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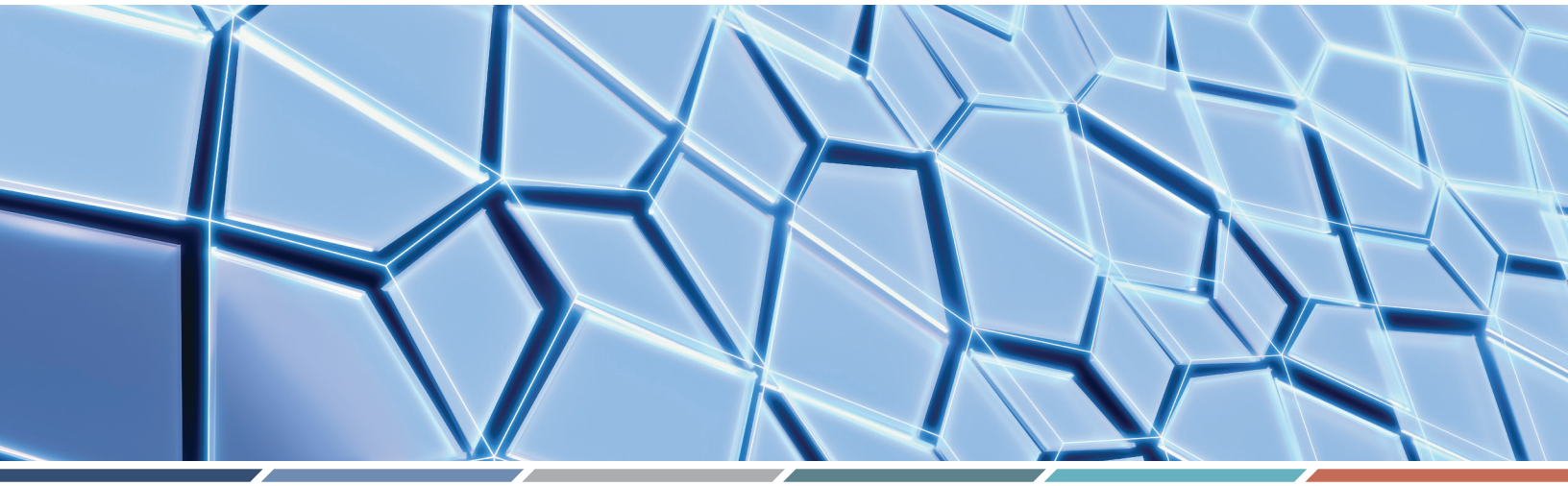

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Could Your Beta Be Better?

Foreign exchange reserves are a necessary burden, particularly for emerging economies that can be particularly exposed to capital flight and dollar or euro-denominated debt liabilities. They have been important for preventing and mitigating crises, but they also impose opportunity costs at both the national and global levels—especially when investment return comes second to safety and capital preservation.

Strategic benchmarks and asset allocations are seldom interrogated to improve efficiency or cut the costs that can be incurred by unnecessary constraints or biases. Now, however, a dramatic decline in yields and credit spreads in global fixed income, compounded by the threat of structurally higher inflation and rising rates, is forcing many reserves investors to reconsider their strategies.

In this article, we consider the substantial enhancement that can be made with some relatively straightforward adjustments, such as setting aside a tranche of reserves for conservative multi-asset credit investment. Drawing upon some of our own practical experience, we also suggest that further enhancements can be achieved with more active and tailored strategies.

