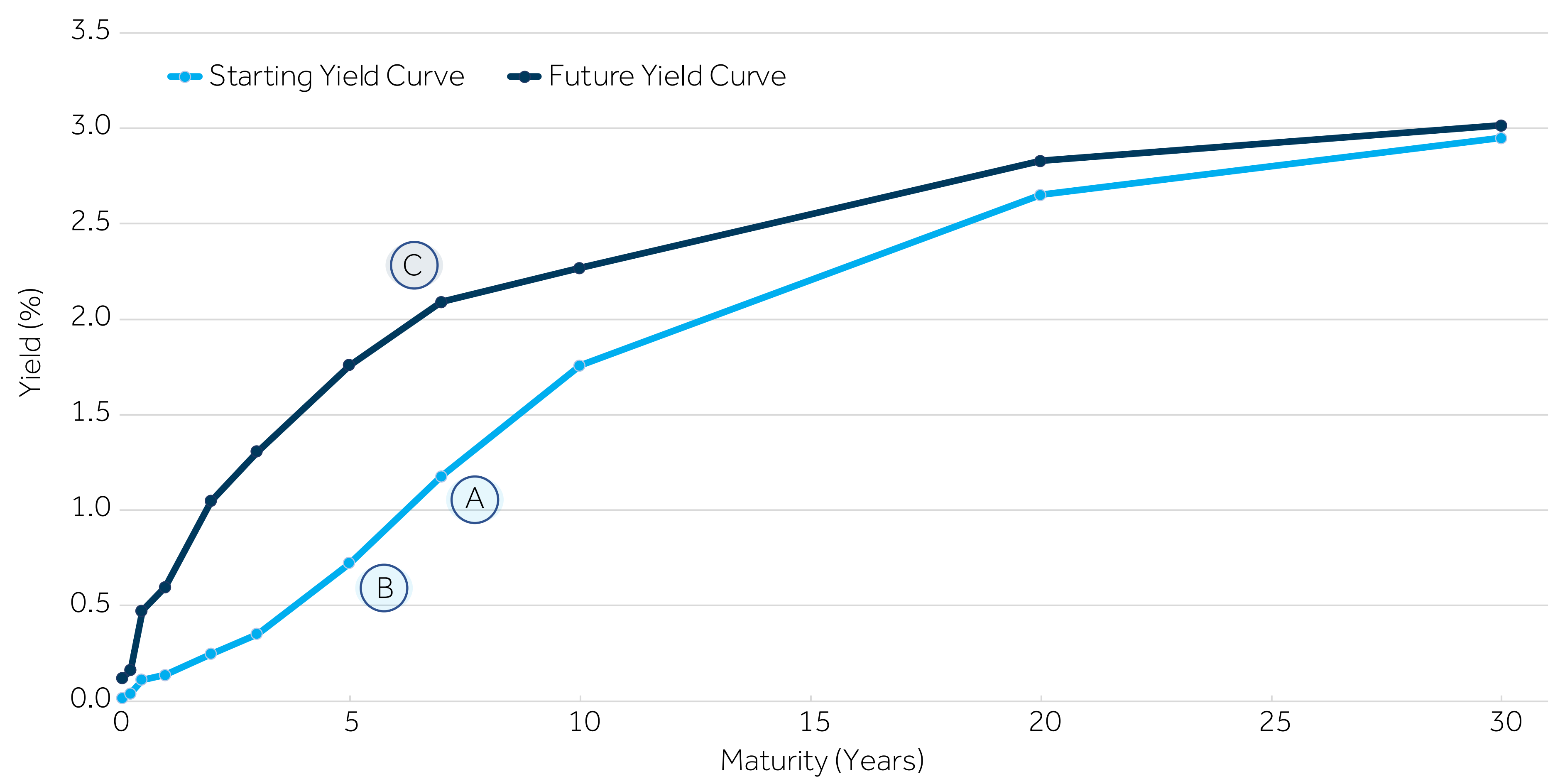
1. Income: The investor receives periodic coupon payments for each bond they hold in their portfolio. This is captured by the yield to maturity which represents the internal rate of return on a bond.

2. Growth: Assuming a fixed yield curve, if the spot yield curve is upward sloping – which is typically observed in fixed income markets – bond prices increase as bonds approach maturity. This passage of time gives rise to the roll-down return, which captures mark-to-market changes in the yield.

3. Valuation: Dynamics of the spot yield curve drive the repricing in the bond market.

ILLUSTRATING THE BUILDING BLOCKS FOR FIXED INCOME

A hypothetical example of a yield curve and the contribution of different return drivers. For illustrative purposes only. The yield corresponding to point A represents the income. The difference between yields corresponding to points A and B (A and C) represents the growth (valuation) component.



Source: Barclays Private Bank, March 2023

YIELD AS THE ANCHOR OF NOMINAL RETURNS

Nominal total returns for fixed income securities tend to be strongly anchored by their current yields. This is particularly true for medium-to-long-term government bonds over longer investment horizons (see figure).

Intuitively, by investing in a bond and holding it to maturity, an investor locks in the initial nominal yield. Over shorter investment horizons, valuation adjustments play a more prominent role because interest rate changes have an immediate effect on bond prices. However, a rise (fall) in interest rates leads to higher (lower) yields which will partially offset the valuation impact over longer time horizons. As such, the valuation component should be somewhat muted over longer investment horizons.

THE SANDS OF TIME AND ROLL-DOWN RETURN

As bonds age and roll down the yield curve, a capital gain is generated. The impact of the movement along the yield curve is a function of two factors: the steepness of the yield curve and the bond duration.

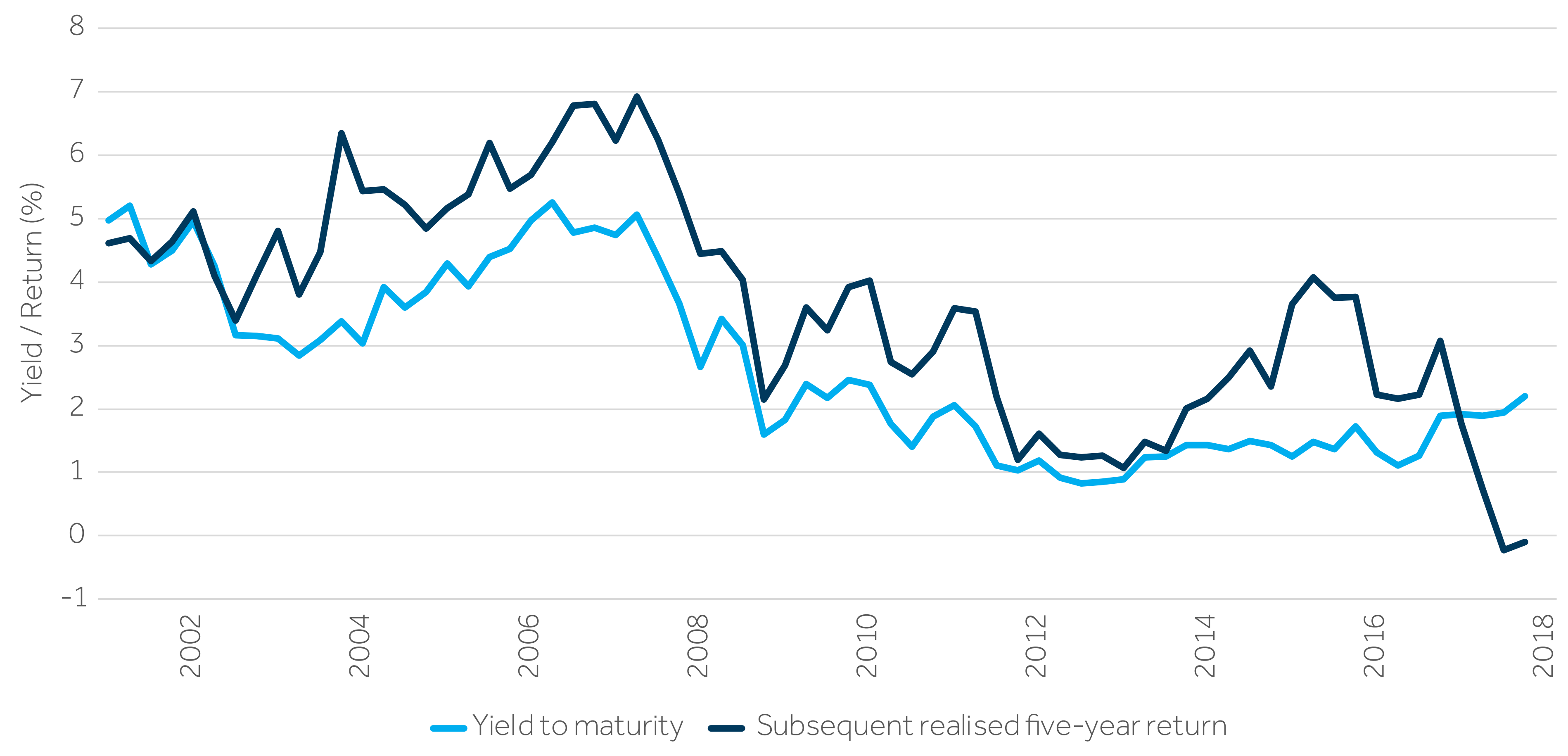
Roll-down benefits investors in single-name bonds and fixed income indices alike. If a bond index is regularly (perhaps monthly) rebalanced to keep its maturity stable, selling some of the securities held in the portfolio and buying other fixed income instruments with longer duration (to reset the bond portfolio duration to its initial value) will generate capital gains due to the roll-down of the liquidated bond positions.

LOOKING AHEAD

The income and growth components of expected returns are determined by the current yield curve and the duration of the index. To estimate the valuation adjustment, it is necessary to forecast future changes in the yield curve.

YIELD TO MATURITY AS A PREDICTOR OF TOTAL RETURN PERFORMANCE

The yield to maturity and subsequent realised five-year return for the Bloomberg US Treasury Index from September 2000 to December 2022. The last data point used for the five-year return calculation is December 2022. The data frequency is quarterly.



Source: Bloomberg, Barclays Private Bank, March 2023. Past performance is not a reliable indicator of future performance. The value of investments can fall as well as rise and you may get back less than you invested.

To ensure internal consistency of the model, the expected returns for short-term interest rates are incorporated in the model to help build forecasts for term premia. A term premium measures the compensation for holding a longer-term bond instead of rolling shorter-dated bonds. It can be positive or negative. Expectations are based on a parsimonious blended approach which combines market-implied information with mean-reversion assumptions derived from the projected economic path.

EXPECTATIONS HYPOTHESIS: MARKET KNOWS BEST

Market-implied expectations can be extracted from the yield curve using the expectations hypothesis, which posits that long-term interest rates can be calculated from current and future short-term interest rates (plus risk premium).

A fixed income investor could commit their funds either by purchasing a zero-coupon bond with the time to maturity that is equal to the investment horizon (say five years), or by rolling over one-year zero-coupon bonds. If the two strategies are equivalent in terms of investment performance, then an upward-sloping (downward-sloping) spot yield curve indicates an expected increase (decrease) in short interest rates.

A similar argument can be made for the forward yield curve. Therefore, according to the expectations hypothesis, forward rates should also reveal market-implied future interest rates.

