Saving for long-term goals and diversifying with stocks

Bonds can be used to save for future expenses such as education or retirement. In a portfolio context, bonds can finance current spending while stocks generate potential price appreciation over time. High-quality bonds generally diversify well with stocks.

Balancing risk and return

The search for yield should be balanced against the risks involved with holding bonds. The primary risks are deteriorating credit quality and rising market yields. The risk from rising yields can be addressed through barbells or portfolio laddering.

Performance varies among sectors

The performance among different sectors of the bond market can vary considerably. Treasury securities usually do best when investors seek safety. Lower-quality bonds generally outperform when investors expect the economy to improve. Returns on low-quality bonds usually correlate more with returns on stocks than with Treasuries.

Sectors with better potential returns can be more volatile

Bonds that have the highest potential returns usually also have the most volatile returns. Bonds with lower credit quality and longer maturity tend to have the biggest price movements, both up and down.

Chart 1: Bond market yields – bigger dots = higher credit quality

Source: BofA Merrill Lynch Global Research. The size of each dot is proportionate to the average credit rating of the sector. Munis yield is taxable equivalent at 35% tax rate.
Bond basics

When you buy a bond, you are lending your money. The borrower could be a government, a corporation, or indirectly, an individual. In return for the use of your funds, the issuer of the bond promises to make periodic interest payments and to return the principal amount at maturity.

When you buy a bond you are making a loan. In return, you receive the promise of periodic interest payments and the eventual return of your principal.

Exhibit 1: Basics of a bond transaction

When buying a bond, an investor lends money to the issuer.

Investor | Lends $ | Issuer

The issuer promises to make interest payments and to return the principal at maturity.

Investor | Promises regular interest payments and return of principal at maturity | Issuer

Source: BofA Merrill Lynch Global Research

The bond market is often called the debt market, because the issuers are borrowing money, or the fixed income market, because the interest payments on individual bonds usually do not vary.

Income and the potential for capital gains

For most individual investors the appeal of a bond is usually the income and potential for price gains, although investors ought to be aware of the potential for losses as well.

- For a bond purchased directly, rather than through a fund, you can count on receiving the scheduled interest payments and the return of principal at maturity, provided the issuer does not default. That predictability, sometimes called “permanence and definition” can be particularly useful for people saving for long-term goals such as college tuition or retirement.

- For bond funds (mutual funds, closed-end funds, and exchange-traded funds), the stream of income payments is not as predictable—it will generally rise and fall with market rates. But funds can offer diversification, and the ability to re-invest principal payments and possibly interest payments at market rates. Actively managed funds, which aim to outperform the market, tend to have higher fees than passively-managed funds, such as exchange-traded funds (ETFs), which usually just aim to match a market index.

For most investors the appeal of bonds is the income.
Bonds in your portfolio
The income stream from bonds can complement the returns from stocks in a portfolio. The appeal of stocks is generally the potential for capital gains. But investors don’t realize capital gains until they sell their shares. Bonds can give you income to spend in the meantime.

Retirees can use their bond portfolios as a source of income to finance living expenses. The size of the portfolio, the yield, and the safety of the principal are among the relevant considerations in using bonds for this purpose.

Some investors, particularly high net worth individuals, use bonds to preserve their wealth. If the portfolio is large enough, the investor could potentially live off the income and not have to tap into the principal.

Parents can use bonds to save for their children’s education. Individuals can use bonds to save for retirement. Zero-coupon bonds (see below) and inflation-adjusted bonds (page 16) can be used for these purposes.

The income
Most bonds pay a fixed rate of interest semi-annually.
The payouts are called coupons, a throwback to the days when investors literally clipped coupons to receive their payments. A bond with a $1,000 par value (or face value) with a 4% coupon would pay $20 semi-annually (every six months), and then $1,000 at maturity. See Chart 2 above left. Preferred securities (Page 20) generally pay their coupon every three months. Other bonds pay floating rate coupons.
Here, the payout is tied to the movement in some other index, perhaps the three-month LIBOR or the growth in the consumer price index.

Some bonds pay no coupon at all.
Zero coupon bonds are sold at deep discounts to the par value and pay the par value at maturity. For example, a 10-year zero coupon bond might sell at $67 and mature at the par value of $100. That appreciation in the price over a 10-year period translates to an annual yield of about 4.0%. Chart 3 above right shows how the price of a zero coupon bond rises towards par as the maturity date approaches. “Zeros” usually have higher yields than otherwise similar coupon-paying bonds. Zeros could make sense for investors saving for long-term goals who do not need current income.
Bonds can pay a fixed coupon, a variable coupon, or no coupon at all.

**Getting your money back**
Most bonds have a fixed maturity. Provided the issuer does not default, the investor will receive the par value of the bond on the maturity date and the coupon payments along the way. For some bonds, the issuer has the option to call (redeem) the security before it matures, subject to pre-specified conditions.

**Traditional calls**
A traditional call option enables the issuer to redeem the security, usually at par, usually at any time after a specified date. This type of call option is found among preferred securities, most municipal bonds and corporate high-yield bonds.

For example, a bond issued with a 10-year maturity might become callable five years after issuance. In market parlance, the bond is said to be issued with five years of call protection. The short hand version is 10 non-call 5.

High yield bonds, municipals, and preferreds can generally be called at the issuer’s discretion after a specified date.

The issuer would typically call the security if it could re-finance at a lower rate. For example, if the bond were issued with a 5% coupon, and market rates have since declined to 3%, the issuer might call the security and issue a new bond at the lower market rate.

Such calls usually work to the disadvantage of the investor because the re-investment choices are likely to be less favorable in the lower rate environment. Also, the issuer’s option to call the security at par or some other specified price generally limits how high the price of the bond can rise. For those reasons, investors usually demand a higher yield on callable bonds than on bonds that are not callable.

**Make-whole calls (MWCs)**
MWCs allow the issuer to redeem the security at its discretion. The redemption price is not fixed, as with a traditional call. Instead, the price is the greater of the par value of the bond (typically 100) or the price that corresponds to a particular yield spread over a specific Treasury security. When market yields decline, the MWC price is usually above par, sometimes substantially so. MWCs are common among investment-grade corporate bonds and some municipal bonds.

The MWC structure is much more favorable for the investor than a traditional call because it allows the investor to benefit from declines in market yields. For that reason though, issuers rarely exercise MWCs. For the issuer, the advantage of having a MWC is the bonds usually carry a lower coupon rate than bonds with traditional calls. The MWC also gives the issuer more flexibility in the event of a restructuring.


Issuers rarely exercise make whole calls.
All about yield

Yield is a measure of the annualized income return from the bond. In this section we describe the relationship between yield and coupon, different ways to calculate yield, and how to assess the attractiveness of the yield on a bond. In the next section we tie in yield and total return.

