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# The ABCs of MBS

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**Executive summary.** Mortgage-backed securities (MBS) constitute a large portion of the U.S. investment-grade taxable bond market.<sup>1</sup> Although the performance of MBS is influenced by factors that affect all bonds—such as changes in interest rates—it is mainly the prepayment risk of MBS that causes them to perform differently from other bonds. This paper describes the relative characteristics of MBS, including their key risks and attributes, and the implications of investing in MBS alongside government and credit bonds in a taxable investment-grade bond portfolio. We also assess the drivers behind the past performance of MBS as well as the potential diversification properties of MBS going forward.

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1 This paper focuses on the sector components of the Barclays U.S. Aggregate Index—which covers the U.S.-dollar-denominated, investment-grade, fixed-rate, taxable bond market of SEC-registered securities. The index includes bonds from the U.S. government, U.S. credit, and securitized sectors (the latter of which consists of agency mortgage-backed securities, asset-backed securities, commercial mortgage-backed securities, and covered bonds).

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We conclude that analysis of historical performance of MBS has been greatly skewed by the secular decline in interest rates, which has affected MBS results more than other bond sectors. In our view, however, the diversification properties of MBS owing to their cyclical excess returns, their desirable “flight-to-quality” attributes, and their differentiated duration and convexity characteristics make them worthy of consideration for investors’ portfolios. Vanguard therefore suggests that a market-proportionate allocation to MBS remains a reasonable starting point for investors.<sup>2</sup>

**Mortgage-backed securities have grown to become a substantial part of the U.S. taxable investment-grade bond market. Although, in terms of risk, MBS are associated primarily with prepayment risk, they have favorable credit quality, liquidity, and yield attributes. While analysis of historical performance might deter investors from including MBS in a portfolio, our research indicates that the drivers of past performance may not exist to the same extent in the foreseeable future. Thus, when building**

**fixed income portfolios, investors should consider the potential diversification benefits provided by MBS.**

The most common type of mortgage-backed security is a simple “pass-through” security that represents ownership in an underlying “pool” of mortgage loans. An investor who owns the MBS is entitled to receive a pro rata share of underlying monthly mortgage cash flows that are “passed through” to investors. The cash flows consist of interest and principal payments.

Notes on benchmarks: The bond benchmarks used throughout this paper and specifically in Figures 1–2, 4–7, 9–13, and Appendix Figure A-1 correspond to sector components of the Barclays U.S. Aggregate Index, as follows: Barclays U.S. MBS Index, Barclays U.S. Credit Index, and Barclays U.S. Government Index. The term “Securitized ex-MBS” in Figure 1 refers to the Barclays U.S. Securitized Index, excluding the portion comprising the Barclays U.S. MBS Index.

*Notes on risk: All investing is subject to risk, including possible loss of principal. Past performance is no guarantee of future results. Bond funds are subject to interest rate risk, which is the chance bond prices overall will decline because of rising interest rates, and credit risk, which is the chance a bond issuer will fail to pay interest and principal in a timely manner or that negative perceptions of the issuer’s ability to make such payments will cause the price of that bond to decline. In a diversified portfolio, gains from some investments may help offset losses from others. However, diversification does not ensure a profit or protect against a loss in a declining market.*

<sup>2</sup> See Bennyhoff and Thomas (2012) for further discussion of market-capitalization weighting.

MBS are created through a process known as “securitization.” In a typical situation, an originator such as a bank, mortgage company, or thrift institution provides mortgage financing to homeowners. The originator then bundles the mortgages together into a pool and sells interests in that pool to investors. The pools are considered securitized because they are transformed into securities, with the mortgages serving as collateral.

The main types of MBS are issued or guaranteed by one of three mortgage agencies: the Federal National Mortgage Association (FNMA, or “Fannie Mae”), the Federal Home Loan Mortgage Corporation (FHLMC, or “Freddie Mac”), and the Government National Mortgage Association (GNMA, or “Ginnie Mae”), all of which were created by the U.S. Congress to help provide funding to the residential mortgage market.<sup>3</sup>

Fannie Mae and Freddie Mac each purchase mortgage loans from originators; they pool and securitize the loans, and then issue them as a mortgage-backed security. Originators obtain funding by underwriting mortgages that meet specific criteria including loan size, credit score, and down payment amount. Loans that meet the criteria qualify as

“conforming loans” and are eligible to be issued as a Fannie Mae or Freddie Mac agency MBS. Fannie Mae and Freddie Mac are known as “government-sponsored entities,” and their MBS have traditionally carried an implicit—rather than explicit—guarantee of the full faith and credit of the United States. However, since September 6, 2008, each has been under conservatorship of the Federal Housing Finance Agency.<sup>4</sup>

Ginnie Mae does not directly issue its own MBS, but, rather, guarantees the principal and interest payments on MBS that have been issued by originators. To qualify for the Ginnie Mae guarantee, the loans must already be insured by one of several government agencies.<sup>5</sup> Ginnie Mae is a wholly owned instrumentality of the U.S. government and as such, the agency MBS that it guarantees are backed by the full faith and credit of the United States.

It is possible for originators to issue nonconforming, or “private label,” MBS. However, only agency-backed MBS are eligible for inclusion in the Barclays U.S. Aggregate Index.

<sup>3</sup> Fannie Mae was established in 1938 under the National Housing Act and was subsequently divided into two parts by the Fair Housing Act of 1968, with Ginnie Mae becoming the other half (Source: Ginnie Mae, at [www.ginniemae.gov/inside\\_gnma/company\\_overview/Pages/our\\_history.aspx](http://www.ginniemae.gov/inside_gnma/company_overview/Pages/our_history.aspx)). Freddie Mac was founded in 1970 (Source: Freddie Mac, at [www.freddiemac.com/corporate/company\\_profile/?intcmp=AFCP](http://www.freddiemac.com/corporate/company_profile/?intcmp=AFCP)).

<sup>4</sup> As of March 8, 2013 (Sources: Fannie Mae, at [www.fanniemae.com](http://www.fanniemae.com); and Freddie Mac, at [www.freddiemac.com](http://www.freddiemac.com)).

<sup>5</sup> Note: Agencies are listed on [www.ginniemae.gov](http://www.ginniemae.gov).

