



# A review of alternative approaches to fixed income indexing

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- This paper evaluates several alternative index-weighting methodologies<sup>1</sup> commonly used in the global sovereign and U.S. corporate marketplaces.
- 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.
- These alternative weighting methods rely on a very narrow selection of risk factors (including country risk, sector risk, interest rate risk, and credit risk) compared with using a market-capitalization-weighted benchmark approach.
- We conclude that alternative indexes do not represent a better way to measure the performance of a market, but merely a reweighting of risk within that market.

**Acknowledgment:** This paper is an updated version of a 2012 Vanguard paper of the same title by Charles J. Thomas and Donald G. Bennyhoff. The authors would like to thank Joshua M. Hirt for his valuable contributions to this paper.

<sup>1</sup> For a discussion of alternative index-weighting methodologies for equities, see Vanguard’s research paper by Philips et al. (2015).

## 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 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 be fully accomplished only 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 to be relevant. By reflecting the value of all assets that 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 the 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 in 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 considerations, the most important of which is the investor’s perception of the issuer’s willingness and ability to honor the terms

## Notes on risk

*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 the 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.

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—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 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 risk 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**). 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 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 factor beta strategy. The following sections discuss several alternative index strategies in the global sovereign

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



Source: Vanguard.

- 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 Harbron, et al. [2017], 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.
- 5 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, 2014). 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 (see Fidora, Fratzscher, and Thimann, 2006), with investors overweighting their home country to better match the domestic risk factors that they may face.

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

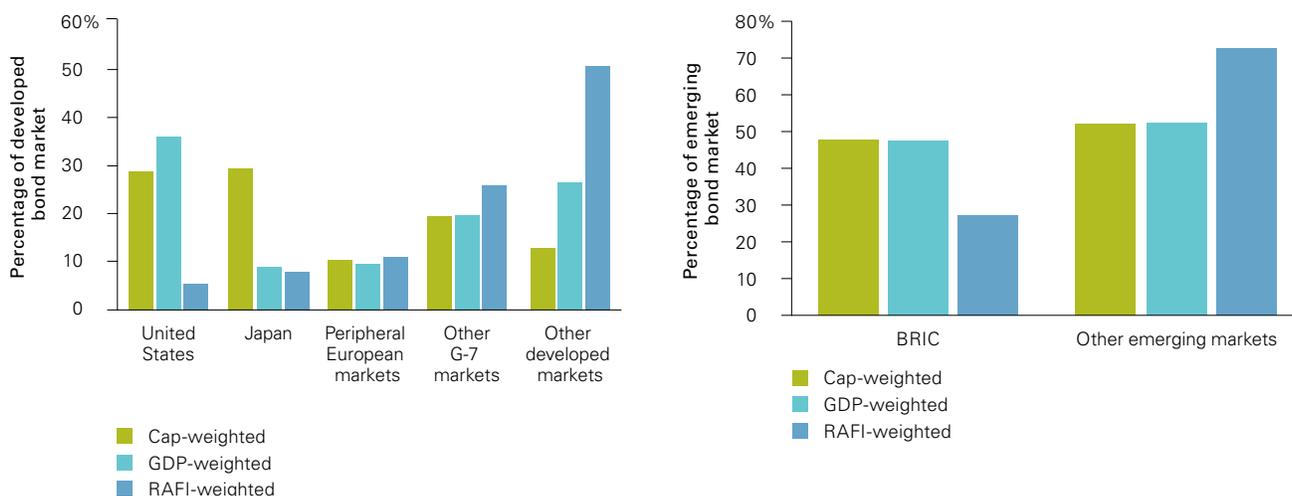
Common non-market-cap-weighted index methodologies in the global sovereign marketplace have focused on moderating exposure to more indebted countries by using country-level metrics, including GDP, landmass, and population. Sovereign-debt issuers have the ability to levy taxes on the economy that they govern and are typically evaluated using broad, macroeconomic measures. Some examples include GDP-weighted versions of the Bloomberg Barclays Global Treasury Index (mostly developed markets) and the Bloomberg Barclays 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 reflected in prices, and therefore in market cap. We evaluate these two alternative weighting methods (GDP and RAFI) in the following sections.

Although the GDP and RAFI methodologies 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). 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. Notable differences versus the global-cap-weighted market involve an underweighting to Japan and an overweighting of other developed markets.

