LIQUIDITY INSIGHTS

J.P. Morgan Global Liquidity

Rising Rates

Managing liquidity through periods of rising interest rates

J.P.Morgan
Asset Management

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EXECUTIVE SUMMARY

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Rising rate environments can challenge even the most sophisticated fixed income investor. As we consider the current market juncture and assess its potential impact on liquidity management, we make these key observations:

- Despite their recent rise, interest rates are currently near all-time lows, with the federal funds target rate at 0%-to-0.25% and the 10-year U.S. Treasury note yielding less than 3%. Rates will inevitably rise as the economic outlook improves and/or inflation expectations increase, leading first to the reduction and eventually to the end of expansionary monetary policy.
- When interest rates rise, the market value of previously issued fixed coupon bond holdings will fall as investor demand shifts to new, higher-yielding bonds. But not all securities are created equal. Bonds with shorter maturities, floating interest rates and/or higher yields should experience less dramatic price declines.
- During periods of rising interest rates and stable credit conditions, investors can improve the total return of their bond portfolios by shifting into shorter duration and higher-income-generating strategies.
- A study of past rising rate cycles and dynamic scenario analysis of potential future rate moves can provide a valuable perspective to an investor managing liquidity through a rising rate environment.

Introduction

The directionality of interest rates is a critical determinant of the performance of fixed income securities. As rates fall and rise in cycles, bond markets can turn from boom to bust, creating or destroying investment value in a sometimes unpredictable fashion. In periods of falling interest rates, previously issued fixed coupon securities will typically increase in market value. When rates are rising, those same securities will decrease in value.

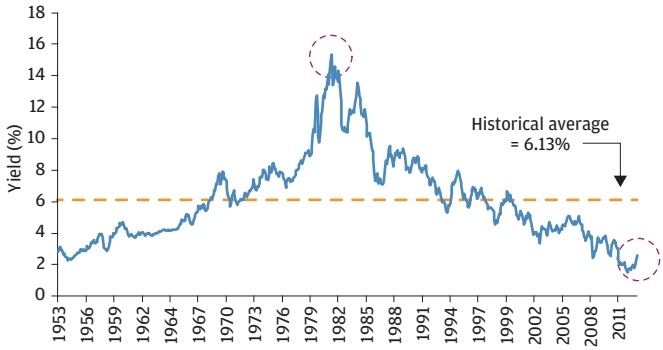
For more than 30 years, U.S. interest rates have been in a period of secular decline. Since September 1981, when yields on the 10-year U.S. Treasury (UST) reached nearly 15.9%, interest rates have trended downward, hitting an all-time low in July 2012, when the 10-year UST yielded just under 1.38%. While rates have recently risen, the move has been relatively muted, and yields remain well below historical averages (**Exhibit 1**).

These extreme low levels—which included negative real rates on the 10-year UST for most of the past two years—resulted from unprecedented monetary stimulus provided by the Federal Reserve (the Fed) and global central banks.

At some point this extraordinary stimulus will be retracted, inflationary pressures will rise, and expansionary monetary policy will end. This should lead to a rise in interest rates, with negative repercussions for existing holdings in most traditional fixed income investments. Fed rhetoric and recent market activity signal that a period of rising rates may be on the horizon.

Interest rates trended downward for more than 30 years and remain below historical averages

EXHIBIT 1: HISTORICAL 10-YEAR U.S. TREASURY YIELD



Source: The Federal Reserve; monthly data as of July 2013.

This paper examines the risks of rising rates. We explore how we arrived at the current market juncture and consider prior rising rate periods, using indexes as proxies to determine how various fixed income strategies performed. We demonstrate how to use dynamic scenario analysis to better understand the possible return implications of interest rate and credit spread movements. Finally, we outline strategies and solutions to best insulate a short-term fixed income portfolio in a rising rate environment.

Extraordinary response to an extraordinary crisis

The current era of low interest rates is best explained by the unprecedented actions that the Fed and other central banks took in response to the global financial crisis. The Fed initially employed traditional monetary policy tools, lowering the federal funds target rate from 5.25% in September 2007 to a 0%-to-0.25% range in December 2008 (where it has since remained). In November 2008, amid near-frozen credit markets, overnight rates close to zero and the U.S. economy mired in the worst recession since the 1930s, the Fed embarked on a program of quantitative easing (QE).

Quantitative easing sought to contain the financial crisis, limit its impact on the broader economy and aid the prolonged recovery by lowering longer-term interest rates to encourage investment and consumption. In three rounds of QE over more than four years, the central bank extended the size and average maturity of its balance sheet assets through the purchase of agency debentures, mortgage-backed securities (MBS) and Treasuries. As of July 2013, the Fed had more than $3 trillion on its balance sheet, compared with less than $1 trillion before the financial crisis. Meanwhile, the Fed's Treasury holdings maturing in less than one year shrank to less than 1% of its Treasury portfolio, down from approximately 50% pre-crisis.

In May 2013, Fed chairman Ben Bernanke indicated that the Fed could begin reducing its monthly asset purchases later this year if improvements in economic growth seem sustainable. In June, after the Fed noted that asset purchases may end altogether in mid-2014, investors aggressively sold off both risk assets and Treasuries.

Long-term bond mutual funds experienced more than $60 billion in net outflows during the month.[1] Prior to June 2013, the last month of net outflows was August 2011. Between the end of August 2011 and June 2013, investors poured in about $450 billion in net cumulative long-term bond mutual fund assets. As flows reversed, fixed income asset sales in June pushed yields of the 10-year UST to over 2.60%, from just 1.63% at the beginning of May. Credit spreads also widened over the month.[2] Yields have risen somewhat since June. As of mid-August, longer tenors had moved more sharply than shorter tenors, year-to-date (**Exhibit 2**, next page).

As the central bank has signaled, reductions in asset purchases will be the first step toward the normalization of monetary policy. (The Fed has repeatedly emphasized that this decision will be "data dependent.") Ending the QE program would be its inevitable second step. If economic conditions warrant, the Fed's further moves would include modifying

[1] Investment Company Institute website.

