BOND INVESTING BASICS: WHY BOND PRICES GO UP AND DOWN

By Annette Thau

Since the late 1970s, changes in the interest rate environment have become the greatest single determinant of bond returns, and managing interest rate risk has become the most critical variable in the management of bond portfolios.

Bond prices go up and down in response to two factors: changes in interest rates and changes in credit quality. Individual investors who purchase bonds tend to worry a lot about the safety of their money. Generally, however, they tie safety to credit considerations. Many individual investors do not fully understand how changes in interest rates affect price. Since the late 1970s, changes in the interest rate environment have become the greatest single determinant of bond return. Managing interest rate risk has become the most critical variable in the management of bond portfolios. In this article, we'll see why.

INTEREST RATE RISK

"Interest rate risk," also known as "market risk," refers to the propensity bonds have of fluctuating in price as a result of changes in interest rates.

All bonds are subject to interest rate risk.

If nothing else makes an impression, but you learn that all bonds are subject to interest rate risk, regardless of the issuer or the credit rating or whether the bond is "insured" or "guaranteed," then this article will have served a useful purpose.

The principle behind this fact is easy to explain.

Let us suppose you bought a 30-year bond when 30-year Treasuries were yielding 4%. Further suppose that you now wish to sell your bond and that interest rates for the same maturity are currently 10%. How can you convince someone to purchase your bond, with a coupon of 4%, when he can buy new issues with a 10% coupon?

Well, there is only one thing you can do: You mark down your bond. In fact, the price at which a buyer would buy your bond as readily as a new issue is that price at which your bond would now yield 10%. That would be approximately 30 cents on the dollar, or about $300 per bond.

But, you will object, if I sell my $1,000 bond for $300, I have lost $700 per bond!

That is precisely the point.

Significant changes in the interest rate environment are not hypothetical. During the past decade, swings of 1% (100 basis points) have occurred on several occasions over periods of a few weeks or a few months. During the late 1970s and 1980s, rates moved up and down, in sharp spikes or drops, as much as 5% (500 basis points) within a few years. Between September of 1998 and January of 2000, interest rates on the Treasury's long bond moved

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from a low of 4.78% to a high of 6.75%, almost 200 basis points. If you held bonds during that period, you will remember it as a period when returns from all types of bonds were dismal.

The basic principle is that interest rates and prices move in an inverse relationship. When interest rates went from 4.78% to 6.75%, that represented an increase in yield of over 40%. The price of the bond declined by a corresponding amount. On the other hand, when interest rates decline, then the price of the bond goes up.

MANAGING RISK

What can you do to protect your money against interest rate fluctuations?

The best protection is to buy bonds with maturities that are either short (under one year) or short-intermediate (between two and seven years).

While all bonds are subject to interest rate risk, that risk is correlated to maturity length. As maturity length increases, so do potential price fluctuations. Conversely, the shorter the maturity of the bond you buy, the lower the risk of price fluctuations as a result of changes in interest rate levels.

To illustrate, let's look at Table 1. This table shows what would happen to the price of a bond selling at par ($1,000), with a 7% coupon, for several different maturities, under three different scenarios:

- Interest rates rise modestly by 50 basis points, to 7.5%;
- Interest rates rise by 100 basis points, to 8%;
- Interest rates rise steeply, by 200 basis points, to 9%.

TABLE 1. INTEREST RATE RISK: BOND PRICE CHANGES IF INTEREST RATES RISE

($1,000 par value bond with a 7% coupon)

	Change in Bond Price If Interest Rates Rise To:		
Maturity	7.5%	8.0%	9.0%
2 Years	–0.9%	–1.1%	–3.6%
5 Years	–2.1%	–3.5%	–4.7%
10 Years	–3.5%	–6.8%	–13.0%
30 Years	–5.9%	–11.3%	–20.6%

Source: Merrill Lynch (material supplied to author).

