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# A review of alternative approaches to fixed income indexing

Vanguard research

February 2012

**Executive summary.** The recent global financial crisis has led to heightened sensitivity to the indebtedness of issuers across the global fixed income marketplace. The implications of the events in Europe for both sovereign and corporate issuers have led some investors to question the merits of indexes constructed based on the traditional method of market-capitalization weighting, according to which larger, more indebted issuers inherently receive a higher weighting in the index. This paper evaluates several alternative index-weighting methodologies commonly proposed in the global sovereign and U.S. corporate marketplaces.<sup>1</sup>

We show that common alternative weighting methods result in a shift away from the risk–reward characteristics of the market, introducing elements of active risk and risk-factor tilts into the index-construction process—a strategy that implicitly assumes that the aggregate price-discovery process of investors is flawed. This is an important

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Note: The authors thank Didier Haenecour, John Malley, and Yan Pu, from the Vanguard Fixed Income and Risk Management Groups, for their excellent research assistance.

<sup>1</sup> For a discussion of alternative index weighting methodologies for equities, see Vanguard’s research paper by Philips et al. (2011c).

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consideration, since investors (in aggregate) incorporate all relevant risks of the issuer—including not only the issuer’s ability to repay the obligations but also the issuer’s willingness to do so—into bond prices and, therefore, into bond market capitalizations. We show that an issuer’s relative indebtedness has little power in explaining yields and returns, an indication that other factors are being reflected in bond prices. We demonstrate that these alternative weighting methods rely on a very narrow selection of factors compared with the approach of a market-cap-weighted benchmark. The result is an emphasis by these methods on or against common bond market risk factors—including country risk, sector risk, interest rate risk, and credit risk. In this sense, we do not believe that alternative indexes represent a better way to measure the performance of a market, but merely a reweighting of risk within that market.

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### Beta, the market, and indexing

Traditionally the term *beta* has been used to describe the risk-and-return attributes of a particular asset class. Accordingly, beta in the typical sense is synonymous with the performance characteristics of “the market,” meaning the total invested capital in a group of securities such as the stock or bond market. An *index* is a group of securities chosen to represent the characteristics of a particular market. *Indexed investing* (or *indexing*) is an investment strategy designed to closely mimic the risk-and-return attributes, or beta, of the benchmark index being tracked. Because an index does not reflect all of the costs and potential implementation hurdles that would make it investable, the index is only a

theoretical performance benchmark. Indexing—via a mutual fund or exchange-traded fund (ETF), for example—reflects these implementation costs and, therefore, should provide investors with a reasonable proxy for achievable or investable beta.

Once the market being measured is clearly defined, we believe that a well-designed index will accurately reflect the risk-and-reward attributes of the total capital invested by participants in that market, which can only be fully accomplished through a market-cap-weighting process.<sup>2</sup> This is an important consideration, since it is these market participants who set prices, incorporating all risks they perceive relevant. By reflecting the value of all assets that

*Notes about risk and performance data: All investing is subject to risk. Investments in bond funds are subject to interest rate, credit, and inflation risk. Past performance is not a guarantee of future results. The performance of an index is not an exact representation of any particular investment, as you cannot invest directly in an index. Current and future portfolio holdings are subject to risk. Stocks of companies in emerging markets are generally more risky than stocks of companies in developed countries. Foreign investing involves additional risks, including currency fluctuations and political uncertainty. Although U.S. Treasury or government agency securities provide substantial protection against credit risk, they do not protect investors against price changes due to changing interest rates. Although the market values of government securities are not guaranteed and may fluctuate, these securities are guaranteed as to the timely payment of principal and interest.*

<sup>2</sup> Market capitalization for a given fixed income issuer is the sum of the value (measured in dollars, euro, yen, etc.) of all of that issuer’s outstanding debt securities. To determine this issuer’s market-cap weight, one would divide that amount by the value of all the securities within the market being measured.

investors have chosen to invest in a particular market, an index provides a benchmark for that market's beta, as well as a benchmark for how the average dollar (or yen, euro, etc.) performed in that market.

Investment performance can be deconstructed into three parts: the portions of return attributable to the market (beta), to market-timing, and to security selection (Brinson, Hood, and Beebower, 1986). The latter two portions are specific to active management, while the first can be measured through benchmark indexes. As a result, we believe that the best index is not necessarily one that provides the highest return over a given period but the one that most accurately measures the risk–reward characteristics of the collective capital invested within the market being tracked.

### Advantage of cap-weighting

A cap-weighted index reflects the relative value of debt securities as determined by market participants, without changing the market's relative composition. This makes cap-weighting distinct from other weighting methods in several important ways.

The key variable determining a security's weight in a cap-weighted index is its price. In public capital markets, the market price of a security reflects every market participant's information, beliefs, and expectations regarding the value of that security. Price thus represents a powerful mechanism collectively used by market participants—often, with very different opinions and valuation processes—to establish and change views on future performance.

In the global fixed income marketplace, investors buy and sell bonds based on a variety of factors, the most important of which is the investor's perception of the issuer's willingness and ability to honor the terms of the obligation. As a result, default risk is

a principal consideration in fixed income valuation and is reflected in the prices of an issuer's bonds. Continuous buying and selling ensures that the price of any given bond reflects the consensus estimate of its intrinsic value, accounting for the expected risk and return from every investor's valuation process. In this sense, *when a benchmark is weighted by market cap, it is a reflection of all market participants' views regarding the relative value of all fixed income securities within that market.* So we believe it is inappropriate to view the benchmark as being weighted by a single factor only—such as price—or even a limited number of factors.<sup>3</sup>

### What are the assumptions of alternatively weighted indexes?

Recently, alternative index-weighting methods for various sectors across the global fixed income market have been devised, perhaps to capitalize on the sentiment associated with events of the recent global financial crisis and ongoing fiscal issues in many developed markets. Common alternative-weighting criteria include gross domestic product (GDP), population, and other macroeconomic measures for sovereign debt; and assets, revenue, and other financial-statement metrics for corporate issuers.<sup>4</sup> We reemphasize here that a cap-weighted benchmark reflects the consensus view of all market participants and therefore can be considered an “all-factor” weighting system. Thus, weighting based on one or several factors, such as those used to form alternative weights, assumes that the market-consensus valuation is wrong, and that these other factors are better predictors of the fair value of a security (see **Figure 1**, on page 4). This seems questionable, given that a rules-based index would have to be based on factors that were publicly available, and as such should be reflected in market prices. In any case, the index provider's decision to deviate from market

3 Another advantage of market-cap-weighting indexing relates to the zero-sum game, the idea that the asset-weighted overperformance in a market must equal the asset-weighted underperformance in a market. (See Sharpe [1991] for a discussion and Philips [2011a, 2010] for an empirical evaluation of the U.S. and offshore markets.)

4 Some index providers may adjust market weights to better reflect the investable opportunity set, accounting for things such as capital controls, liquidity, and float (the portion of an issue actually available for purchase). In our opinion, this paper's discussion does not apply to these deviations from “pure” market weights, as they are primarily done with investability and liquidity in mind, without attempting to deviate significantly from the market's risk–reward characteristics.

**Figure 1.** A market-cap-weighted index is an “all-factor” index



Source: Vanguard.

weights inherently deviates from that market’s performance characteristics (beta) and introduces an aspect of active risk (security selection).<sup>5</sup>

A key question, then, is: What risk exposure do these strategies entail to produce a given return? Although security selection has the potential to enhance returns, systematic tilts toward persistent risk factors within a given market (for example, overweighting speculative-grade corporate bonds in the U.S. bond market) can produce predictable and replicable performance characteristics and may be best considered a targeted beta strategy. The following sections discuss several alternative index strategies in the global sovereign and U.S. corporate debt markets. We compare them with the cap-weighted market, and we demonstrate that these indexes frequently involve a meaningful reweighting of common bond market risk factors.