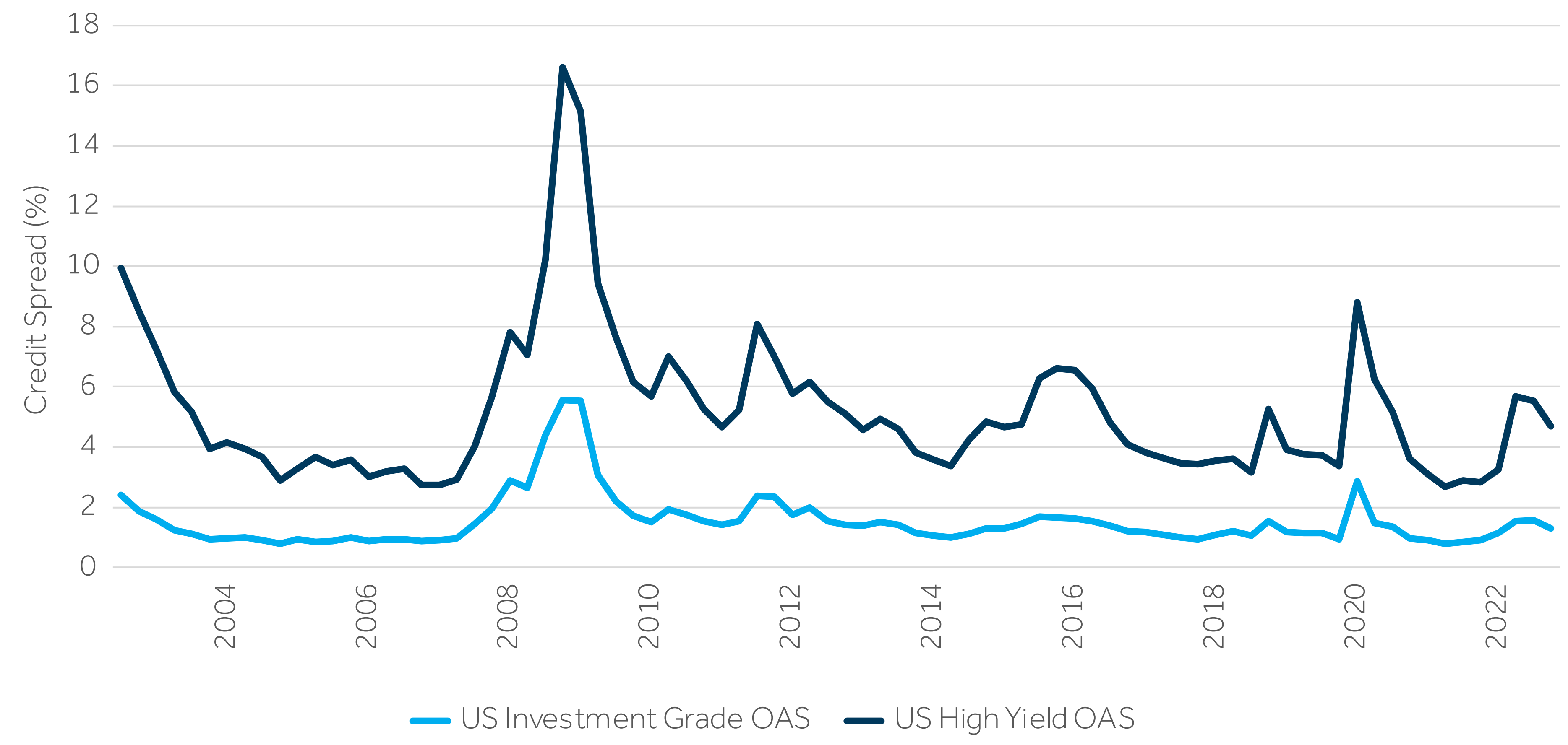
Despite its intuitive appeal, the expectations hypothesis has been challenged on empirical grounds. Among others, Fama and Bliss (1987), Campbell and Shiller (1991), Ilmanen (1995), and Cochrane and Piazzesi (2005) showed that the yield curve has some predictive power for future excess bond returns (the term premium).

CREDIT RISK AND OPPORTUNITY

In addition to interest-rate risk, fixed income securities, such as corporate, high yield and emerging market bonds, are exposed to credit risk. The two main types of such risk are bond downgrades and defaults.

CREDIT SPREAD FOR US INVESTMENT GRADE AND HIGH YIELD BONDS

The option-adjusted spread (OAS) for the Bloomberg US Corporate Investment Grade Bond Index and the Bloomberg US Corporate High Yield Index from September 2002 until December 2022. The data frequency is quarterly.



Source: Bloomberg, Barclays Private Bank, March 2023. Past performance is not a reliable indicator of future performance. The value of investments can fall as well as rise and you may get back less than you invested.

Downgrade risk arises due to an unexpected credit rating downgrade of a bond issue, or the issuer, by the rating agencies. Default risk represents the possibility that the bond issuer might not make timely interest and/or principal payments. Blanco, Brennan and Marsh (2005) classified default events into the five categories: bankruptcy, failure to pay, obligation default or acceleration, repudiation or moratorium (for sovereign entities) and restructuring. Credit risk significantly increases the volatility of corporate, high yield and emerging market bonds relative to government bonds.

However, credit risk also introduces new investment opportunities. The equity betas of fixed income securities exposed to credit risk are significantly higher than those of investment grade bonds. However, Sangvinatsos (2011) and Asvanunt and Richardson (2016) show that credit-risk premium represents an additional source of return which cannot be attributed to term- or equity-risk premium.

To adequately compensate investors for bearing this risk, the total yield embeds a risk premium called credit spread. This component is often represented by the option-adjusted spread and modelled separately from government bond yields (see figure).

ADDING CREDIT SPREAD TO THE EQUATION

The expected returns for fixed income securities which are exposed to credit can be estimated using a two-level building blocks approach. First, the total yield is broken down into two components – the yield on a duration-matching government bond and the credit spread. Duration matching is important for the consistency of the model – it ensures that expectations regarding short-term interest rates and term premium are correctly accounted for.

Therefore, in order to estimate the expected return for riskier bonds and fixed income indices, the results for government bonds are added to the expected credit premium, modelled using the building-blocks approach.

Like government bond yields, credit spreads change over time (see earlier figure). They are driven by company fundamentals and macroeconomic forces and tend to move in the opposite direction to interest rates on Treasuries. In times of stress, accommodative monetary policy and sentiment-driven flight to safety, credit spreads tend to widen, whereas yields typically fall. During risk-on periods, which are characterised by stable growth and bullish equity markets, credit spreads significantly tighten. Therefore, credit spreads exhibit pro-cyclical and mean-reverting behaviour.

In the CMA framework, the income component is represented by the current credit spread, whereas the valuation adjustment is estimated based on the assumed evolution of the credit spread over the next five years. A mean reversion of credit spreads is assumed over the next five years, towards their average over the past ten years.

Roll-down return due to credit spread changes is neglected from the framework. The reasoning behind this is that the quality of data for the corporate bond indices is generally lower compared to those for government bonds, which makes it difficult to construct a reliable and robust estimator for this term. However, the impact of this assumption is relatively low because the roll-down return is typically small.

BEWARE OF CREDIT LOSSES

Modelling credit spreads is necessary, but not sufficient, in estimating credit premium. Credit spreads do not map directly to excess credit returns because of potential credit losses. While the default risk is the main source of credit loss for high yield bonds, the main concern for investment grade bonds is the downgrade risk.

The probability of default represents the likelihood that a borrower will fail to repay their debt. The recovery rate is defined as the portion of the capital invested in the bond that is expected to be recovered by the investor in the case of a default. Therefore, the expected credit loss can be computed as the product of the probability of default and the loss given default (which equals one minus the recovery rate). The first component varies substantially over time, whereas the second component is relatively stable.

Giescke et al. (2011) estimated that credit spreads are approximately twice as large as default losses over the long term. Moreover, they found that credit spreads do not adjust to realised default rates. These results indicate that credit spreads and haircuts can be forecasted separately. Therefore, we capture the combined effect of credit migration, default probabilities and recovery rates by introducing a haircut for credit spreads. The haircut represents a multiplier, which is assumed to be 40% in the model, based on the standard industry approach.

ADDITIONAL CONSIDERATIONS FOR EMERGING MARKET BONDS

Emerging market bonds are debt issued by, or in, emerging market countries. Over the last three decades, emerging market economies have grown strongly, which aided investment returns.

In the CMA framework, emerging market nominal hard currency (EM HC) bonds are considered. This asset class represents the USD-denominated debt issued by sovereign governments (or issued by emerging market corporations but fully held or guaranteed by the government).

Although issued by governments, EM HC bonds are not free from the default risk. Historical data shows that sovereign defaults and debt restructuring have happened many times in the past (see Eichengreen and Lindert 1992 and Reinhart and Rogoff 2009). Some recent examples include Argentina, Ecuador, Venezuela, Lebanon and Greece.

There are many reasons why a sovereign government might default (partially or fully) on its obligations, perhaps driven by macroeconomic, political, structural or regulatory factors.

- External risks are important drivers of the performance of EM bonds: First, the Fed's monetary policy is one of the key drivers.
- Second, emerging markets are generally exposed to geopolitical risks, and many are particularly reliant on trade with China.
- Third, several emerging market countries are heavily exposed to commodity market risks. Most of them produce commodities. Therefore, the impact of a stronger US dollar filters through this channel as well.
- Fourth, emerging markets are less liquid than developed markets, which can add to risk at times of market stress.
- Finally, high dispersion of returns, due to broad geographic coverage, lack of familiarity and various other behavioural biases, add to the list of risks faced by emerging market investors.

However, over the past two decades, emerging markets have undergone major economic and financial reforms. Many improved their public-spending policies, reduced public debt and increased their foreign currency reserves. These changes are paving the way for more investors to consider emerging markets.

EQUITIES

Our methodology for the expected long-term returns on equities is based on the classical dividend discount model of Gordon (1962). At the heart of our building-block approach lies the premise that the productivity in the real economy ultimately generates the supply of capital market returns. Therefore, our approach belongs to the family of the supply-side model studied in Grinold, Kroner and Sigel (2011) and Ferreira and Santa-Clara (2011).

We decompose the expected returns into three components:

1. Income: The total expected pay-out yield which is equal to the sum of the expected dividend and net buyback yield,
2. Growth: The expected nominal earnings growth, i.e. the sum of the projected real earnings growth and inflation,
3. Valuation: The expected change in the cyclically adjusted price-to-earnings (CAPE) ratio.

To set the stage for our theoretical, building-blocks model, the key terms are defined and each of the factors listed above briefly discussed. The assumptions regarding each of the components are informed by the current economic and financial environment, among other things.

VALUE TRANSFER VIA DIVIDENDS AND BUYBACKS

For much of the 20th century, dividends were the dominant channel for cash redistribution to shareholders. Dividends are the cash distributions of corporate profits to the shareholders. They are sometimes used as an instrument to mitigate potential conflicts between the company's management and its shareholders. In the past, cash dividends have been relatively stable, both in terms of the amount paid out (relative to the stock price) and the distribution schedule during the year.

Following regulatory and tax changes in the US during the 1980s, companies' propensity to repurchase shares increased significantly. In turn, the average dividend yield decreased over time. Although associated with the US initially, the substitution of dividends with share buybacks has gained traction in much of the world. Note that buybacks should be considered net of new share issuances to account for the dilution of ownership.

Both components are cyclical, however they exhibit the lowest variation over time among all the equity building blocks. Regulatory and tax changes are often the main drivers of secular trends in dividend payments, buybacks and share issuances. However, such events are extremely difficult to predict. Currently, the total income return is about 2-5% in developed markets (see figure below).

Dividends and buybacks represent the main channels of value transfer to the shareholders, rather than a source of value creation. Although closely linked, dividend and net buyback yield represent two distinct aspects of the corporate payout policy. Indeed, buybacks might be classed as a growth component. This is because they reduce the number of shares outstanding, which in turn boosts financial ratios on a per-share basis. For example, share repurchases increase the earnings per share – the same aggregate earnings being distributed over a smaller number of shares.