TABLE 2. INTEREST RATE RISK: BOND PRICE CHANGES IF INTEREST RATES FALL

($1,000 par value bond with a 7% coupon)

	Change in Bond Price If Interest Rates Fall To:		
Maturity	6.5%	6.0%	5.0%
2 Years	+0.9%	+1.9%	+3.8%
5 Years	+2.1%	+4.3%	+8.7%
10 Years	+3.6%	+7.4%	+15.6%
30 Years	+6.6%	+13.8%	+30.9%

Source: Merrill Lynch (material supplied to author).

Table 1 shows that if interest rates rise modestly, by 50 basis points, the price of the two-year bond changes very little. But even that modest rise results in a decline of 3.5% ($35) for the 10-year bond and 5.9% ($59) for the 30-year bond. For the 30-year bond, the decline of 5.9% wipes out almost the total amount of interest income for the entire year. If a much sharper rise in interest rates occurs, from 7% to 9%, declines become correspondingly larger. Clearly, if interest rates go up, the holder of bonds with shorter maturities would be less unhappy than the holder of bonds with long maturities.

This phenomenon, happily, operates in reverse. As interest rates decline, bond prices rise. This is illustrated in Table 2, which shows changes in price for various maturities under three declining interest rate scenarios. Once again, the change in price is much smaller for the two-year maturity, but it rises gradually through the maturity spectrum. In this instance, the holder of a bond would benefit from holding the longest maturities because the longer the maturity, the higher the gain. That is the reason that investors anticipating a decline in interest rates position themselves at the long end of the maturity spectrum, in order to realize the largest capital gains.

Several qualifications need to be made concerning both of these tables. First, the exact price changes illustrated are assumed to have occurred as a result of instantaneous changes in yield. In practice, such changes may take weeks, months, or even years. Changes occurring over longer time periods would result in somewhat different numbers because, as noted earlier, the price of a bond moves toward par as it gets closer to maturity, and those price changes occur regardless of what happens to interest rates.

Secondly, the exact price changes illustrated apply only to bonds selling at par, with a 7% coupon. The numbers would be different for bonds with coupons that are either higher or lower. Price changes would be somewhat *larger*, in both directions, if the coupons were *lower* than 7%, and the price changes would be *lower* if the coupons were somewhat *higher* than 7%.

Thirdly, if you look at the price changes that occur in both directions, you will note that these changes are not linear. If interest rates rise, the price of a bond declines as maturity length increases, but those increases occur at a declining rate. That decline in the rate of increase begins to be noticeable approximately after the 10-year mark. Similarly, if interest rates decline, the price of bonds increases

as maturity length increases, but again, at a declining rate that begins to be noticeable at the approximate 10-year mark. Nonetheless, it remains the case that price changes are greatest at the highest maturity length.

Finally, note that the price changes that occur if interest rates move up or down are somewhat larger if interest rates decline than if they go up. For example, for the 30-year bond, if interest rates go up by 100 basis points, the price of the bond declines by 11.3%. But if interest rates decline by 100 basis points, the price of the same bond goes up by 13.8%. Similarly, if interest rates go up by 200 basis points, the price of the 30-year bond declines by 20.6%. But if interest rates decline, the price of the same bond goes up by 30.9%. That distinction is obviously a desirable characteristic: Your bond appreciates more in value if interest rates decline than it loses if interest rates rise. This characteristic has a somewhat formidable name: It is known as *convexity*.

In summary, while the numbers vary somewhat for different bonds, both Table 1 and Table 2 illustrate two basic principles. First, the prices of bonds and interest rates move in opposite directions. If interest rates decline, the price of a bond goes up, and if interest rates rise, the price of a bond declines. Second, bonds with longer maturities incur significantly higher interest rate risk than those with shorter maturities. That is a disadvantage if interest rates rise, but an advantage if interest rates decline.

