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## Insurance Asset Allocation in the New Regime

European insurers are being confronted by several challenges they have not seen for quite a few years, from heightened investment volatility, substantial unrealised losses and rising lapse risk to inflation in claim values.

At the same time, the risk-and-return outlook for virtually every investment asset class was fundamentally reshaped during 2022, due to the lingering impact of the COVID-19 pandemic, ongoing supply chain disruptions, geopolitical tensions, persistently high inflation and rate hikes.

We have updated our intermediate-term capital market assumptions to help insurers re-calibrate their strategic asset allocations for this new investment regime.

We find that both core and extended fixed income, as well as private markets, appear to have gained in efficiency over public equity. In many cases, this development, and the implied asset allocation adjustments, fit well with the challenges insurers face in 2023; but it is also the reason for insurers' unrealised losses, which means adjustments will need to be implemented gradually and carefully.

## Executive Summary

- Equity and fixed income markets moved dramatically during 2022, leading to substantial changes in capital market assumptions.
- We show the effect on estimated return and estimated volatility for a range of asset classes, as well as the effect on estimated returns relative to market Solvency Capital Requirements.
- For an illustrative life insurer and an illustrative general insurer, we show the effect on estimated return, estimated volatility and market Solvency Capital Requirements of re-allocating 1% of a portfolio pro rata to a range of asset classes under our new capital market assumptions.
- Our main conclusions are:
  - Higher yields have made core fixed income more attractive
  - Higher yields and wider spreads have led to large improvements in relative value for extended fixed income
  - Return expectations for public equity remain similar: lower market valuations are offset by anticipated lower earnings growth
  - The relatively high estimated returns from private equity and the diversification and yield benefits of private fixed income suggest they might be an efficient way to spend risk and capital budgets, where an insurer can take on some illiquidity

For most life insurers, higher inflation and rates has one positive effect. The present value of their long-duration liabilities declines rapidly as rates rise; and because the duration of their assets tends to be meaningfully shorter than that of their liabilities, their capital position improves as the value of their liabilities falls faster than that of their assets.

That is meaningfully good news. But the good news ends there.

For non-life insurers, particularly those with a high proportion of long-tail business in which claims can take time to settle, unexpectedly high inflation may result in surprisingly high claim values, potentially leading to reserve deficiencies.

In their short-tail business, margins are coming under pressure as inflation pushes up the value of claims while governments and regulators urge insurers to limit any offsetting hikes to their premiums.

Similarly, alongside heightened investment volatility, life insurers face meaningfully higher lapse risk as policyholders realize they can get better yields from competitors or from banking products. We think new business is likely to come down, and therefore life insurers might be forced to realize losses in some existing, low-yielding investments that they put onto their books over recent years, in order to re-invest at higher yields to back more attractive, higher-yielding products.

We see these challenges and concerns feeding into the list of asset classes that insurers currently tell us they are interested in. They are exploring inflation-linked assets such as infrastructure and floating-rate securities and loans. They want to cut the amount of time it will take to recycle their book yield into market yield, and to that end, they are looking at re-investing proceeds from maturing bonds into investments with a yield pick-up relative to core fixed income: high yield, emerging markets debt, private placements, private debt—even private equity, if it comes with long-term equity treatment.

The key question is, do those asset classes also look attractive from a pure risk-return and solvency capital-return perspective? Following the substantial re-pricing of virtually all asset markets in 2022, we believe they do.

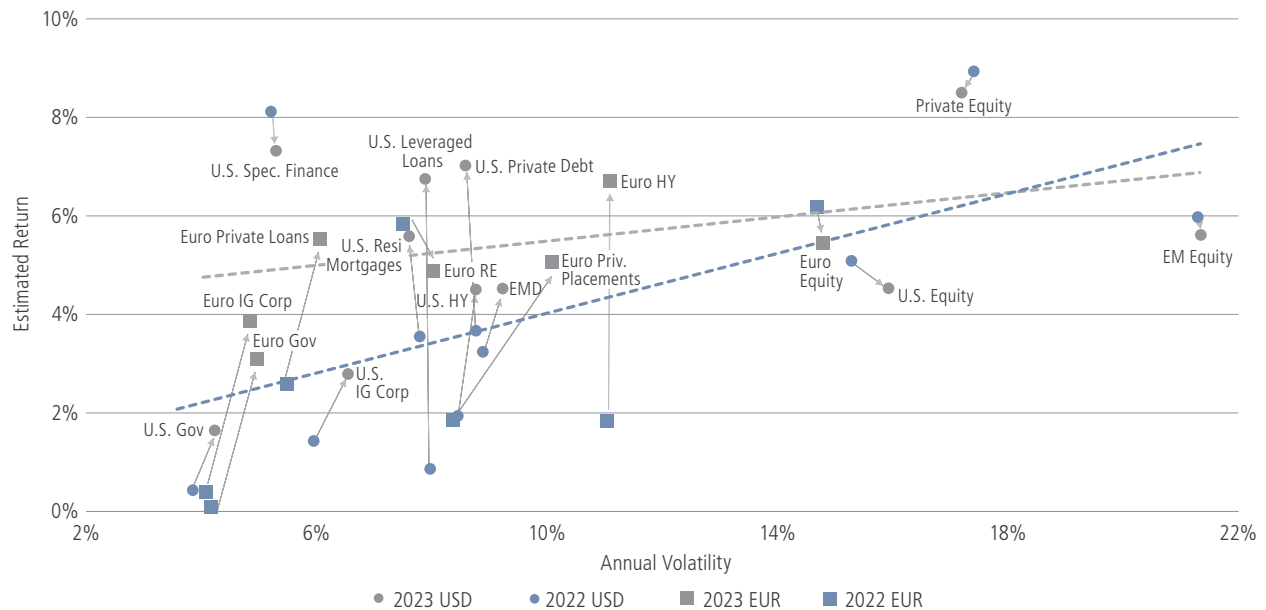
## Capital Market Assumptions: 2023 vs 2022