Executive Summary

- Foreign exchange reserves can be an important buffer against currency crises, but they impose opportunity costs that we believe could be prudently mitigated with adjustments to strategic asset allocation.
- We present a hypothetical reserves investor that has held a portfolio of global government bonds and euro and U.S. dollar cash for 20 years, which has recently fallen behind its performance benchmark.
  - Putting 20% of these "Liquidity" assets into an "Investment" tranche split between corporate bonds and mortgage-backed securities (MBS) would have maintained outperformance over the benchmark.
  - We apply a stringent illiquidity haircut to this portfolio to show how limited the additional liquidity risk would have been in the early years of the holding period, and how it would have disappeared completely within 15 years.
- We describe a real reserves investor whose benchmark was allocated to G10 government and quasi-sovereign bonds, which asked us to model alternative portfolios for it to consider, backtested for 15 years.
  - We removed the quasi-sovereign bonds and showed how adding securitized credit would have raised the return of the portfolio, while diversifying with corporate bonds would have reduced the volatility without giving up too much of the enhanced return.
- We briefly describe two additional real-world case studies:
  - Building a model credit portfolio for an investor seeking to outperform the Special Drawing Rights (SDR) interest rate with short duration and no foreign exchange risk.
  - Modelling an addition of emerging markets debt and bank credit to enable an investor to shorten the duration of its portfolio in order to meet an expected shortfall threshold in a rising interest rate environment.
- We believe all four cases illustrate how revisiting strategic asset allocation benchmarks can help to enhance risk-adjusted return without compromising risk management, particularly as we move into a challenging period of higher inflation and rising rates.

Foreign exchange reserves are held to finance imports and pay foreign-currency debt obligations, and to provide a buffer against capital flight and sudden portfolio outflows. But how much is prudent and how much is over-cautious?

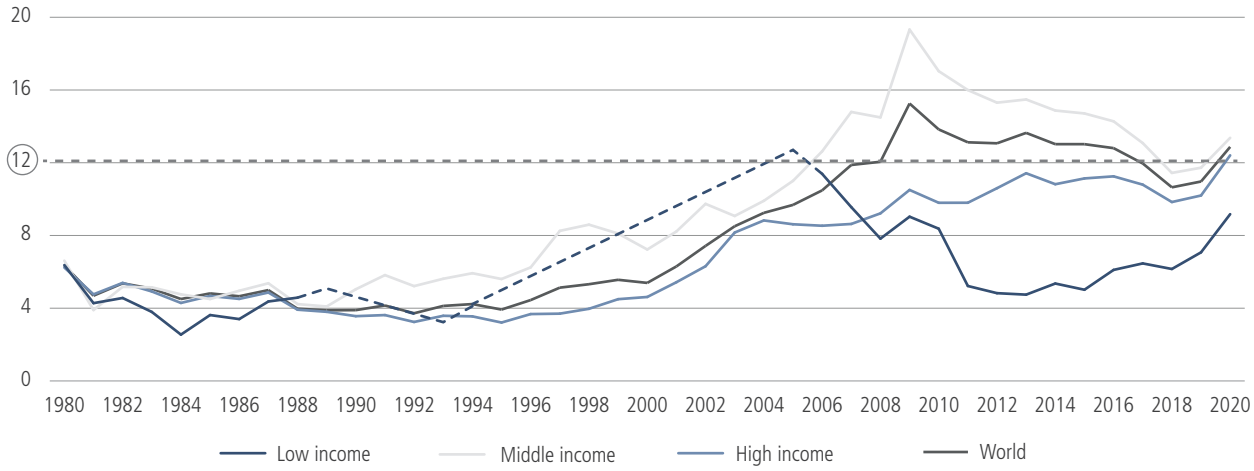
One longstanding rule of thumb, particularly following the balance-of-payments crises in emerging economies in the late 1990s and early 2000s, is to hold enough reserves to cover 12 months of imports and foreign debt repayments. In the aftermath of the Great Financial Crisis of 2008 – 09, however, middle income economies ramped up their reserves to cover almost 20 months of imports. The coronavirus pandemic appears to have led to another uptick over the 12-month threshold (figure 1).