Figure 2. Alternative indexing underweights Japan

Distribution by region for weighting methods in global sovereign debt market: December 30, 2016



Notes: "Cap-weighted" reflects the weights of the Bloomberg Barclays Global Treasury Index for developed markets and the Bloomberg Barclays Emerging Markets Government Universal Index for emerging markets. "GDP-weighted" reflects the GDP-weighted versions of these same two Bloomberg Barclays indexes. "RAFI-weighted" reflects the Citi RAFI Sovereign Developed Markets Bond Index and the Citi RAFI Sovereign Emerging Markets Local Currency Bond Index. See Appendix A for details on country classifications.

Sources: Vanguard, based on data from Bloomberg and RAFI factsheet.

<sup>6</sup> See the Bloomberg website for specific details on these indexes' construction: <https://indices.barclays/>.

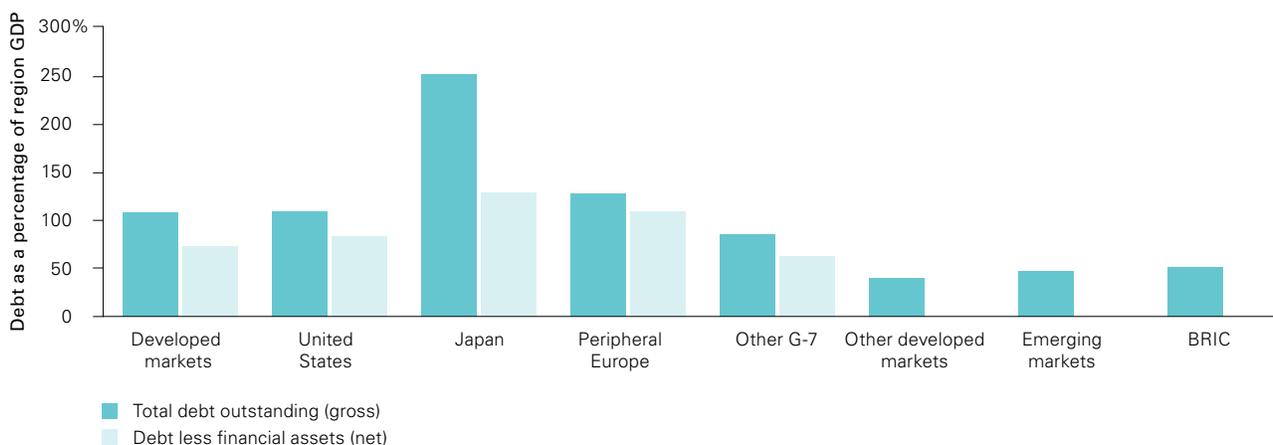
<sup>7</sup> See Arnott et al. (2010) and Arnott (2010). We refer to this method as "RAFI-weighted," based on the notation in these publications.

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**. The implicit assumption here is that the bonds of a government with relatively more debt outstanding are poor investment prospects. The experience of the recent past supports this view: Governments of the peripheral economies of the euro area, including Greece, Ireland, Italy, Portugal, and Spain, have experienced pressure from financial markets

precisely because of seemingly unmanageable levels of debt. A focus on the projected deficit spending in the United States and other large developed nations has brought further attention to 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, relatively more debt outstanding does not always indicate that a government's debt is a bad investment.

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

Government debt as percentage of GDP: 2016



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

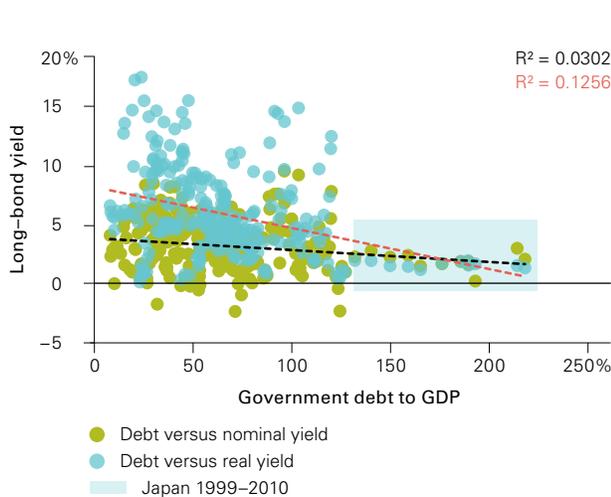
**Sources:** Vanguard and International Monetary Fund, December 2016, *World Economic Outlook*.

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

Focusing on one factor ("indebtedness") may lead to missing other, more important determinants of sovereign risk (see the box "Do issuers have control over their market-cap weighting?" for a related discussion). As shown in **Figure 4**, 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 the 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>

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

Bond yields versus government debt levels in developed markets: 1980–2016



**Notes:** Data include the G-7 countries plus Australia and Switzerland, annually from 1980 through 2016. 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.