## Investment-grade taxable bond market overview

The Barclays U.S. Aggregate Index can be broken down into three traditional sectors, each also making up its own index: U.S. government, U.S. credit, and U.S. MBS.<sup>6</sup> As **Figure 1a** shows, the government sector is the largest: It comprises U.S. Treasuries and U.S. agencies. The agency securities in the government sector consist of unsecured debt, meaning the bonds' creditworthiness is determined solely by the issuing agency's credit quality; there is no securitized collateral generating the principal and interest payments, as in the case of a U.S. MBS issued by an agency.

The relative weightings of the sectors have changed over time, as shown by **Figure 1b**. Although MBS currently constitute a noteworthy portion of the Barclays U.S. Aggregate Index, they did not reach the 20% level until second-quarter 1986. The Barclays U.S. MBS Index contained only ten issues in 1976, but continued to develop and mature as the number of generic aggregates increased (see the accompanying box, "Methodology for inclusion in Barclays U.S. MBS Index"), thus adding to the index's diversification.

## Methodology for inclusion in Barclays U.S. MBS Index

The Barclays U.S. MBS Index contains the MBS pass-through securities of Ginnie Mae, Fannie Mae, and Freddie Mac. According to Barclays (as of March 10, 2013), the index is formed by grouping over 600,000 fixed-rate mortgage pools into roughly 3,500 aggregates according to four parameters:

1. Agency: Ginnie Mae, Fannie Mae, or Freddie Mac
2. Program: For example, 30-year, 15-year.
3. Coupon: For example, 6.0%, 6.5%.
4. Origination year.

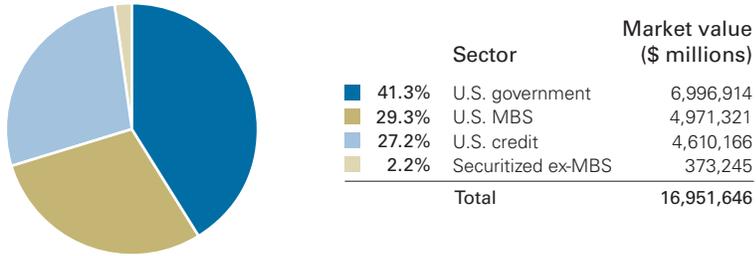
The aggregates represent a proxy for the outstanding pools for a given agency, program, coupon, and origination year. The index's maturity and liquidity criteria are then applied to these aggregates to determine which qualify for inclusion in the index. About 600 of these generic aggregates currently meet the criteria.

Notable exclusions to the U.S. MBS Index include collateralized mortgage obligations, adjustable-rate mortgage securities (though hybrid ARMs are eligible), and non-agency MBS.

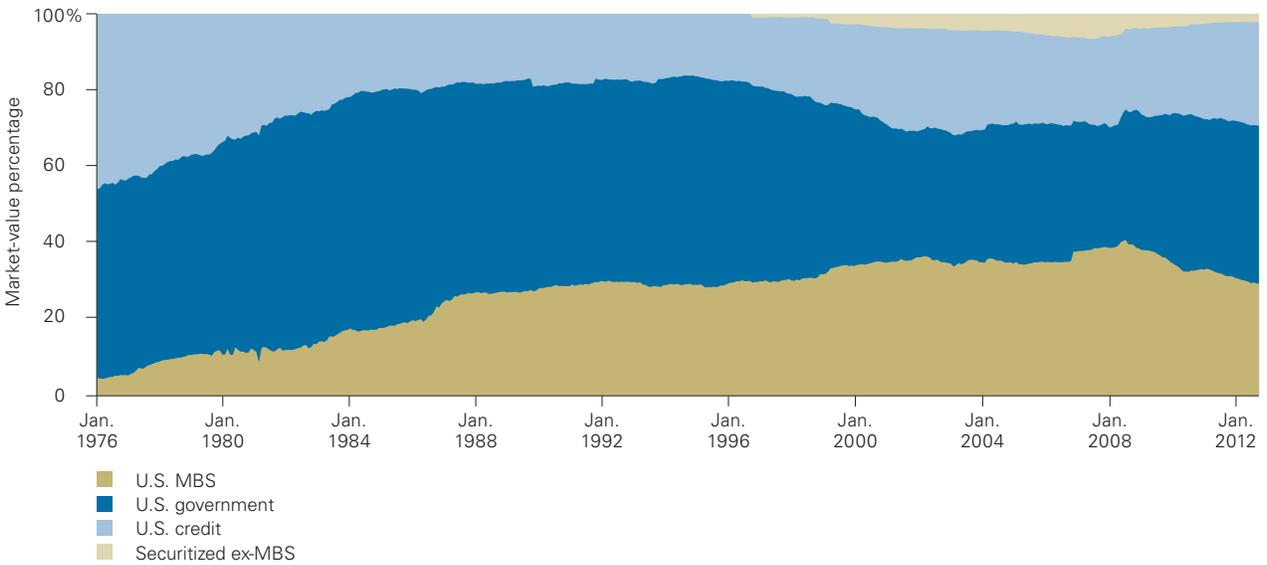
<sup>6</sup> As stated in footnote 1, U.S. MBS are technically a subsector of the securitized sector. This paper's analysis, however, treats U.S. MBS as one of the broad index's three main sectors because MBS constitute such an overwhelming percentage of the securitized sector.

**Figure 1.** Investment-grade bond sectors as of February 28, 2013, and over time

**a. Size and market value of sectors**



**b. Relative size of sectors over time**



Notes: For Figure 1a, data are as of February 28, 2013. The float-adjusted version of the Barclays U.S. Aggregate Index, which differs in that it excludes Federal Reserve holdings of unsecured agency bonds and agency MBS, had the following weightings as of that date: U.S. MBS, 24.9%; U.S. government, 43.7%; U.S. credit, 29.1%; and securitized ex-MBS, 2.3%. For Figure 1b, data reflect the period January 31, 1976, through February 28, 2013.

Sources: Vanguard calculations, using data from Barclays.

## Reviewing relative characteristics of MBS

Investors can gauge the relative attractiveness of MBS by assessing their strength versus U.S. governments and credits in the context of four key fixed income attributes, as summarized in **Figure 2** and discussed in the paragraphs following. The distinguishing characteristic of MBS is their prepayment risk, while they lie somewhere between governments and credits with respect to the other three attributes: credit quality, liquidity, and yield.