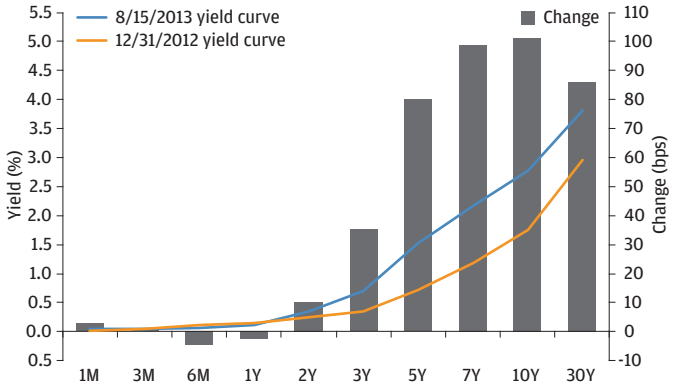
[2] Markit five-year CDX North America Investment Grade index spread widened eight bps (Source: Bloomberg) and the Barclays U.S. Aggregate option adjusted spread (OAS) widened five bps (Source: Barclays).

forward guidance on raising the fed funds target rate and, eventually, increasing that rate.

Fed communications suggest that the current target rate level will likely remain appropriate for a considerable period of time. However, as investors anticipate diminished monetary accommodation and eventual tightening by the Fed, demand for fixed income securities will fall, causing prices to drop and market interest rates to rise.

Longer tenors moved most sharply

EXHIBIT 2: U.S. TREASURY CURVE CHANGE IN 2013



Source: Bloomberg; data as of August 15, 2013.

Note: X axis is not to scale.

Dissecting the past three interest rate cycles

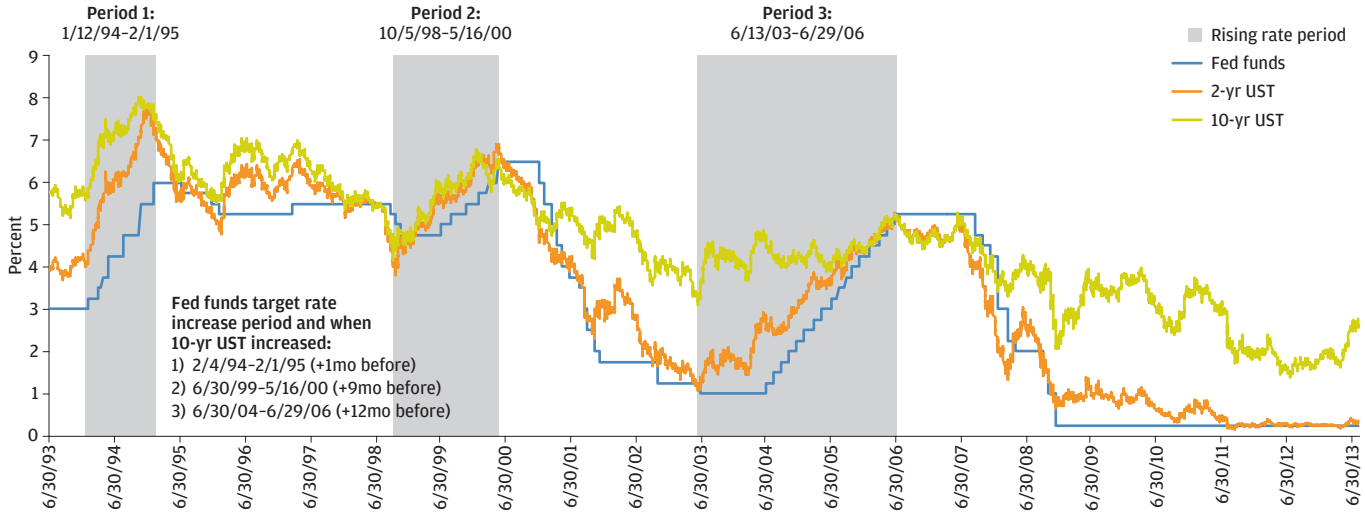
Investors anticipating diminished monetary stimulus would be well served to include as part of their strategic decision-making process a review of the three major periods of monetary tightening and rising interest rates that occurred over the last 20 years:

Period 1: January 1994 to February 1995
Period 2: October 1998 to May 2000
Period 3: June 2003 to June 2006

Each period saw increasing fed funds target rates as well as rising UST yields. In Periods 2 and 3 the markets were able to anticipate and price in the tightening of monetary policy before the fed funds target rate moved. This is evidenced in the rise of UST yields roughly nine and 12 months prior to monetary policy tightening in each respective period. But the 1994 tightening caught markets off guard. Both the fed funds target rate and UST yields began to move higher at roughly the same time (**Exhibit 3**).

Three episodes of Fed tightening, three different market moves

EXHIBIT 3: RISING RATE PERIODS OVER THE LAST 20 YEARS



Source: Bloomberg, J.P. Morgan Asset Management; data as of August 15, 2013.

The precise start and end points of a rising rate period are open to debate. We define the start of the period as the point at which 10-year UST yields begin to rise. The period ends when the Fed stops increasing the fed funds target rate.

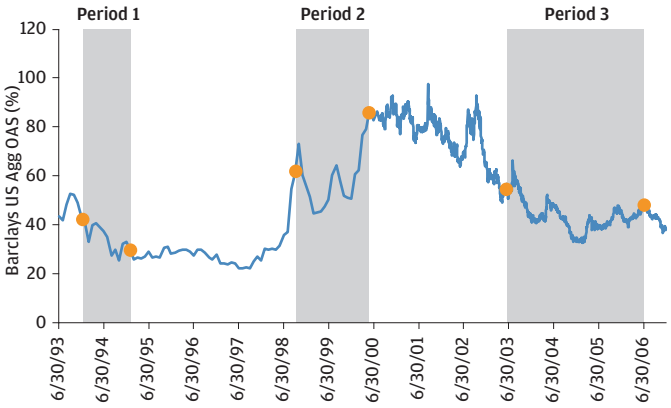
A rising rate period can be characterized by its starting conditions and the pace at which rates rise. During the 1994–95 period (Period 1), the Fed hiked the fed funds target rate seven times over 12 months, from 3% to 6%. The average increase per hike was over 40 bps. At the start of the period, the 10-year UST yield was 5.57% and rose by 209 bps to end at 7.66%. Credit spreads, meanwhile, started at approximately +40 bps and tightened over the period to +30 bps.[3]

During the second period, 1998-2000, the Fed hiked the fed funds target rate six times over 11 months, from a starting level of 4.75% to 6.50%. The average increase per hike was 30 bps. At the start of the period, the 10-year UST yield was 4.16%. It rose by 226 bps to end at 6.42%. Credit spreads started at +60 bps, experiencing intraperiod volatility before finally ending wider at approximately +80 bps.