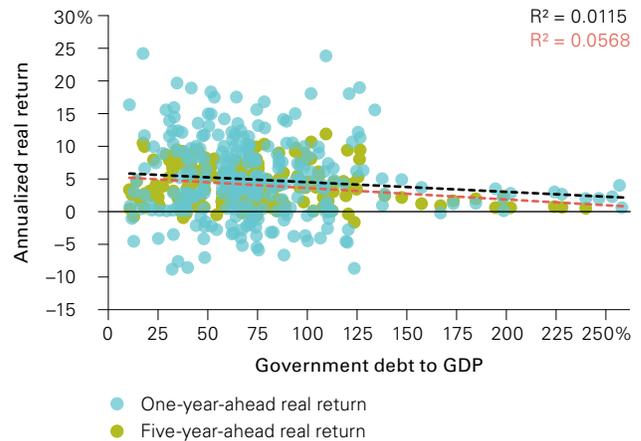
**Source:** IMF.

Extending this view to returns, **Figure 5** 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 with 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 debt outstanding. In short, many

**Figure 5. Debt levels do not predict future returns**

Forward real returns versus government debt levels in developed markets: 1985–2016



**Notes:** Data include the G-7 countries plus Australia and Switzerland, from 1985 through 2016. 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. "One-year-ahead" data cover periods as follows: debt-to-GDP (1985–2015); real returns (1986–2016). "Five-year-ahead" data cover periods as follows: debt-to-GDP (1985–2011); real returns (1990–2016).

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

<sup>8</sup> This was as suggested by the low R-squared regression value. R-squared is a measure of how much of the movement of one variable can be explained by the movement of another variable.

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

## 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 because 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* that issuer's outstanding debt issues will likely 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 issuances 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, causing 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 become concerned about its 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). At the time this research was first published, Greece had 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. Today, we see how the Greece story settled: The market price of Greece's debt trades at a discount to par value, a notable change from before the great recession (**Figure 6**). 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 in indexing.

**Figure 6. Issuers control par value, not market value**

Greek government debt outstanding:  
January 2005–December 2016



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

**Source:** Bloomberg.

specific factors make each country and government unique; thus, different governments are able to sustain varying overall debt levels.

The experiences of some emerging-market countries provide 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.

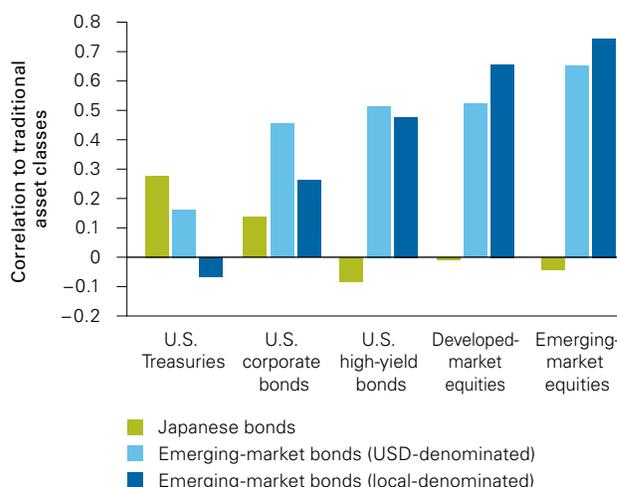
In addition, the *ability* to repay debt is often not as important as a sovereign government's *willingness* to repay its debt, and willingness can be even less predictable. In 2008, Ecuador defaulted on its obligations, despite having debt totaling 33% of GDP in the prior year.<sup>12</sup> This was 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 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**, 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

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

Correlation of sovereign debt to traditional asset classes: 1994–2016



**Notes:** Figure displays monthly correlations of bond indexes relative to a group of traditional asset classes over the period 1994–2016. "Japanese bonds" are defined as the Bloomberg Barclays Global Treasury Japan Index; "Emerging-market bonds (USD-denominated)" are defined as the JPMorgan Emerging Markets Bonds Index Plus; and "Emerging-market bonds (local-denominated)" are defined as the JPMorgan Emerging Local Markets Index Plus. "U.S. Treasuries" are defined as the Bloomberg Barclays U.S. Treasury Index; "U.S. corporate bonds" are defined as the Bloomberg Barclays U.S. Investment Grade Corporate Index; "U.S. high-yield bonds" are defined as the Bloomberg Barclays 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.

**Source:** Bloomberg.

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

<sup>11</sup> See Krugman (2000) for a review of several currency crises.

<sup>12</sup> Source: IMF.

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.

