



## Executive Summary

The ISSG's Ralph Goldsticker and Mellon Capital's Lowell Bennett argue that investors should consider alternatives to issuance-weighted bond indexes that may expose them to issuer concentration and overexposure to weaker issuers. The problems of the eurozone's peripheral members have highlighted the potential pitfalls of using issuance-weighted benchmarks for sovereign debt portfolios. Issuance-weighting results in countries with weaker financial positions having a larger weighting relative to the size of their economies. Issuance-weighted indexes tend to be highly concentrated in just a few countries. That lack of diversification could result in large losses if one of those countries experiences sudden interest rate changes, credit downgrades or outright default. While their analysis focuses on sovereign debt benchmarks, and by extension global sovereign debt index funds, they argue that the same problems may also exist in actively managed fixed income portfolios that are benchmark-aware.

# Rethinking Bond Index Weightings and Concentration Risk

By

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## Issuance-Weighted Bond Benchmarks Are Highly Concentrated

Looking at the country weights for the 13 countries in the Barclays Capital Global Treasury Bond Index ("the Index") that are classified as Majors<sup>2</sup> reveals a high level of concentration (Exhibit 1). The gold bars show the data for the year ended 2006, before the global financial crisis, and the green bars show the data as of November 11, 2011. Japan and the U.S. dominate the index. Even prior to the crisis the two made up 46% of the Index, and as a result of their heavy issuance since, they now represent 58% of the index. On the other hand, the smallest five of the Majors combined comprise only 5% of the index, and the 21 non-Major countries comprise 8.4%, as of November 1, 2011. That averages only 40 basis points each.

This concentration demonstrates a lack of diversification, which might harm a portfolio in two ways. First, interest rate changes in the U.S., Japan and the eurozone are likely to have a disproportionate effect on portfolio returns. Stated another way, a less concentrated portfolio would be expected to be less volatile. Secondly, as recent events have reminded us, sovereign bonds suffer from the risk of downgrades and defaults. Because the issuance-weighted portfolio is so concentrated, the impact of any individual downgrade or default could potentially have a much larger impact on the total portfolio than would be the case with more diversified exposure. Concentration is not just determined by country.

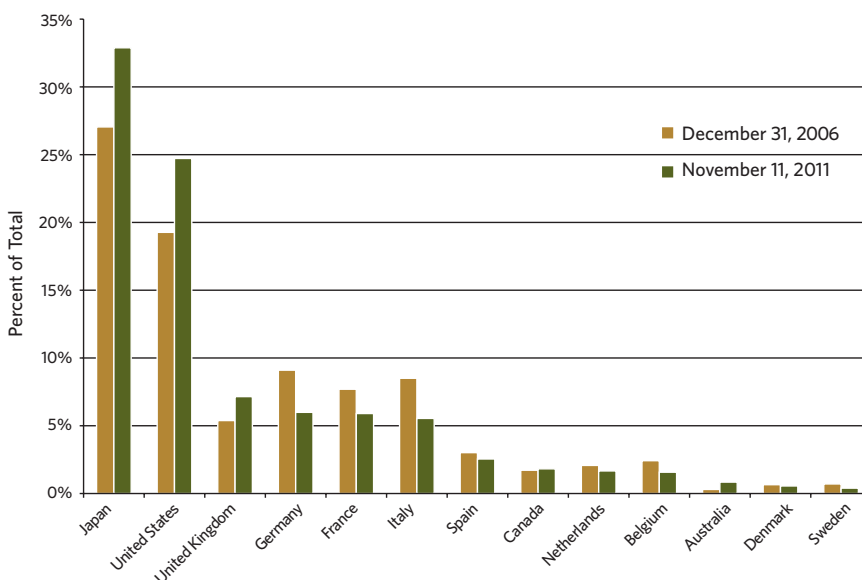
<sup>1</sup> The Investment Strategy and Solutions Group is part of The Bank of New York Mellon, a principal banking subsidiary of BNY Mellon.