During the most recent period, 2003-2006, the Fed raised the fed funds target rate at a more measured pace of 17 times over 24 months from a starting level of 1.00% to 5.25%, moving 25 bps each time. At the start of the period, the 10-year UST yield was 3.11% and rose by 208 bps to end at 5.19%. Credit spreads started at approximately +55 bps and remained relatively flat, ending slightly tighter at +50 bps (**Exhibit 4**).

Each rising rate period experienced a different shift in credit spreads

EXHIBIT 4: CREDIT SPREADS OVER THE LAST 20 YEARS



Source: Barclays, J.P. Morgan Asset Management; data as of August 12, 2013.

It has been seven-plus years since the end of the last rising rate period. The level of monetary stimulus implemented during that time has been unprecedented. For comparison, over the past 20 years the average length of time between the end of a rising rate period and the start of another was approximately four years. As of mid-August, the fed funds target rate was set at 0%-to-0.25%, the 10-year UST yield was 2.77%, and credit spreads were at +57 bps.

History provides no clear example of how such extraordinary monetary policy might be unwound. The Fed's position is complicated further by the prolonged sluggish economic recovery. However, the Fed has indicated that once it begins to increase the fed funds target rate from its current all-time low, the pace is likely to be gradual.[4]

[3] Measured by the option adjusted spread (OAS) on the Barclays U.S. Aggregate index.

[4] "Moreover, so long as the economy remains short of maximum employment, inflation remains near our longer-run objective, and inflation expectations remain well anchored, increases in the target for the federal funds rate, once they begin, are likely to be gradual." (Source: Chairman Ben S. Bernanke Semiannual Monetary Policy Report to the Congress, July 17, 2013.)

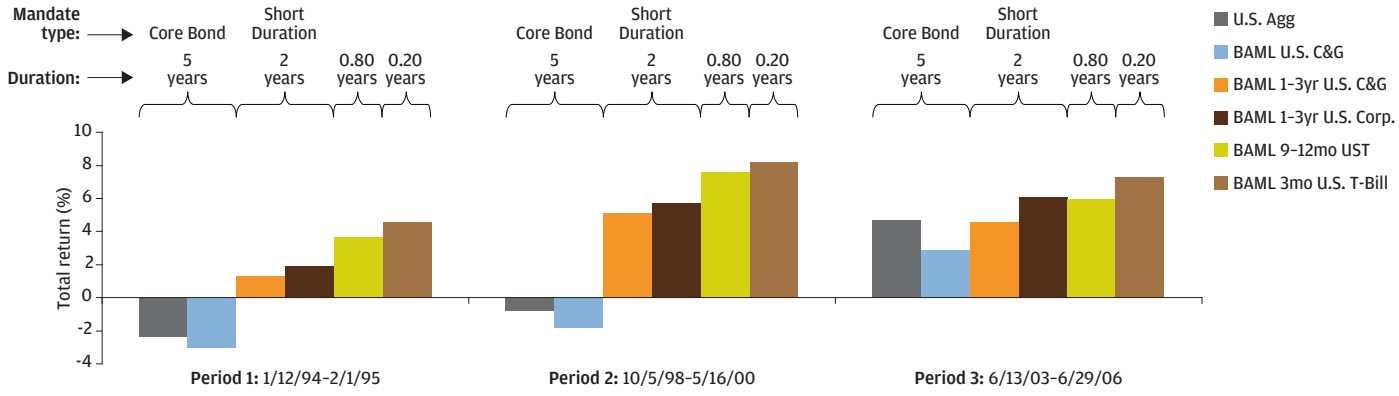
Past performance of different fixed income strategies

Shorter duration strategies outperformed

It is not possible to predict with certainty exactly when the next sustained rising rate period will start (if it hasn't already). Nor can one predict with certainty whether it will be short and quick like Period 1, longer and more evenly paced like Period 3 or somewhere in between. However, strategies with shorter durations have generally outperformed strategies with longer durations during periods of rising rates. As seen in **Exhibit 5**, the BofA Merrill Lynch (BAML) three-month U.S. Treasury Bill index (three-month U.S. T-Bill index), which has a duration of about 0.2 years, outperformed indexes reflective of core bond strategies, such as the Barclays U.S. Aggregate (U.S. Agg) and BAML U.S. Corporate & Government (C&G) Master indexes (each with durations of approximately five years). The BAML three-month U.S. T-Bill index also outperformed indexes reflective of short duration mandates, such as the BAML one- to three-year U.S. C&G index and the BAML one- to three-year U.S. Corporate-only index (each with a duration of approximately two years). The BAML three-month U.S. T-Bill index also outperformed longer government-only indexes, such as the BAML 9–12-month U.S. Treasury (9–12-month UST) index.

Strategies with shorter durations and/or more yield outperformed

EXHIBIT 5: TOTAL CUMULATIVE RETURNS OF SELECT INDEXES OVER RECENT RISING RATE PERIODS



Source: Bloomberg, Barclays, J.P. Morgan Asset Management; data as of August 1, 2013.