Each year, Neuberger Berman updates its capital market assumptions to create future return and risk estimates for the major asset classes, agnostic of any tactical views or alpha-generating potential. This involves a multi-step process that includes a quantitative assessment of the market and discussions with our portfolio management teams (see our framework in the Appendix).

Figure 1 shows the changes in our capital market assumptions for a range of asset classes, from 2022 (blue) to 2023 (gray).

**FIGURE 1: NB CAPITAL MARKET ASSUMPTIONS: 2023 VS 2022**

Estimated annualized return and volatility, five- to seven-year term



Source: Neuberger Berman, Bloomberg, Cambridge Associates, FactSet. Analytics as of December 31, 2022. Non-Euro assets are hedged to EUR using three-month forwards (-2.54% USD to EUR for 2023 & -0.79% USD to EUR for 2022). The performance and risk projections/estimates are hypothetical in nature and reflect the Neuberger Berman's Capital Market Assumptions. The estimates do not reflect actual investment results and are not guarantees of future results. Actual returns and volatility may vary significantly. Asset classes are represented by benchmarks and do not represent any Neuberger Berman investment product or service. Please see Additional Disclosures at the end of the presentation for asset class and index definitions and Neuberger Berman Capital Market Assumptions. Investing entails risks, including possible loss of principal.

Fixed income return estimates have increased meaningfully given movements in yields. Before 2022, the Euro 10-year yield had been below zero for three years. The value of negative-yielding bonds globally reached almost \$20tn. Between December 31, 2021 and December 31, 2022, the U.S. 10-year Treasury yield increased by 236 basis points, the 10-year U.K. Gilt 10-yr yield increased by 277 bps and the Euro 10-year yield increased by 290 bps. The U.S. AAA-BBB spread widened by 38 bps; in the U.K it widened by 55 bps; and the Euro spread widened by 31 bps.

Higher yields and wider spreads have made extended fixed income and private fixed income more attractive, especially at the short end of the curve. Although yields have increased across the curve, curves have also flattened or in some cases inverted, resulting in a more attractive outlook for shorter duration assets such as high yield and private debt relative to longer duration assets. Indeed, by the end of 2022, our estimated returns for high yield had risen as high as our estimated returns for equity, but with half the volatility.

Estimated returns for equity and alternative assets have increased in USD terms, due to lower valuations and a higher risk-free rate. The costs of hedging from USD to EUR have meaningfully increased as well, however; between December 31, 2021 and December 31, 2022, as the U.S. dollar strengthened, the cost of hedging USD to EUR with three-month currency forward contracts has risen from 79bps to 254bps, annualized. In some cases, that is enough to push some equity and alternative asset return estimates lower than they were a year ago.

On the risk side, the volatility of monthly returns was higher in 2022 than in previous years, which moved our long-term volatility estimates up for most asset classes.

Overall, the regression line for the risk and return estimates for these asset classes flattened notably over the course of 2022, rising to the left and falling to the right. That suggests a diminishing marginal estimated return for each additional unit of risk, but also a rising level of estimated return for lower-risk assets. In our view, that strengthens the case for insurers to re-think their higher-risk public equity allocations and consider replacing some of them with assets from the lower-risk fixed income universe.

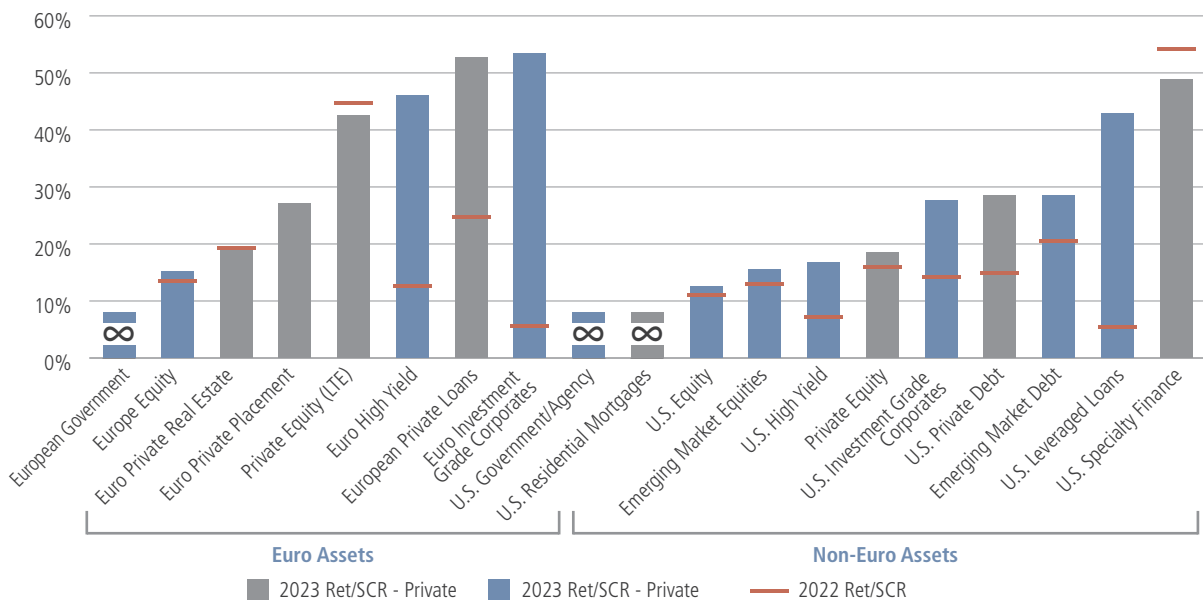
### Estimated Return Relative to Solvency Capital Requirements