### Alternative indexes in the global sovereign market

Common non-market-cap-weighted index methodologies within the global sovereign marketplace have focused on moderating exposure to more indebted countries by using country-level metrics, including GDP, landmass, and population. This reflects the fact that sovereign-debt issuers have the ability to levy taxes on the economy that they govern, and are typically evaluated using broad, macroeconomic measures. Some examples include GDP-weighted versions of the Barclays Capital Global Treasury Index (mostly developed markets) and the Barclays Capital Emerging Markets Government Universal Index.<sup>6</sup> Various industry publications have also featured discussions of a RAFI (Research Affiliates Fundamental Index) weighting system that combines several macroeconomic factors, including GDP, landmass, population, and energy consumption.<sup>7</sup> Note that these alternatively weighted indexes use widely available public data that should, to the extent the data are relevant in determining intrinsic value, be

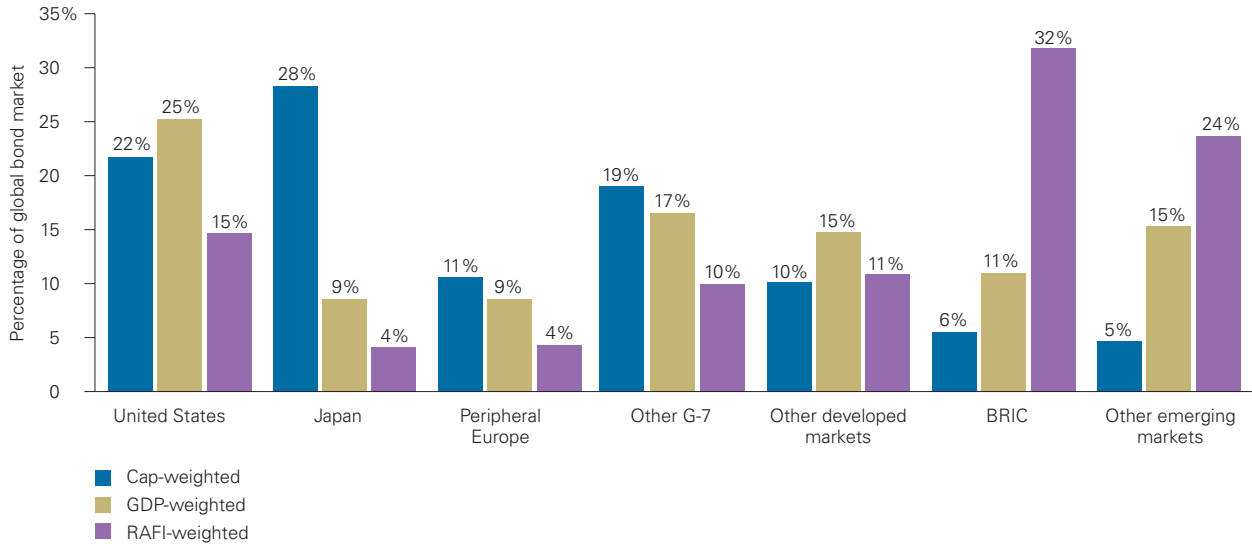
<sup>5</sup> Investors with unique investment objectives might deviate from the *broad* bond market to better form a portfolio that fits their own circumstances, not necessarily with the goal of outperformance due to active management. For example, pension funds often manage their assets to a predefined liability through the use of longer-duration bonds (Stockton, Donaldson, and Shtekman, 2008). In such cases, the investor’s initial market is defined differently so as to isolate securities with specific risk–return attributes (a specific beta). This may also help to explain the home bias that is evident in many global investors’ portfolios (as shown in Fidora, Fratzscher, and Thimann, 2006), with investors overweighting their home country to better match the domestic risk factors that they may face.

<sup>6</sup> See the Barclays Capital website for specific details on these indexes’ construction: <http://www.barcap.com/indices>.

<sup>7</sup> See Arnott et al. (2010b) and Arnott (2010a). We refer to this method as “RAFI-weighted,” based on the notation in these publications.

**Figure 2. Alternative indexing underweights Japan and overweights emerging market countries**

Distribution, by region, for weighting methods in global sovereign debt market: May 31, 2011

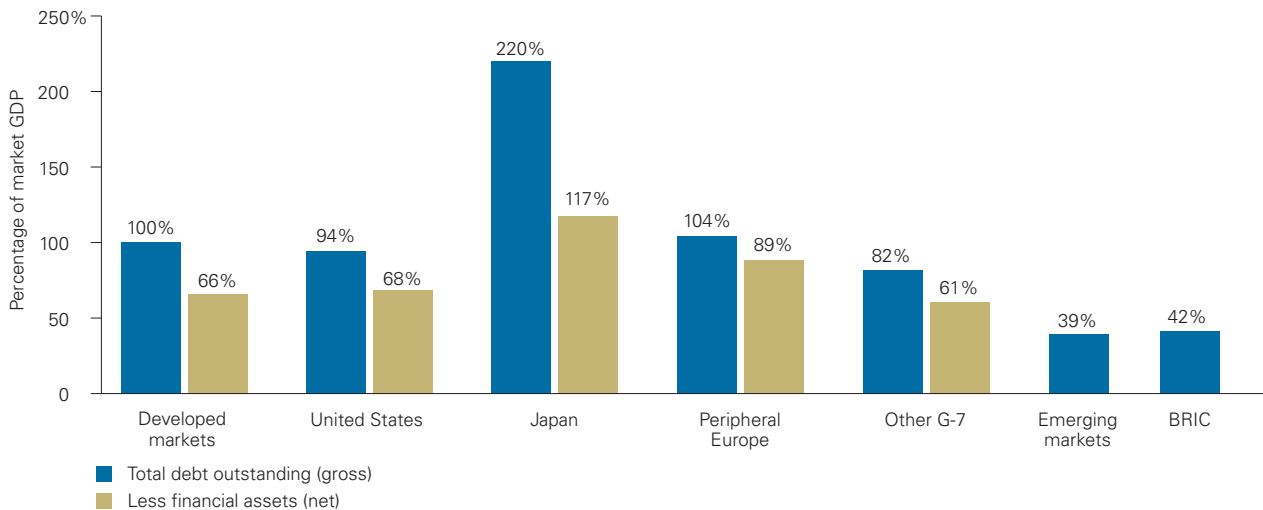


Notes: "Cap-weighted" reflects the combined weights of the Barclays Capital Global Treasury Index and the Barclays Capital Emerging Markets Government Universal Index. "GDP-weighted" reflects the GDP-weighted versions of these same two Barclays Capital indexes. The weights are adjusted to account for the overlap of countries in the two indexes. "RAFI-weighted" reflects the methodology within Arnott (2010a). See Appendix 1, for details on country classifications.

Sources: Vanguard, based on data from Barclays Capital and Arnott (2010a).

**Figure 3. Government debt levels across the world**

Government debt as percentage of GDP: 2010

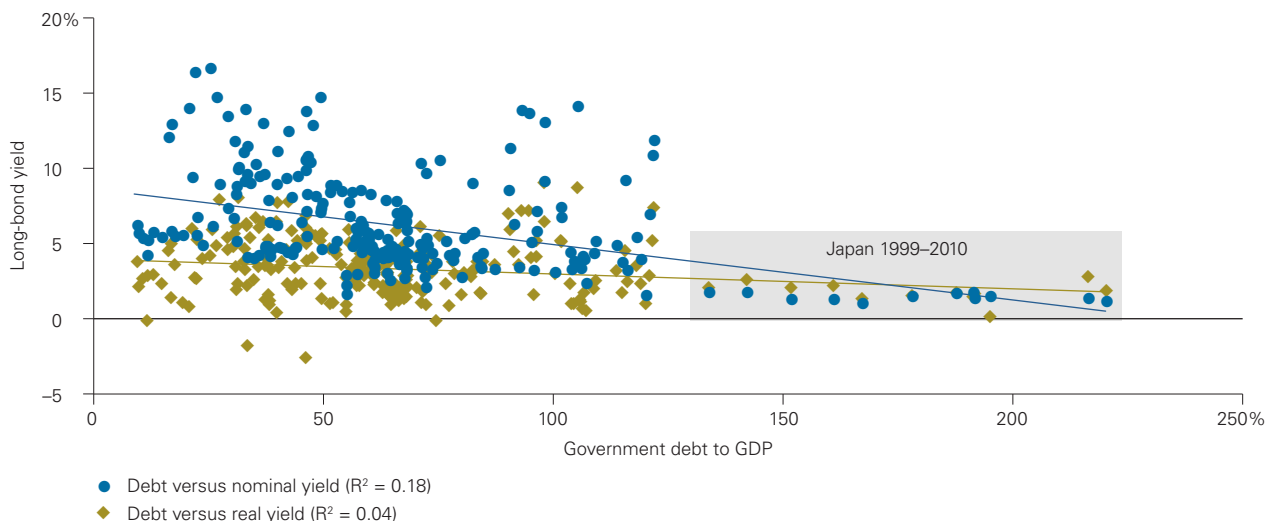


Notes: Net government debt is not available for all emerging market governments, and so is not shown. See Appendix 1, for details on country classifications. "United States," "Japan," "Peripheral Europe," and "Other G-7" country data are subsets of "Developed markets." "BRIC" is a subset of "Emerging markets."

Sources: Vanguard and International Monetary Fund, September 2011, *World Economic Outlook*.

