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# A primer on floating-rate bond funds

Vanguard research

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**Executive summary.** Concerns over the recent rise in interest rates, and over the potential for rates to rise further, have led many investors to reexamine their portfolio allocations to diversified high-quality bond funds. Against this backdrop, investors seeking alternative ways to protect against any rise in interest rates and to improve their portfolios' expected returns may be considering floating-rate bond funds (also known as bank loans, syndicated loans, leveraged loans, and loan-participation funds).<sup>1</sup> The increased appetite for floating-rate funds is evident when examining the assets under management and investor cash flow figures provided by Morningstar Inc. Over the 12 months ended 30 June 2013, assets in floating-rate funds – including both open-end funds and exchange-traded funds (ETFs) – rose by more than 70%, from about \$69.6 billion to about \$120.3 billion, primarily fueled by inflows of more than \$45 billion.

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<sup>1</sup> For information on the importance of maintaining a diversified portfolio in rising-rate environments, see Phillips, Kinniry, Scott, DiJoseph, and Walker (2013).

To help investors evaluate floating-rate funds, this paper reviews key characteristics of the funds and addresses the premise that the funds offer both principal protection and above-average yields. We first compare floating-rate funds and typical fixed income products, highlighting differences between their primary risk-and-return drivers. We then analyse past performance of floating-rate funds in rising-rate environments. Lastly, we review these funds' potential role in a portfolio and discuss aspects to consider before investing in them.

Ultimately, we conclude that floating-rate funds indeed minimize interest rate sensitivity, though at the cost of incurring significant credit risk. As a result, we suggest that investors may be best served by viewing these funds in a light similar to that of high-yield fixed income funds, and not as an alternative to high-credit-quality bond holdings.

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With potentially rising interest rates and relatively low yields, investors are worried about their portfolio allocations to diversified high-quality bonds. Given that the best predictor of bonds' future returns has historically been their current yield to maturity, their returns over the next decade are expected to be muted.<sup>2</sup>

In this landscape, investors have been exploring alternative investments with higher yields, to boost portfolio performance while balancing the risk of rising interest rates. It's no surprise that floating-rate bond funds – which are marketed to address both of these concerns—have attracted a substantial portion of investors' assets.

*Notes on risk: All investing is subject to risk, including the possible loss of the money you invest. Bond funds are subject to interest rate risk, which is the chance that bond prices overall will decline because of rising interest rates, and credit risk, which is the chance that 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. High-yield bonds generally have medium- and lower-range credit quality ratings and are therefore subject to a higher level of credit risk than bonds with higher credit quality ratings. Although US 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. 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. Past performance is no 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.*

<sup>2</sup> For more detailed information on Vanguard's outlook, see Davis, Aliaga-Díaz, and Patterson (2013).

## Floating-rate bonds: What makes them unique?

Floating-rate bonds differ from traditional bonds in several respects that we discuss next – notably, interest rate terms, capital-structure seniority, and borrower credit quality – with each contributing to the asset class’s unique risk–return profile.

### Interest rate terms

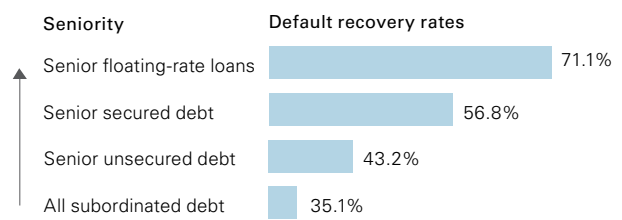
Traditional bonds characteristically have a fixed coupon rate that is determined upon issuance. This rate stays the same through the life of the bond, giving investors periodic, static interest payments known as coupons. As interest rate levels change, the prices of such fixed-coupon bonds adjust so that their overall yield is in line with the market.

Interest payments of floating-rate bonds, however, are determined by a floating reference rate – such as the LIBOR (the London Interbank Offered Rate)<sup>3</sup> or the federal funds rate – plus a fixed spread, or additional yield. Depending on the loan agreement, the rate is adjusted periodically, typically at intervals of 30, 60, or 90 days. As a result, the coupon payments on these loans vary, or “float”, in accordance with prevailing market interest rates. Because the coupon rate mirrors the market rate, floating-rate bonds exhibit minimal price sensitivity to changes in interest rate levels.

### Capital-structure seniority

Floating-rate loans, as opposed to typical debt offerings, are not issued by a firm directly to the public. Instead, banks and similar financial institutions extend loans to firms in need of raising capital. These loans, much like mortgages or other private loans, are then repackaged for sale to investors.

**Figure 1.** Floating-rate loans’ “seniority” has led to higher recovery rates in times of default (1996–2012)



Notes: Recovery rates are issuer-weighted and measured by post-default trading prices. We calculated default recovery rates as the average of annual recovery rates from 1996 through 2012. “Senior floating-rate loans” refers to first-lien bank loans. “All subordinated debt” includes senior subordinated, subordinated, and junior subordinated debt.

Source: Moody’s Investors Service *Corporate Default and Recovery Rates, 1920–2012*; available at moodys.com (28 February 2013).