Instruments that generate little or no accounting volatility and present the highest yields relative to their market Solvency Capital Requirements are likely to resonate most.

Figure 2 looks at the same year-over-year change in our capital market assumptions in terms of Solvency Capital efficiency, by dividing the market Solvency Capital Requirement of each asset class by our 2022 return estimates (red lines) and our 2023 return estimates (blue and gray bars).

**FIGURE 2: SOLVENCY CAPITAL EFFICIENCY: 2023 VS 2022**

Estimated annualized return divided by market Solvency Capital Requirement



Source: Neuberger Berman, Bloomberg, Cambridge Associates, FactSet. Analytics as of December 31, 2022. European Government, U.S. Government/Agency and Residential Mortgages (when LTV<60%) are marked "∞" because they do not incur any market Solvency Capital Requirement. Non-Euro assets are hedged to EUR using three-month forwards (-2.54% USD to EUR for 2023 & -0.79% USD to EUR for 2022). The performance and risk projections/estimates are hypothetical in nature and reflect the Neuberger Berman's Capital Market Assumptions. The estimates do not reflect actual investment results and are not guarantees of future results. Actual returns and volatility may vary significantly. Asset classes are represented by benchmarks and do not represent any Neuberger Berman investment product or service. Please see Additional Disclosures at the end of the presentation for asset class and index definitions and Neuberger Berman Capital Market Assumptions. Investing entails risks, including possible loss of principal.

Here we see a similar story to the one we see with our pure risk and return estimates: fixed income, and especially private fixed income, has become relatively more attractive compared to last year.

Specific asset classes that we believe could be additive to an insurance allocation include high yield bonds, emerging markets debt, private debt, European private placements, European private loans, and private equity (assuming long-term equity treatment under SCR).

We think it is important to note that the implications of our new capital market assumptions can be quite different depending on whether we are considering equity (where price changes can make up a substantial part of total return and where earnings and income on existing investments can fluctuate) or fixed income (where income on existing investments is a fixed and more substantial part of total return).

With equity, a marginal euro has very similar exposure to a change in capital market assumptions as an already-invested euro. There is little benefit from divesting and re-investing. By contrast, a marginal euro allocated to fixed income has not only avoided the price depreciation seen in 2022, but will also now benefit from the higher coupons and yields available in 2023—whereas an already-invested fixed-income euro is stuck in a low-yielding security purchased at a high price, likely showing an unrealized loss.

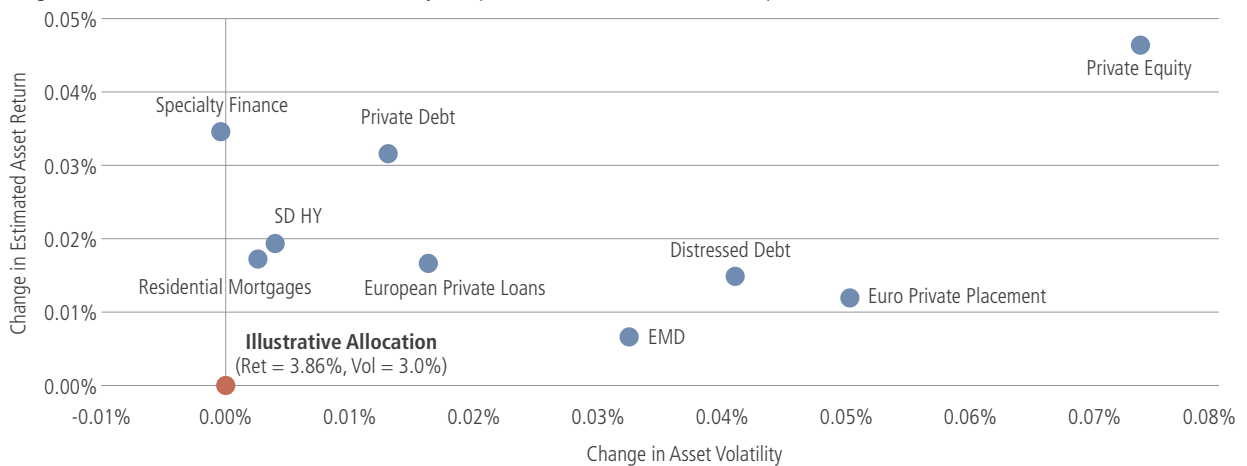
In other words, 2022 has left insurers with a stark dichotomy between high market yields and low book yields (compounded by unrealized losses). As we noted earlier, that could present problems for insurers that are seeking to bridge the gap between book yields and market yields without having to crystalize unrealized losses. This can be avoided by reinvesting only income or principal when existing assets reach maturity, but that will add a lot of time to the process. Reinvesting into markets that offer higher yields than core fixed income can help to cut some of that time to adjustment.