<sup>2</sup> For ease of display, we are showing only the 13 countries as "Majors" in their Global Treasury Bond Index. These 13 Majors comprised 88% of the index on December 31, 2006, and 92% on November 11, 2011.

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Bonds within the eurozone have historically been highly correlated, both in terms of changes in interest rates and in terms of expectations of default risk. The aggregate weight of the countries using the euro is 26% in the Majors subset of the Index, further demonstrating the concentration of this issuance-weighted index.

**Exhibit 1 - Country Weights for the Majors in Barclay Capital Global Treasury Bond Index**



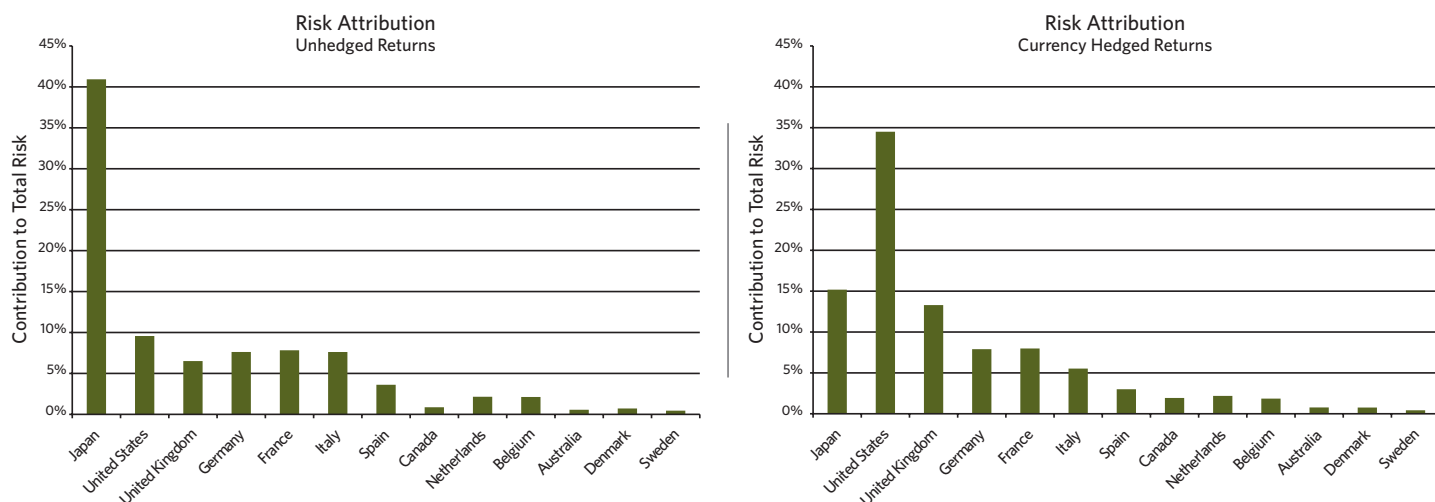
Source: ISSG using Barclays Capital data.

We can also evaluate diversification from the perspective of contribution to index volatility (Exhibit 2). Again, we see a lack of diversification. The chart on the left in Exhibit 2 is calculated using weekly U.S. dollar returns of each country bond index included in the index for the last five years. Japan dominates the portfolio, contributing more than 40% of the total volatility. That volatility comes from two sources: the volatility in yen terms of the Japanese government bonds (JGBs) that comprise more than 30% of the index, and the volatility of the yen versus the U.S. dollar. After Japan, the contribution to index volatility from the rest of the holdings seems more balanced. But there are still many countries that provide a very small contribution, and are potential sources of diversification. Because the index is U.S. dollar-based, U.S. Treasuries contribute less volatility than would be expected based on their large weight because they do not introduce currency risk. Because they are all denominated in euros, Germany, France and Italy each contribute more to the index's volatility than does the U.K. That is because there is not any cross-country diversification of their currency risks.