In 2011, work from the International Monetary Fund (IMF) to develop a more rigorous Reserves Adequacy Metric, based on export earnings, short-term foreign debt exposure and domestic broad money aggregates, suggested that "most EM countries' reserve levels are adequate, with some countries holding much higher reserves than suggested, and only a few falling short." Even following many years of subsequent decline, many countries appear to hold excessive reserves according to this metric. That is potentially problematic, because, as the IMF put it in 2011, reserves "are costly (at both the national and global level) and subject to diminishing returns."[1]

[1] IMF, "Assessing Reserve Adequacy" (February 14, 2011) at https://www.elibrary.imf.org/view/journals/007/2011/008/article-A001-en.xml. See also IMF, "Assessing Reserve Adequacy—Supplementary Information" (February 14, 2011) at https://www.elibrary.imf.org/view/journals/007/2011/010/article-A001-en.xml.

FIGURE 1. MIDDLE INCOME COUNTRIES MAY BE HOLDING EXCESSIVE RESERVES

Total reserves in months of imports



Source: World Bank, IMF.

The first question a reserves investor faces, then, is whether it has more assets than it needs to perform its function. If so, it may be advantageous for the sovereign authorities to carve out some of those excess assets and invest them with a different mandate, potentially via a fully fledged Sovereign Wealth Fund.

Even when the reserves assets are at a more mission-appropriate level, however, we believe much can still be done to improve their efficiency. The inherent opportunity cost associated with excessive foreign exchange reserves can be exacerbated when investment return comes second to safety and capital preservation. Strategic benchmarks and asset allocations are seldom interrogated to improve efficiency or cut the costs that can be incurred by unnecessary constraints or biases.

The reflexive conservatism of much reserves management has been a hidden problem over recent years, as it has been rewarded by a dramatic decline in core euro and U.S. dollar-denominated government bond yields and credit spreads. Now, however, the threat of structurally higher inflation, tightening developed market monetary policy and rising rates is forcing many to reconsider the efficiency of their strategies.[2]

Better Beta: Diversifying an Investment Tranche

To give a sense of the direction that re-think could take, here we describe a hypothetical reserves investor that established a simple portfolio of 50% global government bonds and 50% euro and U.S. dollar cash 20 years ago, with a view to outperforming a blended inflation benchmark by one percentage point per annum (figure 2).

That portfolio easily outperformed its benchmark until around 2012—the final months of the Great Financial Crisis and eurozone crisis—largely because of the steady decline in interest rates and bond yields. Since then, however, it has struggled to keep up, as rates ran out of room to fall further and coupon and principal proceeds were steadily ploughed into low-yielding assets. By the end of 2021, its since-inception performance had fallen behind the benchmark.

Our proposal would have been to hold only 80% of the portfolio in these "Liquidity" assets, and to redirect 20% into a still relatively conservative "Investment" tranche, split between investment grade corporate bonds and U.S. agency mortgage-backed securities (MBS). These assets have shorter duration than the typical portfolio of government bonds, making them relatively attractive as we anticipate a period of rising rates. That said, they would have had enough duration to match the existing allocation as rates were declining, but also enough credit risk exposure to begin to outperform once the zero bound was being approached in late 2009. By the end of January 2022, the result could have been as much as 20 percentage points of extra cumulative return for the Proposed over the Original Allocation.

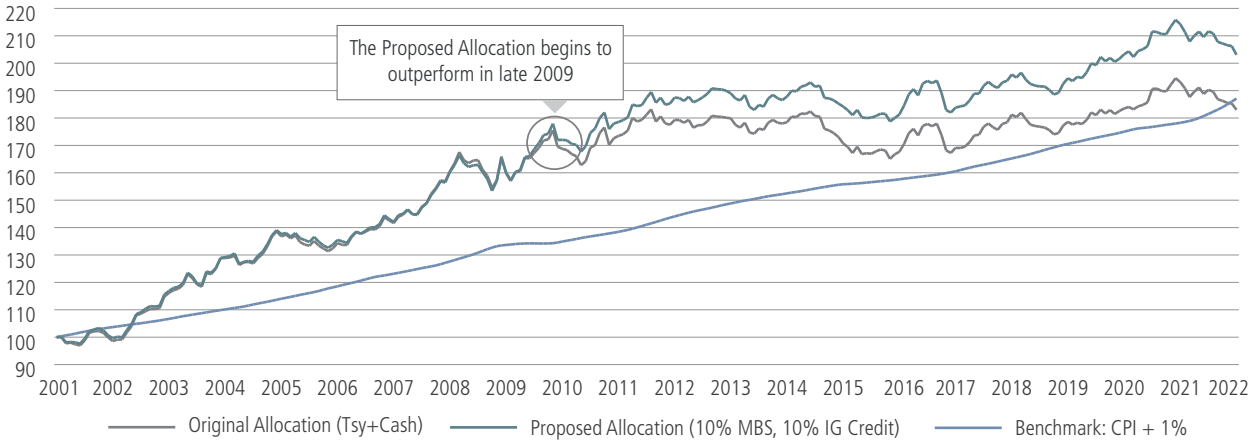
[2] For our latest market views, see our *Fixed Income Investment Outlook* 2Q 2022, at https://www.nb.com/en/gb/fiio/fixed-income-investment-outlook-2q2022