### Marginal Analyses for Life and General Insurers

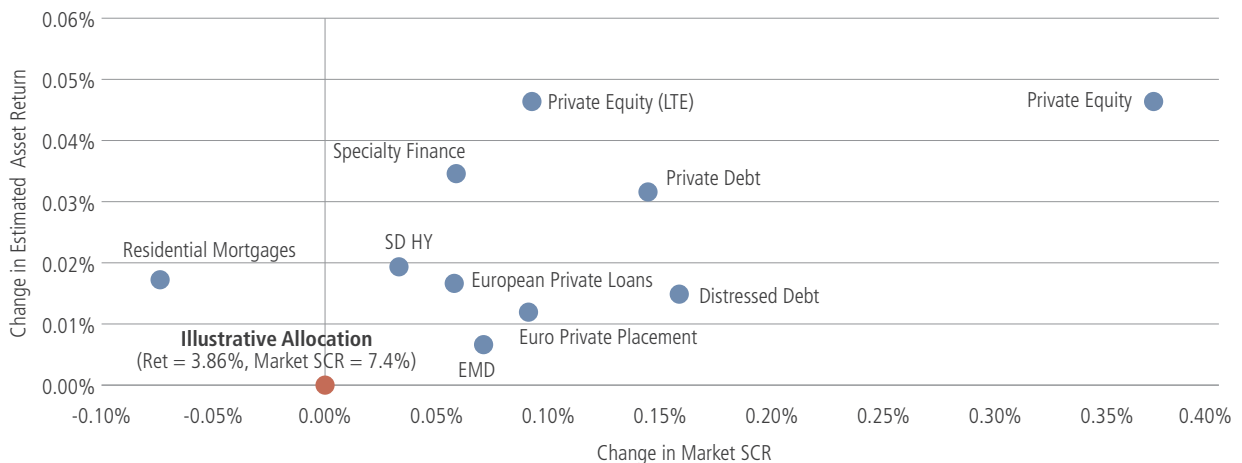
To further explore the potential for these investments to add value to an insurer’s asset allocation, we run a marginal analysis for an illustrative life insurer (Figure 3) and for an illustrative general insurer (Figure 4). We take the insurer’s original portfolio and we re-allocate 1% *pro rata* to each of the asset classes shown, in turn, and show the effect that has on the portfolio’s estimated return, volatility and market Solvency Capital Requirement.

**FIGURE 3: MARGINAL ANALYSIS: ILLUSTRATIVE LIFE INSURER**

Change in estimated annualized return and volatility of a portfolio when 1% is re-allocated *pro rata* to each named asset class, in turn



Change in estimated annualized return and Market Solvency Capital Requirement of a portfolio, when 1% is re-allocated *pro rata* to each named asset class, in turn



Source: Neuberger Berman, Bloomberg, Cambridge Associates, FactSet. Analytics as of December 31, 2022. Non-Euro assets are hedged to EUR using three-month forwards (-2.54% USD to EUR for 2023 & -0.79% USD to EUR for 2022). The original asset allocation of the illustrative insurer is shown in the Appendix. The performance and risk projections/estimates are hypothetical in nature and reflect the Neuberger Berman’s Capital Market Assumptions. The estimates do not reflect actual investment results and are not guarantees of future results. Actual returns and volatility may vary significantly. Asset classes are represented by benchmarks and do not represent any Neuberger Berman investment product or service. Please see Additional Disclosures at the end of the presentation for asset class and index definitions and Neuberger Berman Capital Market Assumptions. Investing entails risks, including possible loss of principal.

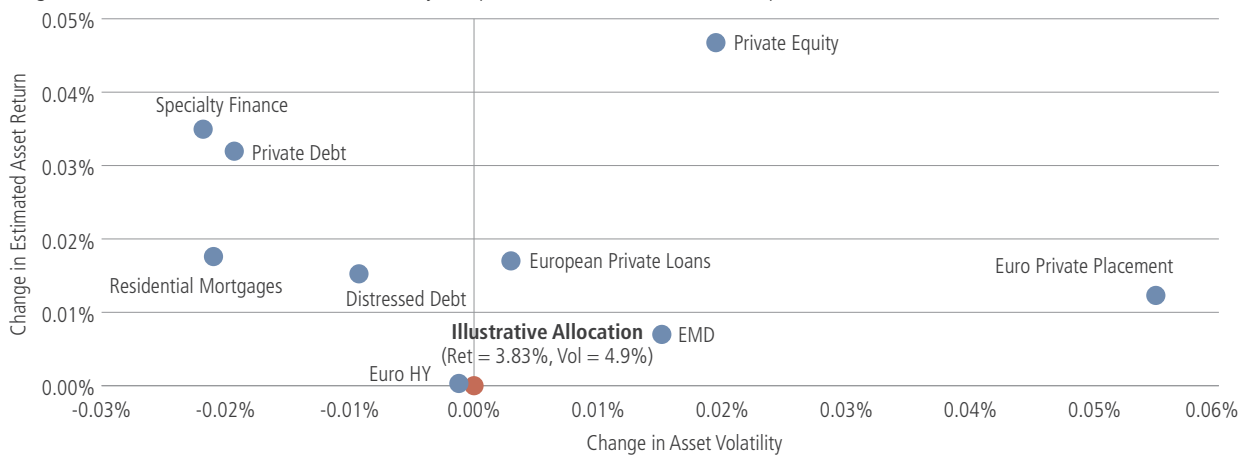
Given the existing large exposures that our life insurer has to public fixed income and the equity market, it is not surprising to find that adding private fixed income asset classes, such as specialty finance, residential mortgages, and private debt, increases the estimated return and decreases estimated volatility. Volatility reduction is achieved mainly through the diversification introduced by different fixed income factor exposures. European private loans and emerging markets debt also provide an attractive boost to estimated portfolio return relative to the additional estimated volatility or Solvency Capital charge they introduce. Residential mortgages could be particularly capital-efficient, incurring no charge at all under Solvency II, if they meet the quality criteria to be subject only to counterparty risk and have a loan-to-value ratio less than 60%.