The chart on the right of Exhibit 2 performs the same analysis, but uses currency-hedged returns rather than U.S. dollar returns. Now, U.S. Treasuries are the largest contributor to volatility. Despite its much larger weight in the index, the contribution from Japan is lower because currency-hedged JGBs were less volatile than bonds from the other countries. Stated another way, Japanese interest rates were less volatile than rates in other countries.

It is important to note that this risk attribution is based on recent volatility. As a result, it may not fully reflect the potential risks from tail events such as defaults or downgrades.

**Exhibit 2 - Percentage Contribution to Index Volatility**



Source: ISSG, using Barclays Capital data (for the period November 2006 to November 2011).

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### Weaker Fiscal Position Results in Larger Weightings

Sovereign issuers are unique in that their only method of external funding is to issue bonds. As we have seen in recent headlines, countries cannot reduce their spending quickly when their income falls. As a result, when things are going badly, they are often forced to issue more debt, and their weight in issuance-weighted indexes rises, and typically continues to rise, right up until they default or are downgraded out of the index. While this risk may to some extent be incorporated in bonds' yields, the rules used to construct the indexes do not reflect the differences in countries' risks. In addition, if there are large investors such as central banks that are not strictly motivated by profits, the bonds' yields may not fully reflect their risks.<sup>3</sup>

### The Roles of (Global) Fixed Income in the Total Portfolio

It is important to understand the roles of global fixed income in the overall portfolio, before suggesting alternatives to issuance-weighted portfolios. The first and most important role is as a diversifying asset aimed at reducing overall portfolio volatility. A fixed income portfolio with low volatility, an acceptable risk-adjusted expected return, and low correlation with equities and other growth assets might well fit that bill. However, issuance-weighting does not explicitly attempt to create an efficient portfolio with an attractive risk/return tradeoff or directly address investment objectives.

<sup>3</sup> Sovereign risk has multiple dimensions. Some examine the ratio of debt to GDP. Others look at the current account balance as a measure of fiscal strength. Others focus on market measures such as yields and CDS spreads. Constructing a comprehensive measure of sovereign risk is interesting in its own right and the subject for another paper.

When one looks at the concentration in issuance-weighted fixed income benchmarks, it is clear that much idiosyncratic risk remains.

The second, more subtle, role that U.S. Treasuries and other sovereign bonds can play is that of a safety asset that reliably rises in value during periods when financial shocks are driving down the value of equities. While most sovereign bonds display safety asset behavior, not all do. Over the last year, the correlation between U.S. Treasuries and the S&P 500 Index was  $-.715$ .<sup>4</sup> The correlations for Japanese JGBs and German bunds with the S&P 500 Index were  $-.426$  and  $-.629$ , respectively. On the other hand, the correlations for countries with weaker fiscal positions such as Italy and Spain were  $+.089$  and  $+.044$ , respectively. Ideally, if one holds a great deal of equities, the sovereign bond component of the portfolio should be tilted towards bonds that can be expected to behave as safety assets.

### Capitalization or Issuance Weights and the CAPM

Equity index funds and other strategies based on capitalization or issuance weights have been around for almost 40 years. They trace their origins to the Capital Asset Pricing Model (CAPM) which was introduced by William Sharpe in 1964. The CAPM suggests that the “market portfolio,” the capitalization-weighted portfolio of *all* assets, should have the highest return per unit of risk (i.e., the maximum Sharpe Ratio). In practice, many investors’ models have tended to ignore the crucial assumption that the market portfolio consists of all assets. The model’s conclusions don’t necessarily hold when capitalization weights are applied to subsets of the market portfolio. That is not too much of a problem in equity portfolios. Because of their higher volatility, equity volatility should dominate the volatility of the total market portfolio, so that the CAPM can be applied to equity portfolios without too much concern.