So now we have the two faces of interest rate fluctuations: risk and opportunity. It may sound paradoxical, but a rising or strong bond market is one in which interest rates are declining because that causes bond prices to rise. You can sell a bond for more than you paid for it and make a profit. A weak bond market is one in which interest rates are rising and, as a result, prices are falling. If you have to sell your bonds, you have to do so at a loss. In either case, the changes in price are correlated to maturity length.

Here are some questions and answers that will help illustrate several other important aspects of managing interest rate risk:

If long-term bonds are so risky, why would anyone purchase them?

One reason is that many investors believe that long-term bonds provide the highest yields (or maximum income). That, however, is not necessarily true. If all other factors are equal, long-term bonds have higher coupons than shorter-term bonds of the same credit quality. But intermediate bonds in the A to AA range often yield as much as AAA bonds with far longer maturities, and they are much less volatile. (Note that this relationship is considered normal. But there are times when interest rates on short maturities are higher than interest rates on longer maturities.)

You might, of course, want to purchase long-term bonds for other reasons. One would be to "lock in" an attractive interest rate for as long as possible, if you think you are not going to sell the bonds before they mature. Also, if you think interest rates are about to decline, buying bonds at the long end positions you for maximum capital gains. That would imply that you consider potential capital gains as important (or more so) than interest yield, and in all likelihood that you intend to resell the bonds before they mature.

How do interest rate fluctuations affect the price of a bond if I hold it to maturity?

If you hold bonds to maturity, you recover your principal in full (assuming there has not been a default). No matter what kind of roller coaster ride interest rates take during the life of a bond, its value will always be par when the bond is redeemed. Bonds purchased either above par (premium bonds) or below par (discount bonds) are also redeemed at par. The price of discounts gradually rises to par; the price of premiums falls to par. These changes occur very gradually, in minute annual increments and are reflected in the current price of any bond.

I own bonds issued years ago, when coupon rates were 4%. Rates are now much higher. Can't I sell my old bonds and buy new ones with higher coupons in order to earn more income?

The swap by itself will not result in higher yields: If you buy a bond that is comparable in maturity length and credit quality, the transaction will be a wash, because you would have to sell at that price at which the buyer of your old bonds would be indifferent to buying your bond or one carrying a higher coupon, meaning at the exact price which would result in the prevailing yield. Therefore, your income from the bonds would not change.

For example, let us assume you own 10 bonds with a par value of $10,000 and a coupon rate of 4%. That means that annually you receive interest (coupon) income of $400. Assume further that over a period of several years, interest rates have risen to 8%. You sell your bonds for approximately $500 per bond, for a total of $5,000, which you now reinvest. You now own $5,000 (par value) bonds, and you will now receive annual interest of 8%; that is, $400. Therefore, even though you are now earning a coupon rate of 8%, you will be earning the same dollar amount as before the swap. Moreover, you would be out the transaction costs (commissions) incurred in selling the old bonds and buying the new bonds.

This does not mean that you should never consider swaps. There are other valid reasons for swapping. On the preceding transaction, you would generate a capital loss of approximately $5,000 and that might be used for tax purposes to offset capital gains on other transactions. Or you might swap to upgrade credit quality. You might increase yield by buying lower-

quality bonds, or by buying different bonds.

Please note two caveats. In the preceding example, you would have taken an enormous hit to principal. Also, costing out a swap accurately is complex.

CREDIT RATINGS AND VALUATION

There is widespread misunderstanding about what credit ratings really mean, and how they affect the returns that you earn and the overall riskiness of your portfolio.

Investors generally rely on bond ratings to evaluate the credit quality of specific bonds. Credit ratings indicate on a scale of high to low the probability of default; that is, the probability that debt will not be repaid on time in full. Failure to redeem principal at maturity would constitute a default. Failure to make interest payments on time (that is, to pay coupons to bondholders) would also constitute a default. In plain English, ratings answer two questions: How likely am I to get my money back at maturity, and how likely am I to get my interest payments on time?