RELIABILITY AND ROBUSTNESS OF EQUITY INCOME

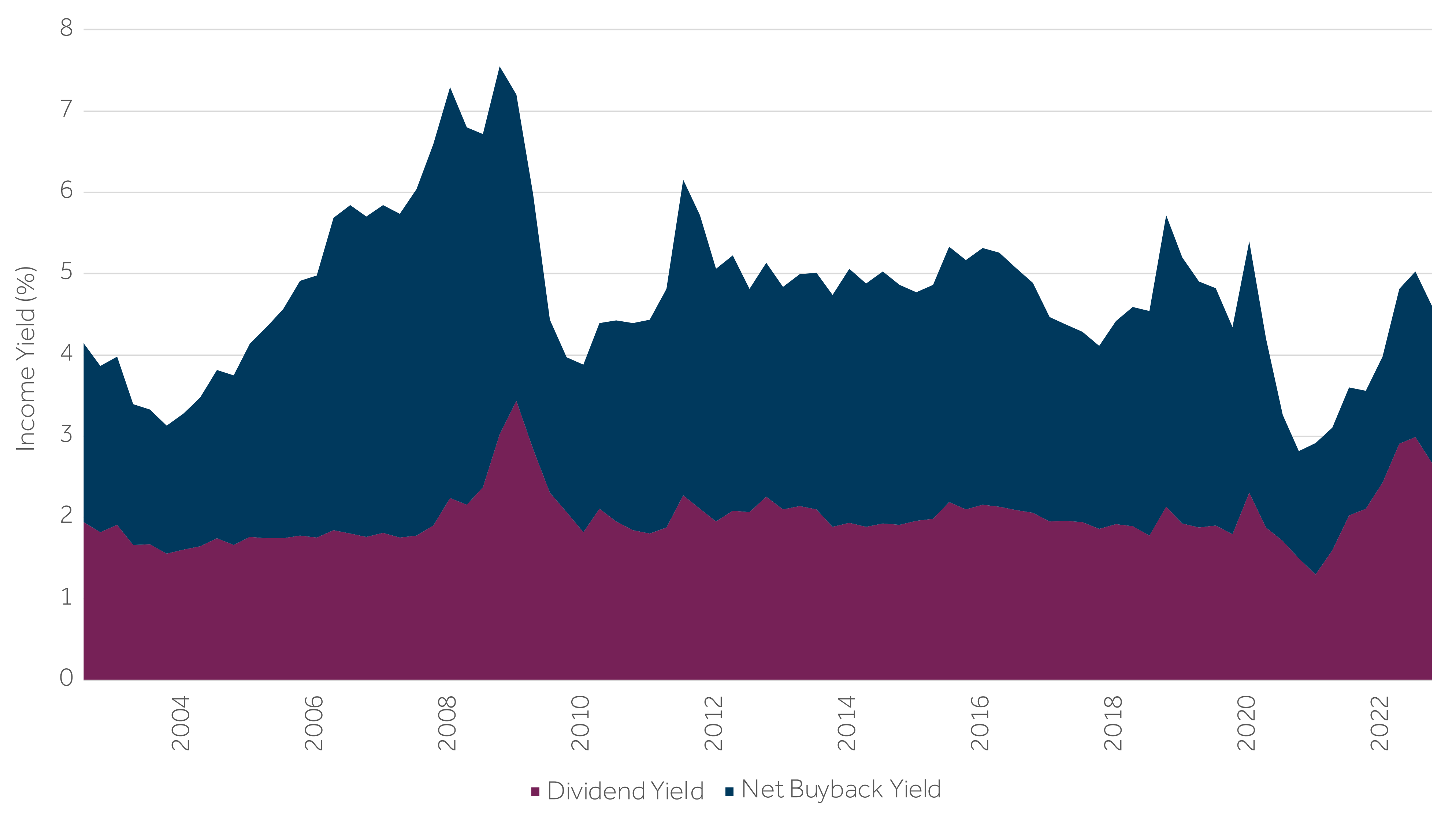
To build the long-term forecasts for dividend yield and net buyback yield, it is worth briefly revisiting two approaches that are commonly applied in the investment industry.

Ferreira and Santa-Clara (2011) estimate the dividend yield using the current dividend-price ratio, which is consistent with the 'random-walk' hypothesis. Their framework does not include buybacks. In the spirit of their model, the current net buyback yield could be used as the estimator for the second component of the income pillar. This approach is often used by investment professionals. However, cyclical fluctuations in dividend payments, buybacks and share issuances could create excess variability in the estimates. Given an investment horizon of five years, it is worth estimating an income yield – as the most stable component of the expected equity returns – in a more robust way.

Grinold, Kroner and Siegel (2011) use the longest available sample to estimate the historical averages of dividend yield and net buyback yield. By construction, the advantage of this approach is that the two components are likely very stable over time. However, the structural shifts in the

INCOME FOR US EQUITIES

The dividend and net buyback yield for the MSCI USA Net Total Return Index from September 2002 until December 2022. The data frequency is quarterly.



Source: Bloomberg, Barclays Private Bank, January 2023. Past performance is not a reliable indicator of future performance. The value of investments can fall as well as rise and you may get back less than you invested.

corporate payout policy are neglected in their framework (unless the available sample coincides, by chance, with the period of interest).

Based on these insights, the two components of the income pillar are estimated by assuming a linear convergence of the dividend and net buyback yield from current levels to their respective ten-year averages over the next five years. Therefore, the framework's estimates are driven by the sample that spans a full business cycle.

A dynamic component is added to the model by accounting for the current levels and recognising the fact that policy changes take time. Overall, the estimator smooths out the effects of macroeconomic regimes within a cycle. Additionally, it prevents the use of older observations, which implicitly account for the structural changes in the corporate payout policy.

EQUITIES AS GROWTH DRIVERS

Equities offer one of the greatest growth prospects among all asset classes. Generally, corporate growth is generated by investing retained earnings or new capital into profitable business projects.

In the long run, the aggregate earnings growth is inextricably linked with economic growth. During boom and bust periods, investors' behavioural biases, and overexuberance or pessimism, often lead to strong market overreactions. However, diverging trends between economic and corporate earnings growth tends to have a finite life.

Bernstein and Arnott (2003), Cornell (2010) and Grinold, Kroner and Siegel (2011) argue that if corporate earnings grow faster (slower) than the economy over a long period of time, returns on capital (labour) will increasingly dominate returns on labour (capital). Such trends cannot continue indefinitely, since they would either deplete rewards for labour, government, and other non-corporate entities, or drive down business profits to zero. Therefore, corporate earnings growth and economic growth must be co-integrated in the long run. In economic terms, this means that the marginal product of capital and labour are decreasing functions. Moreover, the long-term aggregate earnings and economic growth are ultimately bounded by the rate of technological progress and the growth of input factors.

GETTING REAL ABOUT EARNINGS GROWTH

To build expectations for the growth pillar of expected equity returns, nominal earnings growth is decomposed into real earnings growth and inflation. The rationale for this approach is twofold. First, Van Binsbergen and Koijen (2010) found that nominal earnings growth has a predictable low-frequency component. However, their research suggests that this is likely due to the predictability of the inflation rate. Second, earnings growth rates for different time periods are directly comparable only when normalised by the average level of prices in the economy.

Real earnings growth is notoriously difficult to forecast (see Fama and French 2002, Chan, Karceski and Lakonishok 2003 and Cochrane 2008). Some authors argue that real earnings growth should be bounded from above by real GDP growth. A substantial part of the economic growth is generated by private companies, which are arguably the main drivers of growth.

Across geographies, companies typically account for up to 50 percent of GDP (with a tendency to decrease further). This means that a large share of growth is generated outside of shares that are publicly traded on stock exchanges. Moreover, in most countries, the composition of equity market indices does not mimic that of GDP. Another detrimental factor is share issuance, which is a drag on stock returns due to the dilution effect. This is particularly pronounced in fast-growing emerging economies.

Due to globalisation, many companies have become multinational in nature. Outsourcing of production in recent decades was spurred by lower costs in emerging markets and improving trade conditions. Furthermore, the revenues of global companies are generated internationally, adding exposure to macro-financial factors in different geographies to those where the business is listed.

Additionally, large-cap equity indices are rebalanced relatively frequently, which creates an upward bias for aggregate earnings growth estimates. On the other hand, economic growth is not subject to a such bias. These factors might boost earnings growth beyond the domestic GDP growth cap.

By taking stock of these arguments, the framework follows the common approach taken in the industry and considers the forecast of real earnings growth based on expected real GDP growth. This is augmented by a forecast which is based on expected real revenue growth and profit margin.

The five-year forecast is constructed using a blended approach that combines these two methods. In this way, a robust, macro-consistent and forward-looking supply-side estimate is obtained for the growth component of expected equity returns.

VALUATION IN THE SPOTLIGHT

The valuation pillar of equity returns captures the changes in the price-to-earnings (P/E) ratio, which represents the price that investors are willing to pay per unit of a company's earnings. Due to its tendency to mean revert (see Campbell and Shiller 1998), many market practitioners use P/E ratios as an indicator of future returns.

Historically, low (high) values of a P/E ratio are typically interpreted as a sign of high (low) future returns. There are many definitions of the P/E ratio. The cyclically adjusted price-to-earnings (CAPE) ratio, which smooths out cyclical swings in corporate earnings and accounts for the impact of inflation, is one that is commonly used. It can provide better forecasts of stock returns over longer investment horizons compared to other valuation methods.

In the short term, changes in P/E ratios are primarily driven by investor sentiment. Like earnings growth, the P/E ratio fluctuates substantially and is difficult to predict.

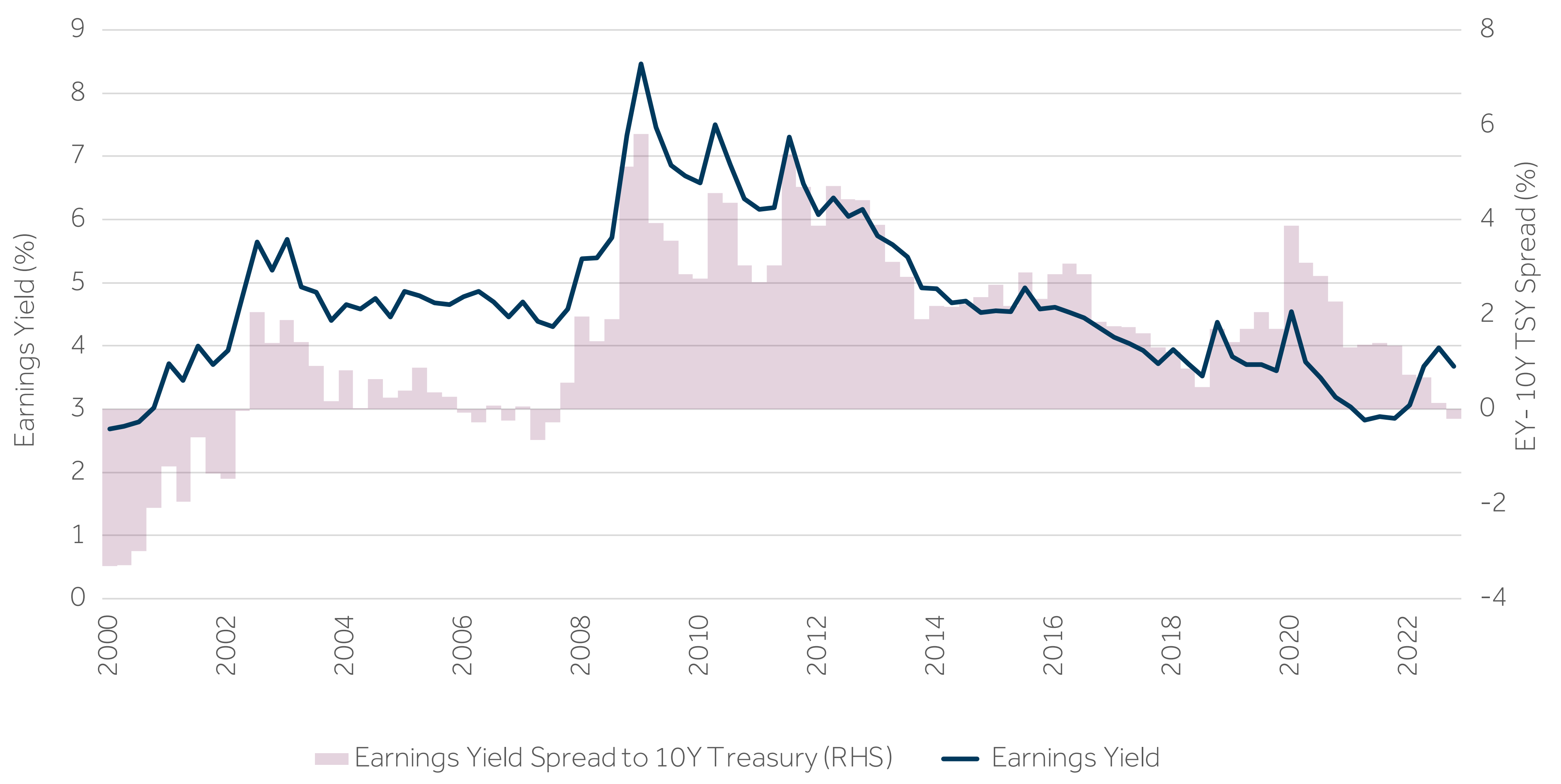
The predictability improves to some extent over longer investment horizons. Lee, Myers and Swaminathan (1999), Carlson, Pelz and Wohar (2002), Philips and Ural (2016) and Davis et al. (2018) show that the key long-term factors are the risk-free rate and the 10-year bond yield (or alternatively the term premium), inflation and its volatility, as well as changes in the dividend payout policy. For broad equity indices, the sectoral composition can substantially change. Such shifts may create a significant structural bias.