### Prepayment risk

Prepayment risk, the hallmark characteristic of MBS, results from homeowners' option to prepay their mortgage loans when it becomes advantageous to do so. The risk to MBS investors lies in the fact that exact prepayment amounts are not known in advance; risks are furthermore associated with both increases and decreases in interest rates.<sup>7</sup>

When interest rates fall, homeowners have an incentive to refinance their mortgages, which causes principal to be paid to MBS more quickly. Known as *contraction risk*, this requires an MBS investor to reinvest cash flows at lower yields. MBS investors are also subject to *extension risk*, the possibility that rising interest rates will slow the rate at which mortgages are prepaid. This slows the return of principal to investors, limiting the amount of cash flow to be reinvested at higher yields. In contrast, bonds not subject to prepayment risks have fixed cash flows, because the cash flows are not altered by changes in interest rates.

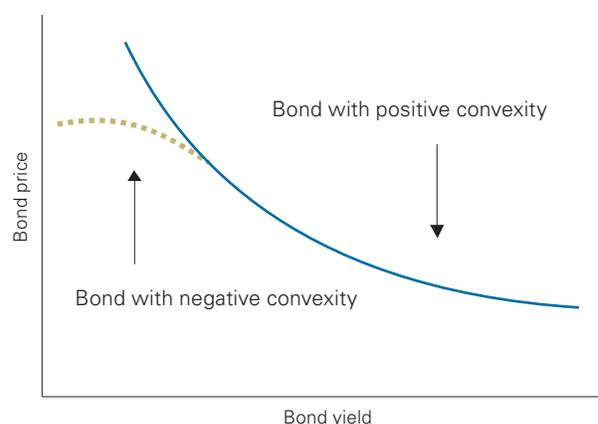
Prepayment risk results in negative convexity, a phenomenon whereby callable bonds do not enjoy the same magnitude of price increase as noncallable bonds of the same duration when yields fall. The relationship is illustrated in **Figure 3**. MBS exhibit the characteristics of callable bonds because the principal of these securities can be returned sooner than indicated by the expected maturity date. (For a more detailed discussion of convexity and duration, see Bennyhoff, 2010.)

**Figure 2.** Overview of U.S. MBS relative characteristics

Attribute	Relative to U.S. governments	Relative to U.S. credits
Prepayment risk	↑	↑
Credit quality	↓	↑
Liquidity	↓	↑
Yield	↑	↓

Source: Vanguard.

**Figure 3.** Price/yield relationship with respect to convexity



Source: Vanguard.

<sup>7</sup> See Beckett (1989) and Fabozzi (2000) for a more detailed discussion of factors affecting prepayment.

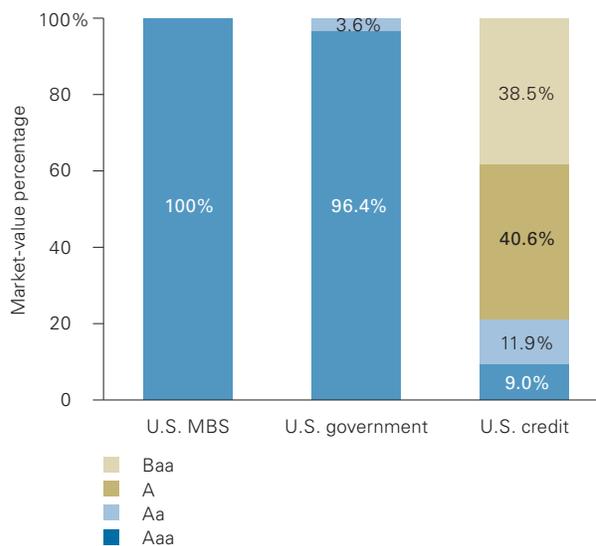
### Credit quality

U.S. government-agency MBS are considered virtually credit-risk-free. They are 100% Aaa-rated, as opposed to U.S. credits, which have exposure to lower levels of the investment-grade spectrum. At first glance, it would seem that MBS are considered to have credit quality superior to that of U.S. government bonds (see **Figure 4**). However, there is some nuance here that needs to be recognized. U.S. Treasuries, which have the full backing of the U.S. government, account for roughly 88% of the Barclays U.S. Government Index. The remaining 12% of issues include other types of agency bonds whose ratings are not Aaa.<sup>8</sup> The capital markets still treat U.S. Treasuries and agencies as of higher credit quality, since MBS credit quality should be no better than their ultimate guarantor. Thus, as a whole, the U.S. government sector’s credit quality is deemed higher than that of the MBS sector.

### Liquidity

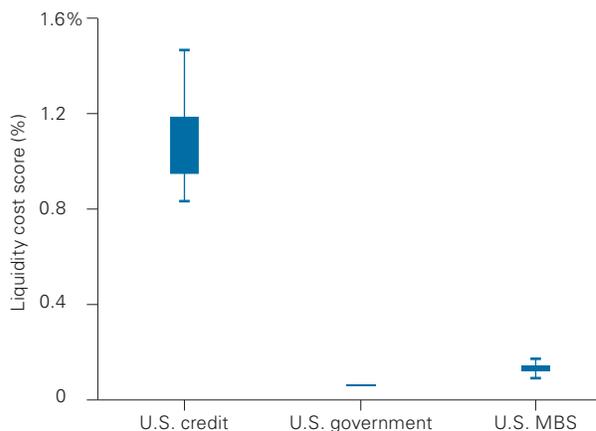
MBS are extremely liquid—much more so than U.S. credits, but not quite as liquid as U.S. governments. The \$313.6 billion average daily trading volume of MBS is closer to the \$528 billion posted by U.S. Treasuries than to the \$20.9 billion of U.S. credits.<sup>9</sup> The cost incurred by investors to trade MBS is also relatively low. **Figure 5** shows each sector’s average liquidity cost score (“LCS”), which measures the cost to trade a round-trip transaction. The boxes in the figure represent the middle 50% of all observations, while the upper and lower “whisker lines” represent the top 25% and bottom 25% of all observations, respectively. MBS are much closer to governments in terms of having both a low average LCS and a less-volatile LCS relative to credits.

**Figure 4.** Credit quality of bond sectors



Notes: Data as of February 28, 2013. The U.S. government percentages had a 0.02% weighting in A-rated issues that was too small to depict on the chart. Ratings shown are those of Moody’s Investors Service. Sources: Vanguard calculations, using data from Barclays.