Coupon rate and yield
The yield of a bond might differ from its coupon rate. The distinction arises because the purchase price could be above or below the par value of the bond.

The coupon rate is the annual payout as a percentage of the par value of the security. A $1,000 par security with a 5.00% coupon rate would pay $50 in interest per year.

The yield measure takes into account the price that the investor pays for the security. The price could be above par (a premium bond) or below par (a discount bond).

Table 1: Bond Yield to Maturity

<table>
<thead>
<tr>
<th></th>
<th>5-year maturity, 4% coupon</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Discount bond</td>
</tr>
<tr>
<td>Coupon rate</td>
<td>4.00%</td>
</tr>
<tr>
<td>Price</td>
<td>95.00</td>
</tr>
<tr>
<td>Yield</td>
<td>5.15%</td>
</tr>
</tbody>
</table>

Source: BofA Merrill Lynch Global Research

Table 1 shows examples of discount, par-priced bonds and premium bonds that have 4.00% coupons.

- A discount bond is priced below par. The yield exceeds the coupon rate because the price will rise towards par as the bond approaches maturity. Using the example in Table 1, the discount bond is priced at 95.00 and pays a 4.00% coupon. The investor will receive the par value of 100 when the bond matures in five years. That translates to a 5.15% yield to maturity. (YTM, see next page.)

- A premium bond is priced above par. Its price will compress towards par by maturity. For a premium bond, the yield is less than the coupon rate, reflecting the erosion of the premium as the bond approaches maturity. The example in Table 1 shows a bond priced at 105.00, again with a 4.00% coupon. At maturity, the investor receives par, making the YTM 2.92%.

Timing of payouts and accrued interest
Most bonds pay interest on specified dates six months apart. The interest payment accrues over the course of the six-month period. For example, if the bond pays $50 semi-annually, the accrued interest three months after the last payment date is $25.

The accrued interest is added to the price of a bond purchased in the secondary market. For most preferreds, the accrued interest is imbedded in the price.

For most bonds, the interest accrual is separated from the price of the bond. If you buy a bond in the secondary market (i.e., not a new issue) in between the interest payment dates, you will pay the seller the price of the bond plus the accrued interest. You will receive the full semi-annual coupon payment when the payment date arrives. For example, with a $50 semi-annual payout and a transaction taking place halfway between the previous payment dates, the seller would receive the price of the bond plus $25 accrued interest. On the payment date three months later, the buyer would receive $50.
In contrast, for $25 par preferred securities (page 20) the accrued interest is imbedded in the price, as it is with common stocks. If you buy a preferred while the dividend is accruing, you do not pay anything extra to the seller, because the price already reflects the accrued dividend. At the end of the dividend period, the price of a preferred security will decline by the amount of the dividend payment, other things equal.

**Measuring yield changes: basis points**
The bond market convention is to express yield changes in basis points. A basis point equals 0.01% or, one-hundredth of one percent. For example, the difference between a yield of 3.00% and 3.50% is 50 basis points. Alternatively, yield changes could be expressed in percentage points. A move from 3.00% to 3.50% is a 0.5 percentage point change.

**Calculating yield**
Current yield (CY) is the simplest yield measure. CY is the standard measure for perpetual preferred securities and common stock. It’s also the yield metric used for most mutual funds, exchange traded funds and closed-end funds. CY is generally not applied to bonds that have a fixed maturity.

**Current yield = Coupon payment/Price**

CY is the coupon payment on a security divided by its price. For example, if a $25 par preferred with a 7.00% coupon were selling at a discount, say, $23.00, its CY would be 7.61% (the 7.00% coupon payment times the $25.00 par price, divided by the $23.00 market price). If the same security were selling at a premium, say $27.00, its CY would be 6.48%.

**Yield to maturity (YTM)**
Yield to maturity (YTM) and related metrics are the standard for bonds and preferreds that have a stated maturity. The key difference versus CY is that the YTM takes into account the maturity date of the bond and the time value of money: a dollar in the future is worth less than a dollar today. The calculation of the YTM is not straightforward, but can be done easily with many financial software applications.

We will use a simple example. We assume a bond that pays an annual coupon and returns full principal value at maturity. Suppose we know the price, the coupon rate, and the maturity of the bond, and want to calculate the yield.

Mathematically, the YTM is the discount rate that equates the present value of the cash flows of the bond to the price of the bond. The cash flows are the coupon payments and the return of principal at maturity. The formula is:

\[ P_x = C_1/(1+YTM) + C_2/(1+YTM)^2 + C_3/(1+YTM)^3 + \ldots + C_n/(1+YTM)^n + P/(1+YTM)^n \]

Where \( P_x \) is the Price of the bond, \( C_t \) is the coupon payment in period \( t \), \( P \) is the principal value, and \( n \) is the period when the bond matures. YTM is the only unknown in the equation, but it cannot be solved for directly. The solution requires a series of iterations—you keep plugging in values for YTM until the right hand side of the equation equals the bond’s price. Fortunately, financial software packages do that calculation.

**Calculating YTM: find the discount rate that equates the present value of the cash flows of the bond to its price.**
For the more conventional semi-annual paying bonds, you would make some slight modifications to the formula. Some other points from the equation above:

- Those with a background in finance may recognize the YTM as the internal rate of return on the bond.

- The equation shows the inverse relationship between the YTM and the bond’s price— the lower (higher) the YTM, the higher (lower) the price. Intuitively, this means that the higher the rate at which future cash flows are discounted, the lower the present value of the security.

### Table 2: Bond Yield to Maturity

<table>
<thead>
<tr>
<th>5-year maturity, 4% coupon</th>
<th>Discount bond</th>
<th>Par-priced bond</th>
<th>Premium bond</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupon rate</td>
<td>4.00%</td>
<td>4.00%</td>
<td>4.00%</td>
</tr>
<tr>
<td>Price</td>
<td>95.00</td>
<td>100.00</td>
<td>105.00</td>
</tr>
<tr>
<td>Yield</td>
<td>5.15%</td>
<td>4.00%</td>
<td>2.92%</td>
</tr>
</tbody>
</table>

Source: BofA Merrill Lynch Global Research

Table 2 above, which is the same as Table 1 on page 5, illustrates the how yields and prices move in opposite directions. As the price of the bond rises (95, 100, 105), the yield declines (5.15%, 4.00%, 2.92%). We discuss the inverse relationship between prices and yields in more detail on pages 8, 12, and 14.