MEAN REVERSION OVER THE BUSINESS CYCLE

Evaluating the repricing effect from a historical perspective is particularly important for investment horizons of five-to-ten years (or over the span of one business cycle). Following the industry standard, the framework's model is predicated on the premise that P/E ratios are mean reverting. In terms of the expected convergence level and speed of mean reversion, the P/E ratio is assumed to reach its ten-year average over the next ten years.

EARNINGS YIELD FOR US EQUITIES

The earnings yield – being the inverse of the cyclically adjusted price-to-earnings (CAPE) ratio – and its spread to the 10-year government bond yield for the MSCI USA Net Total Return Index from March 2000 until December 2022. The data frequency is quarterly.



Source: Bloomberg, Barclays Private Bank. Past performance is not a reliable indicator of future performance. The value of investments can fall as well as rise and you may get back less than you invested.

COMMODITIES

Commodities are physical assets, which are mostly used as production inputs for other goods and services. As pro-cyclical assets, commodity prices are driven by economic growth, inflation and industrial production. The aggregate supply and demand, as well as the storage and transportation, represent other important factors which influence commodity prices. Additionally, most commodities are denominated in US dollars. On average, broad commodities are expected to be negatively correlated with the greenback.

Commodities are considered to be an inflation hedge (see Bodie 1983). They can offer certain return opportunities and diversification benefits (see Erb and Harvey 2006, Blitz and De Groot 2014 and Levine et al. 2018).

There are many different types of commodities, which, according to Geman (2005), can be broadly classified into the following categories: agriculturals (grains, softs, citrus and orange juice, and livestock), metals (industrial and precious metals) and energy (oil, natural gas, coal and electricity).

COMMODITY FUTURES TAKE CENTRE STAGE

Trading spot commodities involves buying, shipping, storing and selling the product, and incurs substantial operational complexity and costs. For most investors, an immediate delivery of commodities is not feasible. An alternative is to use futures contracts. Some of the prerequisites of commodity futures trading are the opening of a margin account and posting of a collateral. Moreover, to avoid physical delivery of the product, investors must liquidate the contract (roll over into the next contract) before the maturity, if they want to close the position (stay invested).

CONTANGO OR BACKWARDATION?

There are two standard shapes of the commodity futures curve, which reflect market expectations regarding anticipated future prices. Normal backwardation refers to the situation when the curve slopes downwards, implying that the prices of futures contracts are lower than the spot price and that they are a decreasing function of the maturity. By contrast, contango is the commonly used term to describe an upward sloping futures curve, suggesting that the prices of futures contracts will be higher than the spot price, and will increase with the maturity.

In the former (latter) case, the futures contracts roll up (roll down) to the spot price as they approach the maturity date. This means that an investor who has a position in commodity futures will lock in a gain (loss) whenever the contract is rolled over in a backwardated (contangoed) market.

The historical record shows that commodity futures curves are typically in a contango. A later delivery date implies higher uncertainty and costs associated with the storage, transportation and insurance of the asset. A rational explanation is that, on average, futures markets reflect the commodity risk premium. However, supply-demand mismatches can be caused by a myriad of factors, such as seasonality, severe weather conditions and natural disasters, transportation disruptions, major regional or global political events. Under these circumstances, an inversion (or backwardation) of the futures curve could happen.

It is important to stress that certain commodity markets tend to be in contango, or backwardation, for structural reasons which are related to hedging pressures (De Roon, Nijman and Veld 2000, Gorton, Hayashi and Rouwenhorst 2013, and Arnott et al. 2014). Commodity producers (consumers) are naturally long (short) the underlying commodity and often hedge their positions by entering into short (long) positions in futures markets. This ultimately contributes to a backwardation (contango).

Another, related reason for a particular commodity market to be contangoed or backwardated, is the storability of the commodity. If it is relatively easy and cheap to store the commodity, then producers might simply stack up their inventories if the market price falls. Copper, for example is one such commodity; it is typically in contango because producers are not compelled to discount future inventory as it can be stored if prices are not satisfactory. Oil, on the other hand, is more difficult and expensive to store; so, it may be more frequently backwardated as producers hedge their commodity exposure to consumers (and speculators) who are willing to assume the price risk, in exchange for the expected roll yield premium.

CHOOSING THE RIGHT BENCHMARK

Erb and Harvey (2006) remark that there is no consensus among index providers regarding the composition of a commodity basket (as opposed to the equity and bond markets, where indices are constructed using a market capitalisation weighting). Tang and Xiong (2012) find that the 'financialisation' of commodity markets has led to increased volatility of the non-energy commodity complex. Moreover, the correlations of commodity markets with the oil market shifted higher.

From the economic point of view, this means that supply and demand forces prevalent in individual markets are not the only factors which impact commodity prices. For instance, the aggregate risk appetite of investors in broad commodity indices seems to be an increasingly important factor.

In the CMA framework, commodities are considered on a broad basis. The framework follows the industry standard and uses the Bloomberg Commodity Index as a proxy for the whole asset class (Bloomberg 2018).

This index blends different types of underlying exposures in a basket that comprises individual front-month commodity futures contracts (which roll over approximately every second month). This index has several characteristics:

- The Bloomberg Commodity Index is well diversified and provides broad exposure to commodity markets.
- The index is constructed using futures contracts which are liquid, standardised, exchange-traded and cost-efficient investment vehicles. Moreover, this implies that the index represents an investable benchmark.
- The index assumes a full cash collateral.

The individual commodity weights are determined using liquidity and US dollar-weighted production data. To reduce concentration risk, certain exposure limits are introduced. The index is rebalanced on an annual basis.

BUILDING BLOCKS OF COMMODITY RETURNS

The framework estimates the expected returns for commodities using the building-blocks approach. Like fixed income and equities, commodity returns can be decomposed into: income, growth and valuation components.

The income component is given by the interest on the collateral. The growth one is represented by the commodity roll returns. While, the valuation component is captured by the expected spot-price return. Each component is now discussed in more detail.

COLLATERAL RETURN

Assuming that commodity futures are fully cash-collateralised, the proxy used for this component is the collateral return, which is estimated as the expected return on a three-month US Treasury bill. Estimates of the income component are based on the framework's macroeconomic forecasts, which include those for ultra-short fixed income.

ROLL RETURN

Erb and Harvey (2016) define the commodity roll return as the cost or benefit of staying invested in the futures contract over time. Since the roll return describes the convergence of the futures contract price to the spot price, it is a function of the shape of the futures curve.

To isolate the effect of the roll yield, the historical time series of the cumulative roll return is extracted from the difference between the Bloomberg Commodity Index and the Bloomberg Spot Index. Macroeconomic and financial conditions have substantially changed over the last 30 years, and particularly since the GFC.

For these reasons, instead of relying on the simple long-run historical average to forecast the roll return, a better approach would be to anchor estimates to the post-GFC period. To this end, only the last 10 years of commodities roll index data is considered.

Finally, in the spirit of mean reversion, it is assumed that the roll return will linearly converge to this level over the next five years. Additionally, it is important to reflect the ongoing acceleration of the transition towards "green economies" in calculations. Therefore, various scenarios are considered.

SPOT RETURN

To estimate commodity spot returns, the nominal spot return is first decomposed into the real return and inflation rate. This step ensures that projected inflation is embedded in the five-year expected return for commodities. Moreover, this approach ensures that account is taken of the fact that, on average, inflationary pressures push commodity prices higher.

Second, given a strong negative correlation between roll yield and real spot return, a regression model is estimated and the roll yield forecasts are used to obtain real spot return projections.

HEDGE FUNDS

Hedge funds generate returns by leveraging their exposures to asset classes such as equities and fixed income, often by means of long-short strategies and derivatives. They follow dynamic trading strategies in an attempt to generate significant alpha while sheltering portfolios in market sell-offs. Although these traits could make them attractive to investors, it is important to distinguish between single manager and diversified hedge fund strategies.

THE PROMISE OF HIGH RETURN IS NOT WITHOUT RISK

Single manager hedge fund strategies often involve both long and short positions in highly volatile and tail-risk-exposed securities, such as small-caps, high yield bonds or options. Moreover, a potential lack of transparency, complexity, and high fees and expenses make them admissible only for certain investors.

The decision regarding an investment in hedge funds is a balancing act between the potential alpha and diversification benefits, versus the risks which are specific to individual hedge funds.

SELECTION IS KEY...

The hedge fund universe is tremendously diverse. HFR (2020) classifies single manager hedge funds into four primary categories: equity hedge, event-driven, macro and relative value. It is not surprising that the performance of hedge funds is characterised by high dispersion. As such, the selection of hedge funds, and adding of manager-specific (idiosyncratic) risk, is extremely important for portfolio construction.

... BUT DIVERSIFIED STRATEGIES INFORM THE ASSET ALLOCATION POLICY

Hedge fund indices are constructed as portfolios of hedge fund managers. In the context of the optimal long-term asset allocation policy, hedge funds are considered at the index level. Therefore, the CMA framework for hedge funds revolves around well-diversified strategies.

Defining the most representative benchmark index for hedge funds is not a trivial task. It is important to distinguish between liquid and illiquid strategies, which are reported on at daily and monthly frequencies, respectively. The selected proxies are based on the industry standard. For liquid hedge funds, the HFRX Global Hedge Funds Index is used. The illiquid benchmark in the framework is the HFRI Fund Weighted Composite Index.

HEDGE FUND INDICES ARE NOT FREE OF BIASES

Although diversified strategies reduce idiosyncratic risks to a certain extent, hedge fund indices are also subject to certain biases. Fung and Hsieh (2000) highlight three challenges that typically result in an overstated performance of hedge funds indices.

First, survivorship bias is a result of the removal of certain index members, which typically happens if a fund is closed because of poor performance. As a consequence, index returns are representative of successful funds only and tend to be upward biased. However, survivorship bias is not an issue for hedge funds only – it is well documented for all asset classes (see Rohleder, Scholz and Wilkens 2011).

Second, selection bias is a consequence of hedge fund managers having the freedom to choose between whether to report fund returns or not to third-party databases. Moreover, if that information is disclosed, they can also choose which performance metric to report. This means that hedge fund managers could choose to report returns only for well performing hedge funds (see Fung and Hsieh 1997).

Last, but not least, backfilling bias could artificially inflate performance metrics. When a new fund is added to the database, historical returns are backfilled. Fund managers are incentivised to provide instant histories if they have a good track record. Therefore, backfilling refers to an instantaneous inclusion of a fund's performance during the early, incubation period when it is admitted to a database (see Capocci, Corhay and Hübner 2005 and Jorion and Schwarz 2019).

THINKING OUTSIDE OF THE (BUILDING-BLOCKS) BOX

Due to the lack of transparency for data on hedge funds, it is not possible to apply the building-blocks methodology to hedge funds. Complexity and the sophistication of the underlying strategies exacerbate the problem. Therefore, a different methodology needs to be built to estimate expected returns for hedge funds.