**Figure 5.** Liquidity of bond sectors

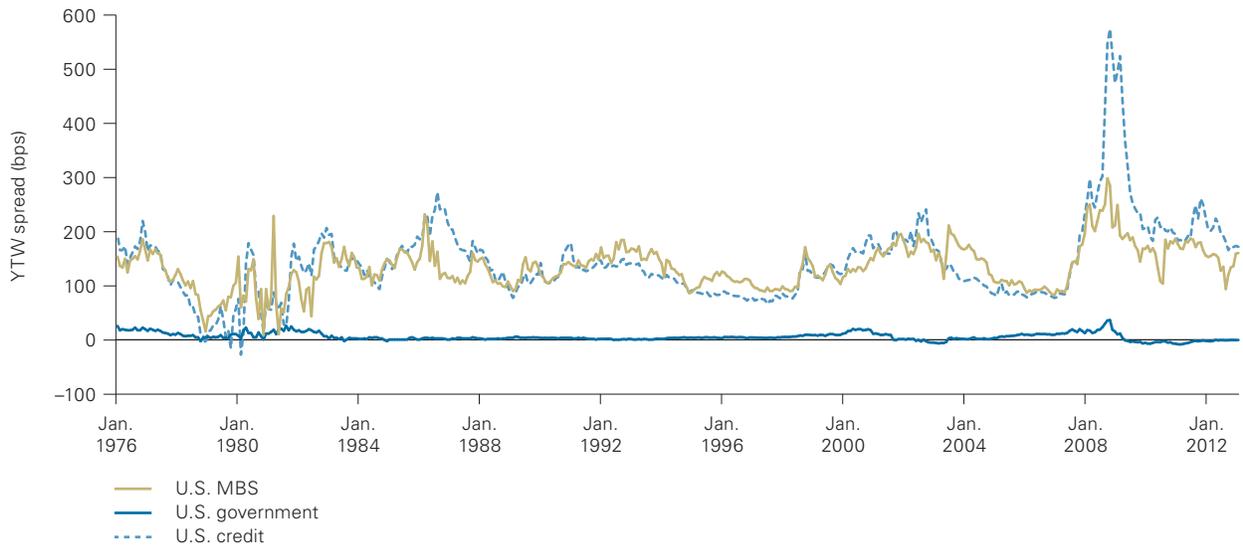


Notes: Figure reflects monthly data from March 2010 through February 2013. Boxes in the figure represent the middle 50% of all observations, while upper and lower “whisker lines” represent the top 25% and bottom 25% of all observations, respectively. Sources: Vanguard calculations, using data from Barclays.

<sup>8</sup> Source: Barclays, as of February 28, 2013. The ratings referred to are those of Moody’s Investors Service. Standard & Poor’s downgraded U.S. debt from AAA to AA+ on August 5, 2011.

<sup>9</sup> Source: Securities Industry and Financial Markets Association (SIFMA), as of February 14, 2013. SIFMA data reflect trading volume for “corporate debt,” not U.S. credits. However, because the two are similar, we believe that in this case corporates can serve as a good proxy for the relationship.

**Figure 6.** Historical yield spread of major U.S. bond sectors versus U.S. Treasuries



Notes: Figure reflects monthly data from January 1976 through February 2013. YTW = yield to worst (that is, the estimated yield that an investor would receive if a bond issue were called by the issuer prior to maturity); bps = basis points (1 basis point = 1/100 of 1 percentage point).

Sources: Vanguard calculations, using Barclays data.

## Yield

MBS are considered “spread” products because their yields are expected to exceed those of U.S. Treasuries. **Figure 6** shows the historical excess yield versus U.S. Treasuries for MBS, U.S. governments, and U.S. credits. Where MBS differ greatly from credits and governments is the makeup of the yield spread. All of these issues receive compensation for default and liquidity risk, though the amounts for governments and MBS are small versus those for credits (the fact that

governments have any spread is largely attributable to the unsecured agency exposure). However, MBS investors receive additional yield in exchange for accepting prepayment risk. Therefore, although the total yield spread for MBS and credits has been similar, the credits yield spread has been due almost entirely to default and liquidity risk. This was seen during the 2008–2009 credit crisis, when spreads spiked much more for U.S. credits than for MBS—see **Figure A-1**, in the Appendix, for a detailed illustration.

## Historical impact of MBS on bond portfolios

The yield advantage of MBS over U.S. government bonds and their lower default and liquidity risk versus credit bonds would seem to suggest that they should have a place in an investor's bond portfolio. A closer look at historical data, however, highlights the complexity of this analysis of MBS performance. **Figure 7** summarizes returns, standard deviations, and correlations for the three main U.S. bond sectors, as well as the broad bond market from January 1976 through February 2013. Although MBS outperformed governments over this period by roughly 30 basis points (8.2% versus 7.9%), they did so with a greater than 1 percentage point difference in volatility (standard deviation of 6.5% versus 5.3%). At the same time, MBS underperformed credits, but they did so with only slightly less volatility. This might partly explain investors' tendency to adhere to government/credit strategies rather than to those that include MBS. That said, MBS did provide diversification benefits during the period cited, as evidenced by the respective correlations of MBS versus governments (0.86) and credits (0.88), in line with the correlation exhibited between governments and credits (0.88).

Investors who are discouraged by the tendency of MBS toward volatility in the period just discussed might thus decide to avoid including them in their portfolios going forward. We believe, however, that the time-period-dependency of this analysis makes such a conclusion questionable. Certainly for the foreseeable future, it will be extremely difficult for bonds in general to achieve levels of return similar to those of the past, given today's low-yield environment. In particular, the secular decline in interest rates in the United States has had an especially negative impact on MBS performance relative to that of governments and credits. Nevertheless, despite historical events that have provided headwinds for MBS, we believe that their potential to add diversification to a portfolio makes them attractive going forward. We next look more closely at the forces behind the historical performance of MBS.