FIGURE 2. A MORE DIVERSIFIED INVESTMENT TRANCHE COULD IMPROVE PERFORMANCE

Hypothetical reserve investor's existing and proposed allocations

	Liquidity Tranche			Investment Tranche	
	Global Tsy	**USD Cash**	**EUR Cash**	**U.S. Agency MBS**	**Global Credit**
Original Allocation	50%	30%	20%	0	0
Proposed Allocation	50%	20%	10%	10%	10%

Cumulative return, rebased to 100 on January 31, 2001



Summary risk-return statistic

Jan 2001 – Jan 2022	Existing Allocation	Proposed Allocation	Diff
Annualized Return	2.92%	3.43%	0.51%
Volatility	4.79%	4.63%	-0.16%
Information Ratio	0.61	0.74	0.13
Maximum Drawdown	-9.9%	-7.8%	2.12%

Source: Bloomberg, Neuberger Berman. Data as of January 31, 2022. Indices used: Bloomberg Global Aggregate Treasuries Total Return Index USD Unhedged; Barclays Benchmark Overnight USD Cash Index; Barclays 3-Month Euribor Cash Index; Bloomberg Global Aggregate Credit Total Return Index USD Unhedged; Bloomberg Global High Yield Total Return Index USD Unhedged; Bloomberg U.S. Mortgage Backed Securities Index Total Return USD Unhedged; CPI is a blend of 60% U.S. Consumer Price Index and 40% Euro Area Monetary Union Index of Consumer Prices. For illustrative purposes only. Indexes are unmanaged and are not available for direct investment. **Past performance is no guarantee of future results.**

Would the proposed allocation have increased the risk? Apparently not. Both volatility and maximum drawdown would have been lower.

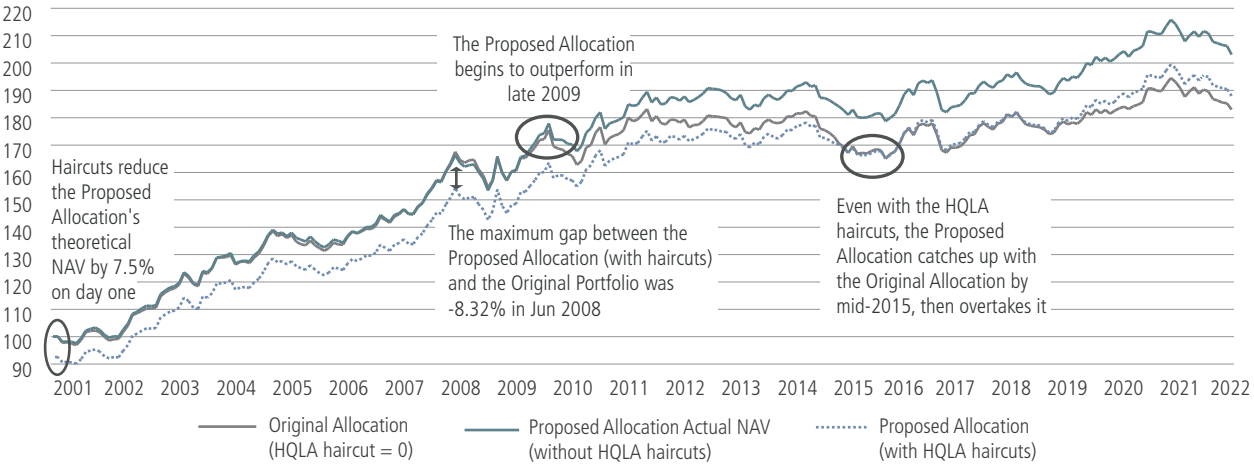
But what about liquidity risk?