One viable option is to design a blended approach which relates hedge funds to the core asset classes (equities and bonds) and possibly some alternative investments (perhaps commodities). Fung and Hsieh (1997), Liang (1999), Hasanhodzic and Lo (2007), and Bali, Brown and Caglayan (2011) consider linear multifactor models for hedge fund returns replication.

Given the dynamic nature of hedge fund strategies and the fact that they often trade non-linear derivative contracts, one could rightfully raise a question whether linear models are a good modelling choice for the replication of hedge fund returns. In their empirical study, Amenc et al. (2010) find that non-linear models do not necessarily improve upon the linear benchmark.

Ibbotson, Chen and Zhu (2010) argue that non-traditional betas are neither well explained nor readily available to investors. For this reason, they suggest using only traditional betas, when replicating hedge fund returns. In this setting, non-traditional betas are naturally incorporated in the alpha, which represents the added value of hedge fund investments.

Therefore, the CMA framework's model is based on a multivariate regression technique, which is the standard approach applied in the industry.

THE MAIN DRIVERS OF HEDGE FUND RETURNS

To ensure internal consistency, the candidate factors in the framework are sourced from the CMA universe. In particular, four factors are used to estimate the expected returns for hedge funds: government bonds, high yield bonds, equities and commodities. Each of these factors encapsulates a specific form of market risk.

Government and high yield bonds embed term and credit premium. Equity returns are driven by the equity risk premium, which is closely related to economic growth. Finally, commodities reflect the key factors of real asset returns, and are closely related to economic growth and inflation.

To tackle this problem from a risk premium angle, hedge fund returns in excess of cash are regressed onto excess returns of the four factors. The rationale for this approach is threefold. First, it offers an intuitive economic interpretation. Second, it is advantageous from a statistical point of view, because risk premia are less correlated than asset returns. Finally, the performance of hedge funds is, in practice, often quoted on a reference-rate-plus-spread basis. The excess return representation seamlessly fits into this narrative.

PRIVATE MARKETS

Private markets now represent a significant part of institutional portfolios, after four decades of strong growth. Historical data supports the notion that private markets can diversify portfolios, enhance the risk-return profile and provide investors with exposure to niche companies.

In this section, the main characteristics of private markets are analysed, including their key risks and opportunities, and a brief summary of private credit, equity, and real estate markets is provided. Lastly, the framework's approach is outlined for estimating the expected returns for these three sub-asset classes.

ILLIQUIDITY AND COMPLEXITY RISKS ARE KEY CHALLENGES

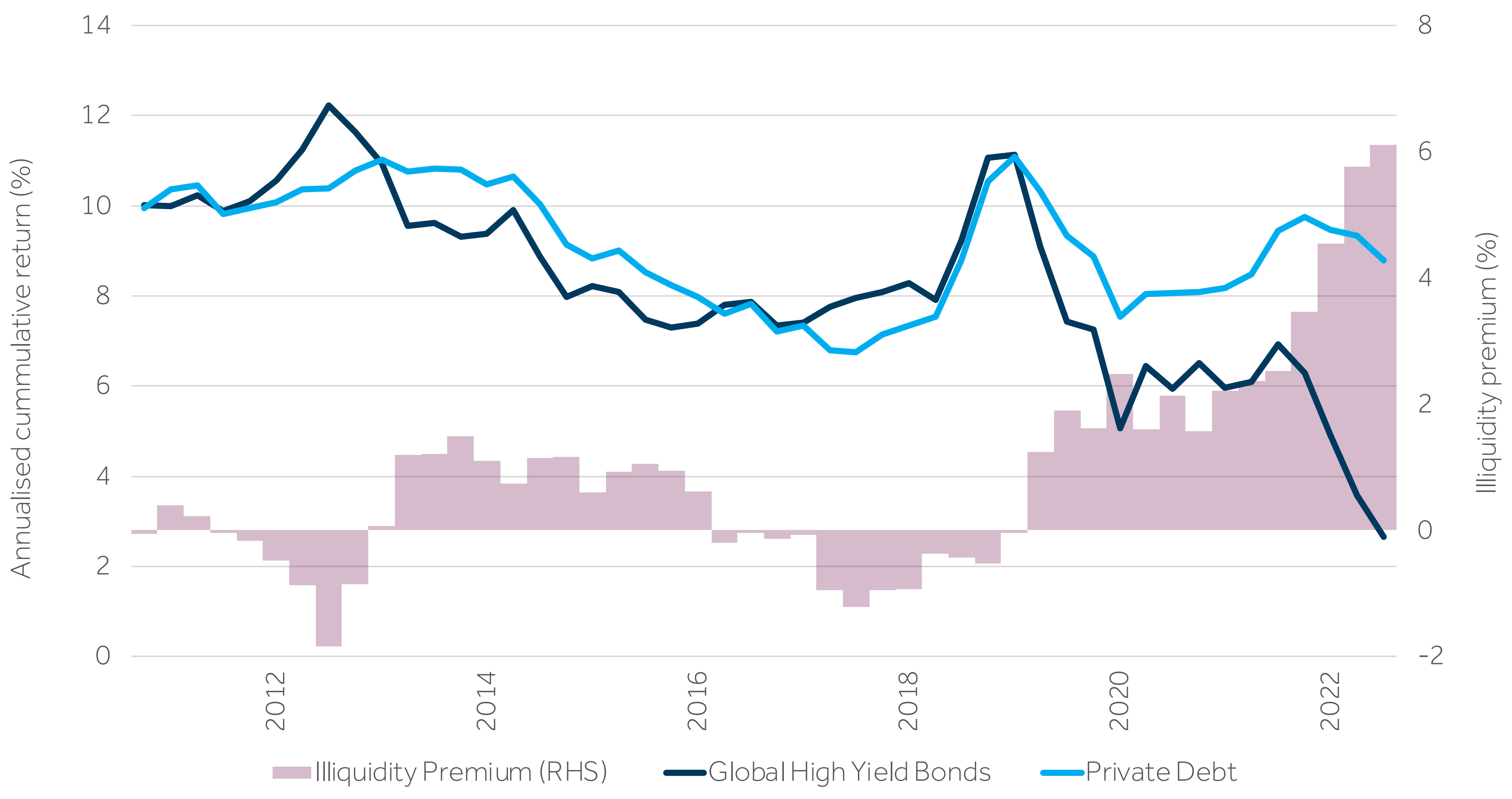
Private assets are not traded on market exchanges. Transactions are infrequent and require more time for finalisation, and trade details are only partially available. Valuations are based on professional appraisals, and historical data exhibit a persistent and slowly oscillating autocorrelation structure. Moreover, by design, investments in private equity represent long-term capital commitments.

Private market investors are inevitably exposed to more illiquidity risk than investors in public markets. The impact of this risk can be mitigated, to some extent, with time diversification (or spreading investments over time instead of a quick entry into the market). However, private equity markets – like many other markets – experience boom-and-bust cycles, and deploying capital too slowly can be detrimental for returns. While extremely difficult, finding the right pace of investment calls is a key component for successful investing.

In addition to the illiquidity risk, the lack of transparency, asymmetric information and the intricacies in private equity transactions create complexity risk. Whether investors get compensation for such risks, or not, ultimately depends on the private equity firm (and the depth and quality of their due diligence processes and selection skills). As such, it is little surprise that private markets are characterised by a large dispersion of fund returns (see Kaplan and Schoar 2005).

PRIVATE DEBT RETURNS COMPARED WITH THOSE FROM GLOBAL HIGH YIELD DEBT

Private credit vis-à-vis listed (global high yield) bonds. A comparison of 10-year moving average performance from December 2010 until September 2022. The difference in performance is attributed to the illiquidity premium. The data frequency is quarterly.



Source: Bloomberg, Preqin, Barclays Private Bank, March 2023. Past performance is not a reliable indicator of future performance. The value of investments can fall as well as rise and you may get back less than you invested.

PRIVATE CREDIT

Private credit refers to debt which is held or extended to private companies. The private credit investment universe is very broad. Cambridge Associates (2017) classifies private credit strategies into three categories: capital preservation, return maximisation, and opportunistic and niche strategies.

A very common type of private debt is direct loans, which represent senior or subordinated illiquid loans to middle-market companies in the US. Nesbitt (2019) defines middle-market companies as businesses whose earnings before interest, taxes, depreciation, and amortisation (EBITDA) range from $10 million to $100 million, which typifies the size of medium and small firms quoted in the Russell 2000 Index. This middle-market segment includes around 200,000 businesses and corresponds to about one-third of private sector GDP.

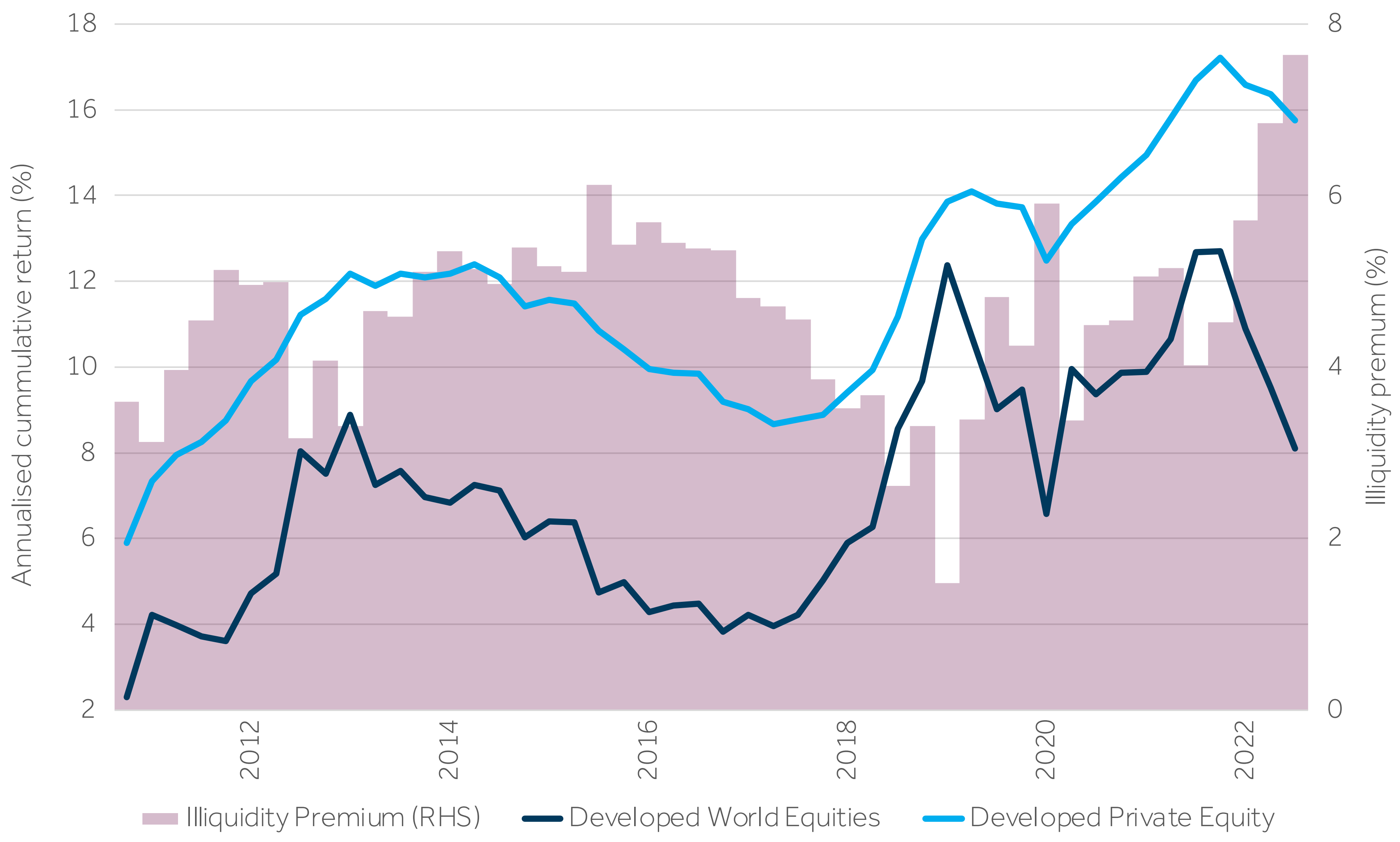
Traditionally, direct loans have been a core business for commercial banks. Regulation in the banking sector introduced since the GFC has resulted in more rigid restrictions – in particular regarding the types of loans and the leverage employed by financial institutions – and increased capital requirements. As a result, banks' advantage in this area over non-bank lenders quickly melted away because of the substantially higher costs associated with the middle-market lending businesses.