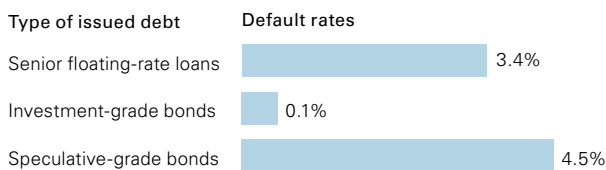
Floating-rate loans are considered “senior” in a firm’s capital structure, meaning they typically have among the highest claims to a borrower’s assets in the event of default. This trait, combined with loan agreements that require firms to secure their assets with collateral, has led to higher recovery rates than for less-senior debt (see **Figure 1**). Although recovery rates are a useful measure in the *event* of a firm’s default, they do not indicate a firm’s *likelihood* of defaulting and thus do not reflect an investment’s quality.

### Borrower credit quality

Floating-rate loans most commonly serve as an alternative source of financing for companies whose credit quality is rated below-investment-grade, or “junk”. These companies may find it comparatively more difficult or costly to access credit in the capital markets, such as fixed interest rate bonds.

3 The LIBOR refers to the average overnight lending rate between major banks.

**Figure 2.** Average annual default rates of floating-rate loans have significantly outpaced those of investment-grade bonds (1996–2012)



Notes: Default rates are issuer-weighted. We calculated them as the average of annual default rates from 1996 through 2012. “Senior floating-rate loans” refers to first-lien bank loans.

Sources: Senior floating-rate loan data retrieved from Moody’s Investors Service *June 2013 Monthly Default Report*; available at moodys.com. Investment-grade and speculative-grade bond data retrieved from Moody’s *Corporate Default and Recovery Rates, 1920-2012*; available at moodys.com (28 February 2013).

According to Morningstar, credit qualities of floating-rate funds range from BB (predominantly speculative) to B (speculative low-investment-grade), with a category average of B. For perspective, this is the same average as that of high-yield bond funds. It’s not surprising, then, that default rates of floating-rate loans have significantly outpaced those of investment-grade bonds and more closely resemble those of speculative-grade bonds (see **Figure 2**).

### Unique characteristics, unique risk–return drivers

#### Low interest rate risk

When investing in a bond, investors are primarily compensated for taking on two types of risk: interest rate risk and credit risk. As mentioned earlier, floating-rate funds, by design, curtail the effects of the former; this is reflected in their Morningstar category average duration of 0.42 years.<sup>4</sup> As such, prices of these bonds are not expected to significantly respond to interest rate fluctuations. With interest rate risk nearly eliminated, credit risk is the primary driver of returns.

#### High credit risk

Floating-rate funds’ minimal interest rate risk has understandably led some investors to assume that the funds can be used as an alternative to other short-duration funds, including money market and short-term bond funds. However, the *magnitude* of the credit risk incurred with floating-rate funds is much greater than that for money market and short-term bond funds. This is because floating-rate funds invest in below-investment-grade loans, whereas money market and short-term bond funds invest in high-quality securities. Thus, the returns of floating-rate funds are inherently tied to the considerable credit risk associated with “junk”-rated loans.

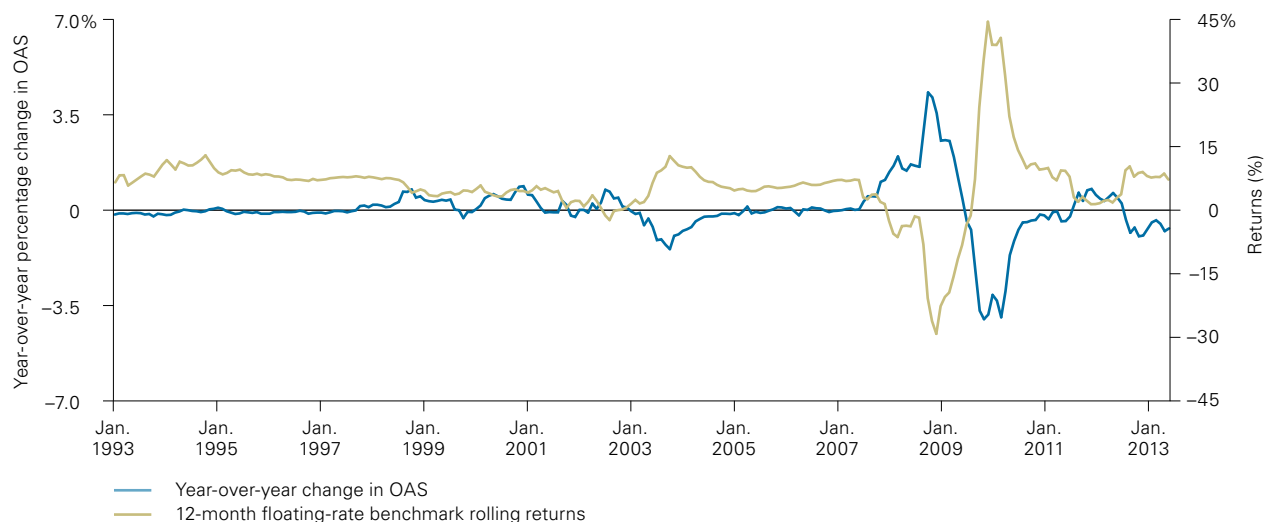
**Figure 3** demonstrates the significance of this relationship; the correlation between annual changes in the option-adjusted spread (OAS) of the Barclays U.S. Corporate Bond Index – a common measurement of US credit risk – and the 12-month rolling returns of the floating-rate benchmark is –0.90. This strong inverse relationship reflects the tendency of floating-rate fund returns to move in the opposite direction of credit spreads. Such a relationship does not hold for money market or short-term bond funds.<sup>5</sup> Therefore, investors should be careful to note the widely dissimilar risk-and-return drivers of floating-rate funds and other short-duration fixed income alternatives.