On the other hand, when this cap-weighted or issuance-weighted approach is applied to only a subset of the fixed income portion of the market, the violations of the CAPM assumptions are so severe that the conclusions don’t stand up. As a result, there is no reason to believe that the issuance-weighted fixed income portfolio should have the maximum Sharpe Ratio. Another significant conclusion of the CAPM is that the only risk that should be rewarded is beta (the correlation with the market portfolio). That is because all other risks can in principle be diversified away. When one looks at the concentration in issuance-weighted fixed income benchmarks, it is clear that much idiosyncratic risk remains. One way to illustrate this point is to look at the portion of assets’ risk that is explained by the capitalization-weighted benchmark. The average correlation between the Majors and the Barclays Global Treasury Bond Index was  $+.42$ .<sup>5</sup> By way of reference, the average correlation between the 30 stocks in the Dow Jones Industrial Average Index and the S&P 500 Index was  $+.70$ .<sup>6</sup>

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4 Correlations based on currency hedged weekly returns of the 7-to-10-year maturity subsection of the Barclays Capital Treasury Index for the specified individual countries for the year ending November 11, 2011.

5 Uses the currency-hedged return for the last five years ending November 2011; would be lower if we used the unhedged return.

6 Uses returns for the last five years ended November 2011.

In addition to the problems of less than optimal diversification and issuer concentration, portfolios based on issuance weights effectively delegate the portfolio's duration to the issuers.

The final test we performed to evaluate the usefulness of the CAPM framework in a sovereign bond portfolio was a reverse optimization. It uses portfolio weights, the assets' risks and the correlations to infer the expected returns that would make the weights optimal. When we used the technique with the weights of the Majors in the Barclays Global Treasury Bond Index, the resulting expected returns seemed highly implausible.<sup>7</sup> For example, the relatively large weight and high volatility of U.K. bonds implies an expected return that is very much higher than those of bonds from all other countries.

### **Unlike Equities, Issuance-Weighting of Sovereign Bonds Does Not Reduce Turnover**

The first equity index fund was an equal-weighted S&P 500 portfolio. Portfolio managers quickly realized that one of the benefits of using capitalization weighting was that relative price changes did not require portfolio rebalancing. With an issuance-weighted portfolio, rebalancing is required only when there is new issuance. In equities, the size and frequency of capital actions are relatively small compared to the volatility of prices. However, with sovereign debt, the relationship is reversed. Relative price volatility is low, and issuance can be large. Over the last five years, among the Majors, differences in issuance would have caused more than three times as much turnover as returns. For example, during 2008, the amount of U.S. Treasuries in the index grew by 181/2%, and that of U.K. gilts by 37%. On the other hand the amount of French and Japanese bonds grew by about 5% and that of German bunds by less than 1/2%. The variability of returns was much smaller. The average local currency return of the Majors was about 7%, and the standard deviation of returns across the countries was 3.44%.

### **Issuance-Weighting Manages Neither Duration Nor Currency Exposures**

In addition to the problems of less than optimal diversification and issuer concentration, portfolios based on issuance weights effectively delegate the portfolio's duration to the issuers. Since 2001, the average maturity of the bonds in the Barclays Capital Global Treasury Bond Index climbed from 7.5 to 8.5 years, and the duration rose from 5.4 to 6.7 years. That affects the risk of the portfolio, as well as creating problems for investors trying to match their assets to their liabilities.

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<sup>7</sup> We used weekly currency hedged returns for the last five years ending November 2011 to calculate the risks and correlations.

Issuance-weighting ignores the difference between local and foreign currency exposure, their correlations with the local currency, and their cross-correlations.

Unless the currency exposures are systematically hedged, currencies are an important component of the portfolio. In fact, currencies have been more volatile than the underlying bonds. Over the last five years, the volatility of the Barclays Global Treasury Bond Index hedged to U.S. dollars has been 3.04%, while the volatility of the unhedged version of the index was 7.5%. Issuance-weighting ignores the difference between local and foreign currency exposure, their correlations with the local currency, and their cross-correlations. In our view, a thoughtfully constructed portfolio should take currency exposures into consideration. For example, it is unlikely that the same country weights would be optimal both before and after the creation of the euro.