**Figure 4.** Debt levels and yields have a weak relationship

Bond yields versus government debt levels in developed markets: 1980–2010



Notes: Figure includes the G-7 countries plus Australia and Switzerland, annually from 1980 through 2010. The “nominal yield” series represents the average yield level of that country’s ten-year maturity government bond within each year. The “real yield” series adjusts that yield to real terms, using end-of-period consumer price inflation from the IMF. Government debt is shown gross of financial assets, as defined by the IMF. The results are similar using net debt.

Sources: IMF and Thomson Reuters.

reflected in prices, and therefore market cap. We evaluate these two alternative weighting methods (GDP and RAFI) in the following sections.

Although these two weighting methodologies (GDP and RAFI) produce different weights, the implications are the same: Both may produce large, persistent, country biases relative to the cap-weighted sovereign market (see **Figure 2**, on page 5). The country weights associated with the alternatively weighted indexes are the result of a shift away from countries that have high market value relative to their alternative weighting factors and toward countries with low market value relative to their alternative weighting factors. For both weighting methods, the two most notable differences versus the global-cap-weighted market involve an underweighting to Japan and an overweighting to the sovereigns of emerging market governments.

These country biases reflect the general appeal of alternative weighting methodologies: They reallocate weight away from governments with the highest

relative debt levels, as shown in **Figure 3**, on page 5. The implicit assumption here is that the bonds of a government with relatively more debt outstanding are poor investment prospects. The experience of the past few years supports this view: Governments of the peripheral economies of the Euro area, including Greece, Ireland, Italy, Portugal, and Spain, have been experiencing pressure from financial markets precisely because of seemingly unmanageable levels of debt. Recent attention on the projected deficit spending in the United States and other large developed nations has led to a further focus on this issue. At first glance, abandoning market weights may seem to be an investment solution to avoid trouble spots in the global sovereign market. However, as we discuss in the next section, investors should be cautious about applying the experience of the peripheral European countries more generally. We emphasize that a relatively larger value of debt outstanding does not always indicate that a given government’s debt is a bad investment.

## Do issuers have control over their market-cap weighting?

Like equity issuers, fixed income issuers can come to market with new securities at any time. This has raised concerns for some fixed income investors, in that it seems to imply that index investors are at the mercy of issuers. If an issuer can increase the supply of its debt, can't the issuer simply increase its weighting in an index just by issuing more debt, thereby compelling index investors to buy more?

It's true that an issuer can increase the total par, or face value, of its outstanding supply of debt, but this doesn't necessarily imply that an issuer can control its market weighting. Market cap is based on the price of debt, which is set by market participants, not the issuer. Issuers cannot "force" investors to purchase new issues that are brought to market; rather, investors choose to purchase the debt at a price they feel fairly represents its value. If an issuer dumps new debt securities on the marketplace to the extent that investors begin to expect the debt may not be repaid, then *all* of that issuer's outstanding debt issues will reflect this expectation. Prices will then decline to reflect the value of the debt, and the issuer's market cap will drop.

It might seem that all new issuance should result in a price adjustment: All else equal, a more indebted issuer seems less likely to be able to meet its obligations. But rarely are things "all else equal." In economic terms, *demand* for an issuer's debt is constantly changing. Any number of conditions may change that cause investors to shift their buying behavior and adjust the prices of an issuer's outstanding securities. An issuer's indebtedness is just one factor to consider in pricing bonds.

In addition, it may be useful to think of an issuer as having a given "capacity" to issue more debt without having much of an impact on its ability to repay, and thus little impact on overall prices. Once the issuer hits that capacity, market participants begin to become concerned about its

**Figure 5.** Issuers control par value, not market value

Greek government debt outstanding:  
January 2005–September 2011



Notes: Figure displays par and market values for Barclays Capital Greece Government Index.

Source: Barclays Capital.

indebtedness, with prices reflecting their concern. This is consistent with academic research on sovereign-debt dynamics, which suggests there may be a certain level of debt that governments can reach before a slowdown in economic growth begins (Reinhart, 2010). The situation in Greece in recent years fits this story fairly well: After Greece issued additional debt throughout 2009 as a result of the global recession, market participants became concerned about the Greek government's ability to meet its obligations. Market prices declined, and Greece's market cap fell substantially below the par value of its debt (Figure 5). The point to remember is that governments and companies can issue more debt, but investors decide what price they are willing to pay for it, and it is the market price that matters for indexing.

## Does 'indebtedness' matter for yields and returns?

Focusing on one factor ("indebtedness") may miss other, more important things in determining sovereign risk (see the box "Do issuers have control over their market-cap weighting?" for a related discussion). As shown in **Figure 4**, on page 6, since 1980 in a group of the largest developed markets, government indebtedness (as measured by debt to GDP) and yields have had a weak relationship. Across the time period and across countries, we find a wide range of both nominal and real yields associated with any given level of government debt. In fact, Japan's presence in the nominal sample shows an opposite relationship from what many might expect: Higher debt levels were actually associated with lower yields, because of Japan's low inflation. After accounting for inflation differences across these countries, as shown in the real yields, government indebtedness had almost no power in explaining yield levels.<sup>8</sup>

Extending this view to returns, **Figure 6** shows the relationship of government debt levels and future real returns across the same group of developed markets, using market-weighted sovereign-debt indexes to measure returns. As in **Figure 4**, there is but a weak relationship between this debt and yields. This is because, when compared to other factors (inflation, central bank activity, economic expectations, fiscal policies and priorities, liquidity, and market accessibility, to name a few), a government's debt outstanding may be relatively unimportant in determining appropriate yields.<sup>9</sup> A look back at **Figure 3** emphasizes this point: Some governments own significant financial assets that could be sold to fund debt repayments (this is accounted for in the net debt measure in the figure), a factor that market participants take into consideration when pricing the overall stock of debt outstanding. In short, many specific factors make each country and government unique; thus, different governments are able to sustain varying overall debt levels.

The experience of some emerging market countries provides useful case studies for this point. In the late 1990s and early 2000s, many emerging markets experienced financing difficulties, with some eventually defaulting on their obligations, despite lower levels of debt than many developed markets. For example, Russia defaulted on its sovereign debt in 1998, with externally held government debt totaling about 30% of GDP in 1997, while Argentina defaulted on its sovereign debt in 2002, with government debt totaling about 55% of GDP in 2001.<sup>10</sup>

In both instances, a significant contributing factor undermining the ability of these issuers to repay their debt was the collapse of a fixed-exchange-rate regime that resulted in a depreciating national currency and appreciating dollar-denominated government debt. The challenges associated with fixed exchange rates and their role in precipitating sovereign defaults have been well documented, and the experiences of Argentina and Russia are not unique.<sup>11</sup> Governments with fixed exchange rates and debt denominated in foreign currency (typically, emerging markets) face different risks than those with floating exchange rates and debt denominated in their national currency (typically, developed markets). Exchange-rate policy is an important factor in sovereign risk and is not captured by the relative size of a country's GDP, landmass, population, or energy consumption.

In addition, the *ability* to repay debt is often not as important as a sovereign government's *willingness* to repay its debt, and willingness can be even less predictable. In 2008, Ecuador defaulted on its obligations, despite having debt totaling 33% of GDP in the prior year.<sup>12</sup> This was largely the result of a policy decision, not any economic hardship; the decision to default came after the election of a new president. In contrast to these emerging market experiences, Japan has managed a government debt

8 This was as suggested by the low R-square of the regressions. R-squared is a measure of how much of the movement of one variable can be explained by the movement of another variable.