Other investment strategies in the private credit space include:

- Distressed debt, which is similar to direct lending but generally riskier due to its focus on distressed opportunities,
- Mezzanine debt, which represents a hybrid of equity and debt financing,
- Other types of private credit such as special situations and venture debt.

PERFORMANCE OF DEVELOPED MARKET PRIVATE EQUITIES AGAINST LISTED EQUITIES

Developed private equity vis-à-vis listed (developed world) equity. A comparison of 10-year moving average performance for equities and private equity in developed markets from December 2010 until Setember 2022. The difference in performance is attributed to the illiquidity premium. The data frequency is quarterly.



Source: Bloomberg, Preqin, Barclays Private Bank, March 2023. Past performance is not a reliable indicator of future performance. The value of investments can fall as well as rise and you may get back less than you invested.

PRIVATE EQUITY

Private equity refers to equity investments in privately held companies by professional investors. Broadly, such investments can be classified into three categories, based on the stage of development for the private companies: venture capital, growth capital and buyouts.

Private equity became an important element of the financial system in the 1980s. Investors typically take an active role with investee companies for two reasons.

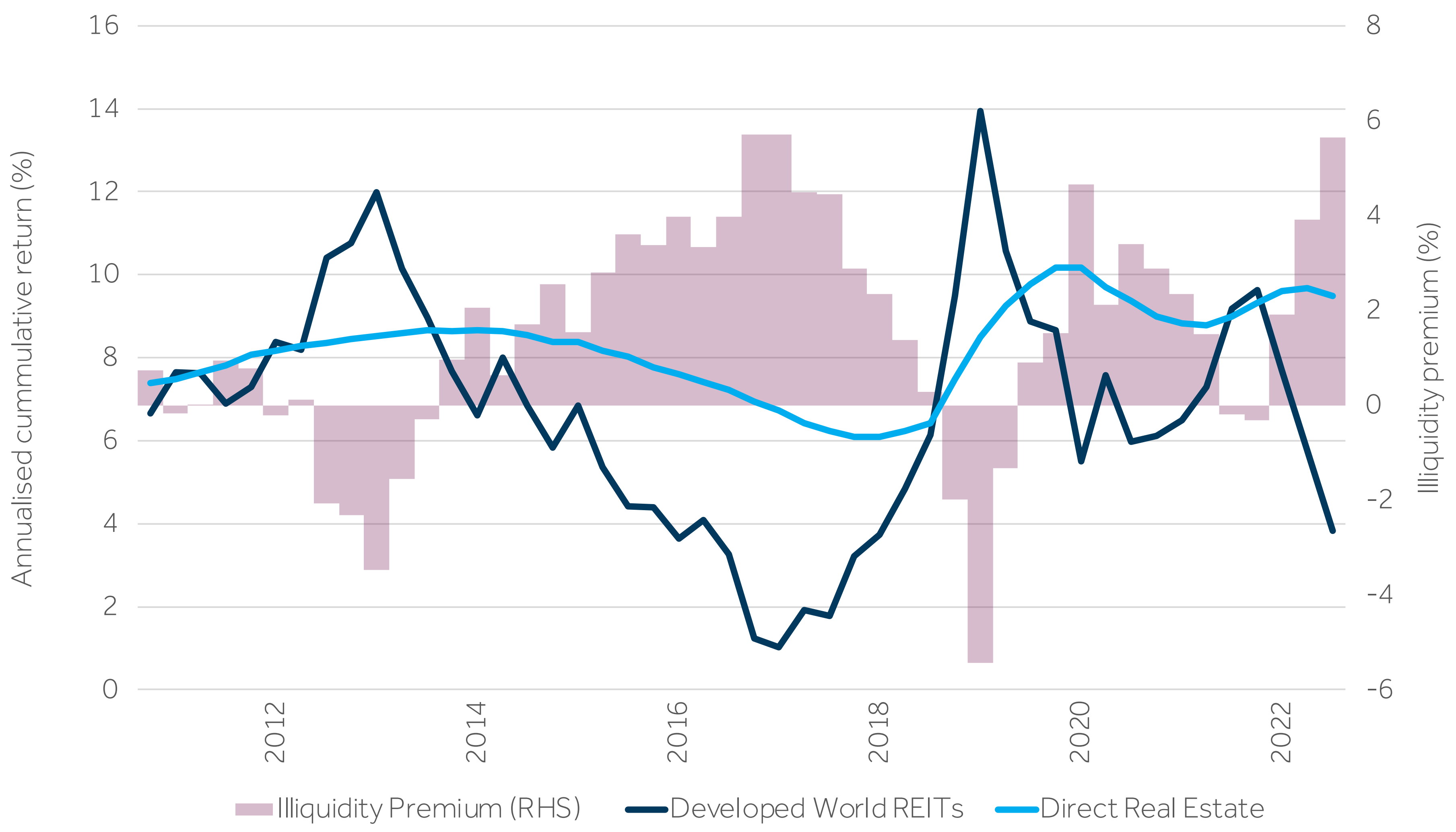
First, early-stage companies can benefit from professional guidance across a range of business functions. Most entrepreneurs are highly specialised and do not have much strategic, financial or commercial expertise. Therefore, access to investors' consultation and networking capabilities can be useful.

Companies which are at the growth capital stage might need to change their management style or rethink their long-term strategy (for instance, if they want to acquire a competitor). Meanwhile, mature, established companies might stagnate. Investors can help to reinvigorate businesses, possibly through a change of ownership, building better relationships with creditors and ultimately, hopefully, increasing earnings power.

Second, and perhaps a more obvious reason, investors may want to protect their capital. The key to any financial transaction is information. Investor activism can reduce the risks of adverse selection and moral hazard. It is arguably one of the most important roles of private equity investing.

PERFORMANCE OF DIRECT REAL ESTATE AGAINST REITS

Direct real estate vis-à-vis developed world REITs. A comparison of 10-year moving average performance from December 2010 until September 2022. The difference in performance is attributed to the illiquidity premium. The data frequency is quarterly.



Source: Bloomberg, Preqin, Barclays Private Bank, March 2023. Past performance is not a reliable indicator of future performance. The value of investments can fall as well as rise and you may get back less than you invested.

PRIVATE REAL ESTATE

Real estate belongs to the class of real assets. Real assets represent (or are closely related to) tangible, physical assets such as infrastructure, natural resources or property. An exposure to real estate is particularly attractive to investors because it offers storage of value and inflation protection.

Private real estate investments can be securitised and non-securitised. Securitised private real estate is also known as unlisted real estate and is measured at the fund level. Non-securitised private real estate refers to a direct ownership of residential apartments, complexes or housing developments, office buildings, warehouses, industrial properties, land and retail real estate. Direct real estate is measured at the asset level.

To estimate the expected returns for private real estate, a benchmark index needs to be defined. Following the industry standard, the CMA framework uses the National Council of Real Estate Investment Fiduciaries (NCREIF) National Property Index. The index is composed of operating commercial properties (apartment, hotel, industrial, office and retail properties) which are held for investment purposes only, and it is market-value weighted. The composite total returns are reported on an unleveraged basis. Therefore, the benchmark is representative of the direct real-estate segment.

EXPECTED RETURNS FOR PRIVATE MARKETS

Private markets are not for everyone. Investors who are interested in the asset class must be willing, and able, to accept the illiquidity risk, for which they are compensated by an illiquidity risk premium. This is also reflected in historical data generally being made available quarterly, as opposed to public markets which are characterised by daily liquidity.

To estimate the expected returns, an illiquidity premium is added to the expected returns for a comparable public market index. The illiquidity premium is estimated by blending results of three different approaches, which are in line with standard models for private markets used in the financial industry.

First, a long-term average of the performance spread between the private market index and the selected public equities index is considered. For the three sub-asset classes discussed above, the following approach is applied. For private credit, the performance of private credit is compared with the performance of US high yield bonds. The performance of a broad private equity index is compared with developed global large-cap equities. Finally, the public market benchmark for direct real estate is based on developed global real estate investment trusts (REITs). REITs are modelled as equities because real estate is classified as one of the equity sectors, according to the Global Industry Classification Standard (GICS).

Second, following Longstaff (2018), an estimator of illiquidity premium is constructed using the option pricing theory. In this model, illiquidity is represented as a restriction on the decision when to sell a thinly traded asset. As a result, the key drivers of the illiquidity premium are the volatility of the underlying asset and the length of the lock-up period.

Third, private market index returns are regressed on the public market returns of equities, high yield bonds and REITs. This approach is motivated by our methodology for the expected returns for hedge funds.

FOREIGN EXCHANGE

International asset allocation brings many benefits to investors. An expansion of the investment universe beyond home markets creates return-enhancing and diversification opportunities for investors. However, it exposes them to new risks as well.

FOREIGN EXCHANGE RISK

One of the key challenges is the currency risk. A foreign exchange (FX) rate is the rate at which one currency can be converted to another (the price of the unit of a foreign currency, expressed in the home currency denomination).

FX risk typically amplifies the total risk of investments in foreign assets. This effect is particularly pronounced for low-volatility assets, such as cash and fixed income. On the other hand, the results are rather mixed for equities – the optimal hedging policy depends on the nature of the home currency, say commodity-driven versus safe-haven currencies (see Campbell, Serfaty-De Medeiros and Viceira 2010).

Dumas and Solnik (1995) find that the FX risk premium is a significant component of asset returns in international financial markets. However, many investors are reluctant to keep a significant foreign currency exposure in their portfolios. One possible explanation is that FX rates are rather volatile, yet they do not offer attractive returns.

THE FOREIGN EXCHANGE FACTOR ZOO

Any foreign exchange rate combines a long position in one currency with a short position in another.

Currencies are driven by many factors, acting over different time horizons and ranging from financial and macroeconomic to political ones (interest rate differentials, cross-currency basis, inflation, monetary aggregates, total output levels and output gaps, productivity, net foreign assets and commodity prices).

In the short term, high volatility makes predicting foreign exchange movements very difficult. For example, in a highly influential paper, Meese and Rogoff (1983) find that the random walk hypothesis outperforms economic models. Recently, Rossi (2013) and Cheung et al. (2019) critically reviewed the literature on exchange rate forecasting and found no easy answer to the question. They concluded that exchange rate predictability depends on the investment horizon, sample period and forecast evaluation method.

The lack of consensus and unifying theoretical or empirical framework, after half a century of modern finance research, poses serious challenges for currency modelling. Cenedese and Stolper (2012) stress that the variety of models and their failure to consistently provide reliable forecasts has nudged many practitioners to use model averaging to produce their FX forecasts.

FOCUSING ON THE KEY LONG-TERM DRIVERS

The CMA framework's baseline approach focuses on the fundamentals. In particular, relative purchasing power parity (PPP) is applied in combination with a mean reversion assumption for real exchange rates, as the baseline approach for spot foreign exchange rate forecasting.

The relative PPP is an intuitive concept that has deep roots in economic theory – it is based on the law of one price. It is often used as an anchor for long-run real exchange rates (Rogoff 1996). Although transaction costs and other market frictions might dilute the relationship between the price levels and exchange rates, PPP should at least approximately hold in the long run to prevent international trade arbitrage (Taylor and Taylor 2004).

To estimate the expected foreign exchange rate, the real exchange rate (RER) is calculated. Although persistent trends are occasionally observed, foreign exchange rates generally exhibit mean-reverting behaviour over longer horizons. In addition, the RER is assumed to converge towards a level which is estimated by combining mean-reverting signals over the past five and ten years.