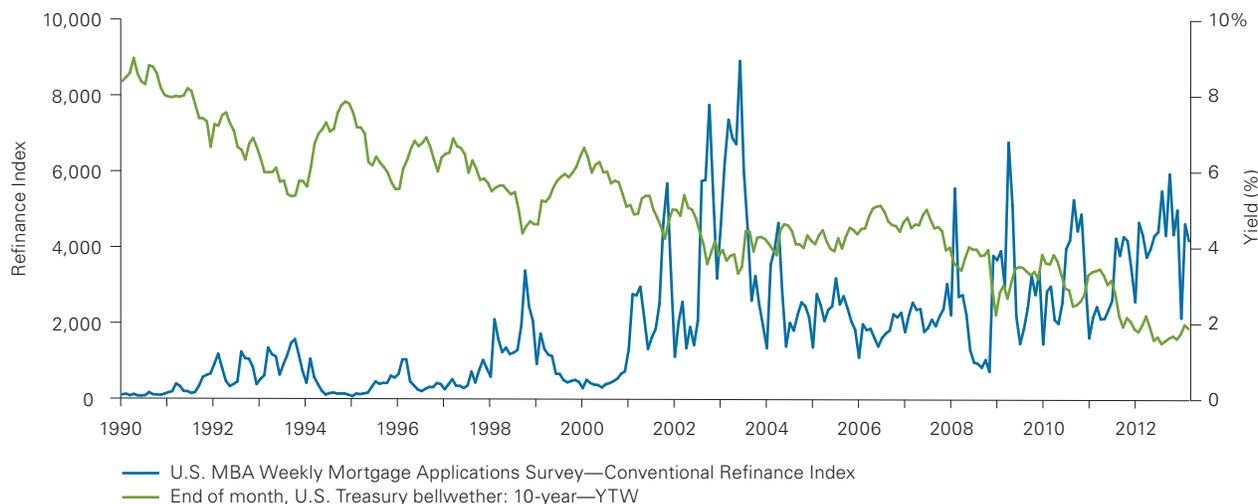
**Figure 7.** Historical performance data of bond markets

	U.S. MBS	U.S. government	U.S. credit	U.S. aggregate
Annualized return	8.2%	7.9%	8.7%	8.2%
Annualized standard deviation	6.5%	5.3%	7.0%	5.5%
Worst 12-month return	-12.0%	-4.5%	-15.8%	-9.2%
Best 12-month return	48.7%	30.3%	41.9%	35.2%
Correlation of return to U.S. MBS	1.00	0.86	0.88	0.94
Correlation of return to U.S. government	0.86	1.00	0.88	0.96
Correlation of return to U.S. credit	0.88	0.88	1.00	0.96
Correlation of return to U.S. aggregate	0.94	0.96	0.96	1.00

Note: Figure reflects monthly data from January 1976 through February 2013.

Sources: Vanguard calculations, using data from Barclays.

**Figure 8.** Impact of declining interest rates on refinancing applications



Notes: Figure reflects monthly data from Barclays from January 1990 through February 2013; and monthly data (transformed by Vanguard from weekly data) from Thomson Reuters Datastream for the Mortgage Bankers Association Weekly Mortgage Applications Survey—Conventional Refinance Index from January 5, 1990, through March 1, 2013. The Refinance Index measures applications for conventional mortgages to refinance existing mortgages.

Sources: Vanguard calculations, using data from Barclays, Thomson Reuters Datastream, and Mortgage Bankers Association.

### Drivers of MBS historical performance

Since the early 1980s, interest rates have trended downward.<sup>10</sup> Although falling interest rates have generally resulted in positive returns for all bonds, they have adversely affected the relative returns of MBS for two notable reasons: One is heightened refinancing activity and the other is falling relative durations.

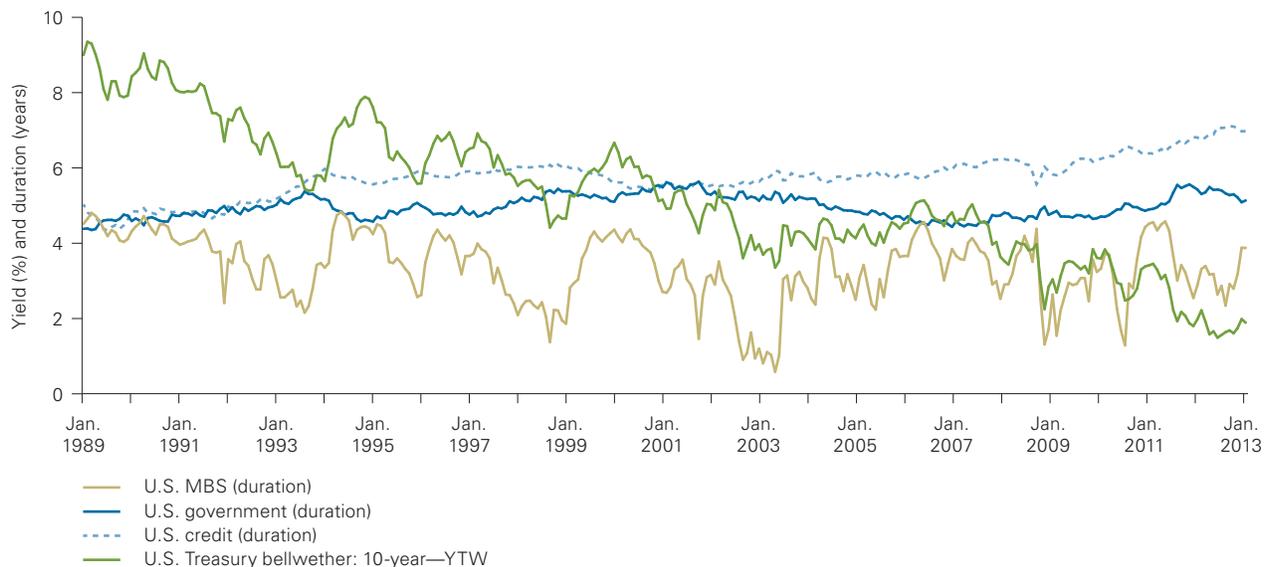
### Increased refinancing

Since 1990, refinancing activity has increased in the United States. **Figure 8** highlights that the prime reason for the continued rise in refinancing has been the downward trend in interest rates. This positive refinancing activity has triggered continuously increased prepayments, resulting in a persistent headwind to the relative performance of MBS.<sup>11</sup>

<sup>10</sup> Source: Federal Reserve. From March 2, 1981, through February 5, 2013, the 10-year constant-maturity Treasury rate dropped from 13.62% to 2.04%.

<sup>11</sup> Data availability limited our analysis to a start date of 1990. Given the acknowledged relationship between interest rates and refinancing, we believe it is reasonable to conclude that refinancing acted as a headwind during the 1980s as well.

**Figure 9.** Impact of declining interest rates on duration



Note: Figure reflects monthly data from January 1989 through February 2013.