We applied haircuts to the value of the two portfolios using the High Quality Liquid Assets (HQLA) factors set out in the Basel III framework for liquidity risk measurement (figure 3). The purpose is to impose a penalty on the valuation of certain asset classes that reflects an assumption that the investor will be unable to sell some or all of the allocation during a period of market stress, or would incur severe losses in doing so. Because the Original Allocation does not attract a penalizing HQLA haircut but corporate bonds and MBS do, this inevitably shows a negative impact on the Proposed Allocation.

Figure 3 shows the actual valuation of the Proposed Allocation as a green line, together with the valuation of the Original Allocation, net of its HQLA haircuts, as a gray line: note that these two lines follow the same path as the green and gray lines in Figure 2, because there is no haircut for the Original Allocation. The blue dotted line shows the valuation of the Proposed Allocation net of its penalizing HQLA haircuts.

FIGURE 3. DIVERSIFICATION DOES NOT UNDULY COMPROMISE VALUATION, EVEN AFTER ADJUSTMENT WITH HIGH QUALITY LIQUID ASSETS HAIRCUTS

Asset value after High Quality Liquid Assets haircut, rebased to a value of 100 for the Existing Allocation on January 31, 2001



HQLA haircuts assumed for each asset class

	Global Tsy	USD Cash	EUR Cash	US Agency MBS	Global Credit
HQLA category	Level 1	Level 1	Level 1	Level 2B	Level 2B
Haircut	0%	0%	0%	25%	50%

Source: Bloomberg, Neuberger Berman. Data as of January 31, 2022. Indices used: Bloomberg Global Aggregate Treasuries Total Return Index USD Unhedged; Barclays Benchmark Overnight USD Cash Index; Barclays 3-Month Euribor Cash Index; Bloomberg Global Aggregate Credit Total Return Index USD Unhedged; Bloomberg U.S. Mortgage Backed Securities Index Total Return USD Unhedged. For illustrative purposes only. Indexes are unmanaged and are not available for direct investment. **Past performance is no guarantee of future results.**

We can see that, on day one, those haircuts amounted to a 7.50% reduction in valuation at the whole-portfolio level. That haircut, relative to the Original Allocation, would have reached its widest point, 8.32%, in June 2008. In other words, were the investor to have liquidated as much of its assets as possible in June 2008, during a period of market stress, the assumption is that the proceeds would have been worth 8.32% less under the Proposed Allocation than under the Original Allocation—because of an inability to sell certain assets at all, or because of severe losses incurred by selling less-liquid assets.

Thereafter, however, the superior overall performance of the Proposed Allocation would have closed the gap generated by the haircuts and ultimately erased it. By the end of 2015, the Proposed Allocation would have had a higher value than the Original Allocation, even after taking account of the heavy penalties of the HQLA haircuts.

The HQLA haircuts are a theoretical (and stringent) measure of the potential consequences, during a period of market stress, of choosing less-liquid investments. Investors may have other ways to estimate these potential consequences. Whichever measure they use, they will need to consider how much of this theoretical loss of liquidity they can afford, and for how long. But the essential conclusion is evident. Does an institution believe it may need to liquidate 100% of its assets—or indeed, 91% of its assets—at short notice? Even with these stringent haircuts, we can see that this hypothetical reserves investor can afford to exchange at least some short-term liquidity for a likely enhancement to long-term asset growth.