### Table 3: Alternative yield measures, 10 year maturity, callable in 5 years

<table>
<thead>
<tr>
<th>Discount Bond</th>
<th>Par-priced Bond</th>
<th>Premium Bond</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield to Maturity</td>
<td>5.00%</td>
<td>5.00%</td>
</tr>
<tr>
<td>Coupon rate</td>
<td>4.00%</td>
<td>5.00%</td>
</tr>
<tr>
<td>Price</td>
<td>92.21</td>
<td>100.00</td>
</tr>
<tr>
<td>Current yield</td>
<td>4.34%</td>
<td>5.00%</td>
</tr>
<tr>
<td>Yield to Call</td>
<td>5.82%</td>
<td>5.00%</td>
</tr>
<tr>
<td>Yield to Worst</td>
<td>5.00%</td>
<td>5.00%</td>
</tr>
</tbody>
</table>

Source: BofA Merrill Lynch Global Research

The top three rows of Table 3 below show how the price could vary for bonds with the same yield and different coupon rates. For a given yield, the discount bond has a lower coupon and a lower price: the lower price compensates investors for the lower coupon. The premium bond costs more but it also pays a higher coupon rate.

**Yield to Call (YTC)**

Some bonds entitle the issuer to call, or redeem, the security, typically at par, prior to its stated maturity date. (See page 4). The YTC follows the same concept and calculation as YTM, except that it uses the call date, rather than the maturity date for the maturity.

The usefulness of the different yield measures arises when evaluating bonds priced at discount to par versus bonds priced at par or a premium. Table 3 gives examples using bonds with different prices that all have a 5.00% YTM, a 10-year maturity, are callable at par five years after issuance and pay a semi-annual coupon.

For securities priced at a discount to par, the YTC exceeds the YTM. In the event that the issuer called the security, the investor who purchased the bond at its price of 92.21 would get an extra lift from receiving par at the call date.

**Yield to Worst (YTW)**

The YTW is the lower of the YTC and the YTM¹, and more realistic than either one alone. The last row of Table 3 shows the YTW of the three types of bonds.

---

¹ Some municipal bonds have more than one call date, and a specific call price for each date. In such cases, the YTW is the lowest of the various YTCs and the YTM.
The yield to worst is the lower of the yield to call and the yield to maturity.

For example, the YTW for a bond priced at a premium is the YTC. An issuer is more likely to call a security priced at a premium than one priced at a discount. The premium price means that the coupon rate on the security exceeds the market yield. That often means that the issuer would be able to reduce financing costs by calling the security and reissuing a new one at a lower coupon rate.

For a bond priced at a discount, the YTW is the YTM. The issuer is unlikely to call a bond priced at a discount because it would be paying par value for something priced below par.

**Effective or option-adjusted yield**
The YTC/YTW approach makes a very simple assumption about whether the bond will be called: if it is priced above par it will be called; if it is priced below par, it will not be called, regardless of how far away the call date might be. The reality is not so simple. Whether or not a bond will be called when the call date arrives depends upon how interest rates change over time. The option adjusted spread (OAS) methodology, which we outline on page 10, calculates different possible interest rate paths over time, and hence allows for different scenarios regarding whether the bond will be called.

The OAS approach calculates an effective or option-adjusted yield, which removes the effect of the call option. Other things equal, the lower the price of the bond, the closer the effective yield will be to the YTM, and the higher the price of the bond, the closer it will be to the YTC. That’s because a bond priced below/above par is less/more likely to be called.

Bond yields vary with the credit quality of the issuer, expected inflation, expected future yields, and overall business conditions,

**Evaluating yield**
In most cases, the appeal of a bond depends upon the yield. Here are some basic considerations in assessing the yield on a particular bond:

**The probability that the borrower will default**
Bondholders will demand a higher yield from borrowers who appear to be less likely to be able to make timely interest payments or to return the principal at maturity. Top-quality borrowers like the US government can borrow at the lowest rates. Most other bonds must pay a higher yield than Treasuries in order to account for the higher default probability. The yield spread over Treasuries will vary over time and among issuers depending upon the market’s perception of business conditions and as the fundamentals for a company improve or worsen. (See pages 10-11).

**The potential erosion of the future payments from inflation**
When you buy a bond you exchange your payment today in return for a series of payments in the future. Inflation erodes the purchasing power of those future payments. Higher/lower expected inflation generally calls for higher/lower yields.

**Changes in yields and market value of bonds**
Suppose you buy a bond that pays a 3.00% coupon rate. If market yield a year from now is 4.00%, the price of your bond will decline: you will have to reduce the price in order to compensate investors for the below-market rate. Likewise, your bond would appreciate in value if market yields decline, because your bond now pays more than the market yield.
Compensation for risk
The yield on a bond should compensate investors for the length of time they are locking up their money, the interest rate risk they are taking, and the credit risk they are taking. The yield curve touches on the first and second elements. Yield spreads deal with the third. We discuss the first two elements below and the third on the next page.

Chart 4: Treasury yield curve
Shows how yields (vertical axis) vary with maturity

Yield curve: a picture of yields and maturity
The yield curve depicts how yields change as maturity changes. Chart 4 above illustrates a yield curve for Treasury securities. Yields are on the vertical axis, and the maturities on the horizontal axis. The yield curve charted above is positively sloped, meaning that yields rise as maturities extend. For example, the yield for a two-year maturity is 0.85%, while the yield on a 10-year maturity is 1.9%.

Short-term Treasury yields are influenced to a large degree by Federal Reserve policy. Long-term Treasury yields are influenced largely by expectations of future inflation.

Changes in the shape of the yield can often reflect changes in market perceptions about business and financial conditions.

• The yield curve flattens when short-term yields rise more than long term yields, or when short-term yields decline by less than long-term yields. One reason that the yield curve could flatten is that the market begins to expect the Federal Reserve to raise short-term interest rates soon. Another possible reason is that the market expects lower inflation in future years.

• The yield curve steepens when long-term yields rise by more than short-term yields, or long-term yields decline by less than short-term yields. One reason for the curve to steepen is if the market raises its expectation for inflation in coming years.

• The yield curve is usually positively sloped, meaning that yields rise as maturity extends. That’s because investors usually want compensation for the extra risks and uncertainties involved in committing funds for a longer period. At times though, the yield curve is negatively sloped, or inverted. That usually happens after the Federal Reserve has raised rates for an extended period, and the market expects a slowing in economic growth and lower inflation in future years.
Federal Reserve policy influences short-term rates, inflation expectations affect primarily long-term rates.

**Spread vs. Treasuries: a measure of relative yield**

Treasury securities are generally used as the benchmark for the US bond market, since they are considered to be virtually free from credit risk. The attractiveness of other bonds is often measured by their yield in relation to the yield on a Treasury security of the same maturity.