Higher-yielding strategies outperformed

Another trend can be observed: higher-yielding indexes fared better than lower-yielding indexes with comparable maturities. Thus the BAML one- to three-year U.S. Corporate-only index outperformed the lower-yielding BAML one- to three-year U.S. C&G index (which has about 80% in government-related securities) for each period. This is primarily due to the yield cushion provided by corporate credit spreads, which helps to offset price declines. It also reflects the fact that rising rates typically accompany periods of economic expansion, which tend to support risk assets, sometimes leading to credit spread tightening.

Pace and length of rate increases affect performance

During periods in which interest rates increased sharply and quickly, longer duration indexes underperformed more dramatically. Their higher yields could not quickly offset the steeper interest-rate-driven declines in market price. However, when rates rose over a longer period of time and in a more measured fashion, as they did in Period 3, negative price returns were offset by the greater interest income earned over a longer period of time, which reduced the magnitude of underperformance.

KEY RISKS TO CONSIDER IN A RISING RATE PERIOD

- Duration
- Spread duration
- Opportunity cost
- Extension risk

See primer in Appendix for details.

Performance volatility was lower for shorter strategies

While strategies may exhibit similar overall returns during certain rising rate periods, the volatility they experience can vary greatly. Period 3 provides a good example. Here, the U.S. Agg and BAML one- to three-year U.S. C&G indexes both generated positive total returns of similar magnitude, yet the BAML one- to three-year index had roughly one-third the volatility of the longer duration U.S. Agg. Meanwhile, the BAML three-month U.S. T-Bill index not only delivered higher returns but also lower volatility than all of the other indexes shown, in all three periods (**Exhibit 6**).

Shorter duration strategies experienced less volatility

EXHIBIT 6: RISING RATE PERIODS OVER THE PAST 20 YEARS

	U.S. Agg	BAML U.S. C&G	BAML 1-3yr U.S. C&G	BAML 1-3yr U.S. Corp.	BAML 9-12mo UST	BAML 3mo U.S. T-Bill
Duration	5 years	5 years	2 years	2 years	0.8 years	0.2 years
CUMULATIVE RETURN (%)						
Period 1: 1/12/94-2/1/95	-2.33	-3.04	1.32	1.89	3.63	**4.58**
Period 2: 10/5/98-5/16/00	-0.76	-1.84	5.07	5.68	7.53	**8.16**
Period 3: 6/13/03-6/29/06	**4.68**	2.84	**4.58**	6.07	5.93	**7.31**
ANNUALIZED RETURN (%)						
Period 1: 1/12/94-2/1/95	-2.21	-2.88	1.25	1.79	3.44	**4.34**
Period 2: 10/5/98-5/16/00	-0.47	-1.15	3.11	3.48	4.60	**4.98**
Period 3: 6/13/03-6/29/06	1.51	0.92	1.48	1.95	1.91	**2.34**
VOLATILITY OF RETURNS (ANNUALIZED, %)						
Period 1: 1/12/94-2/1/95	4.02	3.99	1.68	1.72	0.86	**0.31**
Period 2: 10/5/98-5/16/00	3.61	4.04	1.17	1.43	0.41	**0.21**
Period 3: 6/13/03-6/29/06	**3.64**	4.22	**1.27**	1.39	0.45	**0.35**
WORST 1-MONTH RETURN (%)						
Period 1: 1/12/94-2/1/95	-3.37	-3.05	-0.83	-0.85	-0.21	**0.16**
Period 2: 10/5/98-5/16/00	-2.85	-3.10	-0.61	-0.72	-0.05	**0.19**
Period 3: 6/13/03-6/29/06	-3.37	-4.02	-1.02	-1.02	-0.19	**0.04**

Source: Bloomberg, Barclays, J.P. Morgan Asset Management; data as of August 1, 2013.

Using sensitivity analysis to prepare for rising rates

As we have seen, in a rising rate period a portfolio invested in longer tenor fixed coupon bonds will likely suffer lower total returns than one invested in shorter tenor fixed coupon bonds. Beyond that basic principle, it is worth remembering that there are two components of total return—price and income—which we can analyze using sensitivity analysis.

In this paper, a sensitivity analysis begins by looking at the U.S. Treasury yield curve as of June 30, 2013, using tenors in six-month increments out to three years. We then "shock," or change, the yield at each point along the curve, resulting in a hypothetical yield curve for six months into the future (December 30, 2013). Using this hypothetical shift in the curve, we estimate the approximate six-month total return for the period commencing June 30. We then separate that approximate total return into its income and price components. We analyze four different scenarios here for illustrative purposes.

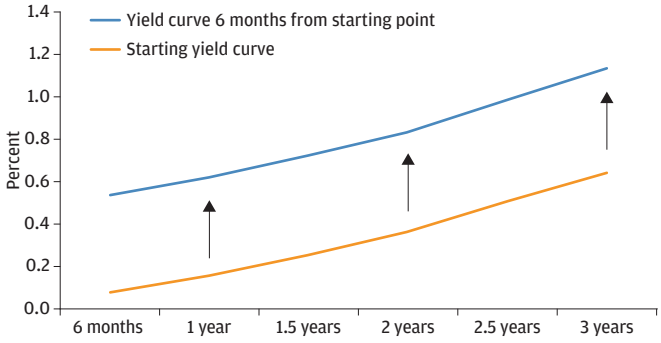
Scenario 1: Illustrative parallel shift of the UST yield curve

Consider a hypothetical six-month period, starting at June 30, 2013, in which interest rates increase in precisely parallel fashion, rising at each point along the Treasury curve by an assumed +50 bps. As the example illustrates, an investor who bought a three-year Treasury note at an annualized yield of 0.65% at the beginning of the period would receive an income return of approximately 0.33% (~65 bps x 6/12 months). The investor's price return would be roughly -0.89%, due to the

SCENARIO 1: PARALLEL SHIFT OF THE UST YIELD CURVE

	Starting rates	Rates in six months	
	06/30/2013 (%)	Shift (bps)	Resulting curve (%)
6 months	0.07	0.50	0.57
1 year	0.15	0.50	0.65
1.5 years	0.25	0.50	0.75
2 years	0.36	0.50	0.86
2.5 years	0.51	0.50	1.01
3 years	0.65	0.50	1.15

SCENARIO 1: YIELD CURVE SHIFT



SCENARIO 1: 6-MONTH RETURN

	Price return (%)	Income return (%)	Total return (%)
6 months	0.00	0.04	0.04
1 year	-0.21	0.08	-0.13
1.5 years	-0.40	0.13	-0.27
2 years	-0.58	0.18	-0.40
2.5 years	-0.69	0.26	-0.44
3 years	-0.89	0.33	-0.56

Source: J.P. Morgan Asset Management. Diagram is shown for illustrative purposes only.

move higher in rates. Combining the two, the total return would be about -0.56% for the six-month period.