Using this two-tranche template for asset allocation, the asset allocation for the Investment Tranche could have its risk exposures dialled up or down according to the investor's regular reserve-adequacy reviews. Tactical additional risk exposure to government bonds, credit, securitized products and equities could be implemented synthetically via index derivatives, thereby preserving liquidity in the Investment Tranche with which to replenish the Liquidity Tranche should it become necessary. This is likely to be more operationally efficient than attempting ongoing rebalancing between the two tranches.

Credit Diversification in a Real-World Official Portfolio

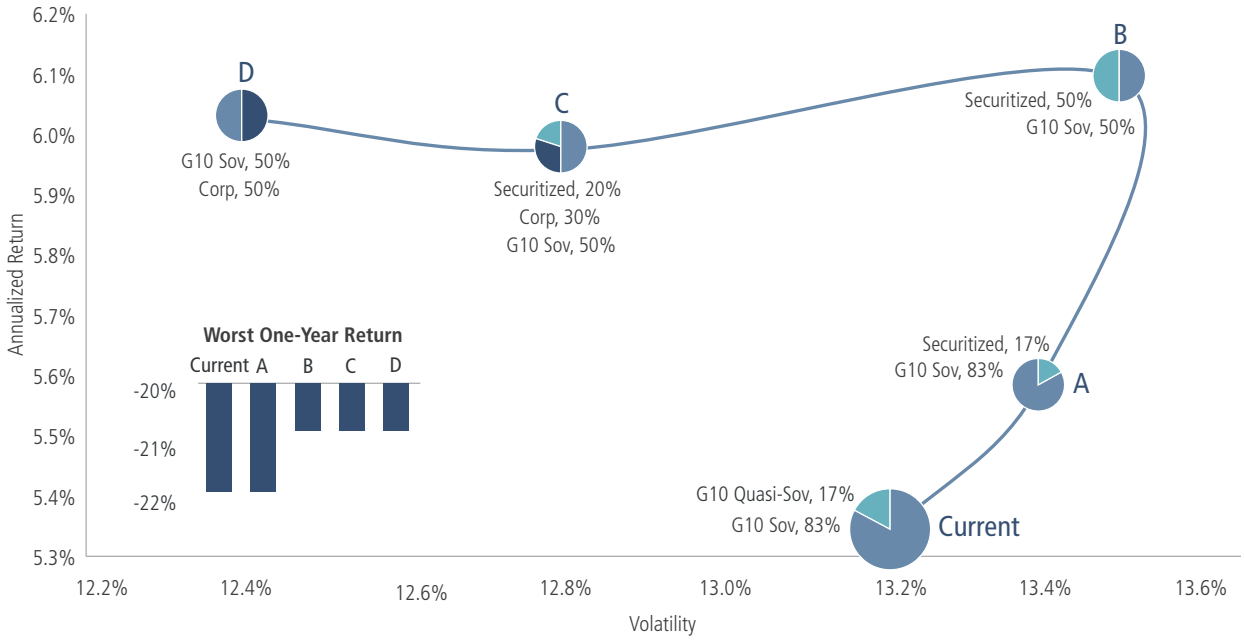
Neuberger Berman proposed a similar solution to one official institution that approached us for help early in 2021. It needed to improve the return outlook for its portfolio without taking on a large amount of extra risk. It is based in an emerging market, and its benchmark was 83% allocated to G10 government bonds and 17% to G10 quasi-sovereign bonds. In our 15-year backtests, this portfolio returned 5.34% annualized with volatility of 13.21%. The worst 12-month period saw a drawdown of -21.6%. Duration averaged 4.3 years.

From our conversations, it became clear that taking more interest rate risk was not desirable—that anchored our model portfolios to a duration of around 4.5 years. Further conversation revealed that the clearest opportunities for taking more risk lay in liquidity and credit exposures.

From these exchanges, it emerged that the surprisingly large allocation to quasi-government bonds had been intended to gain a modest pick-up in yield while preserving government bond-like liquidity. We questioned this approach based on our observation that, in times of risk aversion, quasi-government bonds have in fact become quite illiquid—indeed, considerably less liquid than global investment grade corporate bonds or investment grade securitized debt tranches, which also tend to offer higher yields.