Private equity could also be an attractive addition to the portfolio, providing a meaningful increase in estimated return to compensate for its higher estimated volatility and higher Solvency Capital charge. Moreover, should the investment be eligible for treatment as long-term equity, the Solvency Capital Requirement could be reduced from as much as 44% (plus symmetric adjustments) to just 22%.

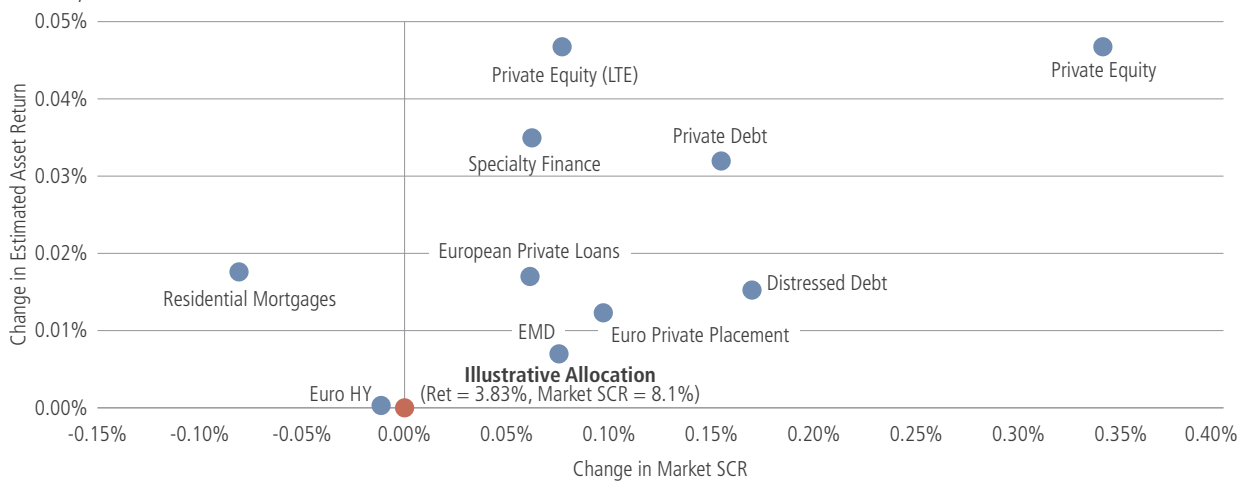
For our illustrative general insurer, the marginal analysis results are quite similar. Besides specialty finance, European private loans, private debt and short-duration high yield bonds also provide attractive default-adjusted estimated return relative to their contribution to estimated portfolio risk or capital for a general insurer’s portfolio. Residential mortgages also come out well from the analysis again, and while long-dated residential mortgages are more suitable for life insurers, there are short-dated residential mortgages that have more optimal Solvency Capital Requirements for the shorter liabilities of a general insurer’s balance sheet.

**FIGURE 4: MARGINAL ANALYSIS: ILLUSTRATIVE GENERAL INSURER**

Change in estimated annualized return and volatility of a portfolio when 1% is re-allocated pro rata to each named asset class, in turn



Change in estimated annualized return and Solvency Capital Requirement of a portfolio, when 1% is re-allocated pro rata to each named asset class, in turn



Source: Neuberger Berman, Bloomberg, Cambridge Associates, FactSet. Analytics as of December 31, 2022. Non-Euro assets are hedged to EUR using three-month forwards (-2.54% USD to EUR for 2023 & -0.79% USD to EUR for 2022). The original asset allocation of the illustrative insurer is shown in the Appendix. The performance and risk projections/estimates are hypothetical in nature and reflect the Neuberger Berman’s Capital Market Assumptions. The estimates do not reflect actual investment results and are not guarantees of future results. Actual returns and volatility may vary significantly. Asset classes are represented by benchmarks and do not represent any Neuberger Berman investment product or service. Please see Additional Disclosures at the end of the presentation for asset class and index definitions and Neuberger Berman Capital Market Assumptions. Investing entails risks, including possible loss of principal.