All bonds are not subject to default risk. Any security issued *directly* by the U.S. government is considered free of default risk. Although these bonds are not rated, they are considered the safest and highest-quality securities that you can buy because a default by the U.S. government is deemed impossible. This includes all Treasury securities, as well as savings bonds.

Bonds issued by entities other than the U.S. government, such as corporate bonds and municipal bonds, are rated by a number of agencies that specialize in evaluating credit quality. The best-known rating agencies are Moody's, Standard & Poor's (S&P), and Fitch (now Fitch IBCA). Bonds are rated when issuers initially come to market, and subsequently, as issuers bring additional issues to market. Issuers pay the agencies for the rating.

On a scale from the best credit quality to the lowest, Table 3 lists the symbols used by each of the major credit rating agencies. These symbols are on the left-hand side. The right-hand side of Table 3 is a translation into plain English of what the ratings mean. Standard & Poor's adds plus (+) and minus (–) signs to its ratings. A plus signifies higher quality; a minus signifies somewhat lower quality. For instance, a rating of B+ is slightly higher than a rating of B. A rating of B– is slightly lower than a B rating. Moody's adds a 1 to indicate slightly higher credit quality; for instance, a rating of A1 is a higher quality credit rating than an A rating.

In order to protect their investments, many individual investors limit their purchases to bonds that are at minimum rated "investment grade," which corresponds to BBB (Standard & Poor's) and Baa (Moody's). The term "investment grade" stems from the fact that fiduciary institutions, such as banks, are permitted by law to invest only in securities rated at the minimum "investment grade." That rating denotes a fair margin of safety. Note that some ads for bond funds use the term "investment grade" to imply extraordinarily high quality, which is misleading.

TABLE 3.
CREDIT QUALITY RATINGS AND WHAT THEY MEAN

Moody's	Standard & Poor's	Fitch IBCA	
Aaa	AAA	AAA	Gilt edged. If everything that can go wrong does go wrong, they can still service debt.
Aa	AA	AA	Very high quality by all standards.
A	A	A	Investment grade; good quality.
Baa	BBB	BBB	Lowest investment-grade rating; satisfactory, but needs to be monitored.
Ba	BB	BB	Somewhat speculative; low grade.
B	B	B	Very speculative.
Caa	CCC	CCC	Even more speculative. Substantial risk.
Ca	CC	CC	Wildly speculative. May be in default.
C	C	C	In default. Junk.

WHY RATINGS CHANGE

Ratings are assigned on the basis of extensive economic analysis by the rating agencies mainly to determine revenues available to the issuer to cover debt service. The more money available to cover the debt service, the higher the rating.

When forecasting economic conditions for the next six months or for perhaps one year, experts stand on reasonably secure ground. But the further they predict into the future, the more imprecise and unreliable their forecasts become. Any prediction of economic conditions that goes out more than five years becomes guesswork. Bear in mind, however, that bonds are rated for their entire life, even if that is 30 years.

As a result, some forecasts turn out to be incorrect. When ratings are reviewed, they may change. As the economic fortunes of the issuer vary, so will the ratings.

Over time, changes in ratings can be major. For example, State of Louisiana bonds were rated AAA in the mid-1980s. In early 1990, they were rated barely investment grade. Occasionally, changes in ratings are more sudden. For instance, State of Massachusetts ratings went from AA to barely investment grade within the space of one year.

More dramatic rating changes sometimes occur in the corporate bond sector. For example, if a company buys another with debt, the amount of debt may increase

sharply virtually overnight. And that increase would cause the rating to deteriorate virtually overnight as well.

RATINGS AND INTEREST RATES

Above all, credit ratings affect the cost of borrowing—that is, the interest rate that will have to be paid by the issuer to attract buyers. The interest cost to the issuer is the coupon you will earn.