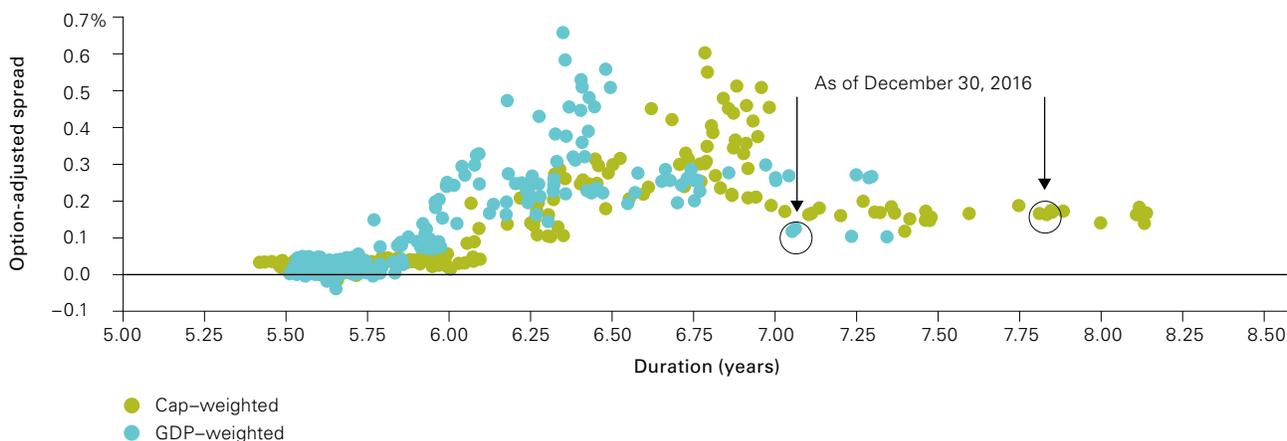
This highlights our more general point, that focusing solely on an issuer’s relative level of debt ignores other factors that may influence a government’s ability to repay its debt. The governments of large, diverse, developed nations with floating exchange rates and substantial economic, financial, 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 of 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

**Figure 8. Duration and credit spreads for developed-market debt: January 31, 2001, through December 30, 2016**



**Note:** Figure displays characteristics of the two different weighting methods for the Bloomberg Barclays Global Treasury Index.  
**Source:** Bloomberg.

by the option-adjusted spread (OAS).<sup>13</sup> However, alternative weighting can 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.

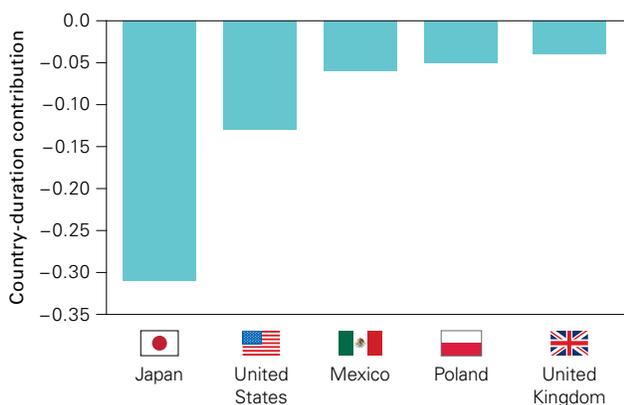
Overweighting a shorter-duration country (for example, the United States) or underweighting a longer-duration country (for example, the United Kingdom or Japan) both have the effect of lowering the index’s average duration relative to the market. The overall effect in both a GDP-weighted and a RAFI-weighted index is to lower duration by 0.71 and 1.16 years, respectively, relative to the market. Lower-duration bonds, all else being 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 of emerging-market sovereign bonds

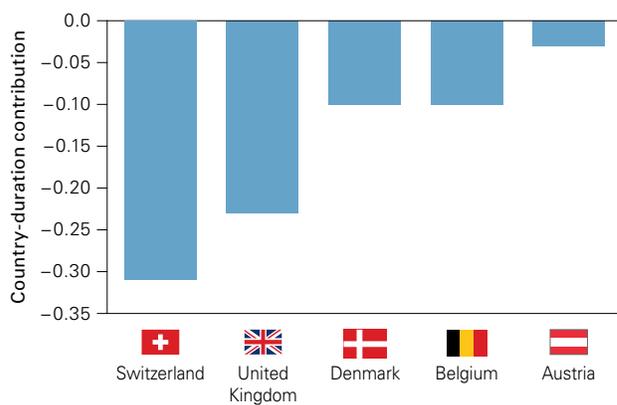
For emerging-market sovereigns, the results of alternative weighting methods are slightly different, with a decrease in duration but also an increase in credit risk (**Figure 10**). Although both market-cap- and GDP-weighting methods resulted in a similar variability of duration over time, the GDP-weighted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