Except in the municipal market, the convention is to look at the basis point difference or spread between the yields. For example, if the yield on a 10-year corporate bond were 4.00%, and the yield on a 10-year Treasury were 2.00%, the spread on the corporate bond would be 200 basis points.

In the municipal market, the convention is to look at the ratio between the two yields. For example, if the yield on a muni is 1.80% and the yield on a Treasury of the same maturity is 2.00%, the muni yield ratio is 90%.

**Spread to worst**

How do you evaluate the spread for a bond that could be called prior to its maturity date? Suppose for example the bond has 10 years remaining to maturity and can be called in three years. Do you compare its yield to that of the 10-year Treasury or the 3-year Treasury?

The simplest way to address this problem is to use the *spread to worst*. That is, the spread that applies to the yield to worst, which is the lower of the yield to call and the yield to maturity. (See page 7.)

If the security in our example were priced above its call price, the relevant comparison would be with the yield on a 3-year Treasury. If the security were priced below its call price, the relevant comparison would be with the 10-year Treasury. The reasoning is that other things equal, a bond that is priced above its call price is likely to be called, while a bond priced below its call price is not likely to be called.

**Option adjusted spread**

The drawback of looking at the spread to worst is that it makes a simplistic assumption: if the bond is currently priced above par it will be called, if it’s priced below par, it will not be called, regardless of how far away the call date is, and where market yields might be during the period after the call date arrives. In fact, the prospect for a call depends upon the path of interest rates over time.

Also, as a practical matter, the spread to worst could change dramatically when the price of the security goes above or below its call price. When the price is above the call price, the relevant benchmark is a short-term Treasury. When the price falls below the call price, the relevant benchmark extends to a longer-term Treasury. The difference in those spread measures could be very large.

The option adjusted spread (OAS) approach takes into account various possible paths for interest rates, and the associated outcome with regard to a call. The OAS is the spread versus Treasuries that equates the present value of the bond’s cash flows under different assumptions about interest rate movements. The approach estimates the value of the call option on the bond, and ultimately the yield spread excluding the amount needed to compensate for the call option. Calculating OAS measures requires the use of statistical software.

The OAS methodology is most relevant for bonds with conventional calls such as high yield bonds, preferreds, and also mortgage backed securities. It is less relevant for investment grade corporate bonds and Treasuries, which generally do not have conventional calls.
Historical spreads
Charts 5 and 6 above show the yield spreads for investment grade and high yield (below investment grade) bonds respectively. Note how the yield spreads widened during the financial crisis in 2007-8 as investors required greater compensation for the greater probability of default. Also note by comparing the values on the vertical axis, that spreads for high yield bonds are always larger than spreads for investment grade bonds, reflecting the greater probability of default.

Credit ratings and default potential
The yield and eventual return that you receive will be influenced by the credit quality of the borrower. Safer credits, borrowers that are perceived to be better able to make good on their obligations, command lower yields, while riskier credits command higher yields. Those higher yields reflect the compensation needed to account for the perception of a greater probability of default.

In the event of a bankruptcy, the bondholders usually wind up receiving a portion of the original principal value.

Default and recovery value
For most bonds, the failure to make scheduled interest payments or return the principal at maturity constitutes a default. In the event that the issuer declares bankruptcy, a bankruptcy court would typically decide upon a recovery value for the bondholders—usually some portion of the initial principal value. The decision could take several years.

The credit rating on a bond represents the rating agency’s assessment of the potential loss from default on a bond. The potential loss reflects the estimated probability of default and the likely recovery value in the event of default. Investment grade bonds carry ratings of at least Baa3 / BBB- / BBB- from Moody’s, S&P, and Fitch respectively. High yield ratings are Ba1 / BB+ / BB+ and lower.

While by no means perfect, the credit ratings on corporate and municipal bonds have a reasonably good track record for assessing the risk of default. Based on historical experience, a low-rated bond is more likely to default than a bond with a higher rating.
Total return: income + price change

The yield represents the annualized income return that you will receive if you hold the bond to maturity and receive the scheduled payments along the way and par value at maturity (that is, the bond does not default). But the price of the bond can fluctuate as the maturity date approaches. If you hold the bond to maturity, you will get the principal value back. But if you sell the bond prior to maturity, your total return will depend upon the market price when you sell.

Total return reflects both the income and the price change that occurs with changes in yield.

For a given period, the total return on the bond equals the sum of the coupon income, the interest earned from the re-invested coupons and the price change.

\[
Total\ return = coupon\ income + income\ from\ re-invested\ coupons + price\ change
\]

The coupon income is simply the interest received. The income from re-invested coupons is the interest on the interest. That is, the return on the re-invested coupon payments.

Yields and prices move in opposite directions

As described on pages 6-7, the price of the bond will change with market yields and, for bonds priced at a discount or premium, as the bond approaches maturity. The price will rise when its yield declines, and decline when its yield rises.

Table 4 below shows how the price of bonds with a 3.00% coupon / 3.00% initial yield would change as market yields change over a one year horizon. For example, for a 10 year maturity, a one-percentage point rise in yield would knock the price down by 7.5%. A one-percentage point decline in yield would boost the price by 8.2%.

<table>
<thead>
<tr>
<th>Change in yield (pct points), one year horizon</th>
<th>2-yr maturity</th>
<th>5-yr maturity</th>
<th>10-yr maturity</th>
<th>30-yr maturity</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>2.0%</td>
<td>4.0%</td>
<td>17.2%</td>
<td>50.2%</td>
</tr>
<tr>
<td>-1</td>
<td>1.0%</td>
<td>2.0%</td>
<td>8.2%</td>
<td>21.9%</td>
</tr>
<tr>
<td>0</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>+1</td>
<td>-1.0%</td>
<td>-1.9%</td>
<td>-7.5%</td>
<td>-17.1%</td>
</tr>
<tr>
<td>+2</td>
<td>-1.9%</td>
<td>-3.8%</td>
<td>-14.4%</td>
<td>-30.4%</td>
</tr>
</tbody>
</table>

Table 4: Price return for a given change in yield, coupon=initial yield=3%

Does not include the effect of rolling down the yield curve
Source: BofA Merrill Lynch Global Research

Duration: a measure of the sensitivity of the price to changes in yield

Modified duration is a bond statistic that measures the sensitivity of the price of a bond to changes in market yields. Specifically, modified duration measures the percentage change in price for a small instantaneous change in yields for all maturities. For example, if the modified duration were 6, then an instantaneous one-percentage point rise in yield would reduce the price of the bond by roughly 6%. We show the average duration of different bond market sectors on page 23.