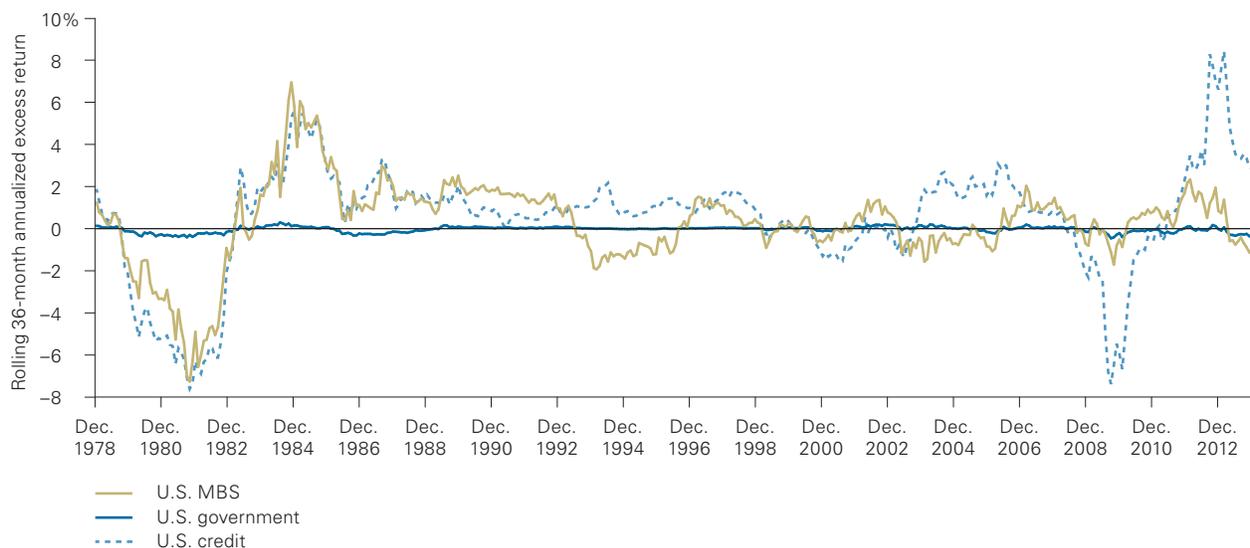
Sources: Vanguard calculations, using Barclays.

### Decreasing relative duration

A second headwind has been the decreasing relative duration of MBS. Bond durations are not stable over time, and bonds such as MBS that have negative convexity have a direct relationship with changes in interest rates: That is, as rates fall, these bonds' duration falls. The opposite is true for bonds with positive convexity: As interest rates fall, the bonds' duration increases. **Figure 9** demonstrates that these relationships have held true: The correlations

between the monthly changes in interest rates and duration for MBS, U.S. governments, and U.S. credits from January 1989 through February 2013 were 0.83,  $-0.71$ , and  $-0.38$ , respectively. Decreasing duration has meant that with each subsequent decline in interest rates, MBS became less sensitive to small changes in interest rates. Lessened sensitivity to interest rates in the face of declining interest rates has led to relative underperformance.

**Figure 10.** Cyclicalty of excess return to U.S. Treasuries



Note: Figure reflects monthly data from January 1976 through February 2013, in rolling 36-month increments.

Sources: Vanguard calculations, using data from Barclays.

### Diversification attributes of MBS

As mentioned, despite the historical performance of MBS, investors can still expect MBS to provide diversification benefits in broadly diversified portfolios. One reason for this is the cyclicalty of MBS excess returns; another is the desirability of MBS during periods of “flight to quality”; and a third reason is the duration and convexity profiles of MBS in the current low-interest-rate environment.

### Cyclicalty of excess returns

The cyclicalty of MBS excess returns can, for instance, benefit a portfolio that also holds U.S. governments and credits. The higher yields of MBS relative to governments can potentially result in outperformance by MBS over the long term. While MBS possess limited default and liquidity risk, they differ from credits because of their yield spread due to prepayment risk. Since the appetite for those risk premiums fluctuates, the result has been cyclical excess returns (see Figure 10). Investors who

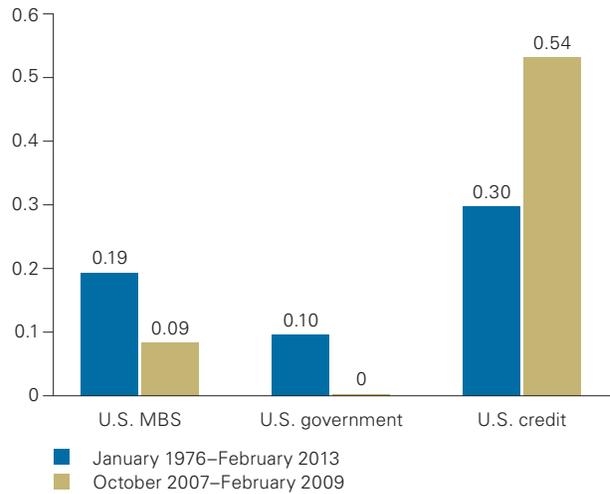
decline to include MBS in a portfolio of only U.S. governments and credits are forfeiting a potential buffer in the form of a somewhat differentiated pattern of returns. For example, a surge in refinancing applications in mid-1992 was a driver of MBS underperformance, whereas default and liquidity worries at end of 2008 enabled MBS to outperform credits.

**Flight-to-quality properties**

Although MBS performance relative to bonds has been cyclical over the long term, MBS have exhibited critical diversification benefits versus stocks during times of market stress.<sup>12</sup> This was most evident during the credit crisis of 2007–2009 (see Figure 11). As the figure shows, MBS and other investment-grade bonds have been less-than-perfectly correlated to stocks over the long term. However, during the recent credit crisis, the correlation of both MBS and government bonds versus U.S. stocks fell, while the correlation of credits versus stocks rose.

It’s important for investors to recall that during 2007–2009, stocks lost –50%. Credits also fell, but only by –2.65%, which still provided diversification benefits versus stocks. MBS, on the other hand, provided even better diversification properties, because they gained 12.51%, slightly lagging the 13.37% increase for governments.<sup>13</sup>

**Figure 11. Correlation to stocks during credit crisis**



Notes: Figure reflects monthly data from January 1976 through February 2013. Stocks represented by Spliced Total Stock Market Index (Dow Jones Wilshire 5000 Index from 1975 through April 22, 2005; and MSCI US Broad Market Index thereafter).