For that reason, our next step was to show the effect of re-allocating from quasi-government bonds to corporate bonds and securitized credit (figure 4).

FIGURE 4. ENHANCING YIELD AND RETURN WITH A LARGER CREDIT ALLOCATION
Hypothetical model portfolio return and volatility, September 2006 to September 2021



Source: Bank of America Merrill Lynch, Neuberger Berman. Data as of September 30, 2021. Indices used: ICE BofA Global Government (1-10 year) TR Index COP Unhedged; ICE BofA Global Quasi-Government (1-10 year) TR Index COP; ICE BofA Global Corporate (1-10 year) TR Index COP Unhedged; ICE BofA Global Collateralized (1-10 year) TR Index COP Unhedged. For illustrative purposes only. **Past performance is not indicative of future results**

As with our hypothetical reserves investor, we were able to show this real-world investor the potential for a credit allocation to enhance return, risk and drawdown profile. As the chart shows, progressively adding securitized credit raised the return of the hypothetical portfolio with only a moderate increase in volatility, while diversifying with corporate bonds substantially reduced the volatility and worst one-year return without giving up too much of the enhanced return.

Special Drawing Rights and Short-Duration Yield

We worked on a similar adjustment to a fixed income portfolio for an institution which has liabilities linked to the interest rate on Special Drawing Rights (SDR). That interest rate, which is paid to the IMF's creditor-members and also by countries that have drawn down or been allocated SDRs, has a floor of 0.05%. The challenge this investor faced was that the SDR-weighted, blended interest rate of the SDR valuation currencies, the U.S. dollar, euro, pound sterling, yen and yuan, had fallen to near-zero. It needed a portfolio that could outperform the SDR interest rate with a duration of less than 2.5 years and no active currency risk against the SDR-weighted basket.

While maintaining 45% of the investor's portfolio in government and government-agency bonds, we proposed allocating the rest to a mix of U.S. and European corporate bonds rated A and above and U.S. agency mortgage-backed securities rated AA- and above. In addition, we proposed to hedge 5% of the U.S. dollar exposure back to the yen, in order to take advantage of a favorable interest-rate differential. At the time, which was June 2021, the net currency exposure remained aligned with the SDR basket, and the portfolio's yield exceeded the SDR rate by 28 basis points, with duration of just 1.5 years.

A third example that illustrates the role of broadening credit risk exposures in the current low-rate environment was a benchmark proposed for a central bank that needed its portfolio to maximize returns subject to an annual expected shortfall of 0.5% with a 95% confidence level. At the time it was not possible for a benchmark with an average maturity in excess of three years to meet that shortfall constraint, due to the heightened interest rate sensitivity of bonds trading with such low yields—but a developed markets government bond benchmark with shorter duration delivered an unsatisfactory yield. We were able to show that adding select emerging markets and A rated bank credit maintained yield while improving expected shortfall and keeping average maturity below three years.

A Shared Archaeological Challenge

In all these cases, the shared challenge was, in many ways, archaeological.

Was the current benchmark selected for a reason? Did the investor have a clear assessment of the relative liquidity of its benchmark, and was it overestimating the liquidity it needed? Our initial conversations are often geared toward uncovering these foundations.

The proposed shift in benchmark allocation can raise deeper, social and governance-related questions: How does financing global governments and quasi-sovereign institutions compare with financing primarily U.S. corporations and mortgages and auto loans for primarily U.S. consumers, in terms of the investor's mission and mandate?

In all the cases described here, the essential question was one we have come across more and more over the past five or six years. How can we use broader, more flexible credit allocations to seek to maintain returns, within tight constraints on liquidity, drawdown risk, credit quality and, especially, duration—as well as idiosyncratic constraints specific to our institution's mandate?

The benchmark portfolios that arose from our conversations with these clients were only a starting point. There may be scope to take more credit risk, more liquidity risk, or more region-specific risk. And for most of the official institutions that we talk to, once the optimal fixed income beta is agreed, the potential for added value from active management can be explored.