Other things equal, the duration is greater the longer the maturity of the bond and the lower the coupon and yield. In other words, the price of bonds with longer maturities and lower coupons and yields will fluctuate more with changes in yield. We can see the influence of the maturity in Table 4 above. For any given column in the Table, the price change for a given change in yields is greater for longer maturities.

Convexity: how duration changes as yields change

For non-callable bonds, the price increase for a given decline in yields exceeds the price decrease for the same rise in yields. Returning to the example from Table 4, the one percentage point decline in yields generated an 8.2% price increase, while the same rise in yields generated a 7.5% loss. This relationship is a result of positive convexity: the duration of a bond rises as its yield declines.
Positive convexity: the price increase for a given decline in yields exceeds the price decrease for the same rise in yields.

Bonds with call options (see page 4), especially mortgage backed securities (MBS see page 18), often have negative convexity, meaning that duration rises as yields rise. For these bonds the price decrease for a given rise in yields exceeds the price increase for the same decline in yields. A rise in market yields can extend the duration of a callable bond by making it more likely that the bond will reach its full maturity rather than be called. Likewise, the duration of MBS would extend when rates rise because homeowners would be less likely to re-finance their mortgages. Similarly, when rates decline companies are more likely to call the security, and homeowners are more likely to pre-pay their mortgages, which generally pushes duration lower. Investors demand a higher yield in order to compensate for negative convexity.


Combining income and price

So far we’ve considered the effect that changes in yield have on the price return of a bond. The other main component of return is income.

Table 4 showed that the longer the maturity of a bond, the more sensitive its price is to changes in yield. Typically yields are higher for bonds with longer maturities, that is, the yield curve is usually positively sloped. That extra income helps compensate investors for the extra price risk and sometimes extra credit risk for longer maturities.

Longer maturities usually have higher yields, compensating investors for at least some of the extra price risk.

Table 5 below shows how total return (income + price change) varies for different maturities as yields change. The first data column in Table 5 shows the yields assumed for different maturities. The total return for a given yield change is approximately equal to the price change shown in Table 4 plus the yield. For example, from Table 4, if yields rise by a percentage point, the price of a 10-year bond would decline by 7.5%. The total return would be that price decline plus the assumed 3.00% yield on the bond or -4.5%.

The higher yield for longer maturities that comes with a positively-sloped yield curve cushions some of the effect of the price loss when yields rise.

<table>
<thead>
<tr>
<th>Initial yield</th>
<th>Change in yield (pct points), one year horizon</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-2</td>
</tr>
<tr>
<td>2-yr maturity</td>
<td>1.0%</td>
</tr>
<tr>
<td>5-yr maturity</td>
<td>2.0%</td>
</tr>
<tr>
<td>10-yr maturity</td>
<td>3.0%</td>
</tr>
<tr>
<td>30-yr maturity</td>
<td>4.0%</td>
</tr>
</tbody>
</table>

NM = not meaningful, assumed yield decline exceeds the initial yield, does not include the effect of rolling down the yield curve or the reinvestment rate.

Source: BofA Merrill Lynch Global Research
A closer look at the effect of rising yields

The sensitivity of the price of a bond to a change in market yields should be put in some perspective. A rise in yields reduces the price of bonds, as we described on page 12. But the damage is not permanent. Provided the issuer does not default, the bond will mature at par, and the principal will be returned to the investor. The loss from higher yields winds up being more like an opportunity cost: The investor receives a lower stream of income than what the market is paying.

For example, suppose you buy a 10-year security at 100 (par) that pays a 2% coupon rate. If a year from now the market yield is 3%, the price of your bond (now a nine year maturity) would be 92.2—a 7.8% decline. That’s the price needed in order for the bond to match the 3% market yield.

If you were to sell at this point, you would book a loss, but if you hold the bond to maturity, you would get back your initial par value (Chart 7). The drawback is that in the meantime, you are getting a 2% coupon while other investors are getting 3%. Viewed another way, the bonds will underperform the rest of the market.

Chart 7: Bond price, 2% coupon, 10 yr maturity, 1 pp rise in yield in year 1

Prices revert to par

The sensitivity of the price of an individual bond to changes in yield will decline over time as the maturity shortens.

It might not always make sense to avoid long-term maturities when yields rise

In Table 4 on page 12 we showed how the price of a bond with long-term maturity is more sensitive to a rise in yields than the price of a bond with a short-term maturity. That does not necessarily mean that investors who expect rising yields should avoid long-term securities. The calculations on the previous page assume other things equal, but other things are rarely equal.

• As mentioned on page 12, when the yield curve is positively sloped, the extra income on longer maturities compensates for some of the greater sensitivity of the
price to higher yields. That is, the extra price decline for a given rise in yields can be at least partially offset by the extra income for longer maturities.

- Market rates rarely move in unison. For example, typically when the market begins to expect the Federal Reserve to raise rates, yields on short maturities rise by more than yields on long maturities. That is, the yield curve flattens. Historically, yields on shorter maturities have fluctuated more than yields on longer maturities.

- Interest rate risk can be at least partly managed through ladders and barbells as we discuss on page 25-26.

**Bond funds vs. individual bonds when rates rise**

Investors can purchase bonds directly with individual securities, or indirectly through funds such as open ended mutual funds, exchange traded funds, and closed end funds. We discussed some basic considerations in this decision on page 2.

In both forms of ownership, investors can ultimately be made whole for a given rise in yields, but the mechanics and timing differ.

**Individual direct holdings**

Suppose you own a 10-year bond. As each year passes, the maturity of the bond will decline, so the sensitivity of the price to changes in market yields will diminish. Additionally, if the yield curve is positively-sloped, yields will decline as time passes since the time remaining to maturity will shorten. This *rolling down the yield curve* (see page 26) will counter some of the impact of rising market yields. And again, barring default, you will receive the par value at maturity.

**Holdings through funds**

Prices of bond funds and ETFs will also generally decline as yields rise. Returns will generally recover, although the process is not as straightforward as with an individual bond.

The duration/maturity of funds will not automatically shorten over time as they would with direct holdings. And the potential benefit from rolling down the yield curve will be small for funds that stay within a particular maturity range.

But, the payouts on bond funds that re-invested their maturing proceeds would rise and fall with market rates over time, which eventually compensates for the initial change in market price. The recovery process will take longer for funds with longer maturities since the portfolio rebalancing would involve re-investing the proceeds of bonds that were sold at a price below par. The duration statistic for a particular fund gives a good indication of how long it would take for the fund to recover from a one percentage point rise in yield.

Additionally, successful active fund managers might be able to steer toward shorter maturities before rates rise. Naturally, the decisions of active fund managers could hurt the performance as well. The recovery process is generally more straightforward for passively managed funds such as exchange traded funds.