## **Conclusion: Major Change Demands Major Decisions**

The market environment, and therefore capital market assumptions, have materially changed since the end of 2021. We believe that increases the importance of re-thinking asset allocation—for all investors, but particularly for insurance companies that invest heavily in the fixed income markets that moved so dramatically last year.

Insurance companies will need to navigate this regime shift carefully, balancing the need to generate yield in line with the market with the constraints of their existing asset mix, the increased risk of lapse and rising claims inflation. We believe there are new opportunities in extended and private fixed income investment that have the potential meaningfully to enhance the estimated risk-adjusted returns of insurance portfolios, as well as improve their Solvency-Capital efficiency.

## Appendix

### Indices Used

**Europe Government:** Bloomberg Euro Treasury Index

**Euro Investment Grade Corp:** Bloomberg Euro Corporate Index

**Euro HY:** Bloomberg Euro High Yield Index

**European Private Loans:** iBoxx Euro Non-Financials BBB (5-7 years) Index

**Europe Equity:** MSCI Europe Index

**Europe Real Estate:** Custom Index: Dynamic combination of MSCI Europe Large Cap Index and S&P Eurozone Sovereign Bond Index

**U.S. Government/Agency:** Bloomberg U.S. Government Index

**US Investment Grade Corporate:** Bloomberg U.S. Corporate Index

**Euro Private Placement:** Custom Index: Bloomberg Euro Corporate Index + 80 bps

**U.S. HY:** Bloomberg U.S. Corporate High Yield Bond Index

**Leveraged Loan:** Credit Suisse Leveraged Loan Index

**Emerging Markets Debt:** Custom Index: 50% J.P. Morgan Emerging Markets Bond Global Diversified Index (EMBI Global Diversified) / 50% J.P. Morgan Corporate Emerging Markets Bond Index (CEMBI)

**Residential Mortgages:** Custom Index: 50% Bloomberg U.S. MBS / 50% Citi RMBS Index

**U.S. Equities:** S&P 500 Index

**Emerging Markets Equities:** MSCI Emerging Markets Net Return Index

**Private Equity:** Cambridge Associates Global Buyout Index

**Private Equity (LTE):** A sub-set of equity investments consisting only of equities that are listed in the European Economic Area (EEA) or of unlisted equities of companies that have their head offices in countries that are members of the EEA.

**Private Debt:** Custom Index: B/Split B Credit Suisse Leveraged Loan Index leveraged by 50%.

**Specialty Finance:** Bloomberg U.S. Corporate BB High Yield (1-3 years) Index

### Neuberger Berman Capital Market Assumptions Framework

Asset Class	Return Estimate	Risk Estimate
Fixed Income	Market yields of public indices adjusted for default cost <sup>1</sup>	
Equity	"Building Block" approach <sup>2</sup>	Historical volatility of monthly return series from 2007
Liquid Alternatives	Factor regression	
Illiquid Alternatives	"Building Block" approach <sup>2</sup>	Historical volatility of quarterly series from 2007 with de-smoothing

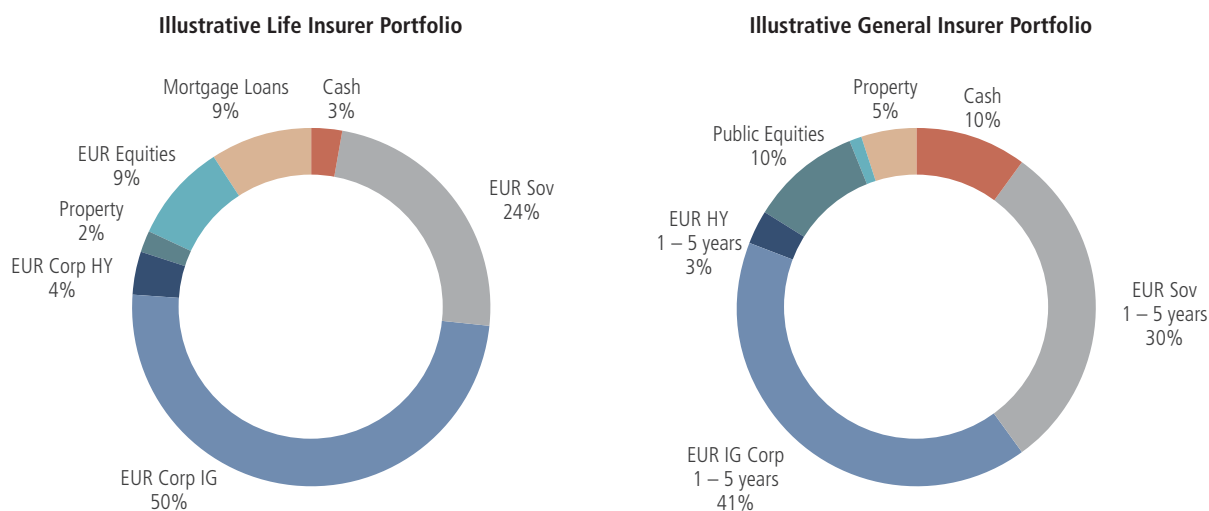
Source: Neuberger Berman. For illustrative purposes only.

<sup>1</sup> For certain asset classes where a standard public index may not be readily available, NB will create a proxy index using a combination of similar asset classes. Default costs are estimated at the CUSIP level then aggregated to the index level; where CUSIP-level data is unavailable, NB will estimate default costs at the index level.