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

a. GDP-weighted versus market-cap



b. RAFI-weighted versus market-cap



**Notes:** Figure displays the five largest (in absolute terms) countries’ duration contributions of alternative weighting methodologies versus the cap-weighted developed-market treasury universe as defined by the Bloomberg Barclays Global Treasury Index (see Appendix A for details on country classifications). “Country-duration contribution” is computed as: (Weight Alternative – Weight Market Cap) \* (Country Duration – 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 7.86 years; GDP-weighted-index duration was 6.70 years; and RAFI-weighted-index duration was 7.15 years. Bloomberg data are as of December 30, 2016; RAFI weightings are from Citi RAFI, applied to Bloomberg Barclays country indexes.

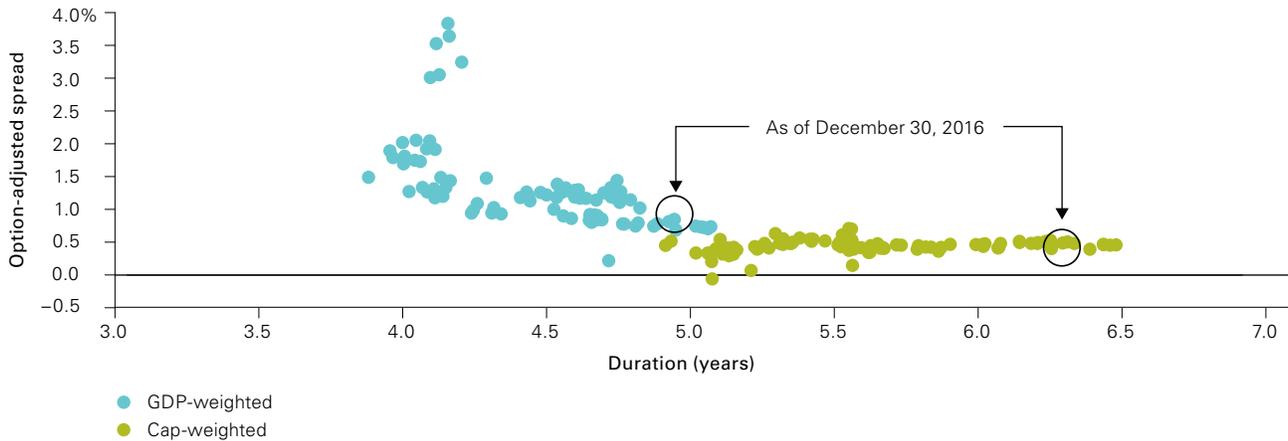
**Sources:** Vanguard, based on data from Bloomberg and Citi RAFI.

<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.

**Figure 10. Alternative index weightings result in lower duration and credit quality in emerging-market sovereigns**

Duration and credit spreads for emerging-market debt: January 31, 2009, through December 30, 2016

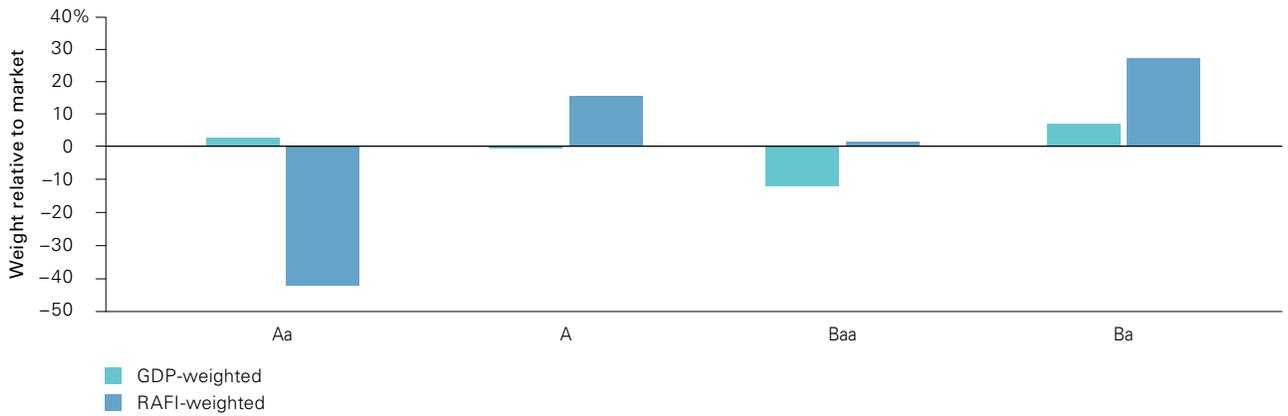


**Notes:** Figure displays the OAS and duration for the market-cap-weighted and GDP-weighted versions of the Bloomberg Barclays Emerging Markets Local Currency Government Universal Index from January 2009 through December 2016. We used the local currency index to avoid any potential distortions from hard-currency issues.