The maturity of funds will not shorten over time as with individual bonds, but the ability to re-invest proceeds could mitigate the impact of changes in yield.
Sectors of the bond market

The bond market consists of many different types of borrowers. The performance of different sectors of the bond market can vary, sometimes sharply, depending upon economic and financial conditions. We divide the sectors into broad categories: government and corporate, domestic (US issuers) and international. Table 6 below shows our estimate of the size of the different bond market sectors.

Table 6: Size of US bond market, $ trillions, December 31, 2016

<table>
<thead>
<tr>
<th>Sector</th>
<th>Size (trillions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>US Treasury: Bills</td>
<td>$1.8</td>
</tr>
<tr>
<td>Notes and bonds</td>
<td>$10.5</td>
</tr>
<tr>
<td>TIPS and floating rate</td>
<td>$1.6</td>
</tr>
<tr>
<td>GSEs/MBS</td>
<td>$8.5</td>
</tr>
<tr>
<td>Municipals</td>
<td>$3.8</td>
</tr>
<tr>
<td>Investment Grade Corporates</td>
<td>$6.9</td>
</tr>
<tr>
<td>High Yield Corporates</td>
<td>$1.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$34.4</strong></td>
</tr>
</tbody>
</table>

Source: BofA Merrill Lynch Global Bond Indexes, Federal Reserve Board Flow of Funds, Securities Industry and Financial Markets Association

US federal/municipal government linked

This category consists of Treasuries, TIPS, debt from government sponsored enterprises (GSEs), mortgage backed securities (MBS) from the GSEs, and municipal debt.

Treasury securities: US full faith and credit backing

Treasury securities are backed by the full faith and credit of the government. Treasuries are the benchmark instrument in the bond world, since they are considered to be largely free of credit risk. Yields on other bonds are evaluated in relation to the yields on Treasuries. Treasury securities are rated AAA by Moody’s and Fitch, and AA+ by S&P.

Despite the large budget deficits in the US, the markets consider Treasury securities to be among the safest financial assets in the world. Investors who purchase Treasury securities generally accept lower yields than for other bonds in return for the high degree of safety. Treasury securities generally perform best among the bond market sectors when the market is concerned about the economic or financial conditions. A “flight to quality” generally benefits Treasuries most.

Treasuries bills are issued with maturities of one year and less. They do not pay a coupon. They are issued at a discount to par and rise to par value at maturity. That accretion from the discount price to the par value represents the yield. Treasury notes are issued with maturities of two through 10 years, and bonds are issued with maturities of 30 years.

Treasury Inflation Protection Securities (TIPS): inflation protection

TIPS also have the full faith and credit backing of the US government. The par value of TIPS moves proportionately to the consumer price index (CPI). The coupon payment moves proportionately with the CPI as well. Specifically, the coupon payment is the fixed coupon rate on the TIPS, multiplied by the CPI-adjusted par value.

For example, suppose a TIPS was issued five years ago at a price of 100 with a 2.00% coupon, and CPI has risen by 10% since then. The par value would now be 110, and the semi-annual payment would be $1.10. ($110 * 2.00% / 2).

The annualized return on a TIPS that is held to maturity will approximate the sum of the stated yield on the security (which could be negative) and the annual inflation rate over the remaining life of the bond. For more see The Fixed Income Digest: TIPS primer 07 April 2017.

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2 On rare occasions, one and three-month Treasury bills have been issued at premiums, giving them negative yields. The yield on Treasury bills is quoted on a discount basis.
Treasury Floating Rate Notes (FRNs)
The Treasury began issuing FRNs in 2014. The securities have a two-year maturity. The coupon rate, paid quarterly, is tied to the sum of the highest accepted discount rate on the most recent three-month Treasury bill and a fixed spread. The spread is set at the auction.

The clearest alternative to FRNs is two-year fixed-rate Treasury notes. FRNs should appeal to investors who believe that three-month Treasury bill yields will rise by more than the expectations that are built into the yield on the two-year Treasury.

Government Sponsored Enterprises (GSEs)
GSEs issue debt to fund their purchases of mortgages, and for other purposes. Debt issued by the GSEs is sometimes called agency debt. Housing related GSEs that issue debt are Fannie Mae, Freddie Mac, and the Federal Home Loan Bank Board. Fannie and Freddie use the funds that they raise from debt issuance in order to buy mortgages that they bundle into new securities. The Financing Corporation (FICO) and the Federal Farm Credit Banks are also GSEs.

This debt is not guaranteed by the US government, but the markets treat it as if it has a large degree of government protection. The major ratings agencies assign the same credit rating to the GSEs as they do to the federal government, reflecting the belief that the government would ultimately support the debt.

Mortgage-backed securities
A mortgage backed security (MBS) is form of ownership in mortgage loans that are made by banks and other financial institutions. The holder of a residential MBS is essentially on the other side of the mortgage payment made by a household: the MBS investor receives a monthly payment that consists of a combination of principal and interest on the outstanding mortgage loans.

The most common mortgage structure is the passthrough. In this structure, the bank or loan-service provider sells the monthly principal and interest payments from a pool of mortgages to a government sponsored enterprise (GSE) such as Ginnie Mae, Fannie Mae and Freddie Mac. These entities then distribute (pass through) the payments to the holder of the MBS.

The main question that investors face with MBS from GSEs is the timing of the principal payments. When mortgage rates decline, homeowners are more inclined to re-finance their mortgages, mortgage pre-payments will rise, and investors will receive their principal sooner. That would likely reduce the returns on MBS that were purchased above par, but raise the return on securities purchased at a discount. In contrast, a rise in rates would slow the pace of pre-payments and extend the life of MBS. See our primer Fixed Income Digest Educational Series: Primer on Mortgage Backed Securities 06 January 2015.

MBS are typically not assigned credit ratings by the major agencies. Ginnie Mae securities have the full faith and credit backing of the US government, but Fannie and Freddie securities do not. But, as with GSE debt, the market generally treats these securities as if they have a high degree of government protection.

Collateralized Mortgage Obligations
CMOs are created from MBS. The main distinction is that a CMO, unlike a mortgage passthrough, does not distribute cash flows evenly. A typical CMO is divided into classes or tranches. The tranches differ in the mix of principal and interest payments each period, and hence the sensitivity of the price to changes in interest rates. CMO buyers ought to be aware of the sensitivity of the returns to changes in market yield.
Municipal bonds
Municipal bonds are debt issued by state and local governments to finance capital projects such as major highways, schools, and hospitals.

The interest income on public purpose munis and some private-purpose munis is exempt from federal taxation. Interest on some muni bonds is subject to the Alternative Minimum Tax (AMT). The interest income on a small part of the municipal market, most notably, Build America Bonds, is subject to federal taxation. Most states do not tax the interest income from their own bonds, but do tax the interest from bonds issued by other states.