The principle for this is easy to explain. Think of a bond as a loan and imagine that you are a bank that is lending to a borrower. You would ask a lot of questions relating to the probability of repayment. To whom would you rather lend money: to a struggling businessman with no collateral who wants to start a business, or to IBM? The answer is obvious. Now suppose you are the struggling businessman or John Doe. Chances are that if your banker turns you down, you will find a different banker, who will charge you higher interest costs. You may even go to your neighborhood loan shark (or equivalent), who will lend you the money, but charge you a much higher interest rate than the bank.

This is also true for bonds. The most creditworthy issuers—say, large states with diverse economies, blue-chip corporations with very little debt, or the U.S. government—borrow at a lower cost. Less creditworthy clients have to pay higher interest. Consequently, bonds with the highest quality credit ratings always carry the lowest yields; bonds with lower credit ratings yield more. Note that the yield, in a sense, provides a scale of credit-worthiness: higher yields generally indicate higher risk—the higher the yield, the higher the risk.

RATINGS CHANGES & PRICE

If bonds are downgraded (that is, if the credit rating is lowered), the bond price declines. If the rating is upgraded, the price goes up. In fact, bond prices sometimes change if there is even a strong possibility of an upgrade or a downgrade. This is because anxious investors sell bonds whose credit quality is declining and buy bonds whose credit quality is improving.

Unless there is a genuine risk of default, however, price changes in response to upgrades or downgrades are far less major than those occurring due to changes in interest rate levels. With rare exceptions, ratings go up one notch or down one notch in the rating scale, and prices go up or down by perhaps 1% or 2% per bond in response to rating changes. The change in price corresponds to the amount necessary to bring the yield of a bond (and therefore its price) in line with other bonds rated at the same level. For bonds rated AA, for example, a downgrade to A+ may not make a noticeable difference in the price.

This point needs to be emphasized because many individual investors are needlessly worried about relatively minor downgrades and this fear is sometimes exacerbated by the financial press. For bonds that have very high credit quality (AA or AAA), a deterioration in the rating is not a major cause for concern. It would not result in a serious deterioration in the price of the bond. A more serious concern would be a series of downgrades, particularly if downgrades drop the credit rating to below investment grade.

There is one notable exception to the preceding statements. During the takeover craze of the 1980s, corporate bond prices were exceptionally volatile because of the possibility of downgrades due to takeovers.

Here are some questions and answers that deal with common investor concerns about bond credit ratings:

Doesn't a downgrade mean my bonds are no longer safe?

That is usually not the case. The rating scales used by the agencies are very conservative. Distinctions between rating levels are often based on nuances. Any bond rated investment grade or better continues to have good margins of safety, even after a downgrade.

However, certain downgrades are more significant than others and should be viewed as red flags:

- A downgrade that drops a bond rating to below investment grade;
- A downgrade of more than one notch (say from AA to A–);
- A string of downgrades in close succession.

If any of these occurs, you might want to review whether you wish to continue owning that security.

My bonds are insured, or AAA, or government guaranteed. Won't that guarantee that principal remains safe?

No. What is guaranteed is that interest payments will be made on time and that principal will be redeemed in full at the bond's maturity. There is no connection between that guarantee and what happens to the price (or value) of bonds due to fluctuations in interest rates. Changes in interest rates affect *all* bonds, whether they are those of Fly-by-Night airlines or obligations of the U.S. government. If interest rates rise, the value of your bonds will decline. If interest rates decline, the value of your bonds will rise. Period. No exceptions.

How frequently do defaults occur?

That depends, of course, on the type of bond under discussion. But overall, if you consider primarily bonds that are at least investment grade in credit quality, default rates are relatively low. Since the Second World War, and despite a few well-publicized defaults in the corporate sector, no bonds have ever defaulted while currently rated AA. Only two defaults have occurred to bonds rated A. Similar statistics prevail for municipal bonds. (While some bonds that were initially highly rated eventually defaulted, these had been downgraded prior to the actual default. Hence, it is prudent to monitor the ratings of bonds in your

portfolio.)