### **Building a Better Index Weighting Method**

The most significant problem with weighting the portfolio by issuance, in our view, is portfolio concentration and therefore higher-than-necessary risk. As we saw above, more than 50% of the Barclays Capital Global Treasury Bond Index is invested in just two countries. There are several alternative approaches. The choice will depend on one's assumptions. At the extreme, if you believe that all sovereign bonds are the same, i.e., bonds from all countries have the same expected returns, risks, and correlations, then the optimal portfolio would be equal-weighted. It would have minimum risk, no concentration, and since all bonds are assumed to have the same expected return, it would have the same expected return as all other portfolios. Moving a step closer to reality, with a robust covariance matrix, we could construct the minimum variance portfolio. It would be less concentrated and less volatile than the issuance-weighted portfolio. It would be optimal only if we believe all bonds have the same expected return, and returns were normally distributed. Because bonds can default, we know that they have "fat tails." As a result, it would make sense to tilt the portfolio away from minimum variance, and towards equal-weighting to reduce portfolio concentration.

The other dimension that we think should be considered in portfolio construction is the bonds' expected returns. The optimal portfolio should be tilted toward bonds with higher expected returns, and away from bonds issued by governments with greater default probabilities. Given the relatively small number of issuers, it may make sense to eliminate the weakest issuers entirely. Expected returns may vary for several reasons. Riskier bonds should have higher expected returns. However, as mentioned above, market segmentation or the actions of central banks may depress expected returns below their equilibrium levels. Again, because the sovereign markets are at least partially segmented, one would expect the faster growing countries to have a higher cost of capital and higher expected returns. The default and downgrade risk of sovereign bonds should be incorporated as well.

The biggest advantage of issuance-weighted indexing is that it provides maximum liquidity. In theory, it is the only strategy that can be simultaneously followed by all investors. As a result, if we deviate from issuance-weighting, then appropriate liquidity filters will need to be incorporated into any strategy.

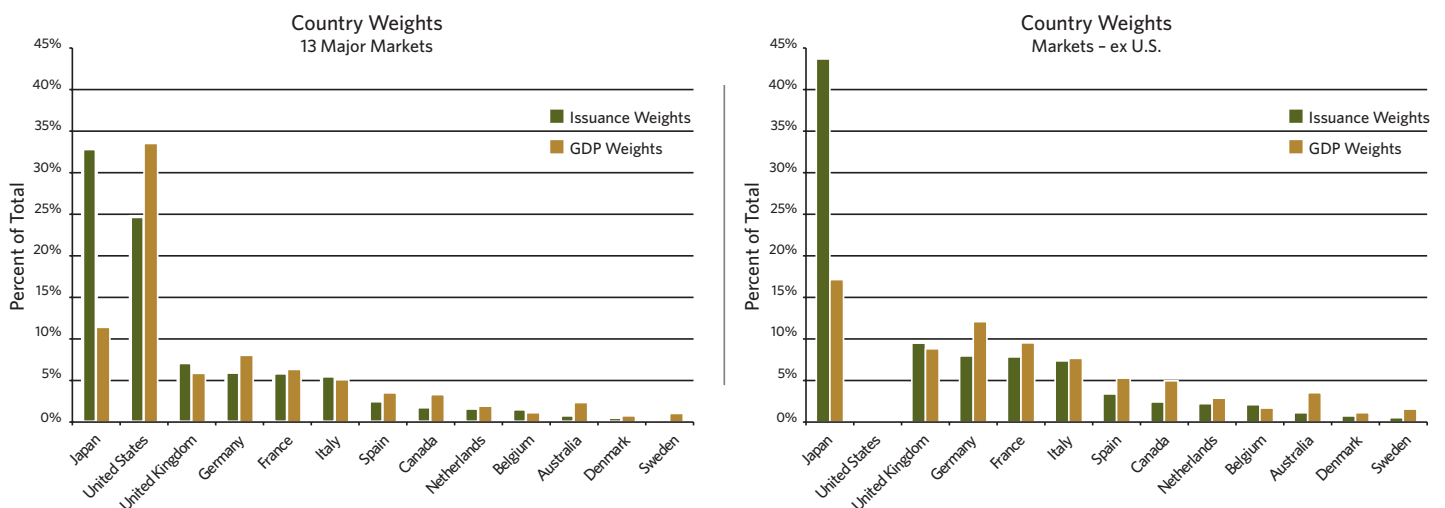
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### What About GDP Weighting?