The two broad types of munis are general obligation (GO) bonds and revenue bonds. GOs are backed by the full resources of the issuer, including its taxing power. The payments from revenue bonds come from the earnings of an enterprise or a specific project. For example, toll road bonds are backed by the revenues collected from the tolls.

Interest income from most municipal bonds is exempt from federal taxation. Investors can evaluate the yields on equal footing with taxable yields with the “taxable equivalent yield” calculations.

Table 7: Taxable equivalent yields for municipal bonds

<table>
<thead>
<tr>
<th>Municipal yield</th>
<th>25.0%</th>
<th>28.0%</th>
<th>31.8%</th>
<th>43.4%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1%</td>
<td>1.33%</td>
<td>1.39%</td>
<td>1.47%</td>
<td>1.77%</td>
</tr>
<tr>
<td>2%</td>
<td>2.67%</td>
<td>2.78%</td>
<td>2.93%</td>
<td>3.53%</td>
</tr>
<tr>
<td>3%</td>
<td>4.00%</td>
<td>4.17%</td>
<td>4.40%</td>
<td>5.30%</td>
</tr>
<tr>
<td>4%</td>
<td>5.33%</td>
<td>5.56%</td>
<td>5.87%</td>
<td>7.07%</td>
</tr>
<tr>
<td>5%</td>
<td>6.67%</td>
<td>6.94%</td>
<td>7.33%</td>
<td>8.83%</td>
</tr>
</tbody>
</table>

Source: BofA Merrill Lynch Global Research

In order to evaluate the yield on munis on an equal footing with the yield on taxable bonds, muni yields are often expressed on a taxable-equivalent yield (TEY) basis. The TEY is the yield that would be needed on a taxable bond in order for it to provide same after-tax yield as a tax-exempt muni. The TEY for a muni bond equals the stated yield divided by one minus the investor’s marginal tax rate. For example, the TEY on a bond with a 3.00% tax-exempt yield for an investor in the 28% federal tax bracket is 4.17% (3.00% / (1-0.28)). The TEY for a given municipal yield is greater for those in higher tax brackets as Table 7 above shows.

The TEY calculation enables you to make a more consistent comparison between yields on munis and yields on taxable securities. The stated yields on munis are sometimes lower than for corporate bonds and Treasury securities of similar credit quality and maturity. But for individuals in higher tax brackets, the TEY is often higher because the income is exempt from federal taxation.

Historically, default rate on investment grade rated municipal bonds has been extremely low. See Table 8 below.

Table 8: Average cumulative default rates, 1970-2015

<table>
<thead>
<tr>
<th>Municipal bonds</th>
<th>1 year</th>
<th>10 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment grade</td>
<td>0.0%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Below investment grade</td>
<td>1.3%</td>
<td>7.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Corporate Bonds</th>
<th>1 year</th>
<th>10 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment grade</td>
<td>0.1%</td>
<td>2.8%</td>
</tr>
<tr>
<td>Below Investment Grade</td>
<td>4.3%</td>
<td>32.4%</td>
</tr>
</tbody>
</table>

Source: Moody’s Investors’ Service
Corporate bonds
Corporations issue bonds to finance a variety of programs including plant and equipment spending. The corporate market is divided into two broad categories: investment grade (also called high grade) and high yield.

### Table 9: Corporate capital structure

<table>
<thead>
<tr>
<th>Loans</th>
<th>Senior Secured Debt</th>
<th>Senior Unsecured Debt</th>
<th>Subordinated debt</th>
<th>Junior subordinated debt/hybrid and trust preferreds</th>
<th>Preferred shares</th>
<th>Common shares</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source: BofA Merrill Lynch Global Research</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 9 above outlines the ranking of different types of securities in the capital structure. The ranking reflects the priority of payment in the event of default. Senior unsecured bonds, the typical corporate bonds, rank behind loans and secured debt in the capital structure, but ahead of preferreds and common shares.

**Investment grade corporate bonds**
The bulk of the IG market is rated towards the bottom of the IG scale. Based on the BofA Merrill Lynch Global bond indexes, roughly 87% of IG corporate bonds are rated BBB or A, as Table 10 below shows.

Corporate bond issuers cover the gamut of industries. Banking, energy, and utilities are the largest sectors of the market. Investors can gain some exposure to non-US companies without taking currency risk via the Yankee market. Yankee bonds are bonds that are issued by foreign companies but denominated in dollars.

Based on data from Moody’s Investors Service, the annual default rate on investment grade corporate bonds has been less than 1%. Over 10-year periods, the cumulative default rate on investment grade corporate bonds has averaged about 2.8%. See Table 8 on the previous page.

### Table 10: Investment grade corporate market by credit rating

<table>
<thead>
<tr>
<th>Credit rating</th>
<th>% of market</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAA</td>
<td>1.2%</td>
</tr>
<tr>
<td>AA</td>
<td>11.7%</td>
</tr>
<tr>
<td>A</td>
<td>44.2%</td>
</tr>
<tr>
<td>BBB</td>
<td>42.9%</td>
</tr>
<tr>
<td>Source: BofA Merrill Lynch Global Bond Indexes</td>
<td></td>
</tr>
</tbody>
</table>

**High yield bonds and senior loans**
Below-investment grade bonds, also called high yield (HY), and less commonly, junk, are issued by the lowest quality companies. The credit ratings are Ba1/BB+/BB+ and lower from Moody’s, Standard & Poor’s (S&P), and Fitch, respectively. In return for the lower credit quality, HY bonds offer better yields than investment grade bonds.

**Senior loans**, sometimes called floating rate loans or leveraged loans, are another form of debt issued primarily by below investment grade companies. Loans rank higher in the capital structure than bonds and are often secured, or backed, by physical assets. The coupon rates on these securities are typically a markup over the three-month LIBOR rate. In most cases, the calculation includes a floor rate for LIBOR, which means that the coupons won’t begin to adjust higher until LIBOR exceeds that rate.

When assessing the yield on a high yield bond or fund, investors need to consider the potential loss from default. The default rate on high yield bonds is considerably higher than for investment grade companies, and the recovery value in the event of default is lower. Chart 8, to the left on the next page, shows that the annual default rate on high yield bonds has been significantly higher than the corporate default rate.
yield bonds has ranged from as low as near 2% to as high as 15%. Table 10 (previous page) shows that over rolling 10 year periods stretching from 1970-2012, the cumulative default rate has been about 32%.