**Figure 4** extends this analysis to view return correlations between floating-rate funds and fixed income benchmarks of various credit qualities. Not surprisingly, as the figure suggests, floating-rate funds (as represented by the Credit Suisse Leveraged Loan Index, which was created in 1992) have performed more similarly to benchmarks with lower interest rate sensitivity and greater credit risk. For instance, the figure shows that floating-rate funds have performed much differently from long-term US Treasuries – which are typified by long durations and high credit quality – while more closely mirroring the performance of high-yield bonds, which are of intermediate duration and low credit quality.

4 Duration is a measurement of a fund’s price sensitivity to changes in interest rates. See Bennyhoff and Zilbering (2010) for a more detailed discussion of duration.

5 Over the same period (1 January 1993 through 30 June 2013), returns of money market funds (represented by the Citigroup 3-Month U.S. Treasury Bill Index) had a correlation to year-over-year changes in the OAS of 0.28; short-term bond funds (represented by the Barclays U.S. 1–5 Year Government/Credit Bond Index) had a correlation of 0.02.

**Figure 3.** Floating-rate benchmark returns can be explained by credit-risk factors (1 January 1993 through 30 June 2013)



Notes: Floating-rate returns represented by Credit Suisse Leveraged Loan Index. Barclays U.S. Corporate Bond Index is used to represent the OAS (option-adjusted spread). OAS changes are calculated as year-over-year changes in monthly OAS.

Sources: Vanguard calculations, based on data from Morningstar, Inc.

### Above-average liquidity risk

Another risk factor of particular importance for floating-rate funds is liquidity risk. In 2000, the US Securities and Exchange Commission mandated the use of mark-to-market loan pricing for active floating-rate managers. This increase in price transparency reduced loan-mispricing fears and consequently led to substantial growth in the floating-rate loan industry.<sup>6</sup> The industry, though, is still roughly half the size of the high-yield bond market and is vulnerable to liquidity shocks in unfavourable loan markets. For example, in 2008, when collateralised loan obligations and hedge funds – the primary investors in the floating-rate loan industry – began selling off their loans en masse, interested buyers disappeared and the market’s liquidity dried up, contributing to depressed loan prices.

**Figure 4.** Correlations of returns of a floating-rate benchmark and benchmarks of varying credit qualities (1 February 1992 through 30 June 2013)

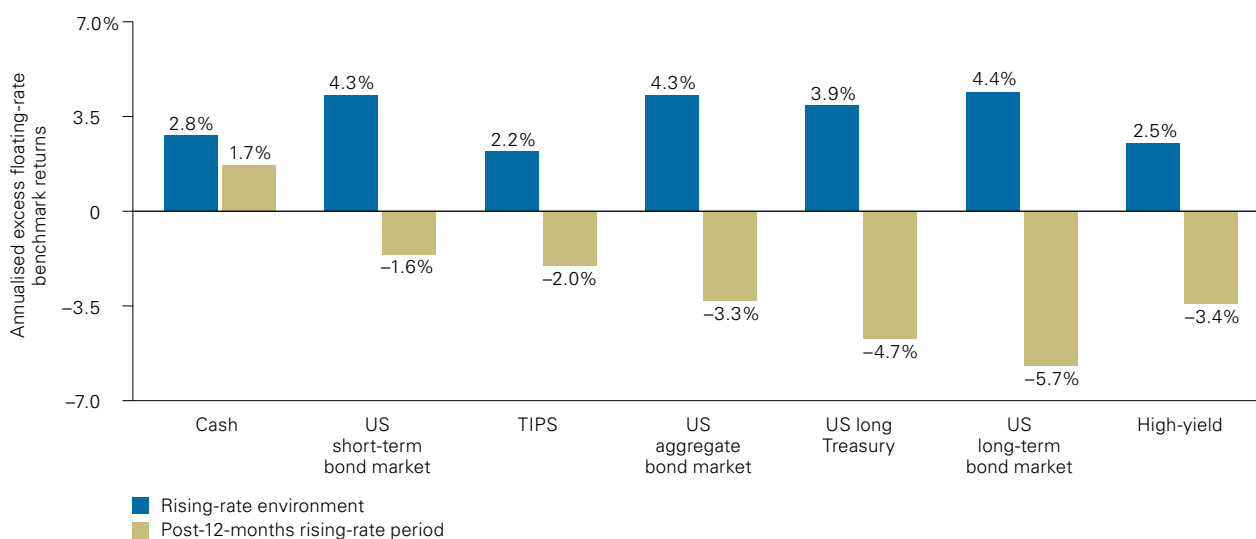
Benchmark category	Correlation
3-month Treasury bill	(0.05)
TIPS	0.15
Short-term Treasury	(0.33)
Long-term Treasury	(0.29)
US aggregate bond	(0.03)
US corporate bond	0.28
Total US stock market	0.44
Corporate high-yield	0.74

Notes: Floating-rate returns represented by Credit Suisse Leveraged Loan Index. Benchmarks used in return calculations for each listed category are represented, respectively, by: Citigroup 3-Month U.S. Treasury Bill Index; Barclays U.S. Treasury Inflation Protected Securities Index; Barclays U.S. 1–5 Year Treasury Bond Index; Barclays U.S. Long Treasury Bond Index; Barclays U.S. Aggregate Bond Index; Barclays U.S. Corporate Bond Index; Dow Jones U.S. Total Stock Market Index, and Barclays U.S. Corporate High Yield Bond Index.