9 See Davis et al. (2010) for a discussion of the drivers of interest rates in the United States.

10 See Reinhart and Rogoff (2009) for a discussion of these and other similar examples.

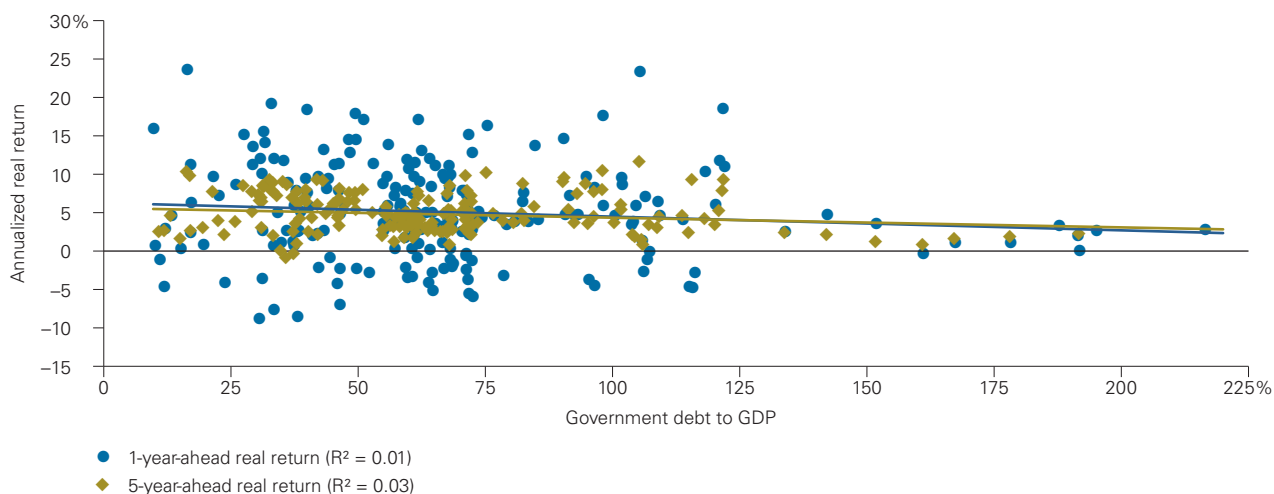
11 See Krugman (2000) for a review of several currency crises.

12 Source: IMF.



**Figure 6.** Debt levels do not predict future returns

Forward real returns versus government debt levels in developed markets: 1985–2010

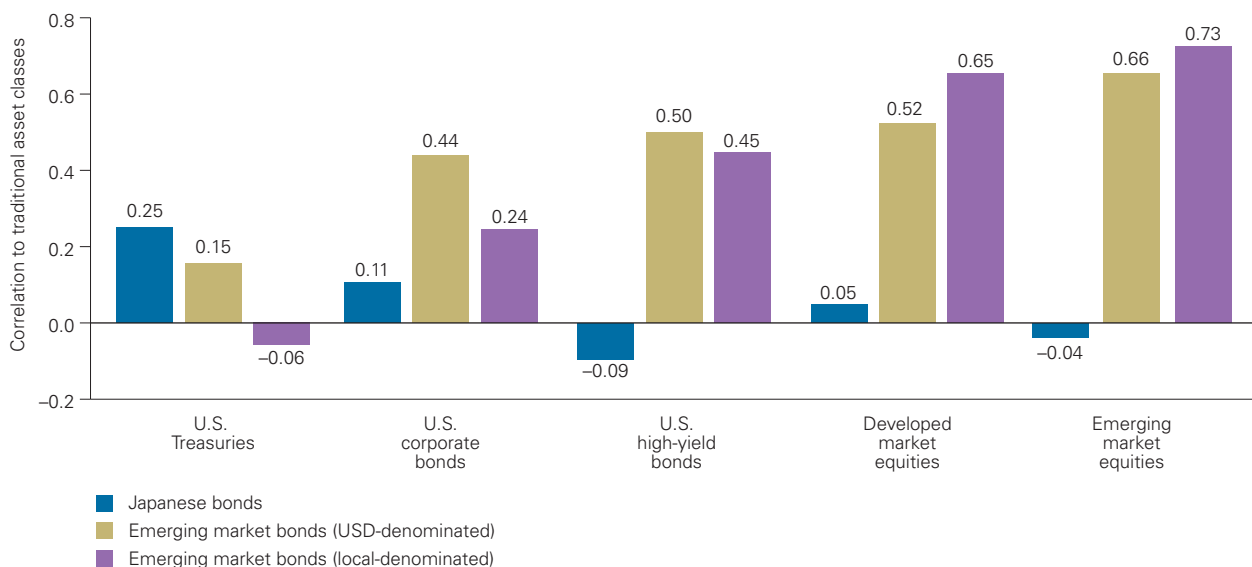


Notes: Data include the G-7 countries plus Australia and Switzerland, from 1985 through 2010. Government debt is shown gross of financial assets, as defined by the IMF. The results are similar using net debt. Returns are calculated based on the Citigroup World Government Bond Index for each country, in local terms, adjusted to real terms using end-of-period consumer price inflation from the IMF. Government debt levels in a given year are compared with both the forward return in the first calendar year following *and* over the five calendar years following. “1-year-ahead” data cover periods as follows: debt-to-GDP (1985–2009); real returns (1986–2010). “5-year-ahead” data cover periods as follows: debt-to-GDP (1985–2005); real returns (1990–2010).

Sources: Vanguard, based on data from Citigroup and IMF.

**Figure 7.** Emerging market bonds have equity-like risk characteristics

Correlation of sovereign debt to traditional asset classes: 1994–2011



Notes: Figure displays monthly correlations of bond indexes relative to a group of traditional asset classes over the period 1994–2011. “Japanese bonds” are defined as the Barclays Capital Global Treasury Japan Index; “Emerging-market bonds (USD-denominated)” are defined as the JPMorgan Emerging Markets Bonds Plus Index; and “Emerging-market bonds (local-denominated)” are defined as the JPMorgan Emerging Local Markets Plus Index. “U.S. Treasuries” are defined as the Barclays Capital U.S. Treasury Index; “U.S. corporate bonds” are defined as the Barclays Capital U.S. Investment Grade Corporate Index; “U.S. high-yield bonds” are defined as the Barclays Capital High Yield Corporate Index; “Developed market equities” are defined as the MSCI World Index; and “Emerging market equities” are defined as the MSCI Emerging Markets Index. All returns are shown in unhedged, U.S. dollar terms.

Sources: Barclays Capital, JPMorgan, and MSCI.

load in excess of 100% of the country's GDP for well over a decade, owing to very low interest service on the debt and a high domestic savings rate, reflecting high domestic demand for bonds. Both country- and government-specific factors determine the level of debt that is sustainable for a given issuer.

Country-specific factors result in different governments having very different risk profiles, regardless of their debt levels. As shown in **Figure 7**, on page 9, market participants' past evaluation of emerging-market countries' debt has reflected the perceived risks of investing in these nations. The country weights of alternative weighting methods have the potential to meaningfully increase risk. Japanese bonds and those of emerging markets are not perfect substitutes: As shown in the figure, since the 1990s emerging-market debt issues have behaved more like an equity investment, reflecting their risk. And, although correlations will change over time, the low historical correlations for Japanese bonds suggest that they may be a more effective diversifier than emerging market bonds for a multi-asset-class portfolio.

This highlights our more general point, that focusing solely on an issuer's relative level of debt ignores other factors that may influence a government's ability to repay its debt. The governments of large, diverse, developed nations with floating exchange rates and substantial economic, financial, and political infrastructure are very different entities from governments of emerging markets, many of which are less politically stable, with less credible institutions, fixed exchange rates, and concentrated, export-oriented economies. We believe that these differences are evident to bond market participants and incorporated into prices.

### Alternative weighting in developed-market sovereign bonds

Country-specific risk factors are likely the most prominent drivers of an alternatively weighted bond index's performance. As shown in **Figure 8**, when implemented within developed market sovereigns, the country tilts that result from alternative weighting methods do not seem to affect the average credit quality of the index, as measured by the option-adjusted spread (OAS).<sup>13</sup> However, alternative weighting does lead to lower overall index duration.<sup>14</sup> **Figure 9** shows the largest absolute country-duration contributions resulting from the two alternative weighting methods examined, relative to the cap-weighted market. Overweighting a shorter-duration country (for example, the United States) or underweighting a longer-duration country (for example, Japan) both have the effect of lowering the index's average duration relative to the market.<sup>15</sup> The overall effect in both a GDP-weighted and RAFI-weighted index is to lower duration by about 0.5 year relative to the market. Lower-duration bonds, all else equal, tend to offer lower yields, lower interest rate risk, and lower expected returns. Lower duration may or may not be in line with an investor's overall objective, but it is important to note that reweighting countries can change the interest rate sensitivity of the index.