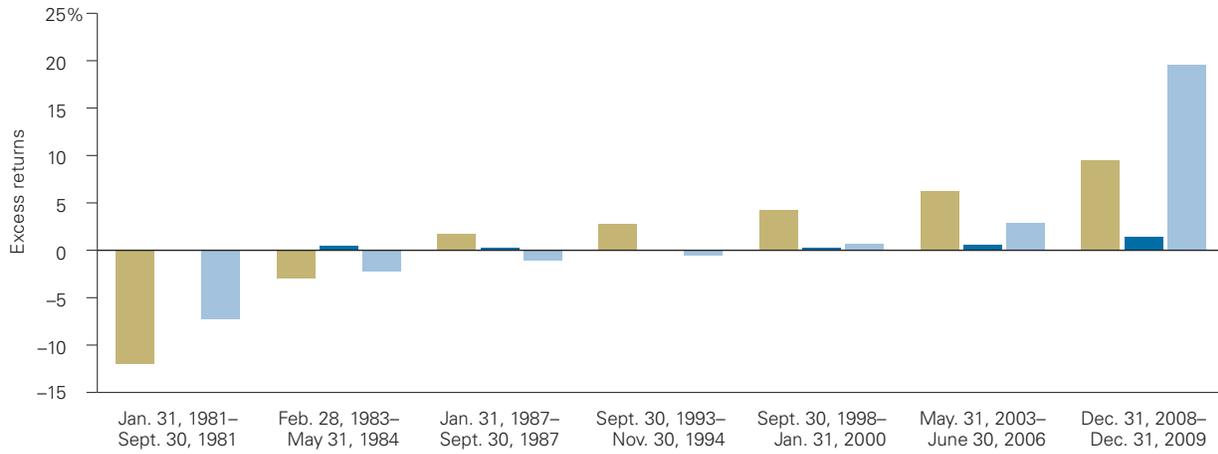
Sources: Vanguard calculations, using data from Barclays.

12 See Philips, Walker, and Kinniry (2012) for a discussion of the role of high-quality bonds during market environments characterized by a flight to quality.

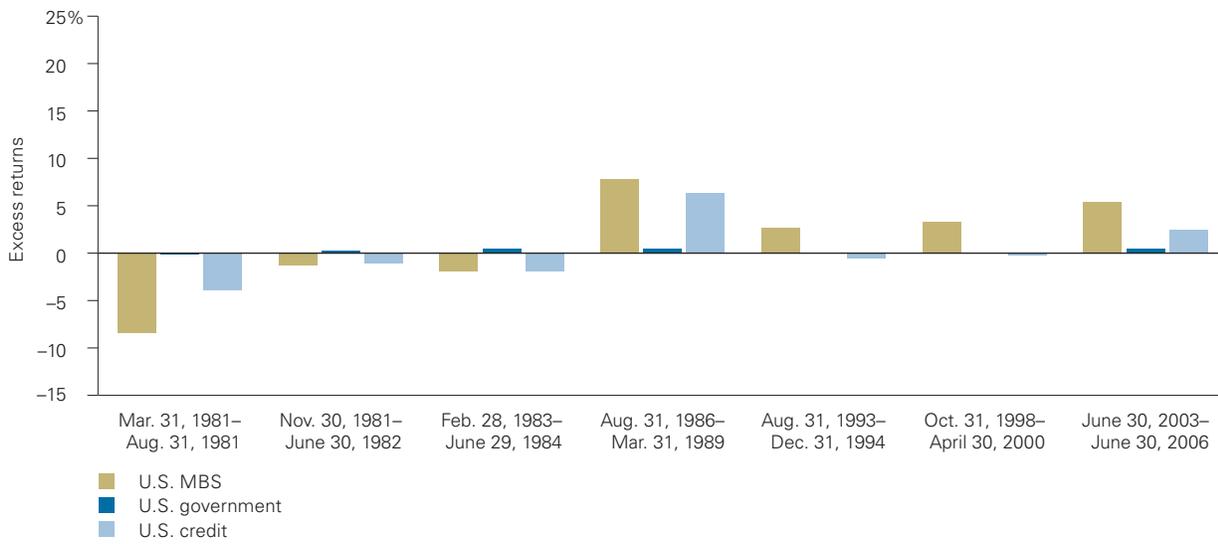
13 Sources: Vanguard and Barclays. Stocks are represented by the Spliced Total Stock Market Index (Dow Jones Wilshire 5000 Index from 1975 through April 22, 2005; and MSCI US Broad Market Index thereafter).

**Figure 12.** Relative performance of MBS: Selected periods

**a. Excess returns versus Barclays U.S. Treasury Index during periods of rising ten-year rates**



**b. Excess returns versus Barclays U.S. Treasury Index during periods of rising two-year rates**



Note: Figure reflects monthly data from February 1981 through February 2013.

Sources: Vanguard calculations, using data from Barclays.

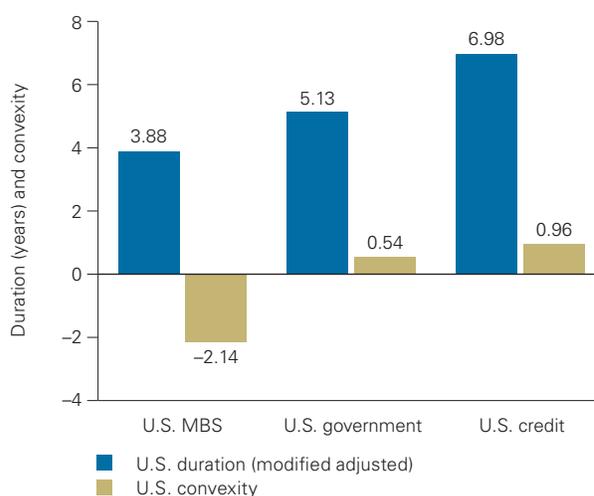
### Duration and convexity profiles

As bonds have benefited from the secular decline in interest rates, it's natural for investors to consider how various kinds of bonds might perform in a rising rate environment. Even during the period of falling interest rates, there have been intermittent periods of rising rates. As this paper has emphasized and **Figures 12a** and **12b** further demonstrate, MBS have provided mixed relative results, outperforming in some years and underperforming in others.<sup>14</sup>

Despite their inherent prepayment risk (particularly in the form of extension risk), it is not inconceivable that MBS could outperform other bond sectors in a rising rate environment. This is because the Barclays U.S. MBS Index currently has a lower duration than the Barclays U.S. Government and Credit indexes (see **Figure 13**), so lower duration in a rising rate environment would be beneficial to the U.S. MBS Index on a relative basis.<sup>15</sup> However, this is not a guarantee. If interest rates were to rise, U.S. MBS duration would likely increase to levels closer to those of the other bond sectors. At some point, the durations would be close enough that the effects of continuing extension risk (that is, slower prepayments) could lead to underperformance. Much depends on which interest rates rise (i.e., long-term versus short-term), how quickly they rise, the amount they rise, and how prepayments might react regardless of the path of interest rates—all of which are extremely difficult to predict.