Sources: Vanguard calculations, based on data from Morningstar, Inc.

6 As at 31 December 2012, about \$550 billion was in outstanding floating-rate loans, according to the Loan Syndications and Trading Association

**Figure 5. Floating-rate benchmark has outperformed in recent rising-rate environments**



Notes: Rising-interest-rate periods refer to: January 1994 through February 1995, June 1999 through May 2000, and June 2004 through June 2006. Post-12-months rising-interest-rate periods refer to: March 1995 through February 1996, June 2000 through May 2001, and July 2006 through June 2007. Floating-rate returns represented by Credit Suisse Leveraged Loan Index. Benchmarks used in calculating returns are represented by: for cash, Citigroup 3-Month U.S. Treasury Bill Index; for short-term bonds, Barclays U.S. 1–5 Year Government/Credit Bond Index; for TIPS, Barclays U.S. Treasury Inflation Protected Securities Index; for aggregate bonds, Barclays U.S. Aggregate Bond Index; for long Treasuries, Barclays U.S. Long Treasury Bond Index; for long-term bonds, Barclays U.S. Long Government/Credit Bond Index; and for corporate high-yield bonds, Barclays U.S. Corporate High Yield Bond Index. All return calculations represent annualised returns.

Sources: Vanguard calculations, based on data from Morningstar, Inc.

### Performance during (and after) rising-rate environments

In rising-rate environments, floating-rate funds can be expected to benefit from rising coupon payments and minimal interest rate sensitivity (compared with fixed-coupon payment, interest-rate-sensitive benchmarks). Since the inception of the Credit Suisse Leveraged Loan Index for floating-rate funds, there have been three periods, totaling 51 months, in which the Federal Reserve targeted interest rate increases (as measured by the target federal funds rate).<sup>7</sup> Over these periods, on an annualised basis, the floating-rate loan benchmark outperformed fixed income benchmarks of varying durations and credit qualities, including the aggregate

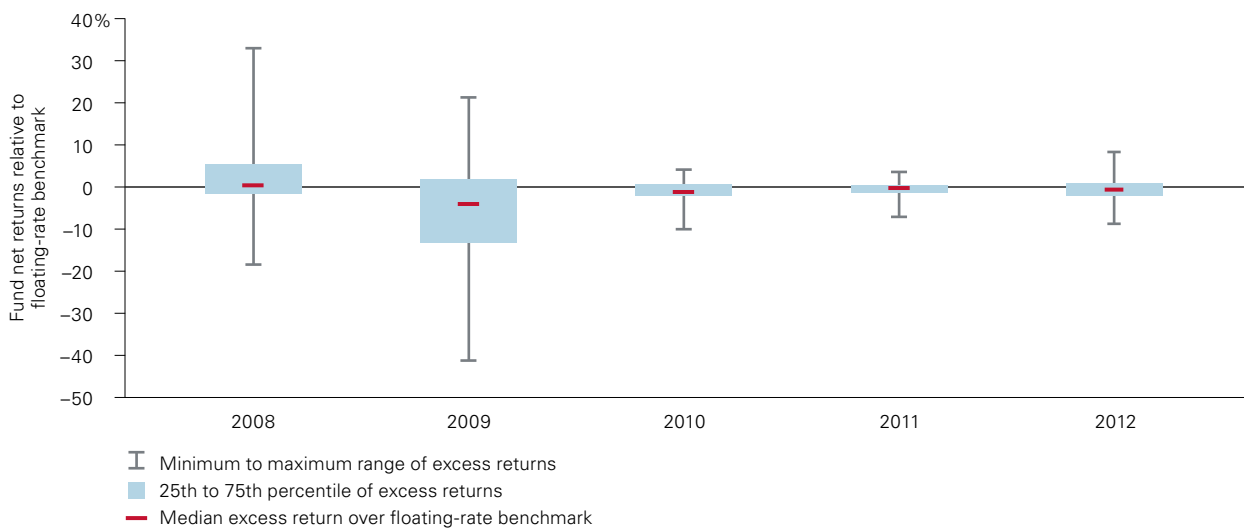
bond market, by 4.3%. These results, alongside post-rising-interest-rates performance, are summarised in **Figure 5**.