Under the same scenario, an investor who purchased a one-year Treasury would see a total return for the period of -0.13%, given the bond's shorter time to maturity and lower duration.

Scenario 2: Illustrative steepening of the UST yield curve

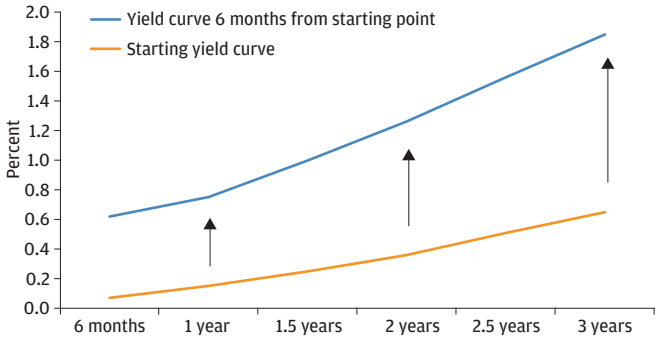
Our first scenario assumed a parallel shift up in rates, but yield curves rarely move in a parallel fashion. We would expect the curve to steepen as the market begins to price in a reduction in the pace of bond purchases by the Fed, causing the intermediate and longer part of the yield curve to rise faster than the very front end. In fact, we saw this kind of nonparallel move in the first half of 2013, when the two-year/10-year curve steepened from +151 bps to +213 bps. When this occurs, negative returns on bonds with longer durations are magnified.

The second scenario for the same hypothetical six-month period depicts such a situation, in which the shift in rates is more pronounced for longer maturity bonds than for shorter ones, with the change in the one-year and three-year security now +60 bps and +120 bps, respectively. As expected, the negative impact on total return is greater for longer securities.

SCENARIO 2: STEEPENING OF THE UST YIELD CURVE

	Starting rates	Rates in six months	
	06/30/2013 (%)	Shift (bps)	Resulting curve (%)
6 months	0.07	0.55	0.62
1 year	0.15	0.60	0.75
1.5 years	0.25	0.75	1.00
2 years	0.36	0.90	1.26
2.5 years	0.51	1.05	1.56
3 years	0.65	1.20	1.85

SCENARIO 2: YIELD CURVE SHIFT



SCENARIO 2: 6-MONTH RETURN

	Price return (%)	Income return (%)	Total return (%)
6 months	0.00	0.04	0.04
1 year	-0.23	0.08	-0.16
1.5 years	-0.50	0.13	-0.37
2 years	-0.95	0.18	-0.77
2.5 years	-1.48	0.26	-1.22
3 years	-2.22	0.33	-1.90

Source: J.P. Morgan Asset Management. Diagram is shown for illustrative purposes only.

Scenarios 3 and 4: Enhancing income via credit spread

Scenarios 3 and 4 start with the same hypothetical interest rate shifts used in Scenario 2. They reaffirm a basic bond market principle: buying fixed coupon bonds with higher yields provides increased return potential (along with increased credit risk), which can help offset interest-rate-driven negative changes in price. Scenario 3 builds on Scenario 2's beginning and ending interest rate levels. We overlay credit spreads on top of those interest rate levels to portray the starting yields on riskier bonds. For the purposes of this illustration, we assume that credit spreads for each point on the yield curve remain constant over the period. The projected approximate returns illustrate the potential benefits of increasing income in a rising rate period, as seen by the three-year security's return, which went from -190 bps in Scenario 2 to -129 bps in Scenario 3, and the return of the one-year security, which went from -16 bps to +4 bps.

In Scenario 3, credit spreads were unchanged over the six-month period. However, as we noted earlier, spreads can widen if investor demand for these riskier securities declines. If this happens when rates are rising, it can cause credit product to underperform Treasuries. Building on Scenario 3, Scenario 4 illustrates the potential impact of a +30 bps spread widening at each point on the yield curve during the six-month period. Note the projected total returns for the period are generally worse than those in Scenario 3.

SCENARIO 3: ENHANCING INCOME VIA CREDIT SPREAD

	Starting yields		Yields in six months	
	Starting spread (%)	Starting yield (%)	Spread shock (%)	Resulting yield (%)
6 months	0.20	0.27	0.00	0.82
1 year	0.30	0.45	0.00	1.05
1.5 years	0.40	0.65	0.00	1.40
2 years	0.50	0.86	0.00	1.76
2.5 years	0.60	1.11	0.00	2.16
3 years	0.70	1.35	0.00	2.55

SCENARIO 4: ENHANCING INCOME VIA CREDIT SPREAD

	Starting yields		Yields in six months	
	Starting spread (%)	Starting yield (%)	Spread shock (%)	Resulting yield (%)
6 months	0.20	0.27	0.30	1.12
1 year	0.30	0.45	0.30	1.35
1.5 years	0.40	0.65	0.30	1.70
2 years	0.50	0.86	0.30	2.06
2.5 years	0.60	1.11	0.30	2.46
3 years	0.70	1.35	0.30	2.85

SCENARIO 3: 6-MONTH RETURN

	Price return (%)	Income return (%)	Total return (%)
6 months	0.00	0.14	0.14
1 year	-0.18	0.23	0.04
1.5 years	-0.40	0.33	-0.07
2 years	-0.80	0.43	-0.37
2.5 years	-1.27	0.56	-0.72
3 years	-1.96	0.68	-1.29

Source: J.P. Morgan Asset Management. Diagram is shown for illustrative purposes only.