Another important factor will be the effects of the Federal Reserve's "quantitative easing" ("QE"). As part of its efforts to keep interest rates low, the Fed has purchased nearly \$1 trillion of MBS over the five years through March 2013—a positive for MBS

**Figure 13.** Duration and convexity of U.S. bond sectors



Note: Data as of February 28, 2013.

Source: Vanguard calculations, using data from Barclays.

performance. Going forward, investors should be aware of the impact that Fed actions, including any "exit strategy," might have on MBS. Although MBS performance has benefited from Fed purchasing, it could also suffer if the Fed ceases its purchases or begins unwinding its positions. As investors assess their bond allocations in light of these events, they can gain MBS exposure as part of a total bond market fund or through a low-cost MBS fund with broad exposure throughout the agency MBS market.<sup>16</sup>

14 Rising rate periods are those identified by Philips and Walker (2011).

15 Dunn, Sella, and Fabozzi (2005) noted that "because the mortgage index typically has less duration than either the corporate or government index, it generally has better relative performance when interest rates rise than when interest rates fall" (p. 153).

16 See Bennyhoff, Donaldson, and Tolani (2012), for additional considerations related to investing in bond funds versus individual bonds. Volpert (2000) and Beckett (1989) noted the importance of broad diversification among MBS securities, to reduce those prepayment risks that are idiosyncratic in nature.

## Conclusion

As this analysis has emphasized, MBS have potentially favorable attributes for investors, including high credit quality, good liquidity, and enhanced yield versus U.S. government bonds, while their most distinguishing risk has been that of prepayment risk. The secular decline in interest rates over the past 30 years and the resultant adverse effects on relative historical performance for MBS are a justifiable concern for investors interested in these securities. On a forward-looking basis, however, it's likely that MBS will be able to provide diversification properties due to their cyclical excess returns, their desirable flight-to-quality characteristics, and their differentiated duration and convexity characteristics. Because of these characteristics, Vanguard believes that investors should consider including U.S. agency MBS in a portfolio alongside U.S. governments and credits. According to this view, and given that MBS represent such a large proportion of the U.S. investment-grade bond market, a market-proportionate allocation to MBS remains a reasonable starting point.

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## Appendix. Yield spreads for U.S. MBS, U.S. governments, and U.S. credits

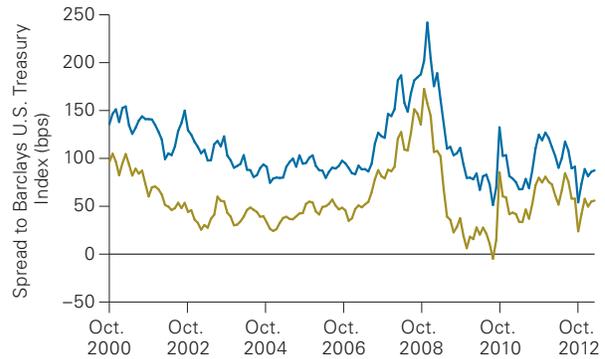
Figure A-1 shows the total yield spreads (blue lines) as well as the amount of the yield spread attributable to default and liquidity risks (olive-green lines). The difference between the two lines reflects the amount of the total spread that is attributable to prepayment risk. The relationship can be summarized as follows:

$$\text{Total Spread} = \text{Default and Liquidity Risk Spread} + \text{Prepayment Risk Spread}$$

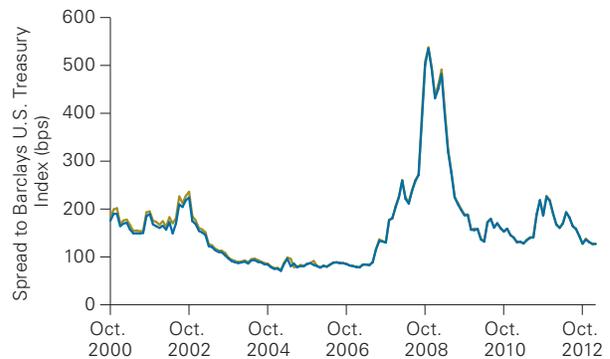
Whereas the yield spreads for U.S. governments and credits consist almost exclusively of compensation for default and liquidity risk, MBS have a substantial amount of total spread attributable to prepayment risk.

**Figure A-1.** Yield spreads for U.S. MBS, U.S. governments, and U.S. credits: October 31, 2000–February 28, 2013

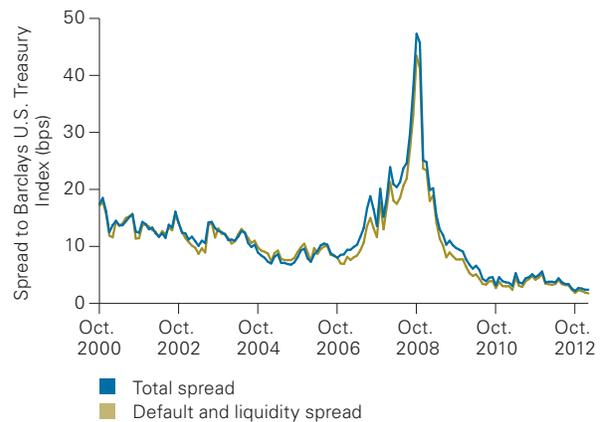
### a. Spread for U.S. MBS



### b. Spread for U.S. credits



### c. Spread for U.S. governments



Notes: Figure reflects monthly data from October 2000 through February 2013. "Total spread" is represented by zero volatility spread, and "Default and liquidity spread" is represented by option-adjusted spread.

Sources: Vanguard calculations, using data from Barclays.



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