### Alternative weighting in emerging-market sovereign bonds

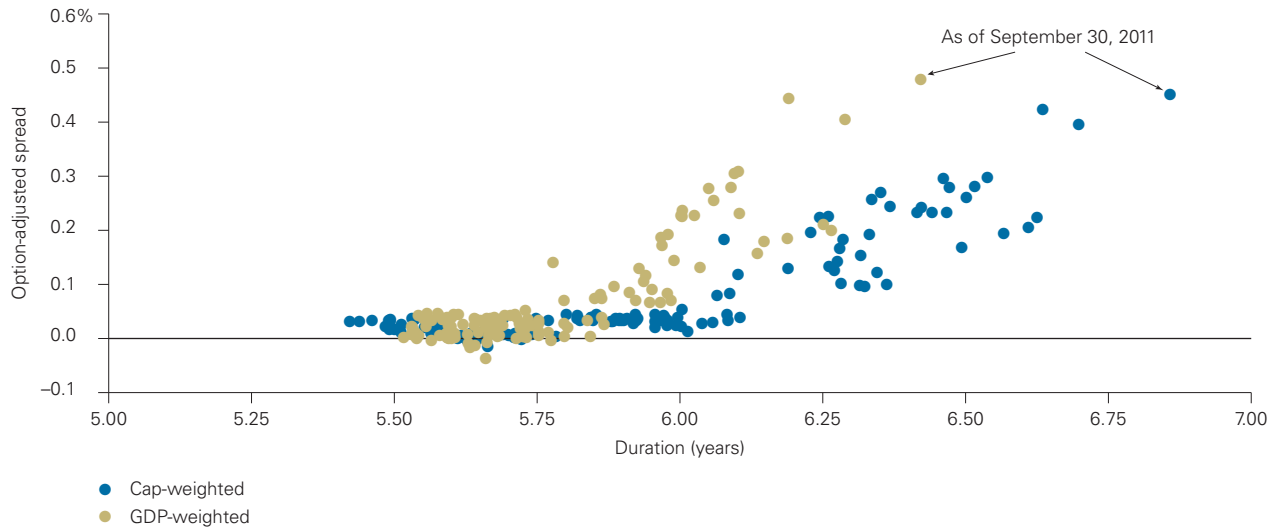
In emerging market sovereigns, the results of alternative weighting methods are slightly different, with a decrease in duration but also an increase in credit risk (**Figure 10**, on page 12). Although both market cap and GDP weighting methods resulted in a similar variability of duration over time, the GDP-

<sup>13</sup> *Option-adjusted spread* refers to the yield spread of a bond versus that of a comparable-maturity "risk-free" bond, with an adjustment for the value of any embedded options.

<sup>14</sup> *Duration* is a common measure of the sensitivity of the price of a bond to a change in interest rates.

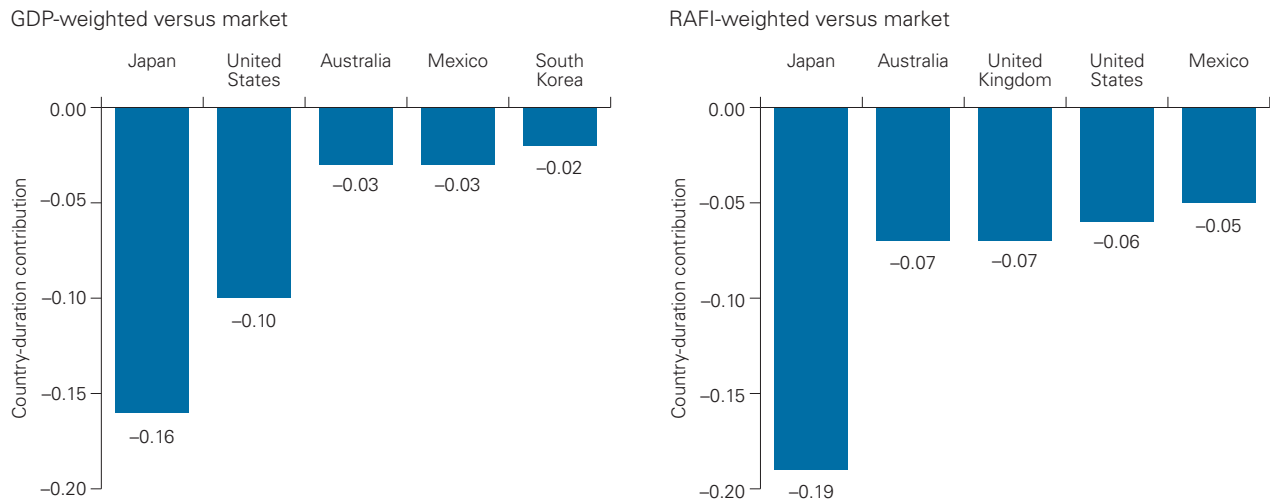
<sup>15</sup> Although a RAFI weighting methodology would *underweight* the United States when implemented within a global investment set, the weighting method would *overweight* the United States when implemented within a developed-market investment set. In a global set, alternative weighting methods overweight emerging market countries, with the majority of the weighting difference being shifted to these emerging countries by Japan and other G-7 governments, not the United States.

**Figure 8.** Duration and credit spreads for developed market debt: January 31, 2001, through September 30, 2011



Notes: Figure displays characteristics of the two different weighting methods for the Barclays Capital Global Treasury Index.  
Source: Barclays Capital.

**Figure 9.** Alternative index weightings result in lower duration within developed market sovereigns



Notes: Figure displays five largest (in absolute terms) countries' duration contributions of alternative weighting methodologies versus the cap-weighted developed-market treasury universe as defined by the Barclays Capital Global Treasury Index (see Appendix 1, for details on country classifications). "Country-duration contribution" is computed as:  $(\text{Weight}_{\text{Alternative}} - \text{Weight}_{\text{Market cap}}) * (\text{Country Duration} - \text{Index Duration})$ . In both alternative weighting methodologies, the most positive country-duration contribution was less than 0.01 year. The cap-weighted index duration was 6.52 years; GDP-weighted index duration was 6.12 years; and RAFI-weighted index duration, 5.87 years. Barclays Capital data as of May 31, 2011; RAFI weightings from Arnott (2010a), applied to Barclays Capital country indexes.

Sources: Vanguard, based on data from Barclays Capital and Arnott (2010a).



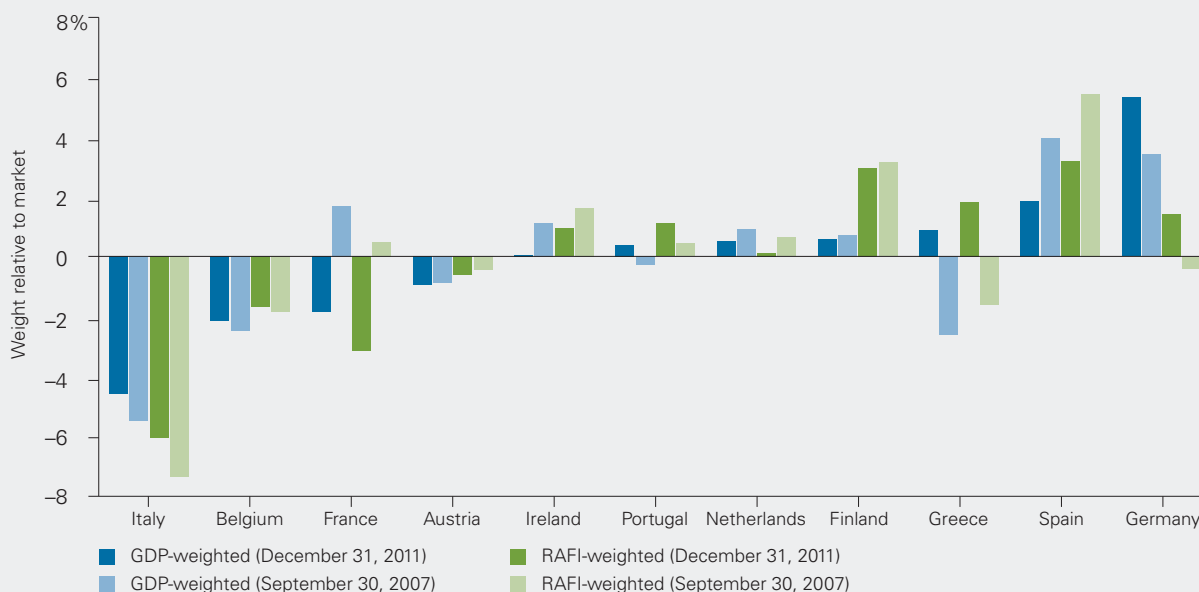
## Alternative weighting in the Eurozone may not avoid the peripheral economies

Over the past several years, the peripheral economies in the Eurozone have been the focus of significant attention. Greece, Ireland, Italy, Portugal, and Spain have all come under pressure from financial markets and have faced increasing interest rate costs due to investors' worries about these nations' fiscal sustainability.<sup>16</sup> Figure 12 shows the impact of GDP-weighting and RAFI-weighting within an investment set that includes only sovereign-government bonds within the Eurozone. Although many investors may look to these strategies as a way to avoid the trouble spots in Europe, the effects of both GDP-weighting and RAFI-weighting may not achieve the desired result. Both before and after the global recession and financial crisis, alternative weighting methods would have involved an overweight to one or more of the

peripheral European countries that have seen a sell-off in their government debt. In addition, the macroeconomic factors used in forming alternative weights are fairly static in nature and do not reflect changing conditions. Consider the example of Greece. Before the crisis, both weighting methods would have underweighted Greece relative to the market. Once Greece's problems became apparent to investors, Greece's debt sold off to reflect the perceived risks associated with that country. As a result, Greece's market weight declined to the point that the more static alternative weighting methods are now overweighted to this country. The country weights shown in Figure 12 may or may not have been in line with an investor's objectives, but they seem to run counter to the intuitive appeal of using alternative weights to avoid the "riskiest" countries.