SCENARIO 4: 6-MONTH RETURN

	Price return (%)	Income return (%)	Total return (%)
6 months	0.00	0.14	0.14
1 year	-0.33	0.23	-0.11
1.5 years	-0.69	0.33	-0.37
2 years	-1.24	0.43	-0.81
2.5 years	-1.85	0.56	-1.30
3 years	-2.68	0.68	-2.00

Source: J.P. Morgan Asset Management. Diagram is shown for illustrative purposes only.

Strategies for insulating a fixed income portfolio

How can an investor protect a portfolio of bonds in a period of rising rates? Though some investors may choose to simply exit the asset class, as seen in June, there are strong arguments for maintaining a core allocation to fixed income. In most interest rate environments, fixed income provides diversification, a steady stream of income and a lower volatility investment over time. Additionally, fixed income portfolios with longer durations have provided higher returns, albeit with greater volatility, over longer time horizons.

However, for investors with shorter investment horizons (especially those with potential near-term cash needs) or those seeking to protect profits realized from longer duration strategies, mitigating potential volatility during the anticipated rising rate environment is a key priority. To that end, investors should consider how they can best employ two effective strategies for managing a rising rate environment: shortening duration and increasing income.

Shortening a portfolio's weighted average duration

The most effective way to protect a portfolio from the impact of rising rates is to reduce its weighted average duration. In traditional fixed income portfolios, this is typically achieved using one or more of the following methods:

- Sales of longer-dated fixed coupon securities and/or reinvestment of interest income and cash from matured securities into those with shorter tenors.
- Purchases of floating rate notes, whose coupons reset on a regular basis. As a floater's coupon resets to adjust for market changes, leading to lower duration, its price should typically experience less volatility.[5]
- Investments in higher coupon or higher-yielding securities, which have shorter interest rate durations relative to lower-yielding bonds with the same maturity.

Increasing the interest income component of total return

Increased income or yield not only lowers duration but also provides greater income return, helping to offset declines in price during periods of rising rates. However, higher yields due to increased credit exposure come with added risk. If credit spreads widen in conjunction with rising rates, these

[5] Most floating rate notes reset interest rates on a monthly or quarterly basis. Thus durations on these securities are typically shorter than three months. However, it is important to note that while the owners of such bonds have limited exposure to changes in interest rates, they are exposed to the creditworthiness of the borrower until the final maturity of the bond. This means that floating rate bonds not issued by the U.S. Treasury can have longer spread durations than interest rate durations. This can result in greater volatility should credit conditions change.

securities could underperform, as seen in Scenario 4 of our sensitivity analysis. In addition to interest rate duration, fixed income investors must also be cognizant of spread duration. Bonds with longer spread durations will typically be more negatively impacted by widening credit spreads than bonds with shorter spread durations.

As seen in prior periods of rising rates, credit spreads may tighten, widen or even remain flat. When rates start to rise, it is important for investors to understand not only where credit spreads are but also where starting yields are relative to historical levels. The extremely low levels on risk-free rates over the last few years have forced investors to seek yield in riskier securities, resulting in tighter credit spreads and low absolute yields. As of mid-August, the credit spread of the Barclays U.S. Agg was relatively tight at +57 bps, down from extreme highs in 2008 of about +260 bps and below its 10-year average of +70 bps. It is possible that as investors sell fixed income securities in anticipation of higher rates, sales will not be limited to risk-free Treasuries alone and credit product may see spreads widen.

SHORT DURATION INVESTMENT STRATEGIES

When considering the key elements of investing in a rising rate environment—duration, income, credit spread exposure—investors can choose among a variety of traditional short-term fixed income products:

1. **A series of overnight deposits:** These will have negligible duration. Generally, they closely track movements in short-term rates and will likely perform best if rates rise sharply over a short period of time. Direct investments with a small number of banks will reduce diversification benefits and should be done in conjunction with in-depth credit analysis. Returns over longer periods may be lower than those on more diversified investment options.

2. **Term deposits:** Durations range from 0 to one year. Term deposits are not marked-to-market, which means there are no unrealized losses. The instruments are not liquid, as there is no secondary market and the buyer typically agrees to withdraw principal only at the end of the stated term. Additionally, when rates are rising, the income received at maturity will generally be lower than that from a series of shorter deposits, as the investor is locked into the lower rate for longer.

3. **Money market portfolios:** These typically have weighted average maturities of less than 60 days. Fund yields will rise in line with prevailing interest rates on a lagged basis depending on the fund's weighted average maturity. These investments seek to eliminate principal losses through their stable net asset value (NAV), which is achieved in the U.S. through amortized cost accounting as established under rule 2a-7 of the Investment Company Act of 1940. (The SEC has proposed changes to the rules governing money market funds that could alter the use of the stable NAV and amortized cost accounting by certain money market funds.)

4. **Managed reserves:** This is J.P. Morgan's definition of the segment between money market and short duration bond funds. Funds in this category seek to generate higher total returns than money market funds while focusing on principal preservation and segmented liquidity needs. They typically have durations between 0.25 and one year, have short-term benchmarks such as the BAML three-month U.S. T-bill index and exhibit lower performance volatility than short-term bond funds. Due to their slightly longer durations (relative to money market funds) and mark-to-market accounting, unrealized losses can occur when rates rise, causing negative returns. However, because of the structure of these portfolios and their short duration, negative returns should be relatively short-lived. Historically, these funds have outperformed money market funds over longer time horizons.

5. **Short-term bond funds:** These funds usually have durations between one and three years and will generally have higher yields than managed reserves funds. They are typically benchmarked against indexes such as the BAML one- to three-year and/or one- to five-year U.S. C&G. Due to their longer durations, unrealized losses are likely when rates rise. Short-term bond funds have traditionally outperformed managed reserves funds over longer time periods, albeit with greater volatility.

6. **Custom strategies:** These strategies are designed to meet the specific objectives and risk tolerances of a given investor and can be implemented for any of the product types, or combinations of product types, described above.