<sup>2</sup> Separate estimates are made for different sources of return (income yield, valuation change, earnings growth), and these "blocks" are aggregated to establish an asset class-level estimated return.



## Illustrative Insurer Portfolios Used in the Marginal Analyses



Source: Neuberger Berman.

## Estimated Return, Risk and Solvency Capital Requirement of Asset Classes Used in the Marginal Analyses

Asset Class	Currency	Estimated Return (%) <sup>1</sup>	Annual Vol (%)	OAS (bps)	Rating	Market SCR (%)
<b>Illustrative Portfolio</b>	–	<b>3.86</b>	<b>3.0</b>	<b>94</b>	<b>A</b>	<b>7.4</b>
SD HY	EUR	5.8	3.9	321	BA1/BA2	12.1
HY	EUR	6.7	7.1	493	BA3/BA2	18.1
European Private Loans	EUR	5.53	5.5	250	BAA3	14.9
EUR Private Placement	EUR	5.06	10.9	255	BAA	18.7
US Private Placement	USD	3.24	6.5	223	BAA	14.3
EMD	USD	4.53	7.7	352	BAA3/BA1	16.4
Residential Mortgages	USD	5.59	5.0	434	BAA	– <sup>2</sup>
Private Debt	USD	7.02	6.2	581	BA3/B1	24.7
Distressed Debt	USD	5.35	12.5	455	B3/CCC1	26.3
Specialty Finance	USD	7.32	3.7	244	BA1/BA2	15.0
Private Equity	USD	8.5	16.9			47.8 (22.0 if LTE <sup>3</sup> )

Source: Neuberger Berman, Bloomberg, Cambridge Associates, FactSet. Analytics as of December 31, 2022. Non-Euro assets are hedged to EUR using three-month forwards (-2.54% USD to EUR for 2023 & -0.79% USD to EUR for 2022). The performance and risk projections/estimates are hypothetical in nature and reflect the Neuberger Berman's Capital Market Assumptions. The estimates do not reflect actual investment results and are not guarantees of future results. Actual returns and volatility may vary significantly. Asset classes are represented by benchmarks and do not represent any Neuberger Berman investment product or service. Please see Additional Disclosures at the end of the presentation for asset class and index definitions and Neuberger Berman Capital Market Assumptions. Investing entails risks, including possible loss of principal.

<sup>1</sup> Non-EUR assets are assumed to be fully hedged into EUR via rolling three-month currency forwards. For fixed income assets, estimated return is defined as market yield-to-worst adjusted for expected default costs; for equity & alternative assets it is defined as intermediate-term (five- to seven-year) expected returns.

<sup>2</sup> Mortgage loans of sufficient quality are subject only to counterparty credit risk under Solvency II; the capital charge is then nil if the loan-to-value ratio is less than 60%.

<sup>3</sup> LTE: Long-Term Equity treatment means a 22% capital charge in listed and unlisted equities, where specific regulatory requirements are met.

## Additional Disclosures

### Index Definitions

The **Bloomberg Euro Treasury Index** consists of fixed-rate, investment-grade public obligations of the sovereign countries participating in the European Monetary Union. This index currently contains euro-denominated issues from 18 countries. The index was created in 1998, with history backfilled to June 1, 1998.

The **Bloomberg Euro Corporate Bond Index** is a broad-based benchmark that measures the investment grade, euro-denominated, fixed-rate corporate bond market. Inclusion is based on currency denomination of a bond and not country of risk of the issuer. The Index was launched on 1 June 1998.

The **Bloomberg Euro High Yield Index** measures the market of non-investment grade, fixed-rate corporate bonds denominated in Euro. Inclusion is based on the currency of issue and not the domicile of the issuer. The index excludes emerging market debt. It was created in 1999 and is part of the Global High Yield Index.

The **Markit iBoxx EUR Liquid Non-Financials Index** is a subset of the Markit iBoxx EUR Non-Financials bonds universe and contains up to 20 investment grade rated non-financial securities with maturity 5 – 7yrs and a BBB rating. All bonds need to have an average rating of investment grade from Fitch Ratings, Moody's Investor Service and Standard & Poor's Rating Services.

The **MSCI Europe Index** captures large and mid cap representation across 15 Developed Markets countries in Europe. With 427 constituents, the index covers approximately 85% of the free float-adjusted market capitalization across the European Developed Markets equity universe.

The **MSCI Europe Large Cap Index** captures large cap representation across 15 Developed Markets (DM) countries in Europe. With 199 constituents, the index covers approximately 70% of the free float-adjusted market capitalization across the European Developed Markets equity universe.

The **S&P Eurozone Sovereign Bond Index** seeks to measure the performance of fixed-rate locally denominated sovereign debt publicly issued by Eurozone country governments for their domestic markets.

The **Bloomberg U.S. Government Index** includes Treasuries (public obligations of the U.S. Treasury that have remaining maturities of more than one year) and U.S. agency debentures (publicly issued debt of U.S. Government agencies, quasi-federal corporations, and corporate or foreign debt guaranteed by the U.S. Government).

The **Bloomberg U.S. Corporate Index** measures the investment grade, fixed-rate, taxable corporate bond market. It includes USD-denominated securities publicly issued by U.S. and non-U.S. industrial, utility and financial issuers that meet specified maturity, liquidity and quality requirements. The Index was launched on January 1, 1973.