Although floating-rate funds have outperformed over the past three rising-rate periods, investor outperformance going forward cannot be assumed, for several reasons. First, as shown in **Figure 3**, floating-rate fund returns ultimately depend on the ability of below-investment-grade firms to make timely interest payments and avoid default. Given the unpredictability of credit markets, investors must be aware of the potential for underperformance if credit spreads deteriorate. For example, when credit spreads widened during

<sup>7</sup> The beginning dates of the rising-interest-rate periods were selected based on two criteria for each period: (1) The target federal funds rate initially increased by at least 25 basis points; and (2) rates rose by at least 100 basis points within the following year. The ending dates signify the peak of each rising-rate period, as indicated by an unchanged or declining target federal funds rate over the four subsequent months. Using this criteria, rising-rate periods were identified as 1 January 1994 through 28 February 1995, 1 June 1999 through 31 May 2000; and 1 June 2004 through 30 June 2006.

**Figure 6.** Choice of active manager affects investors' returns

Range of returns for active floating-rate funds



Notes: Within each highlighted year, outer dashes show ranges for minimum and maximum returns. Floating-rate returns represented by Credit Suisse Leveraged Loan Index. Annual active floating-rate returns cited here reflect only those funds that were included in Morningstar's Bank Loan category and also had returns for the full calendar year. From this sample, the minimum, 25th percentile, median, 75th percentile, and maximum returns were calculated.

Sources: Vanguard calculations, based on data from Morningstar, Inc.

2008, the floating-rate funds benchmark returned -28.8%, underperforming the Barclays U.S. Aggregate Bond Index by 34 percentage points.

An additional concern brought to light in Figure 5 is the underperformance of floating-rate bonds after the target federal funds rate ceases to rise. Significant portions, if not all, of the excess returns witnessed during recent rising-rate periods would have been relinquished (relative to various fixed income benchmarks) had investors not successfully timed their exit positions in the market. As past Vanguard research has demonstrated, investors engaging in tactical asset allocation strategies have failed to consistently produce excess returns (Stockton and Shtekhman, 2010).

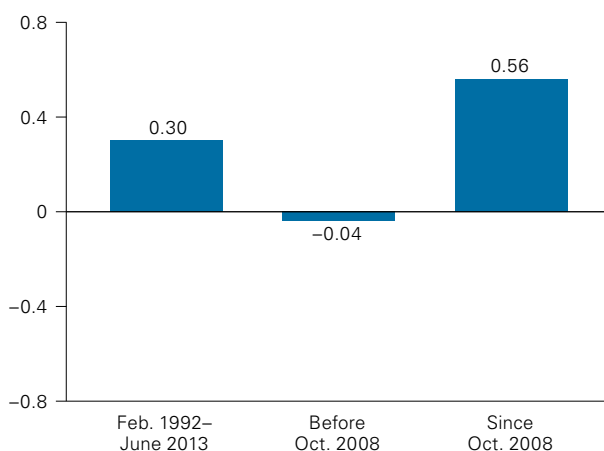
A final risk element to consider is that investors in floating-rate funds are also subject to active manager risk. Active management offers the opportunity to outperform a given benchmark, though typically at the cost of higher expenses, tracking-error risk, and underperformance risk. As shown in Figure 6, active manager selection has, at times, greatly affected floating-rate fund investors' returns, highlighted by a median benchmark underperformance of more than 3.5 percentage points in 2009.<sup>8</sup> Moreover, the average asset-weighted expense ratio of an open-end and ETF floating-rate fund was 0.90% as of June 2013, according to Morningstar – about 0.79 percentage point higher than the average asset-weighted expense ratio of an aggregate US bond index fund.

<sup>8</sup> For additional research on active manager performance, see Philips and Kinniry (2009).

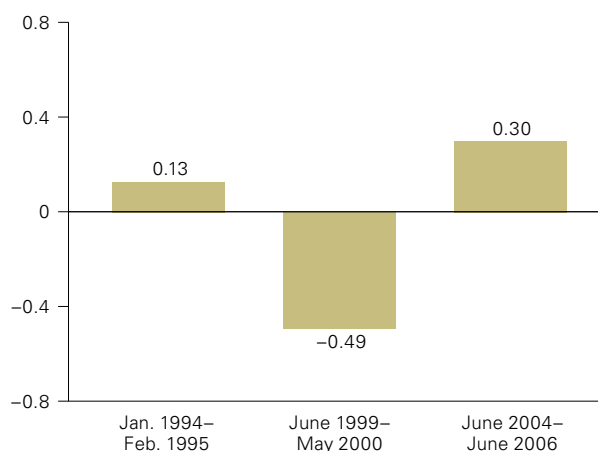
**Figure 7.** Floating-rate funds have not historically served as a reliable inflation hedge

### CPI and floating-rate benchmark-return correlations

a. CPI: February 1992–June 2013



b. Rising-rate periods



Notes: Floating-rate monthly returns represented by Credit Suisse Leveraged Loan Index. “Before Oct. 2008” refers to February 1992 through September 2008; “Since Oct. 2008” refers to October 2008 through June 2013. CPI refers to month-over-month change in Consumer Price Index for all items as reported by US Bureau of Labor Statistics.

Sources: Vanguard calculations, based on data from Morningstar, Inc., and US Bureau of Labor Statistics.

### Floating-rate funds as an inflation hedge?

Historically in the United States, periods of rapidly rising rates have coincided with high or increasing inflation. This relationship has led some to suggest that floating-rate funds can be a suitable fit for investors looking to hedge inflation risks, as evidenced by a low, but positive, 0.30 correlation between floating-rate benchmark returns and changes in the Consumer Price Index.