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Hypothetical Backtested Performance Disclosures

The hypothetical performance results included in this material are for backtested model portfolios and are shown for illustrative purposes only. Neuberger Berman calculated the hypothetical results by running a model portfolio on a backtested basis using the methodology described herein. The results do not represent the performance of any Neuberger Berman managed account or product and do not reflect the fees and expenses associated with managing a portfolio. If such fees and expense were reflected, returns referenced would be lower. The model portfolio may not be appropriate for any investor. There may be material differences between the hypothetical backtested performance results and actual results achieved by actual accounts. Backtested model performance is hypothetical and does not represent the performance of actual accounts. Hypothetical performance has certain inherent limitations. Unlike actual investment performance, hypothetical results do not represent actual trading and accordingly the performance results may have under- or over-compensated for the impact, if any, that certain economic or other market factors, such as lack of liquidity or price fluctuations, might have had on the investment decision-making process or results if assets were actually being managed. Hypothetical performance may also not accurately reflect the impact, if any, of other material economic and market factors, or the impact of financial risk and the ability to withstand losses. Hypothetical performance results are also subject to the fact that they are generally designed with the benefit of hindsight. As a result, the backtested models theoretically may be changed from time to time to obtain more favorable performance results. In addition, the results are based, in part, on hypothetical assumptions. Certain of the assumptions have been made for modeling purposes and may not have been realized in the actual management of accounts. No representation or warranty is made as to the reasonableness of the assumptions made or that all assumptions used in achieving the hypothetical results have been stated or fully considered. Changes in the model assumptions may have a material impact on the hypothetical returns presented. There are frequently material differences between hypothetical performance results and actual results achieved by any investment strategy. Neuberger Berman did not manage any accounts in this manner reflected in the models during the backtested time periods shown.

Index Definitions

The **Bloomberg Global Aggregate Treasuries Total Return Index USD Unhedged** measures the performance, in USD, of Treasury bonds from the Bloomberg Global Aggregate Bond Index, a broad base, market capitalization-weighted bond market index representing intermediate term investment grade bonds traded worldwide.

The **Barclays Benchmark Overnight USD Cash Index** measures the performance of a daily rolling money market deposit in USD.

The **Barclays 3-Month Euribor Cash Index** measures the performance of the three-month Euribor interest rate in EUR.

The **Bloomberg Global Aggregate Credit Total Return Index USD Unhedged** measures the performance, in USD, of corporate bonds from the Bloomberg Global Aggregate Bond Index, a broad base, market capitalization-weighted bond market index representing intermediate term investment grade bonds traded worldwide.

The **Bloomberg U.S. Mortgage Backed Securities Index Total Return USD Unhedged** measures the performance, in USD, of fixed-rate agency mortgage backed passthrough securities guaranteed by Ginnie Mae (GNMA), Fannie Mae (FNMA), and Freddie Mac (FHLMC).

The **ICE BofA Global Government (1-10 year) TR Index COP Unhedged** measures the market capitalization-weighted performance of public debt of investment-grade sovereign issuers, issued and denominated in their own domestic market and currency, with maturities of 10 years and below, in COP.

The **ICE BofA Global Quasi-Government (1-10 year) TR Index COP Unhedged** measures the market capitalization-weighted performance of public debt of investment-grade quasi-sovereign issuers, issued and denominated in their own domestic market and currency, with maturities of 10 years and below, in COP.

The **ICE BofA Global Corporate (1-10 year) TR Index COP Unhedged** measures the market capitalization-weighted performance of public debt of investment-grade corporate issuers, issued and denominated in their own domestic market and currency, with maturities of 10 years and below, in COP.

The **ICE BofA Global Collateralized (1-10 year) TR Index COP Unhedged** measures the performance of investment grade securitized and collateralized debt, including mortgage backed, asset backed, commercial mortgage backed, covered bond, and US mortgage passthrough securities publicly issued in the major domestic and euro-bond markets, with maturities of 10 years and below, in COP.

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