Default rates for junk bonds, which by definition are bonds rated below investment grade, are higher.

Note, however, that even when defaults occur, bond investors seldom lose 100% of the principal value of the bond. Defaulted bonds usually have some salvage value. There is a good deal of speculation in the bonds of defaulted or bankrupt issuers. That is because such bonds may be purchased very cheaply, perhaps as little as 10 to 30 cents on the dollar. Many defaults have taken the form of a suspension of coupon payments. Such bonds are said to be trading flat. If coupon payments are resumed, the price of the bonds can soar. Bondholders may also benefit from the sale of assets of issuers under bankruptcy proceedings. Finally, some bankrupt companies emerge successfully from bankruptcy proceedings, leading to a bonanza for anyone who purchased the bonds while the company was in default.

There is a gradation in risk of default. Any bond that is a direct obligation of the U.S. government is deemed to have zero possibility of default. Bonds issued by federal agencies, or most types of mortgage-backed securities, are deemed to have almost equally high credit quality. Municipal bonds come in a wide variety of ratings, but in the aggregate they have low default rates. Corporates (particularly so-called junk bonds) are far less predictable. And debt of so-called emerging markets is highly speculative.

I want maximum income and maximum safety. My broker advises me to buy 30-year bonds with AAA ratings and just hold them to maturity. Isn't that the safest thing to do?

Not necessarily. That can be a costly and high-risk strategy. It is costly because AAA-rated bonds yield less than bonds with lower ratings but with similar maturities. You are therefore sacrificing income. And it is high-risk for two reasons: One is that, as we have just seen, interest rate risk is far higher for bonds with longer maturities. If you need to resell your bonds before they mature, you might have to take a very costly hit to principal. But in addition, it is very difficult to predict how much you will really earn on bonds with the longest maturities because that will largely be determined by varying reinvestment rates earned on interest income.

As a general rule, if you are concerned about safety of principal and predictable income, it is usually safer to buy bonds with maturities of five to 10 years, rated at least investment grade or somewhat higher (depending on your preferences and tolerance for risk). Interest income from such bonds is likely to be close to (and occasionally higher) than that of AAA-rated bonds with long maturities, so you will not be sacrificing income. But risk to principal is dramatically lower.

Does all of this mean that I should ignore credit ratings?

No. But I have tried to put credit ratings in perspective. Remember that ratings are opinions. The rating agencies do not have any connection to actual debt service payments, which are made by the issuer. Nor do the ratings constitute any kind of recommendation either to buy or sell a particular security. A low rating does not mean that default will occur; and a high rating guarantees nothing, not even that a downgrade won't occur.

A RATINGS SUMMARY

Here is a summary of what you will want to remember concerning ratings:

- When you purchase bonds, you should check credit ratings by the major agencies. Most of the time, ratings issued by the different rating agencies are close. If they are not, then to be safe, assume the lowest rating is accurate.
- Buy bonds rated investment grade (or higher), depending on your risk tolerance. A rating of A or better represents a sound rating, particularly for bonds with maturities under five years.
- Be sure that you understand the main reasons for the rating. What sources of revenue will pay debt? What is the credit history of the issuer? Has it been upgraded or downgraded? Why?
- When you own a bond, monitor its rating. Ask your broker to let you know if any rating changes occur (and check periodically). If a significant downgrade occurs, and you feel uncomfortable holding, you may want to consider selling that security. Note that occasionally the price of some bonds drops in advance of a rating change. The market is sometimes ahead of the rating agencies in sniffing out that a particular security may face potential problems.
- Diversify. Don't put all your assets in one bond. If you have a total of $50,000 to invest, it is more prudent to buy five $10,000 lots than one $50,000 lot. Buy bonds of different issuers to diversify credit risk. And buy bonds with different maturities to diversify interest rate risk. ✦