**Figure 12.** Alternative weighting in the Eurozone

Weighting methods relative to market cap: December 31, 2007, and September 30, 2011



Notes: Figure displays GDP and RAFI alternative weighting methods relative to the market as defined by the Barclays Capital Euro Aggregate Treasury All-Market Index. "GDP-weighted" is defined as each country's 2006 and 2010 GDP for the 2007 and 2011 views, respectively. Countries are sorted by their GDP weighting as of September 30, 2011. RAFI weights for both time periods are taken from Arnott (2010a). For space considerations, we excluded the smallest markets (Cyprus, Luxembourg, Malta, Slovakia, and Slovenia).

Sources: Vanguard, based on data from Barclays Capital, IMF, and Arnott (2010a).

16 See Lemco, Aliaga-Díaz, and Thomas (2010) and Lemco (2011) for Vanguard's assessment of issues that Europe is facing.

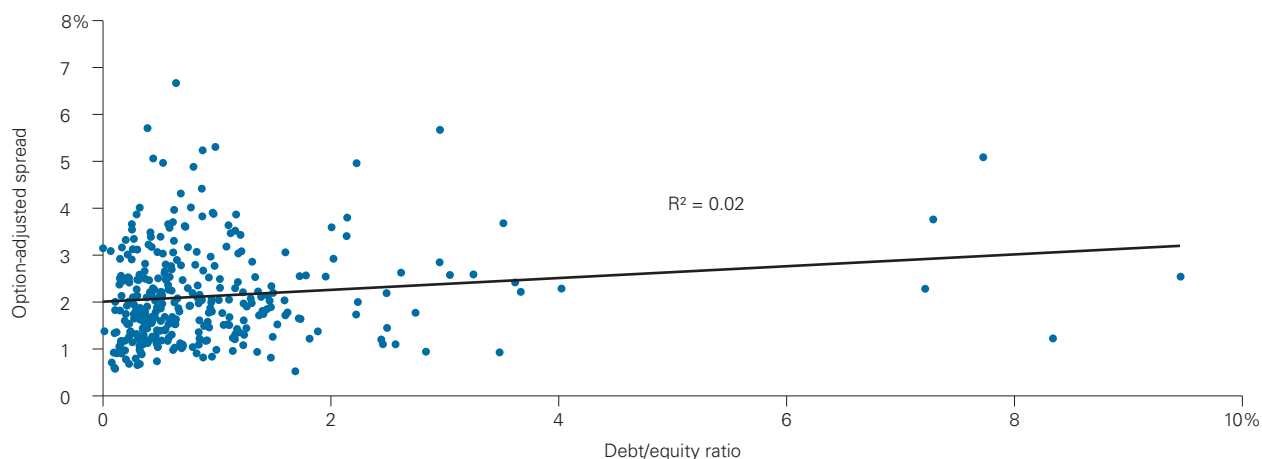
weighted index displayed a much less consistent credit-risk profile, as evidenced by its large OAS dispersion. In addition to a general tilt toward riskier issuers, the distribution across credit qualities matters. **Figure 11**, on page 12, illustrates that alternative weighting methods can lead to concentrations within certain risk buckets, potentially making it difficult to assess an index's overall credit quality. As with developed sovereigns, the different risk characteristics of alternative weighting methods within emerging sovereigns may or may not be in line with an investor's overall objective; the important thing to note is that reweighting countries can change both the credit-risk and interest rate sensitivity of the index.

### Alternatively weighted indexes in U.S. corporate market

Similar to alternative weighting methods for sovereigns, alternative indexes have been designed for U.S. corporate issuers, again with the objective of avoiding the largest issuers. Alternative weights have largely focused on metrics associated with issuer financial performance, such as assets, revenue, and cash flow. Examples include the RAFI Investment Grade Bond Index and the Barclays Capital Issuer Scored Corporate Index for the investment-grade universe; and the RAFI High Yield Bond Index for the high-yield universe.<sup>17</sup> Weighting methods based on financial-statement metrics may differ slightly in implementation, but the general framework is similar. Regardless of the specific weighting criteria, these strategies all tend to redistribute weight from larger issuers to smaller issuers, relative to their cap-weighted counterparts.

**Figure 13.** Company indebtedness and bond risk have a weak relationship

Credit spread and debt/equity ratio for S&P 500 companies: September 30, 2011



Notes: Figure includes S&P 500 companies that are also members of the Barclays Capital U.S. Corporate Investment Grade Index. "Option-adjusted spread" is the cap-weighted average of each company's outstanding debt issues. Debt/equity ratios shown are from financial statements available as of October 25, 2011: For reference, the five companies with the largest debt/equity ratios, in decreasing order, were Western Union, Philip Morris International, Morgan Stanley, Goldman Sachs Group, and Marriott International. We excluded companies that fell into the Barclays Capital High Yield Corporate Index, as they would have changed the scale of the chart, but these companies exhibited a similar relationship, with an R-squared of 0.002. (*R-squared* refers to the percentage of the variance in OAS that is explained by the variance of issuers' debt/equity ratios.)

Sources: Vanguard, based on data from FactSet and Barclays Capital.

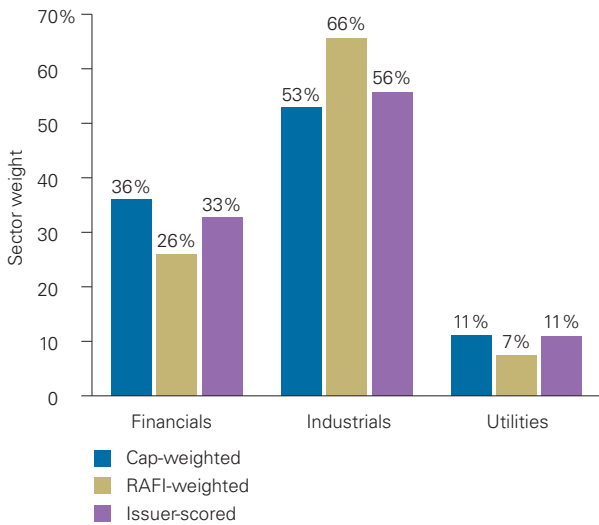
<sup>17</sup> For a discussion of the back-tested performance of the RAFI weighting methodology, see Arnott et al. (2010b). For index construction details and fact sheets, see the Research Affiliates and Barclays Capital websites: <http://www.researchaffiliates.com/rafi/index.htm> and <http://www.barcap.com/indices>, respectively.

As was true for the sovereign market, “large corporate debt issuers” need not be construed here as having any negative connotation: Prudent use of debt financing can be a valuable tool for almost any corporation.<sup>18</sup> In addition, as we demonstrated within the sovereign market, there are many factors to consider in an issuer’s risk other than a company’s indebtedness. **Figure 13** shows the relationship between debt/equity ratios and option-adjusted spreads for the debt-issuing companies in the Standard & Poor’s 500 Index. The weak relationship exhibited in the figure demonstrates that company indebtedness has essentially no explanatory power with regard to the risk of a company’s debt. This indicates that factors other than a company’s relative debt level determine its willingness and ability to meet its obligations.

It should also be noted that corporations use debt differently. Some companies explicitly use debt as part of their business model: For example, the classic banking model involves borrowing on a short-term basis and lending out those borrowed funds at longer maturities, profiting from interest rate differentials. Some companies use debt to a much lesser degree, instead preferring to issue equity and reinvest earnings to fund operations: For example, technology companies historically have had low leverage ratios relative to the broader corporate market (indeed, some have no debt at all). As a result, avoiding the larger issuers can lead to sector tilts within the market. **Figure 14**, which shows the sector distributions of the earlier-mentioned RAFI Investment Grade Bond Index and the Barclays Capital Issuer Scored Corporate Index, indicates that alternative indexes tend to underweight the financial sector, since banks are typically among the largest issuers in the corporate market.<sup>19</sup> This sector tilt seems to be a reaction to recent events in the market, as underweighting financials would have resulted in outperformance by alternatively weighted indexes over the past several years. However, on a forward-looking basis, the fact that the financial sector underperformed in the past is not predictive of future performance.