Furthermore, full convergence is assumed to take place over the next five years. The choice of this parameter is motivated by the results presented in Lothian and Taylor (2000), who estimate the convergence rate towards the fair value and find that 50% of the distance to the fair value is typically closed in 2.5 years. Assuming linear convergence, this suggests full convergence after five years.

The inflation differentials are computed from the CMA framework's macroeconomic projections. The final estimates for nominal FX rates are obtained by adding the two components together. Long-term expectations are constructed for the three currency pairs that are most important in the context of the strategic asset allocation: GBP/USD, EUR/USD and CHF/USD.

Expected risk methodology

Investors expect to be rewarded for the systematic risks they take. For this reason, it is necessary to estimate the key risk parameters – volatilities and correlations – for all asset classes in the CMA universe.

Volatility gauges the dispersion of asset returns and is calculated as the standard deviation of the return distribution. The correlation coefficient measures the degree of linear association between two variables and it is bounded between -1 and +1. Assets with significantly positive (negative) correlation move in the same (opposite) direction, on average. If the correlation is close to zero, then the assets are uncorrelated.

In this section, the framework's methodology is outlined for estimating volatilities and correlations over longer investment horizons. Additional information is then provided regarding some important quantitative aspects of the framework.

THE NUTS AND BOLTS OF THE LONG-TERM RISK METHODOLOGY

The most common approach when computing long-term volatilities and correlations is to use the classical sample estimators. Arguably, this is sufficient in many applications because risk parameters are rather stable over longer investment horizons.

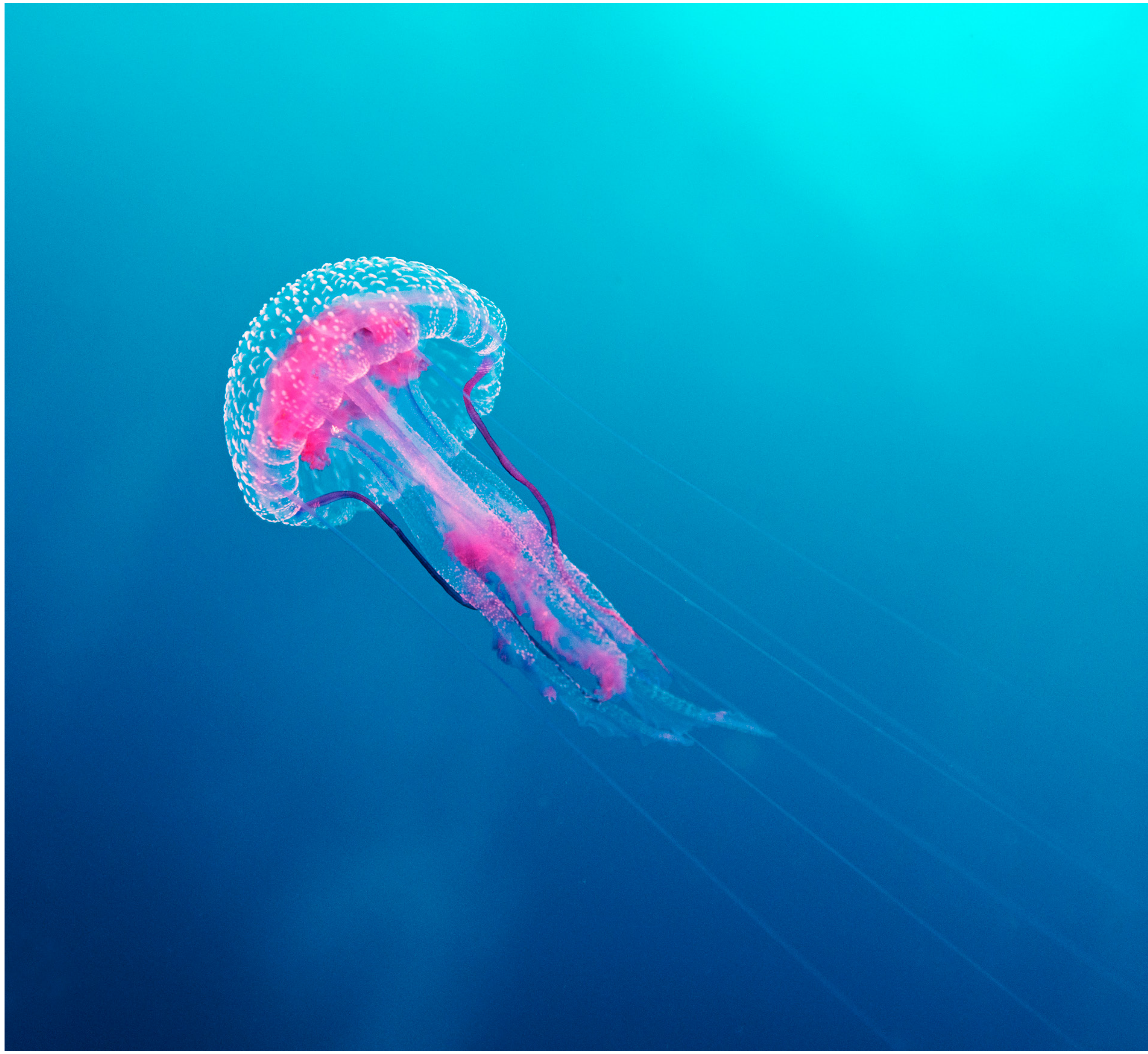
However, a question that often arises in practice is how to incorporate forward-looking information (such as investment views) into the risk methodology. Motivated by the work of Chow et al. (1999), Kritzman and Li (2010) and Bisias et al. (2012), a parsimonious model has been developed that offers a solution to this problem.

In a nutshell, a multi-asset class risk-on-risk-off (MAC RoRo) indicator provides a measure of risk which aggregates and compresses information from all asset classes in the CMA universe. Mathematically, the indicator is based on the Mahalanobis distance, which represents a contemporaneous measure of outlierness in a multivariate setting.

The name of the indicator is motivated by its application – it is used to split the full history of asset returns into two subsamples that correspond to risk-on and risk-off regimes. These regimes are typically characterised by periods of relatively low and high volatility, respectively (see figure).

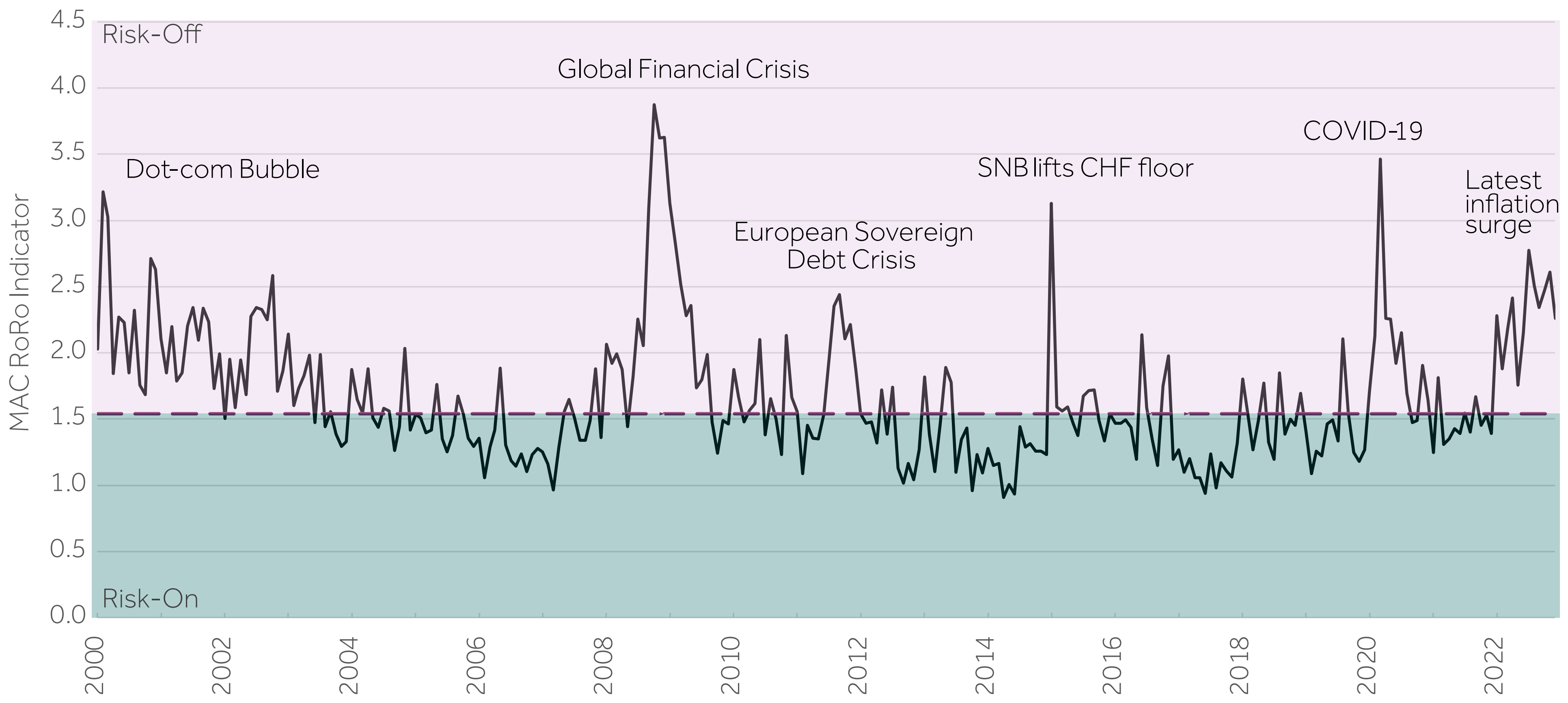
The sample is split into two equally sized subsamples. First, this ensures that the risk parameters demonstrate distinct behaviour in the two subsamples. Second, any other threshold value would favour one subsample over the other and smaller subsamples could create statistical issues when estimating risk parameters.

The covariance matrix is estimated separately for the two regimes. The mixing weights applied to the regime-specific covariances determine whether the final matrix will be in line with neutral, historical estimates (equal weights) or biased towards a risk-on or risk-off regime (unequal weights). This approach provides effective mitigating controls for long-term estimates of the risk parameters.



MULTI-ASSET CLASS RISK INDICATOR

The multi-asset class risk-on-risk-off (MAC RoRo) indicator is a proxy for "outlierness" of financial markets (solid black line). Higher (lower) values indicate periods of elevated (muted) volatility and correspond to risk-off (risk-on) regimes. The risk-on and risk-off regimes are represented by the green and purple areas, respectively, and delineated by the dashed red line. Calculations are based on the historical covariance matrix from January 2000 until December 2022. The data frequency is monthly.



Notes: - MAC RoRo indicator: Multi-asset class risk-on-risk-off indicator.
Source: Bloomberg, Preqin, Barclays Private Bank, March 2023. Past performance is not a reliable indicator of future performance. The value of investments can fall as well as rise and you may get back less than you invested.

THE SCIENCE AND ART OF SAMPLE SELECTION

The data set comprises monthly historical returns since January 2000, capturing a wide variety of market conditions. Both risk-on (bull) and risk-off (bear) market environments are represented, along with conditions specific to different phases of a macroeconomic cycle (recession, recovery, expansion and slowdown). The selected period reflects the balance between:

- The requirement to use as long a time series as possible to improve the quality of the statistical analysis;
- Data availability and its consolidation potential for a large set of asset classes; and
- Representativeness of historical returns during periods characterised by significantly different economic and financial market conditions.