The **Bloomberg U.S. Corporate High Yield Bond Index** covers the USD-denominated, non-investment grade, fixed-rate, taxable corporate bond market. Securities are classified as high-yield if the middle rating of Moody's Fitch, and S&P is Ba1/BB+/BB+ or below. The index excludes Emerging Markets debt. The Index was created in 1986, with index history backfilled to January 1, 1983.

The **Credit Suisse Leveraged Loan Index** tracks the investable market of the U.S. dollar denominated leveraged loan market. It consists of issues rated "5B" or lower, meaning that the highest rated issues included in this index are Moody's/S&P ratings of Baa1/BB+ or Ba1/BBB+. All loans are funded term loans with a tenor of at least one year and are made by issuers domiciled in developed countries.

The **JPMorgan Emerging Markets Bond Global Diversified Index (EMBI GD)** includes U.S. dollar-denominated Brady bonds, Eurobonds, and traded loans issued by sovereign and quasi-sovereign entities.

The **JPMorgan Corporate Emerging Markets Bond Index (CEMBI)** is a market-capitalization weighted index of corporate bonds issued by entities in emerging countries.

The **Bloomberg U.S. MBS Index** tracks fixed-rate agency mortgage-backed pass-through securities guaranteed by Ginnie Mae (GNMA), Fannie Mae (FNMA), and Freddie Mac (FHLMC).

The **S&P 500 Index** consists of 500 U.S. stocks chosen for market size, liquidity and industry group representation. It is a market value-weighted index (stock price times number of shares outstanding), with each stock's weight in the Index proportionate to its market value.

The **MSCI Emerging Markets Index** is a market-value weighted index designed to represent the performance of large- and mid-cap securities in 26 emerging markets.

The **Cambridge Associates Global Buyout Index** is a capitalization-weighted composite IRR of the buyout fund performances across all geographic focus reported to Cambridge Associates; all historical IRRs are subject to, and regularly undergo, revision.

The **Bloomberg U.S. Corporate BB High Yield (1 – 3 years) Index** measures the USD-denominated, high yield, fixed-rate corporate bond market with maturities of 1 – 3 years and a BB rating.

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#### **Asset Class Assumptions & Estimates**

Capital market assumptions used herein reflect Neuberger Berman's forward-looking estimates of the benchmark return or volatility associated with an asset class. Estimated returns and volatilities are hypothetical return and risk estimates generated by Neuberger Berman's Institutional Solutions Group. Estimated returns and volatilities do not reflect the alpha of any investment manager or investment strategy/vehicle within an asset class. Information is not intended to be representative of any investment product or strategy and does not reflect the fees and expenses associated with managing a portfolio or any other related charges, such as commissions and surrender charges. Estimated returns and volatilities are hypothetical and generated by Neuberger Berman based on various assumptions and inputs, including current market conditions, historical market conditions and subjective views and estimates. Capital market assumptions shown reflect Neuberger Berman's long-term (20+ years into the future) estimates or intermediate-term (5-7 years into the future) estimates which are reviewed at least annually. Results will differ depending on whether they are based on Neuberger Berman's long-term (20+ years into the future) or intermediate-term (5-7 years into the future) capital market assumptions. Neuberger Berman's capital market assumptions are derived using a building block approach that reflects historical, current, and projected market environments, forward-looking trends of return drivers, and the historical relationships asset classes have to one another. These hypothetical returns are used for discussion purposes only and are not intended to represent, and should not be construed to represent, predictions of future rates of return. Actual returns may vary significantly. Neuberger Berman makes no representations regarding the reasonableness or completeness of any such assumptions and inputs. Assumptions, inputs, and estimates are periodically revised and subject to change without notice. Estimated returns and volatilities should not be used, or relied upon, to make investment decisions.

**Rate of Return Estimate:** Rate of return or geometric return is a measure of average returns of an investment over a period of time. Geometric rate of returns are typically referred to as annualized compound rate of returns and are always less than or equal to the arithmetic mean return of the same time series. Geometric rate of returns are used for straight-line calculations within the analysis, for example, the cash flow calculations. In straight-line calculations, each year is represented as a gain, so the compound (geometric mean) rate of return is used to adjust for the amount needed to make up for a loss in a given year. For example, if you lose 5% in one year, and gain 5% the year after, you still have less than you started with at the beginning of year one.

**Arithmetic Mean Estimate:** Arithmetic mean or average return is calculated by dividing the sum of a series of numbers by the number of overall items. This is more typically thought of as an "average" of the data set. Arithmetic mean or average return ignores the impact of compounding in the context of analyzing investment returns and is the simple average of returns observed over a period of time. Arithmetic mean returns are used in this material and, if applicable, the Efficient Frontier, because, through randomization, losses and gains are being accounted for each year.

**Standard Deviation:** A statistical measure of the volatility based on the distribution of a set of data from its mean (average value). For example, a portfolio with an average return of 10% and a standard deviation of 15% would return a result between -5% and +25% the majority of the time (68% probability or 1 standard deviation), almost all of the time the return would be between -20% and +40% (95% probability or 2 standard deviations). If there were 0 standard deviation then the result would always be 10%. Generally, more aggressive portfolios have a higher standard deviation and more conservative portfolios have a lower standard deviation.

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