**Figure 14. Non-market-cap weighting for corporates underweights financials**

Sector distribution for weighting methods in U.S. investment-grade corporate market: As of June 30, 2011



Notes: “Cap-weighted” is defined as the Barclays Capital U.S. Corporate Investment Grade Index; “RAFI-weighted” is defined as the RAFI Investment Grade Bond Index; “Issuer-scored” is defined as the SPDRs CBND ETF (tracks the Barclays Capital Issuer Scored Corporate Index).

Sources: Vanguard, based on data from Barclays Capital, Research Affiliates, and SSgA.

### Effects of basing investor decisions on company size

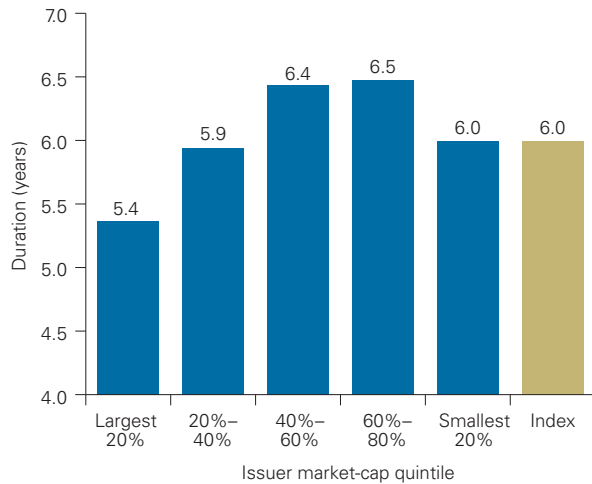
We next investigated the potential effects of basing an investment decision solely on corporate bond issuers’ size, by examining the distribution of interest rate and credit risk across the U.S. market. **Figure 15**, on page 16, displays duration and option-adjusted spreads across different-sized U.S. investment-grade corporate issuers over the past ten years (see **Figure A-1**, in Appendix 2, for results for high-yield issuers). As these figures show, risk attributes change with the size of corporate bond issuers. Larger issuers have typically issued bonds with shorter durations than the market average. As these largest issuers tend to be financials, the

<sup>18</sup> Debt issuance can function as part of an effective corporate-governance program, restricting cash that might otherwise be used by corporate management on risky or frivolous projects. Issuing debt avoids diluting the ownership stake of equity investors. Also, since interest service is expensed and offsets taxable income in the United States, debt issuance provides a tax benefit to issuers.

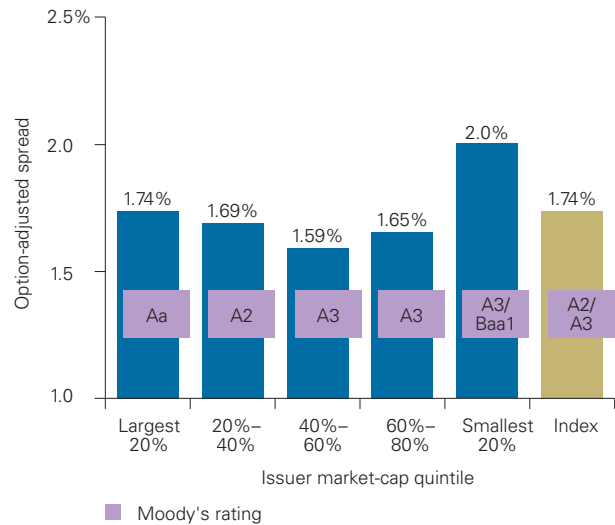
<sup>19</sup> As of June 30, 2011, the largest market-cap quintile of the investment-grade corporate market comprised 70% financial issuers, while financial issuers made up only 36% of the total market.

**Figure 15.** Interest rate risk and credit risk across the corporate market: April 30, 2001–March 31, 2011

**a. Interest rate risk across U.S. investment-grade corporate issuers**



**b. Credit risk across U.S. investment-grade corporate issuers**



Notes: Figure is constructed from issuer-level statistics for constituents of the Barclays Capital U.S. Corporate Investment Grade Index for April 30, 2001, through March 31, 2011. Issuers were sorted by market cap in each month and then grouped so that each quintile shown represented one-fifth of the market cap of the entire index. Duration, OAS, and Moody's Investors Service rating are computed as the market-cap-weighted average within each quintile over the entire time period.

Sources: Vanguard, based on data from Barclays Capital.

shorter average duration seems consistent with the traditional banking business model mentioned earlier. Smaller issuers have been associated with higher spreads (and higher default/credit risk). Considering that higher yields are associated with higher credit risk and that bond prices and yields move in opposite directions, it makes sense that issuers with the smallest market cap (and the lowest aggregate prices) tend to have higher credit risk. This higher credit risk across issuer size also contributes to the duration differences previously discussed, as the smaller, lower-quality issuers typically issue debt with higher coupon payments to compensate issuers for their risk.<sup>20</sup>

Investors considering a departure from a cap-weighted corporate bond investment should note the sector tilts associated with alternative indexes, as well as the relationship between issuer size, duration, and credit risk across the entire market. Depending on one's specific objective, reweighting the market can lead to risk-factor tilts that may make

it difficult to evaluate an index's overall risk profile. For example, overweighting the smallest issuers in the corporate market could increase or decrease duration, depending on what sector that extra weight is coming from. This strategy could also increase the index's credit risk, by overweighting the issuers with higher spreads and lower credit scores. In this example, credit quality decreases, while interest rate risk may increase or decrease, relative to the overall market: The end result is an index that is not necessarily "less risky" overall. As in the sovereign market, focusing solely on issuer size in evaluating ability to repay debt may overlook other issues that market participants incorporate into prices.

### Other considerations in fixed income investing

As we have demonstrated, use of common alternative index weighting methods introduces aspects of active risk and redefines the market's risk characteristics where they are applied. These alternative strategies use weighting factors that have no obvious predictive

<sup>20</sup> Higher yields are associated with lower durations, all else equal.



power to explain the future returns of an issuer. The strategies merely reweight a market's constituents and involve tilts toward common bond market risk factors, including country, sector, duration, and credit risk. In the process, alternative weighting methods may make these important risk considerations more difficult to interpret.

Given that the role of bonds in a portfolio has traditionally been to provide price stability, income, and diversification versus more risky assets, it's not clear that risk-factor tilts are appropriate for most fixed income investors. Because we advocate a broad-based, diversified approach to fixed income investing, we therefore believe market weights are an effective way to gain exposure to the "consensus" portfolio. However, we acknowledge that some investors may wish to depart from market weights. Before doing so, important factors should be considered, including the risks, liquidity, turnover, and implementation costs of the proposed strategy. A key consideration to keep in mind is that if an investor desires to over- or underweight certain risk attributes relative to the market (by targeting a certain country, a lower average duration, or a higher average credit quality, for example), such persistent risk-factor bets may be achieved, and possibly with great transparency and low cost, by using traditional cap-weighted indexes.

In the case of a global sovereign investment, various country- or region-specific index products can be combined to achieve consistent, targeted exposures to certain countries, at the least allowing an investor to determine his or her own allocation between developed and emerging markets. Of course, this assumes that an allocation to global fixed income as an asset class is appropriate for the investor in question, which may or may not be the case. For instance, the currency exposure inherent in international bonds results in risk-and-return characteristics that can be very different than those of an investor's domestic fixed income market.<sup>21</sup> In addition, given emerging market bonds' high

correlation with equity markets (as in Figure 7), it's not clear that this asset class performs the traditional fixed income function of diversifying an equity position. Investors considering an overweight to emerging market bonds (or any allocation at all) might benefit from asking whether their objective could be achieved with more traditional, risky asset classes such as stocks or corporate bonds, since liquidity and implementation costs are likely to be lower.

Investors within the corporate market should consider whether a sector tilt is justified in their portfolio, or merely a reaction to recent market events. Underweighting a sector such as financials *after* it has underperformed is a strategy that may not improve *future* return expectations. In addition, if systematic risk-factor tilts are in line with investors' objectives, it may be possible to change the risk profiles of these investments through a targeted, cap-weighted exposure to traditional segments of the bond market—for example, longer-duration and lower-credit-quality bonds. Not only do market-cap-weighted indexes and indexed investments provide more reliable and transparent risk exposure, but they also tend to be among the least costly ways to invest in fixed income. Particularly for assets with lower expected returns, such as bonds, lower implementation and management costs are important components—arguably the *most important components*—in an effort to improve a portfolio's returns.