**Source:** Bloomberg.

**Figure 11. Alternative index weightings shift credit risk within emerging market**

Credit-quality distribution of alternative weighting methods in emerging-market sovereign debt, relative to market-cap weights



**Notes:** Figure displays distribution across Moody's Investors Service credit-rating buckets of alternative weighting methodologies versus the cap-weighted emerging-market sovereign universe, as defined by the Bloomberg Barclays Emerging Markets Government Universal Index (see Appendix A for details on country classifications). Bloomberg data are as of December 30, 2016; RAFI weightings are from Citi, applied to Bloomberg Barclays country indexes.

**Sources:** Vanguard, based on data from Bloomberg and Citi RAFI.

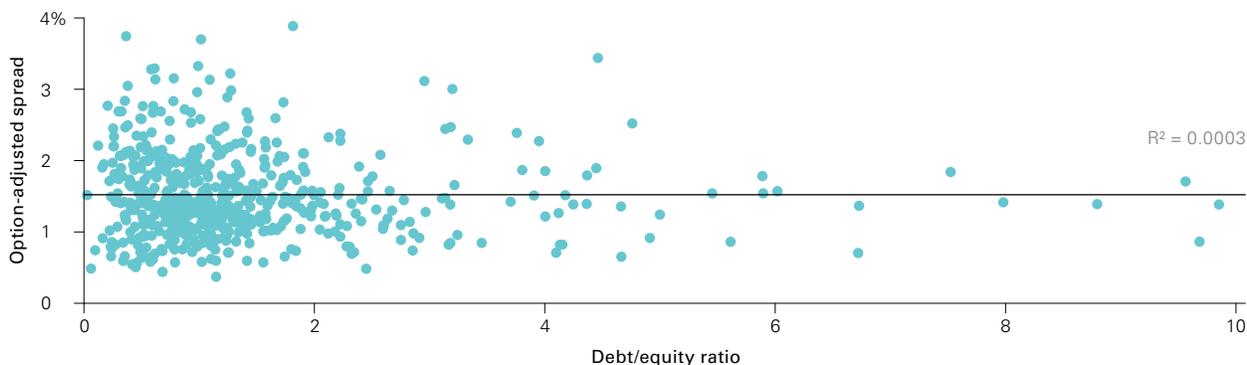
### Alternatively weighted indexes in U.S. corporate market

As with 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 Bloomberg Barclays Issuer Scored Corporate Index for the investment-grade universe; and the RAFI High Yield Bond Index for the high-yield universe.<sup>15</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.

As is 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>16</sup> In addition, as we demonstrated within the sovereign market, there are many factors to consider in determining an issuer’s risk other than a company’s indebtedness. **Figure 12** 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 ability to explain 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.

Figure 12. Company indebtedness and bond risk have a weak relationship

Credit spread and debt/equity ratio for S&P 500 companies: December 30, 2016



**Notes:** Figure includes S&P 500 companies that are also members of the Bloomberg Barclays 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 December 30, 2016: For reference, the five companies with the largest debt/equity ratios, in decreasing order, were H&R Block, United Parcel Service, Lennox International, GlaxoSmithKline, and Boeing. We excluded companies that fell into the Bloomberg Barclays 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 Bloomberg.

<sup>15</sup> For a discussion of the back-tested performance of the RAFI weighting methodology, see Arnott et al. (2010). For index construction details and fact sheets, see the Research Affiliates and Bloomberg Barclays websites: <http://www.researchaffiliates.com/rafi/index.htm> and <https://indices.barclays/>.

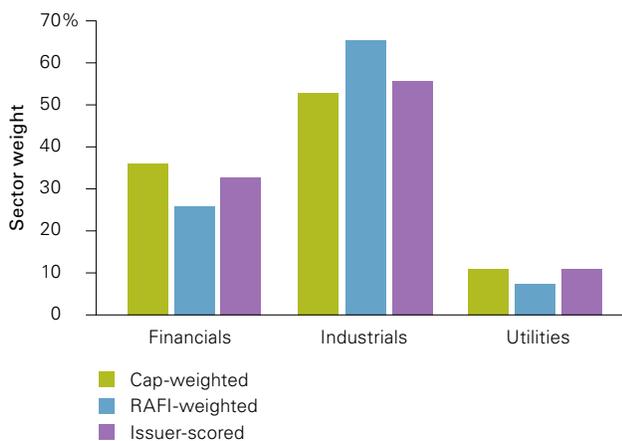
<sup>16</sup> Debt issuance can function as part of an effective corporate governance program, restricting cash that might otherwise be used by corporate management on risky or frivolous projects. Issuing debt avoids diluting the ownership stake of equity investors. Also, since interest service is expensed and offsets taxable income in the United States, debt issuance provides a tax benefit to issuers.