However, as **Figure 7** makes clear, floating-rate funds failed to consistently provide an inflation hedge from February 1992 through September 2008 – a time frame that, as mentioned earlier, included three rising-federal-funds-rate periods. Since that time, high correlations between inflation and floating-rate funds can be explained by concurrent bouts of deflationary pressures and widening credit spreads through the first quarter of 2009, followed by reversions of each – and not by

any inherent inflation hedge within floating-rate loans. As previous Vanguard research has shown (Bhardwaj, Hamilton, and Ameriks, 2011), maintaining a well-diversified portfolio of stocks, bonds, and other asset classes over the long term remains a wise strategy for managing inflation risk.<sup>9</sup>

### Floating-rate funds as a diversifier?

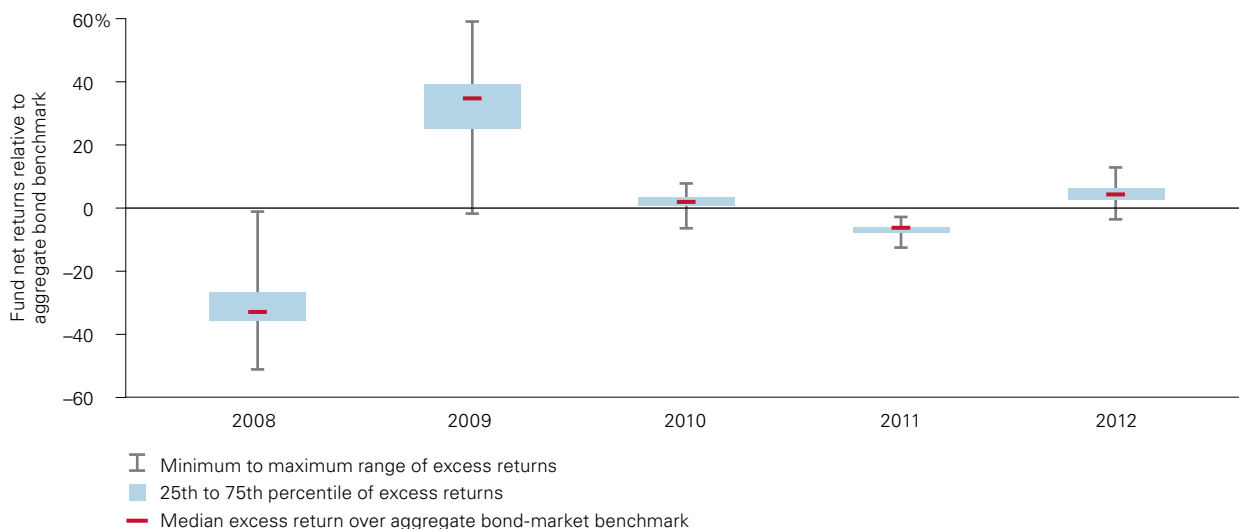
Over the past 20 years, the floating-rate benchmark has exhibited a near-zero (–0.03) correlation with the US aggregate bond market (as shown in Figure 4). **Figure 8** highlights this dissimilarity of returns over the five years through 2012. As a result, some investors may consider floating-rate funds as a potential long-term diversifier within their portfolio. To see how investors would have fared historically, we analysed hypothetical benchmark portfolios representing the US stock market, the US aggregate bond market, and floating-rate loans.

9 For more information on hedging inflation, see Bhardwaj, Hamilton, and Ameriks (2011).



**Figure 8.** Floating-rate funds and the aggregate bond market have widely dissimilar return patterns (five years ended 31 December 2012)

Floating-rate returns relative to US aggregate bond market



Notes: Floating-rate returns represented by Credit Suisse Leveraged Loan Index. Funds included in this analysis were in Morningstar’s Bank Loan category and also had returns for the full calendar year. Aggregate bond-market returns represented by Barclays U.S. Aggregate Bond Index.

Sources: Vanguard calculations, based on data from Morningstar, Inc.

**Figure 9**, on page 10, displays the hypothetical historical returns of multiple US equity/bond portfolios in 10-percentage-point increments, assuming various fixed income allocations to floating-rate bonds and the aggregate bond market (also in 10-percentage-point increments). As the figure shows, a fixed income allocation to floating-rate loans in any proportion would have led to declining portfolio returns for the period. This reflects that the aggregate bond market index outperformed the floating-rate loan benchmark, on average, over the period.

We next examined the volatilities of these same hypothetical historical portfolios. As **Figure 10**, on page 11, shows, benchmark portfolios consisting of at least 80% bonds would have benefited (in reduced volatility) from allocating 10% to 30% of their bond holdings to floating-rate funds. However,

as the figure also shows, this benefit would have quickly diminished as equities in excess of 20% were introduced into the benchmark portfolios. This reflects the well-documented diversification benefits of broad-based bond holdings for investors with balanced portfolios.

Figure 10’s data preliminarily suggest that *some* investors would have benefited from allocating part of their portfolio allocation to floating-rate bond funds – specifically, investors who:

- Maintain highly bond-centric portfolios (80% bond exposure or more).
- Are averse to pure interest rate risk.
- Are not averse to credit risk.