## Conclusion

As a result of the global financial crisis of 2008–2009 and amid ongoing sovereign-debt concerns in much of the developed world, investors have been searching for investment strategies that might have mitigated these crises and in so doing, might have also outperformed the cap-weighted market. With the benefit of hindsight, some alternative weighting strategies have seemingly been created to do just that, but their ability to outperform in the future using these same weighting strategies is uncertain.

<sup>21</sup> See *Global Fixed Income: Considerations for U.S. Investors* (Philips et al., 2011b), for a discussion of the merits of international fixed income from the U.S. perspective, with a particular focus on the challenges that currency presents for this asset class.

We have shown that the common alternative index strategies do not reflect the risk-reward characteristics of a particular market but, instead, a reweighting of risks within that market. This introduces a component of active risk into the index-construction process, whereby certain countries or corporations are reweighted relative to the market's consensus valuations and the aggregate amounts already lent to these issuers by investors. This is an important consideration, since investors (in aggregate) incorporate all of the relevant risk considerations of the issuer—including not only the issuer's ability to repay the obligations but also the issuer's willingness to do so—into bond prices and, therefore, into bond market capitalizations. Bonds from any issuer, whether a country or a corporation, cannot be issued without willing buyers at a price the buyers deem appropriate to compensate them for the risks they assume.

Alternative weighting methods, however, systematically reweight issuers based on predefined criteria that explicitly decouple an issuer's weighting in an index from the market cap of the issuer's debt outstanding. Although intuitively appealing, there is no obvious and consistent linkage between debt outstanding and higher yields/lower prices. On the contrary, the United States and Japan are the world's two largest issuers of debt, and yet they benefit from yields that are among the lowest in the world. On the other hand, emerging countries tend to issue far less debt, but with much higher yields. Although debt outstanding isn't an insignificant consideration when evaluating any issue or issuer, we have shown that other factors are more important to investors. We believe that market-cap-weighted indexes best capture the broadest range of risk factors that matter to, and are incorporated in, prices set by bond investors.

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## Appendix I. Country classifications and index membership by country

Sovereign country classifications (see text Figure 2)

### Developed markets:

- **United States.**
- **Japan.**
- **Peripheral European:** Greece, Ireland, Italy, Portugal, Spain.
- **Other G-7:** Canada, France, Germany, United Kingdom.
- **Other Developed:** Australia, Austria, Belgium, Cyprus, Czech Republic, Denmark, Finland, Hong Kong, Luxembourg, Malta, Netherlands, New Zealand, Norway, Singapore, Slovakia, Slovenia, South Korea, Sweden, Switzerland, Taiwan.

### Emerging markets:

- **BRIC:** Brazil, Russia, India, China.
- **Other Emerging:** Argentina, Belarus, Belize, Bulgaria, Chile, Colombia, Croatia, Dominican Republic, Ecuador, Egypt, El Salvador, Gabon, Georgia, Ghana, Hungary, Indonesia, Ivory Coast, Jamaica, Jordan, Lebanon, Lithuania, Malaysia, Mexico, Morocco, Nigeria, Pakistan, Panama, Peru, Philippines, Poland, Romania, Senegal, Serbia, South Africa, Sri Lanka, Thailand, Turkey, Ukraine, Uruguay, Venezuela, Vietnam.

Index country membership (see text Figures 8–12)<sup>22</sup>

### Barclays Capital Global Treasury Index:

- Australia, Austria, Belgium, Canada, Chile, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Hong Kong, Hungary, Ireland, Italy, Japan, Luxembourg, Malaysia, Malta, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Singapore, Slovakia, Slovenia, South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan, Thailand, United Kingdom, United States.

### Barclays Capital Emerging Markets Local Currency Government Universal Index:

- Brazil, Chile, China, Colombia, Croatia, Czech Republic, Egypt, Hungary, India, Indonesia, Israel, Malaysia, Mexico, Peru, Philippines, Poland, Russia, South Africa, South Korea, Thailand, Turkey.

### Barclays Capital Emerging Markets Government Universal Index:

- Argentina, Belarus, Belize, Brazil, Bulgaria, Chile, China, Colombia, Croatia, Czech Republic, Dominican Republic, Ecuador, Egypt, El Salvador, Gabon, Georgia, Ghana, Hungary, India, Indonesia, Israel, Ivory Coast, Jamaica, Jordan, Latvia, Lebanon, Lithuania, Malaysia, Mexico, Morocco, Nigeria, Pakistan, Panama, Peru, Philippines, Poland, Romania, Russia, Senegal, Serbia, South Africa, South Korea, Sri Lanka, Thailand, Turkey, Ukraine, Uruguay, Venezuela, Vietnam.

<sup>22</sup> Some overlap of countries occurs between developed and emerging markets within these indexes. We chose to display the data this way since the Barclays Capital indexes are investable options that are widely used within the industry. The results are not significantly affected using nonoverlapping IMF country classifications.

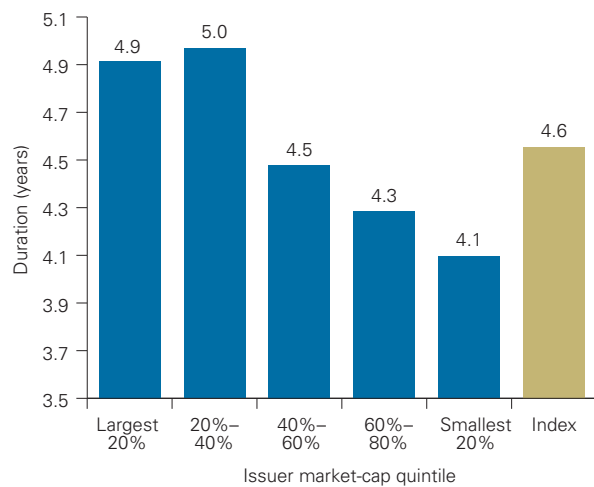
## Appendix 2. High-yield issuers

The high-yield market exhibits a different duration effect than the investment-grade market, with the largest issuers generally having longer-duration securities. This is due to the fact that most of the larger high-yield issuers are not financial in nature and can be roughly classified as “fallen angels”—that is, corporate issuers from a variety of industries that had previously been investment-grade.<sup>23</sup> The effect for credit/default risk is the same in both

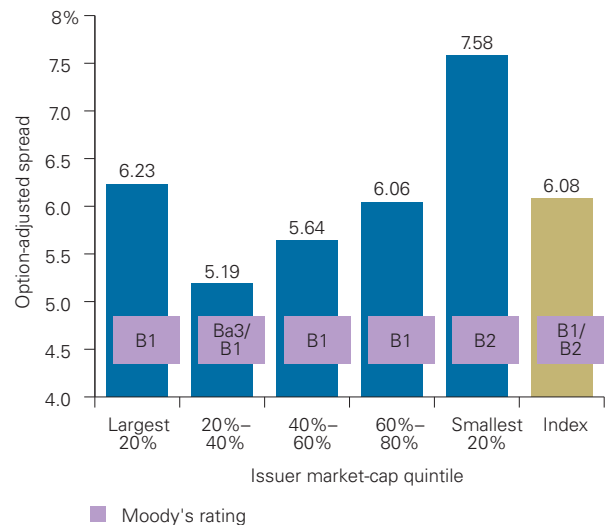
markets: Smaller issuer size has been associated with higher credit spreads. Again, the rationale is the same as for investment-grade issuers: Higher yields are associated with higher credit risk; and bond prices and yields move in opposite directions. Therefore, the issuers with the smallest market capitalization (lowest aggregate prices) tend to have higher credit risk.

**Figure A-1.** Interest rate risk and credit risk across U.S. corporate market: April 30, 2001–March 31, 2011

**a. Interest rate risk across U.S. high-yield corporate issuers**



**b. Credit risk across U.S. high-yield corporate issuers**



Notes: Figure is constructed from issuer-level statistics for constituents of the Barclays Capital U.S. Investment Grade Corporate Index for April 30, 2001, through March 31, 2011. Issuers were sorted by market cap in each month and then grouped so that each quintile shown represented one-fifth of the market cap of the entire index. Duration, OAS, and Moody's Investors Service rating were computed as the market-cap-weighted average within each quintile over the entire time period.

Sources: Vanguard, based on data from Barclays Capital.

<sup>23</sup> Downgraded investment-grade issuers would typically fall into the *largest* segment of the high-yield market because the investment-grade space has larger issuers in general. As of June 30, 2011, the median-issuer market cap in the investment-grade market was roughly \$1.8 billion, versus a \$495 million median market cap in high yield. The ten largest issuers in the high-yield market at that time included companies such as Ford, Ally Financial (previously GMAC), and MGM Resorts.



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