Active management: Money market portfolios, managed reserves and short duration funds are typically actively managed strategies. Active management allows investment professionals to best navigate the uncertainty and volatility caused by the specter of rising rates. They can take advantage of market opportunities by managing duration, sector rotation and security selection.

Conclusion: Historical knowledge, dynamic insight

More than seven years have passed since the end of the last period of rising rates. Unprecedented actions by the Fed have left interest rates well below historical averages. As key economic metrics improve, indications are that the Fed will first reduce expansionary monetary policy and at some point end it.

Inevitably, interest rates will rise. While past precedents can provide some clues as to the possible paths a rise in rates will take, it is impossible to predict with certainty what the unwinding of such extraordinary monetary stimulus may look like. The only certainty is that when rates do rise, market values of portfolios of existing fixed coupon bonds will be negatively affected.

To prepare, investors are well advised to develop a thorough understanding of past market behavior. Their strategic decision-making process should also be guided by a robust scenario analysis of the future possible directions of interest rates, credit spreads and the shape of the yield curve. Finally, it is essential that the evaluation of various investment strategies be informed by the investor's short-term cash needs and risk tolerance.

As this paper has demonstrated, using historical analysis and illustrative sensitivity scenarios, investors who seek liquid portfolios with limited exposure to the negative impacts of rising rates should find an effective solution in shorter duration, higher income strategies.

Appendix: A bond market primer

Bond returns

There are two primary components of a bond's total return for a given period: interest income and change in price. Interest income return is driven by the coupon the bond pays or accrues over the period, while price return is based on the change in market price. A bond's market price fluctuates due to changes in the yield demanded by investors as well as any accretion (or amortization) of bonds that trade at a discount (or premium), which is due to the "pull to par" effect. Both of these factors will be discussed in more detail in the following sections.

TOTAL RETURN = PRICE RETURN + INCOME RETURN

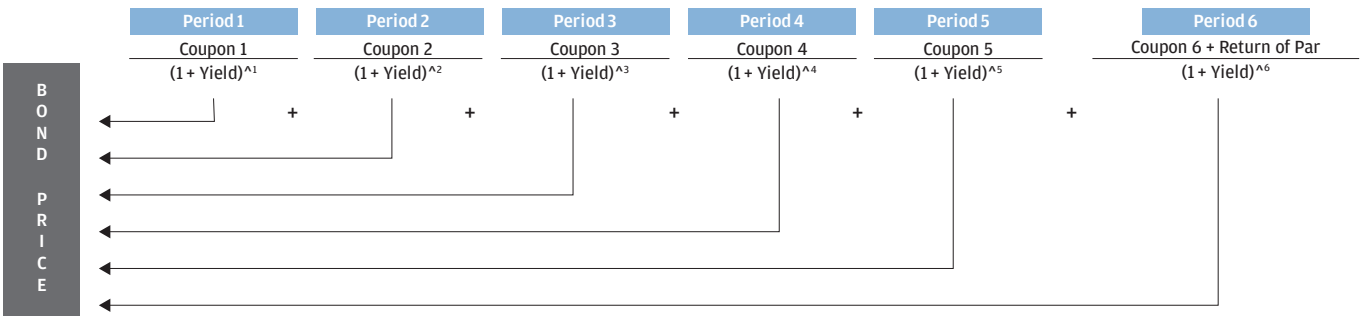
Bond valuation

A bond's price is equal to the present value of its future cash flows discounted at a given interest rate or set of rates. As the required yields demanded by investors increase (or decrease), the discount factor(s) applied to those cash flows increase (or decrease) and the present value, or price, of the bond falls (or rises). This explains the inverse relationship between interest rate movements and the change in prices on existing fixed coupon bonds.

While this full valuation approach should result in the most accurate estimation of the change in a bond's price when rates move, it can be time and resource consuming. A simpler estimation of the change in value of a fixed coupon bond given a small change in interest rates can be made using the bond's duration, as explained in **Exhibit A1**.

A bond's price is the sum of the present value of its future cash flows

EXHIBIT A1: ILLUSTRATIVE CASH FLOWS



Source: J.P. Morgan Asset Management. Diagram is shown for illustrative purposes only.
Note: Yield must match the length of the period that it is discounting; e.g., if coupon payments are semiannual, then semiannual yield is used as the discount factor. Additionally, yields do not need to be constant for every period and may vary from period to period.

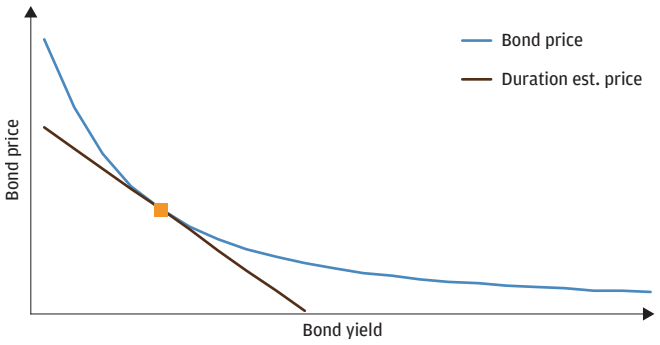
Duration

Generally speaking, the duration of a bond is an estimate of the sensitivity of its price to a change in interest rates, also referred to as interest rate duration. The larger (i.e., longer) the duration, which is stated in years, the more sensitive a bond's price is. For example, if a fixed coupon bond's duration is two years and interest rates increase by 50 bps (0.50%), the duration would estimate an approximate 1% drop in its price (2 x 0.005). Assuming it was initially priced at par ($100), then the new price would be approximately $99. For a bond with a five-year duration, the expected price decrease would be approximately -2.5%, to $97.50. The duration of a portfolio of bonds is the market-weighted average of the duration of all the holdings in that portfolio.

One of the drawbacks to using duration is that it is a linear estimate, when in actuality a bond's price moves in a convex fashion as yields change (**Exhibit A2**). One way to improve the accuracy of the estimate is to use a convexity adjustment.[6] However, to simplify our discussion, throughout this paper duration is used when discussing estimated price impacts.