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. People tend to use market-cap-weighted index funds to gain exposure to specific risk and reward characteristics. Market-cap-weighted indexes provide an unbiased

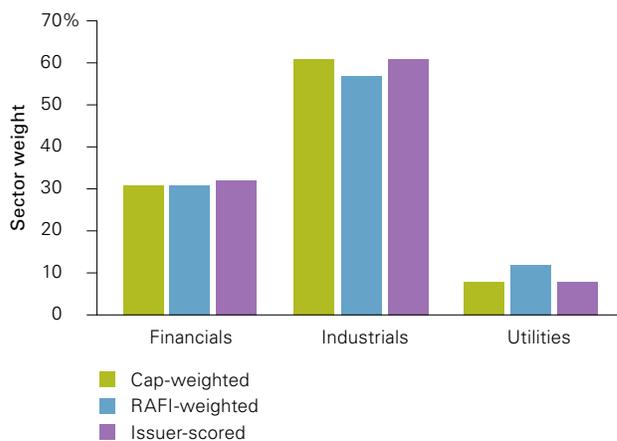
approach to reaching this goal. Conversely, alternatively weighted indexes are marked with less certainty as they can move in line with, overweight, or underweight the market. **Figure 13**, which shows the sector distributions of the RAFI Investment Grade Bond Index and the Bloomberg Barclays Issuer Scored Corporate Index, indicates how alternatively weighted indexes can change unpredictably. Unlike market-cap-weighted indexes, which are more static, Figure 13 shows that alternatively weighted index weights in 2011 differ noticeably from those in 2016, as the alternatively weighted indexes switch between over- and underweighting different sectors. This uncertainty around weightings may not be preferred for investors looking for exposure to specific risk and reward characteristics.

**Figure 13. Market-cap and non-market-cap weighting for corporates: Sector weights more in line in 2016**

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



b. Sector distribution for weighting methods in U.S. investment-grade corporate market: As of December 30, 2016



**Notes:** “Cap-weighted” is defined as the Bloomberg Barclays U.S. Corporate Investment Grade Index; “RAFI-weighted” is defined as the RAFI Investment Grade Bond Index; “Issuer-scored” is defined as the Bloomberg Barclays Issuer Scored Corporate Index. Sector distribution for weighting methods in the U.S. investment-grade corporate market: As of December 30, 2016.

**Sources:** Vanguard, based on data from Bloomberg and Citi RAFI.

## 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. We did so by examining the distribution of interest rate and credit risk across the U.S. market. **Figure 14** displays duration and option-adjusted spreads across different-sized U.S. investment-grade corporate issuers over the past ten years. (See **Figure B-1**, in Appendix B, 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 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 tied to 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 investors for their risk.<sup>17</sup>

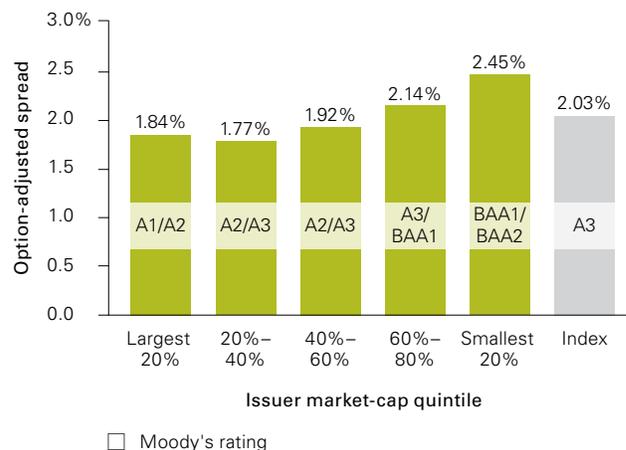
Investors considering a departure from a cap-weighted corporate bond investment should note the sector tilts associated with alternative indexes as well as the relationship between issuer size, duration, and credit risk across the entire market. Depending on one's specific objective, reweighting the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

**Figure 14. Interest rate risk and credit risk across the corporate market: November 30, 2007–December 30, 2016**

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 Bloomberg Barclays U.S. Corporate Investment Grade Index for November 30, 2007, through December 30, 2016. Issuers were sorted by market cap in each year 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 Bloomberg.