TECHNICALLY SPEAKING

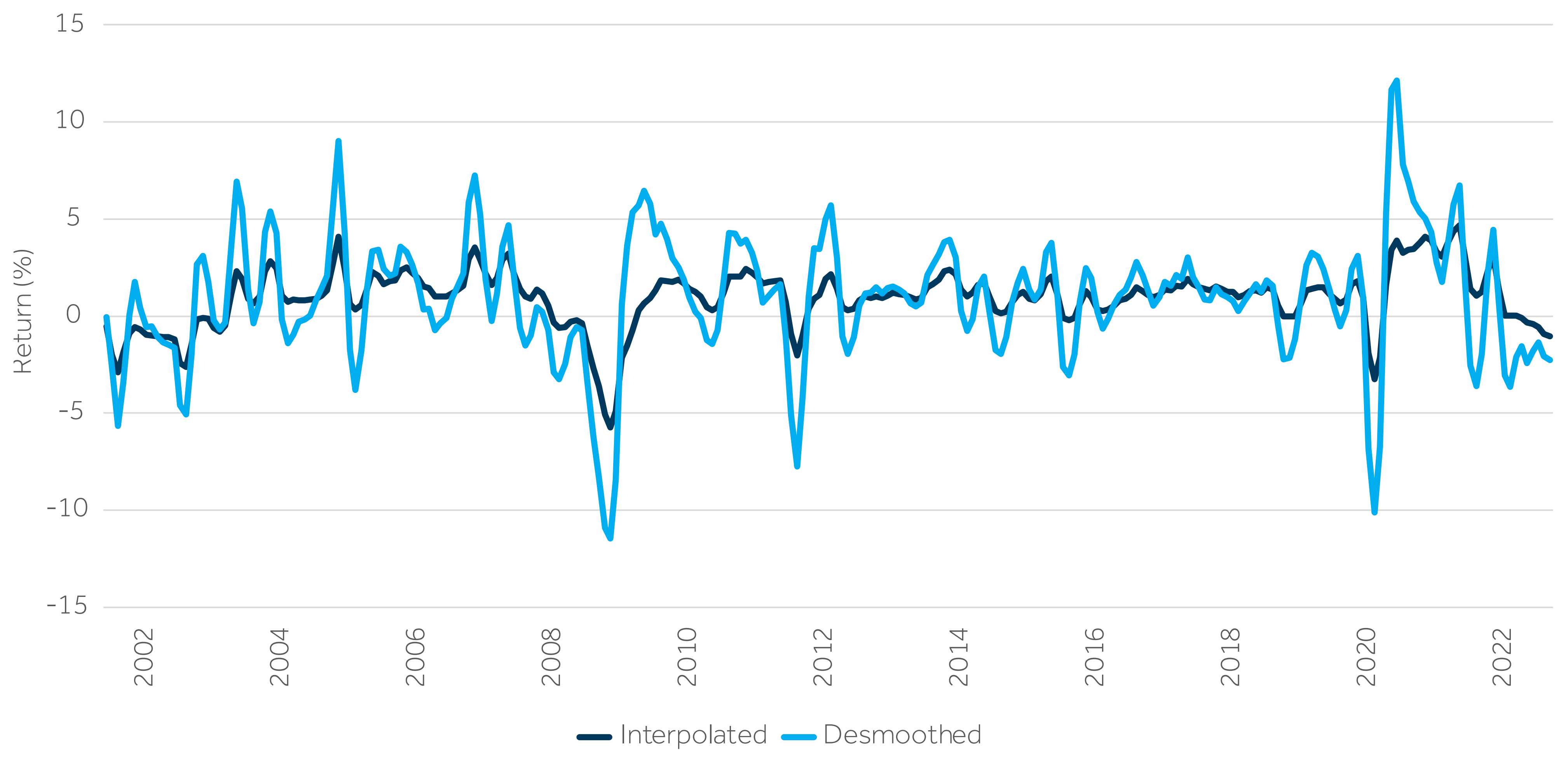
Unlike asset returns, which can exhibit substantial variation over time, risk parameters are typically stable and relatively predictable over longer investment horizons.

However, a panel of monthly returns for a broad range of asset classes exhibits several features which can adversely affect estimation results (see Peterson and Grier 2006). This creates certain technical challenges, such as smoothed returns for private markets, unbalanced histories of different asset classes and estimation risk.

To address these issues, it is necessary to implement adequate data treatment procedures.

AN EXAMPLE OF THE DE-SMOOTHING ALGORITHM FOR VALUING PRIVATE ASSETS

The output of the de-smoothing algorithm for developed private equity (PrEQin Private Equity Benchmark Index). Dark (light) blue line represents the original (de-smoothed) returns from June 2001 until September 2022. The data frequency is monthly (interpolated from the original, quartely, frequency for reporting performance data).



Source: Preqin, Barclays Private Bank, March 2023. Past performance is not a reliable indicator of future performance. The value of investments can fall as well as rise and you may get back less than you invested.

FIGHTING ILLIQUIDITY

Performance of private assets is often only provided quarterly. The reported levels do not represent marked-to-market quotes. They are instead based on subjective valuations and appraisals, which typically result in averaged or smoothed estimates of the returns.

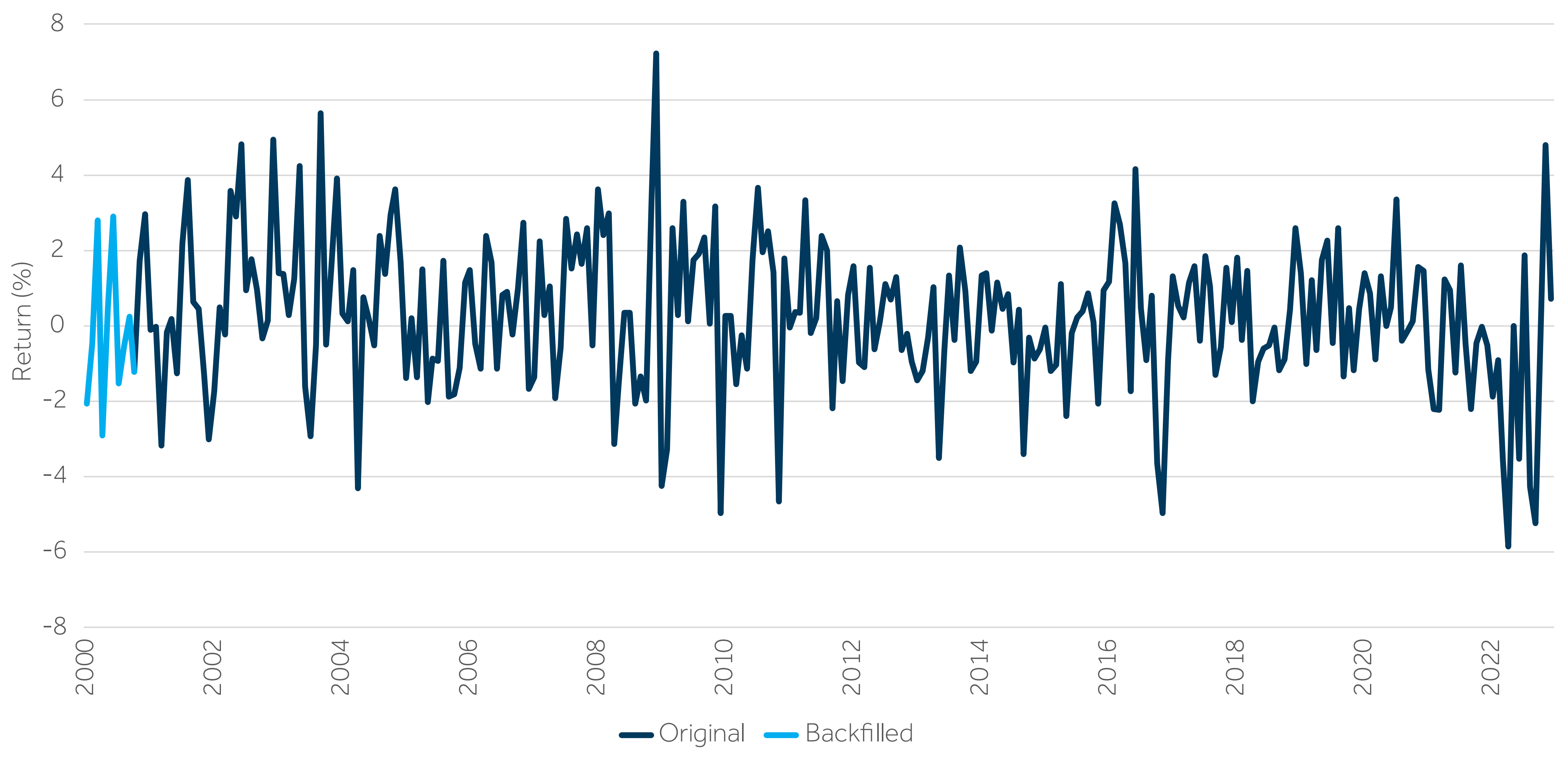
As a consequence, classical sample estimators of risk metrics for private markets are typically biased. This means that illiquid assets may appear substantially more attractive than they would be under more reasonable estimates because of artificially high Sharpe ratios and downward-biased correlations with publicly traded assets. Ultimately, the smoothing-induced distortion of the risk profile of private markets can have an adverse effect on the asset allocation process. This problem is addressed in two steps.

First, a de-smoothing model is implemented which combines econometric procedures proposed in Fisher, Geltner and Webb (1994) and Cho, Kawaguchi and Shilling (2003). In a nutshell, the model generates additional volatility in asset returns based on the assumption that the true, de-smoothed process is hidden behind the appraised returns though a weighted averaging process (see figure).

Second, volatilities are adjusted for private markets based on their positive autocorrelations. The popular square-root-of-time scaling rule for volatility is theoretically correct only under the assumption that returns are independently and identically distributed. Although this is approximately satisfied in many public markets, private markets tend not to meet this condition. Working along the lines of the approach used in Lo (2002), volatilities are adjusted for private credit, private equity and direct real estate.

AN EXAMPLE OF THE BACKFILLING ALGORITHM USED FOR MISSING PERFORMANCE DATA

The output of the backfilling algorithm for the Bloomberg Global Aggregate Treasuries Total Return Index. Dark (light) blue line represents the original (backfilled) returns. The data frequency is monthly.



Source: Preqin, Barclays Private Bank, March 2023. Past performance is not a reliable indicator of future performance. The value of investments can fall as well as rise and you may get back less than you invested.

INFORMATION IS EVERYTHING, DON'T DISCARD IT

First, data sets comprising a broad range of diverse asset classes often feature time series that differ in length as asset classes evolve, and not every asset class has been measured over the full sample period. However, computation of the covariance matrix requires input variables to have pairwise entries, or an equal length and matching observation dates.

A simple solution to this problem is to consider only the common returns history. However, this approach implies that one part of the available longer time series would have to be discarded (to match the remaining histories with the shorter time series). In turn, this could result in considerable information loss. This approach is particularly problematic if a crisis period is excluded from the sample, because the risks would likely be underestimated. Additionally, data removal lowers the precision of volatility and correlation estimates.

To mitigate the estimation risk problem and harness the information available in the full data set, a statistical procedure allows the missing data and updating of the volatilities and correlations of shorter time series to be backfilled, based on the histories of the longer time series (see Stambaugh 1997, Pástor and Stambaugh 2002, and Page 2013). The quantitative procedure is based on a combination of a multivariate regression and machine learning methods for selection of the covariates (see figure).

Within the CMA universe, there are five asset classes which have shorter histories and therefore require backfilling. Global developed government bonds, emerging market hard currency bonds and private equity have approximately one year of missing data relative to the length of the full sample period. Data on private debt is missing the first four years and local currency bonds are missing the first eight years.

NEVER UNDERESTIMATE THE ESTIMATION RISK

Computation of correlation matrices in small samples is subject to the estimation risk. More specifically, a statistical issue arises when the number of variables is similar to the number of observations. In that case, standard errors become large and some of the correlation coefficients might take on extreme values. Moreover, the estimates are not robust – they are overly sensitive to new data and strongly fluctuate over time.

There are several methods to mitigate the estimation risk. The CMA framework uses an approach that is based on the shrinkage method of Ledoit and Wolf (2003, 2004). Essentially, the correlation coefficients which take on too extreme values (in either direction) are pulled back towards the values which are obtained using a structural model. This is achieved by mixing the sample covariance matrix with another covariance matrix known as the shrinkage target.

To build a robust correlation matrix target, we have developed a procedure that is based on a hierarchical clustering method commonly applied in machine learning. The approach leverages asset classification metadata and empirical insights regarding the connectivity of different asset classes.

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