**Figure 9.** Hypothetical scenarios indicate that floating-rate bond exposure historically would have decreased portfolio returns

Average annual returns (January 1992–June 2013)

US equity/bond allocation (%)

	100/0	90/10	80/20	70/30	60/40	50/50	40/60	30/70	20/80	10/90	0/100
0	8.84	8.69	8.52	8.32	8.10	7.84	7.57	7.26	6.94	6.59	6.21
10	8.84	8.69	8.51	8.31	8.09	7.83	7.56	7.26	6.93	6.58	6.21
20	8.84	8.69	8.51	8.30	8.07	7.82	7.54	7.24	6.92	6.58	6.21
30	8.84	8.68	8.50	8.29	8.06	7.81	7.53	7.23	6.91	6.57	6.20
40	8.84	8.68	8.49	8.28	8.05	7.79	7.51	7.21	6.89	6.55	6.19
50	8.84	8.67	8.48	8.27	8.03	7.77	7.50	7.20	6.87	6.53	6.17
60	8.84	8.67	8.47	8.25	8.02	7.76	7.48	7.17	6.85	6.51	6.15
70	8.84	8.66	8.46	8.24	8.00	7.74	7.45	7.15	6.83	6.49	6.12
80	8.84	8.66	8.45	8.23	7.98	7.72	7.43	7.13	6.80	6.46	6.09
90	8.84	8.65	8.44	8.22	7.97	7.70	7.41	7.10	6.77	6.42	6.06
100	8.84	8.65	8.43	8.20	7.95	7.67	7.38	7.07	6.74	6.38	6.02

Notes: This hypothetical illustration does not represent the return on any particular investment. Chart assumes an expense ratio premium of 0.5 percentage point for bank-loan funds relative to US aggregate bond market. Floating-rate returns represented by Credit Suisse Leveraged Loan Index. US aggregate bond-market returns represented by Barclays U.S. Aggregate Bond Index. US total stock market returns represented by Dow Jones U.S. Total Stock Market Index. Change of color from green to yellow to red illustrates returns moving from higher to lower.

Sources: Vanguard calculations, based on data from Morningstar, Inc.

Typically, few investors meet all the listed criteria. Highly bond-centric investors are often very risk-averse and seek to limit price risk from any source. As such, exchanging interest rate risk for a floating-rate fund with prominent credit risk probably runs counter to a bond-centric investor’s preferred risk tolerance.

Instead, investors looking to limit portfolio volatility – without introducing added credit risk—might benefit most from reducing their portfolio’s interest rate exposure through more traditional fixed income funds, such as a diversified short-term bond or short-term Treasury fund, as shown in the hypothetical return scenarios in the Appendix (see Figures A-1 and A-2 on page 12).

## Conclusion

Although floating-rate bond funds have mitigated price sensitivity to interest rate fluctuations and have offered, on average, yields that exceed those of money market funds, they have done so at the cost of increased credit risk. These funds primarily invest in floating-rate loans issued to firms with below-investment-grade credit ratings. Consequently, fund performance ultimately depends on the credit risks facing these firms. As such, floating-rate bond funds exhibit risk–return profiles most similar to those of high-yield funds, and they should not be considered an alternative to broad-based bond holdings.

**Figure 10.** A small or modest allocation to floating-rate bonds would have reduced volatility in all-bond, or nearly all-bond, hypothetical portfolios

Average annual volatility (January 1992–June 2013)

US equity/bond allocation (%)

	100/0	90/10	80/20	70/30	60/40	50/50	40/60	30/70	20/80	10/90	0/100
0	15.13	13.63	12.15	10.68	9.24	7.84	6.50	5.28	4.28	3.68	3.68
10	15.13	13.65	12.19	10.74	9.31	7.91	6.56	5.31	4.23	3.50	3.34
20	15.13	13.67	12.23	10.80	9.38	7.99	6.64	5.37	4.25	3.41	3.11
30	15.13	13.70	12.27	10.86	9.46	8.09	6.75	5.48	4.33	3.42	3.00
40	15.13	13.72	12.32	10.93	9.55	8.19	6.87	5.62	4.47	3.54	3.05
50	15.13	13.74	12.36	10.99	9.64	8.31	7.02	5.79	4.67	3.75	3.23
60	15.13	13.76	12.41	11.07	9.74	8.44	7.19	5.99	4.91	4.04	3.53
70	15.13	13.79	12.46	11.14	9.85	8.59	7.37	6.23	5.20	4.39	3.92
80	15.13	13.81	12.51	11.22	9.96	8.74	7.57	6.48	5.53	4.79	4.37
90	15.13	13.83	12.56	11.30	10.08	8.90	7.78	6.76	5.89	5.23	4.87
100	15.13	13.86	12.61	11.39	10.20	9.07	8.01	7.06	6.27	5.69	5.41

Notes: This hypothetical illustration does not represent the return on any particular investment. Chart assumes an expense ratio premium of 0.5 percentage point for bank-loan funds relative to US aggregate bond market. Floating-rate returns represented by Credit Suisse Leveraged Loan Index. US aggregate bond market represented by Barclays U.S. Aggregate Bond Index. US total stock market represented by Dow Jones U.S. Total Stock Market Index. Change of color from green to yellow to red illustrates volatility moving from lower to higher.

Sources: Vanguard calculations, based on data from Morningstar, Inc.