### 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 power to predict 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, liquidity, 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, they should consider important factors, including the risks, liquidity, turnover, and implementation costs of the proposed strategy. A key consideration 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 greater transparency and lower 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 from those of an investor's domestic fixed income market. 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 in the corporate market should consider whether a sector tilt is justified in their portfolio, or is 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, 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

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 the relevant risk considerations of the issuer—including not only the issuer’s ability to repay the obligations but also its 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-market 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 A. Country classifications and index membership by country

Sovereign country classifications (see text Figure 2)

### Developed markets:

- United States.
- Japan.
- **Peripheral European:** Ireland, Italy<sup>18</sup>, Spain.
- **Other G-7:** Canada, France, Germany, United Kingdom.
- **Other Developed:** Australia, Austria, Belgium, Chile, Czech Republic, Denmark, Finland, Hong Kong, Israel, Latvia, Lithuania, Luxembourg, Malaysia, Malta, Mexico, Netherlands, New Zealand, Norway, Poland, Russia, Singapore, Slovakia, Slovenia, South Africa, South Korea, Sweden, Switzerland, Thailand.

### Emerging markets:

- **BRIC:** Brazil, Russia, India, China.
- **Other Emerging:** Angola, Argentina, Armenia, Azerbaijan, Bahrain, Belarus, Belize, Bermuda, Bolivia, Bulgaria, Cameroon, Chile, Colombia, Costa Rica, Croatia, Czech Republic, Dominican Republic, Ecuador, Egypt, El Salvador, Ethiopia, Gabon, Georgia, Ghana, Guatemala, Honduras, Hungary, Indonesia, Iraq, Israel, Ivory Coast, Jamaica, Jordan, Lebanon, Macedonia, Malaysia, Mexico, Mongolia, Montenegro, Morocco, Mozambique, Namibia, Nigeria, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Qatar, Romania, Saudi Arabia, Senegal, Serbia, South Africa, South Korea, Sri Lanka, Thailand, Trinidad, Tunisia, Turkey, Ukraine, United Arab Emirates, Uruguay, Venezuela, Vietnam, Zambia.

Index country membership (see text Figures 8–12)<sup>19</sup>

### Bloomberg Barclays 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.

### Bloomberg Barclays 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>18</sup> Italy is also a member of the G-7.

<sup>19</sup> Some overlap of countries occurs between developed and emerging markets within these indexes. We chose to display the data this way since the Bloomberg Barclays indexes are investable options that are widely used within the industry. The results are not significantly affected by using nonoverlapping IMF country classifications.

## Appendix B. 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 because most of the larger high-yield issuers are not primarily financial companies and can be roughly classified as “fallen angels”—that is, corporate issuers from a variety of industries that had previously been

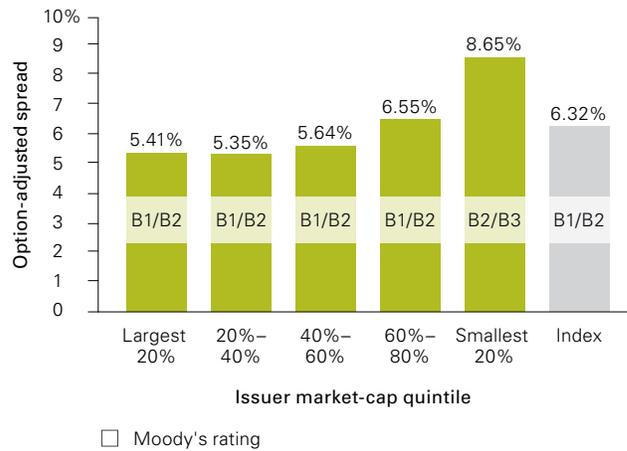
investment-grade.<sup>20</sup> The effect for credit/default risk is the same in both markets: Smaller issuer size has been associated with higher credit spreads. Again, the rationale is the same as for investment-grade issuers, Higher yields are associated with higher credit risk, and bond prices and yields move in opposite directions. Therefore, the issuers with the smallest market capitalization (lowest aggregate prices) tend to have higher credit risk.

Figure B. Interest rate risk and credit risk across the high-yield market: November 30, 2007–December 30, 2016

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 Bloomberg Barclays U.S. High Yield Corporate Index for November 30, 2007, through December 30, 2016. Issuers were sorted by market cap in each year 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 Bloomberg.

<sup>20</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 December 30, 2016, the ten largest issuers in the high-yield market at that time included companies such as HCA (Hospital Corporation of America), Ally Financial (previously GMAC), and T-Mobile.

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