Duration best estimates the change in a bond's price for a small change in yield

EXHIBIT A2: BOND PRICE VS. YIELD



Source: J.P. Morgan Asset Management. Chart is for illustrative purposes only.

Spread duration

Spread duration is a similar concept to that of interest rate duration. Bonds whose issuers are not considered risk-free will typically have higher yields than the risk-free rate.[7] The difference in yields represents the credit spread and compensates the bond buyer for assuming increased credit risk (which is the risk of not receiving the scheduled interest and principal payments). Spread duration estimates the price sensitivity of a bond to a change in the spread incorporated into that bond's yield. If spreads widen to reflect the market's requirement for more compensation for greater credit risk, then the bond's yield could increase and cause its price to decline. If market perception of credit risk declines, then credit spreads tighten and prices increase, assuming underlying risk-free rates remain unchanged.

It is important to note that interest rates and credit spreads can move independently or in conjunction with each other. The movement of either can have a significant impact on the price return of a bond with credit risk.

Putting it all together: Implications for fixed income investments

When yields rise due to changes in interest rates and/or credit spreads, there will be a temporary drop in an existing bond's price. This will cause a drop in the mark-to-market net asset value of a portfolio of bonds. We note that the change in the price of the bond is usually temporary because of the "pull to par" effect, where the price of a bond in good standing (i.e., not at risk of default) will eventually return to par (i.e., the face value that the investor will receive from the bond issuer at maturity).[8]

[6] Duration will estimate the change in price most accurately for a small change in yields, as seen by the closeness of fit of the straight line immediately to the left and right of the starting point (small square). As rates move further from the starting point, the duration estimate of price is less accurate (i.e., the straight line moves farther away from the sloped curve). A convexity adjustment improves the estimate, reducing the distance between the straight line and sloped curve.

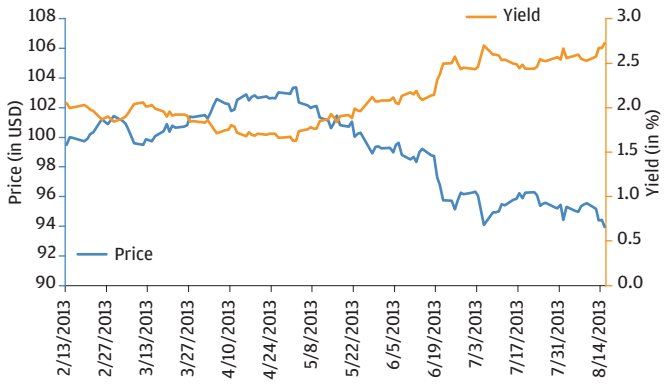
[7] Risk-free rates are the yields of U.S. Treasury securities with comparable maturities. They are generally considered risk-free, as they are issued and backed by the full faith and credit of the U.S. government. All other bonds are considered to have a certain degree of credit risk relative to U.S. Treasuries.

[8] If the bond is trading at a premium (above par), then it will amortize down to par over time; if it is trading at a discount (below par), it will accrete up to par.

For example, consider the U.S. Treasury note with a 2% coupon maturing on February 15, 2023. It was auctioned as a new 10-year Treasury on February 13, 2013. If purchased at a par dollar price ($100), the security should yield 2% if held to maturity. However, rates have since risen, causing this bond's yield to increase to approximately 2.73% on August 15, or its price to fall to $93.95. As expected, rates rose and the price fell (**Exhibit A3**).

Interest rates and bond prices move in an inverse fashion

EXHIBIT A3: U.S. TREASURY NOTE: YIELD VS. PRICE*



Source: Bloomberg; data as of August 15, 2013.

*T 2.0% 2/15/2023 (CUSIP: 912828UN8)

Assuming the U.S. government will pay back its debts, the bond will pay back the $100 par value at maturity. This change in price from its current discount to the eventual value of par at maturity is known as the "pull to par" effect. Note that this will take considerable time if rates stay at or above 2.73% given the 10-year tenor of the security. If the yield required by the market for buying this U.S. Treasury does not retrace to 2%, the owner who bought at par will be carrying the bond at an unrealized loss until maturity. If the investor needs to raise cash and chooses to sell this security, then that loss will become realized.

Opportunity cost

Earlier, we discussed the mathematical reasons for the fall in bond prices when rates rise, but we must also consider the opportunity cost to the investors who bought this issue at par. They are now receiving an annual interest rate of 2% on the face value (or par value) of the principal invested. While they did accrue six months of income, they have lost in opportunity relative to an investor who waited to purchase 10-year Treasuries at the higher interest rate (or yield) of 2.73% on August 15. Both investments should pay back par at maturity, and as such both bonds should be priced close to par as maturity approaches. But by paying a lower price, the investor who bought at 2.73% will earn a higher yield over the tenure of the investment.

Extension risk

It is important to note that some types of securities, such as mortgage-backed securities or callable bonds, allow the borrower the option to pay down principal earlier than originally scheduled. During periods when interest rates fall, borrowers eager to refinance or issue debt at the new lower rates will typically pay back their principal at a faster pace. Consider the example of homeowners who refinance their mortgages when rates fall. As this prepayment takes place, MBS pass-through securities that include a number of refinanced mortgages will generally see a return of principal sooner than originally anticipated.

When rates rise, the opposite usually occurs as principal payments slow and durations of these instruments extend. This is known as extension risk. In these instances, the duration of a portfolio that owns these securities will also increase (or lengthen), exposing it to greater interest rate sensitivity going forward. The longer duration will also increase the opportunity cost to the portfolio by delaying the return of principal, resulting in a reduced ability to take advantage of higher rates. Duration extension can be hedged via sales of these or other securities in the portfolio. Such sales of cash securities (non-derivatives) often result in realizing losses or making permanent those temporary decreases in bond prices due to the higher rate environment into which they are sold.[9]

[9] Portfolios that allow the use of derivatives can typically "short," or hedge, duration extensions via sales of securities they do not own. Such an instance will avoid realizing losses on the initial sale. However, mark-to-market risk will remain.

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INST-PDD-WP-P1 / Sept. 2013

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