In recent rising-rate periods, credit risks have remained relatively flat, leading to excess returns for high-yield and floating-rate bond funds (relative to various bond benchmarks). Given the unpredictability of the credit markets, outperformance during future rising-rate periods cannot be guaranteed. In addition, in the event of outperformance, realised excess returns hinge on investors' ability to tactically enter and exit the market—an approach that Vanguard does not advocate.

investors tend to be risk-averse, however, they would most likely avoid adding a potentially volatile, high-credit-risk fund to their portfolios. Instead, investors interested in reducing their portfolio's price risk from interest rate exposure, credit-risk exposure, or both might achieve more reliable benefits by investing in short-term US bond funds and short-term Treasury funds.

Lastly, floating-rate funds have exhibited a near-zero correlation to the US aggregate bond market over the 21 years ended 30 June 2013. Our research indicates that portfolios containing at least 80% in bonds could have reduced their volatility by allocating 10% to 30% of their bond holdings to floating-rate bond funds. Because bond-centric

## Appendix

**Figure A-1.** Overweighting fixed income allocations to short-term bond funds reduces portfolio volatility because of reduced interest rate risk

Average annual volatility (January 1992–June 2013)

US equity/bond allocation (%)

	100/0	90/10	80/20	70/30	60/40	50/50	40/60	30/70	20/80	10/90	0/100	
Percentage of bonds allocated to short-term bond funds	0	15.13	13.63	12.15	10.68	9.24	7.84	6.50	5.28	4.28	3.68	3.68
	10	15.13	13.63	12.14	10.67	9.22	7.81	6.46	5.22	4.18	3.54	3.52
	20	15.13	13.63	12.13	10.66	9.20	7.78	6.42	5.15	4.09	3.41	3.36
	30	15.13	13.62	12.13	10.65	9.19	7.76	6.38	5.09	3.99	3.28	3.20
	40	15.13	13.62	12.12	10.64	9.17	7.73	6.34	5.03	3.91	3.15	3.05
	50	15.13	13.62	12.12	10.63	9.15	7.71	6.30	4.98	3.82	3.02	2.90
	60	15.13	13.62	12.11	10.62	9.14	7.68	6.27	4.92	3.74	2.90	2.76
	70	15.13	13.61	12.11	10.61	9.12	7.66	6.23	4.87	3.66	2.78	2.62
	80	15.13	13.61	12.10	10.60	9.11	7.64	6.20	4.83	3.58	2.67	2.49
	90	15.13	13.61	12.10	10.59	9.10	7.62	6.17	4.78	3.52	2.57	2.36
	100	15.13	13.61	12.09	10.58	9.08	7.60	6.14	4.74	3.45	2.47	2.24

Notes: This hypothetical illustration does not represent the return on any particular investment. US aggregate bond market represented by Barclays U.S. Aggregate Bond Index. Short-term bonds represented by Barclays U.S. 1–5 Year Government/Credit Bond Index. US total stock market represented by Dow Jones U.S. Total Stock Market Index. Change of color from yellow to green illustrates volatility moving from higher to lower.

Sources: Vanguard calculations, based on data from Morningstar, Inc.

**Figure A-2.** Overweighting fixed income allocations to short-term Treasury bond funds reduces portfolio volatility because of reduced interest rate *and* credit risk

Average annual volatility (January 1992–June 2013)

US equity/bond allocation (%)

	100/0	90/10	80/20	70/30	60/40	50/50	40/60	30/70	20/80	10/90	0/100	
Percentage of bonds allocated to short-term Treasury funds	0	15.13	13.63	12.15	10.68	9.24	7.84	6.50	5.28	4.28	3.68	3.68
	10	15.13	13.63	12.13	10.66	9.21	7.79	6.44	5.19	4.16	3.52	3.51
	20	15.13	13.62	12.12	10.64	9.17	7.75	6.37	5.11	4.04	3.37	3.34
	30	15.13	13.61	12.11	10.62	9.14	7.70	6.31	5.02	3.92	3.21	3.18
	40	15.13	13.61	12.10	10.60	9.11	7.66	6.25	4.94	3.81	3.07	3.03
	50	15.13	13.60	12.08	10.58	9.08	7.62	6.20	4.86	3.70	2.93	2.88
	60	15.13	13.60	12.07	10.56	9.05	7.58	6.14	4.78	3.59	2.79	2.74
	70	15.13	13.59	12.06	10.54	9.03	7.54	6.09	4.71	3.49	2.66	2.62
	80	15.13	13.58	12.05	10.52	9.00	7.50	6.04	4.64	3.40	2.54	2.50
	90	15.13	13.58	12.03	10.50	8.97	7.47	5.99	4.58	3.31	2.43	2.40
	100	15.13	13.57	12.02	10.48	8.95	7.43	5.95	4.52	3.23	2.33	2.32

Notes: This hypothetical illustration does not represent the return on any particular investment. US aggregate bond market represented by Barclays U.S. Aggregate Bond Index. Short-term Treasuries represented by Barclays U.S. 1–5 Year Treasury Index. US total stock market represented by Dow Jones U.S. Total Stock Market Index. Change of color from yellow to green illustrates volatility moving from higher to lower.

Sources: Vanguard calculations, based on data from Morningstar, Inc.

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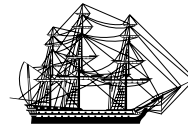
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