Some argue that rather than using issuance, investors should construct a fixed income portfolio using GDP weights. The idea is that rather than lending to the largest borrowers (without regard to ability to repay), one lends to borrowers in proportion to their income or productive capacity. GDP-based weights take an important step towards mitigating the systematic bias toward countries with weaker fiscal positions because many have a large amount of debt outstanding in relation to the size of their economies. But because it focuses only on debt-repayment capacity, rather than issuance relative to that capacity, GDP-weighting doesn't fully address the sovereign risk problem.

We can look at the differences between issuance and GDP weights for Barclays Capital Global Treasury Bond indexes (Exhibit 3). Notice that GDP weights still result in a highly concentrated portfolio. When one looks at the resulting portfolio, adopting GDP weights reduces the weight of Japan rather dramatically, as Japan has by far the highest debt/GDP ratio. However, the chart on the left shows that the resulting portfolio has over 30% of its value invested in the U.S., while the allocation to the smaller countries is still quite low. The chart on the right shows the distribution of the non-U.S. portion of the portfolio. It shows that the non-U.S. exposure is concentrated in just a few countries. While reducing the weight of high debt/GDP countries such as Japan may be desirable, we believe that portfolio allocations with less concentration will provide greater diversification, and will reduce the potential impact of tail events.

**Exhibit 3 - Issuance-Weighted vs. GDP-Weighted Indexes (as of November 2011)**



Source: ISSG using Barclays Capital data.

We argue that investors should design bond portfolios that minimize concentration and the risk of downgrades and defaults.

## Currency Exposures

So far we have addressed only the risk of the underlying bonds rather than the currency exposures that come from holding foreign bonds. We believe the decision to hedge currency exposures or not should be based on the investor's views and investment objectives. If the investor is agnostic about the future direction of the dollar, then currency risk should be viewed as uncompensated, and be hedged. In addition, during the recent risk-on/risk-off market environment, most foreign currencies have been positively correlated with the stock market, which makes them even less attractive. On the other hand, if one is worried about U.S. inflation, or thinks that the dollar will decline secularly due to macro economic factors, then the foreign currency exposure should be left unhedged.

## Conclusion

In sum, we believe issuance-weighted sovereign bond portfolios are inefficient. They tend to be concentrated, and weaker issuers often have a disproportionately high share of the index. Instead, we argue that investors should design bond portfolios that minimize concentration and the risk of downgrades and defaults. They should be tilted toward issuers with higher expected returns, and away from issuers with weaker fiscal positions. Of course, expected risks and correlations should enter into the process as well. For larger investors, a liquidity filter may be necessary in a benchmark-agnostic portfolio. It may be possible to develop the required inputs to construct a portfolio using an optimizer. If not, we think that thoughtfully applied heuristic rules should achieve the kind of efficient portfolio investors are seeking, while avoiding the concentration risk posed by issuance-weighted indexes.

## Index Definitions

The Global Treasury Bond Index tracks fixed-rate local currency government debt of investment grade countries. The index represents the Treasury sector of the Global Aggregate Index. The index includes fixed rate investment grade fully taxable Treasury securities with at least one year until final maturity. The index excludes strips, inflation-linked bonds, and floating rate issues.

Dow Jones® Industrial Average Index is an index based on the average of 30 blue chip stocks that trade daily on the New York Stock Exchange.

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