Chart 9, to the right below, estimates of the recovery value from defaulted HY bonds and loans going back to 1998. The recovery value is the percentage of the original principal that the investors will receive in the event of default. The ultimate settlement is usually determined by a bankruptcy court. The recovery estimates shown in Chart 9 are based upon market pricing in the weeks following the default. Since 1998, the expected recovery rate has averaged 68% for loans vs 42% for HY bonds.

**Preferred securities**

Preferred securities have characteristics of both bonds and equities. Like bonds, the coupon rate is fixed: the company cannot alter the coupon rate based upon changes in profitability, as it can with equities. But preferreds rank lower in the capital structure than bonds—that is, preferred holders rank behind bond holders in priority in the event of default. But like stocks, preferreds generally make payouts quarterly, rather than semi-annually as with bonds.

Financial firms account for the majority of the preferred market. Most preferred securities that are geared towards individual investors have a $25 par value, although some individuals buy preferreds with a $1,000 par value.

Digging deeper, the securities that trade in the preferred market run the gamut from near-equities to bonds. See our primer [The Fixed Income Digest: Primer on preferred securities 02 March 2016](#)

- Traditional preferreds are perpetual securities that pay dividends, not interest. The payments on most perpetual preferreds are non-cumulative, meaning that the issuer does not need to make up any missed payments.

- At the other extreme are baby bonds or senior notes. These are not actually preferreds – they are senior obligations of the company. Baby bonds trade in the preferred market because they have $25 par value.
• In between are different forms of hybrid securities, which pay interest and are cumulative, meaning that the issuer needs to make up any missed payments before it can resume dividends on lower-ranking securities. The issuer can deduct the interest payments from its taxable income, as it can with bond interest, and can usually defer payments for a specified period without entering default.

As we mentioned on page 6, prices for most $25 par preferred securities include the accrued dividend, which builds over the payment period. The price will usually decline on the ex-dividend date, when the accrued dividend resets to zero. In order to remove the effect of the dividend accrual when comparing two preferreds, it’s often better to look at the strip or clean price, which excludes the accrued dividend.

International bonds
US investors could purchase bonds issued by entities in other countries. The two broad categories are bonds issued by other government (sovereign bonds) and bonds issued by corporations.

Table 11: Non U.S. sovereign debt

<table>
<thead>
<tr>
<th></th>
<th>Developed</th>
<th>Emerging Markets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of market ($ billions)</td>
<td>$14,375</td>
<td>$581</td>
</tr>
<tr>
<td>Average yield</td>
<td>0.44%</td>
<td>5.28%</td>
</tr>
<tr>
<td>Average maturity (years)</td>
<td>10.5</td>
<td>11.7</td>
</tr>
<tr>
<td>Average credit quality</td>
<td>AA3</td>
<td>BB2</td>
</tr>
</tbody>
</table>

Source: BofA Merrill Lynch Global Bond Indexes, tickers: N0G1, IGOV, LDMP

Sovereign bonds
Within the non-US sovereign market, the two broad categories are developed countries and emerging markets. We profile the characteristics of these markets in Table 11 above.

Developed country sovereign bonds
The largest bond issuers among developed countries are Japan, the euro zone, and the UK. These bonds are denominated in the local currency. Dollar-based investors benefit when those currencies strengthen against the dollar and lose when they weaken.

Investors can use these bonds to gain exposure to foreign currencies while collecting some interest income. Exchange rates have often accounted for a large share of the dollar-denominated returns on non-US developed country sovereign bonds, as Table 12 shows. Keep in mind that credit quality varies among nations, and as with all bonds, prices will fluctuate with market yields.

Table 12: Returns on developed country sovereign bonds (%)

<table>
<thead>
<tr>
<th></th>
<th>US $</th>
<th>Local currency</th>
<th>Contribution of Exchange rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>5.5</td>
<td>4.6</td>
<td>-0.9</td>
</tr>
<tr>
<td>2012</td>
<td>1.5</td>
<td>5.4</td>
<td>-3.9</td>
</tr>
<tr>
<td>2013</td>
<td>-4.8</td>
<td>1.2</td>
<td>-6.0</td>
</tr>
<tr>
<td>2014</td>
<td>-2.9</td>
<td>9.6</td>
<td>-12.5</td>
</tr>
<tr>
<td>2015</td>
<td>4.6</td>
<td>1.5</td>
<td>3.1</td>
</tr>
<tr>
<td>2016</td>
<td>2.1</td>
<td>4.0</td>
<td>-1.9</td>
</tr>
</tbody>
</table>

Source: BofA Merrill Lynch Global Bond Index, Ticker: N0G1

Emerging market sovereign bonds
The emerging market sovereign market has grown in recent years. Many countries that are categorized as emerging have been growing faster and have better financial metrics than many developed countries. But outer countries are weaker credits. Political stability is another consideration in evaluating emerging market debt.
Investors can choose between emerging market bonds denominated in dollars and those denominated in local currencies. As with developed country bonds, local market debt brings exposure to the movements in those currencies: dollar-based investors benefit when those currencies strengthen against the dollar, and lose when the currencies weaken.

The local currency debt market is far larger than the dollar-denominated market, as Table 13 below shows. The average yield is also higher, the credit rating is stronger, and the interest rate risk (duration) is lower than for dollar-denominated debt. For US investors, these beneficial characteristics must be balanced against the currency risk.

**Table 13: Non-U.S. Corporate debt markets**

<table>
<thead>
<tr>
<th></th>
<th>European</th>
<th>Emerging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of market ($ billions)</td>
<td>$2.005</td>
<td>$1.090</td>
</tr>
<tr>
<td>Average yield</td>
<td>0.87%</td>
<td>3.79%</td>
</tr>
<tr>
<td>Average maturity (years)</td>
<td>5.8</td>
<td>6.8</td>
</tr>
<tr>
<td>Average credit quality</td>
<td>A3</td>
<td>BBB3</td>
</tr>
</tbody>
</table>

Source: BofA Merrill Lynch Global Bond Indexes; tickers ER00, ICPO

**Non-US corporate debt**

Non-US corporate debt is probably less familiar to US residents than non-US sovereign debt. Table 13 above profiles the market. Europe accounts for the bulk of the developed country securities, and roughly two-thirds of the market is investment grade, rather than high yield. Most emerging market corporate bonds are denominated in dollars or euros.
Elements of building a bond portfolio

Balancing returns and risk

In building bond portfolios, investors should consider their desire for yield and return while being mindful of the risks involved and the volatility in the market. Most investors should diversify their holdings and structure their portfolios according to their investment objectives and tolerance for risk. A full treatment of building a bond portfolio is beyond the scope of this Primer, but we will offer some brief guidelines.

As with most investments, the sectors of the bond market that offer the highest potential returns also present the greatest risk. As we have discussed, the two major forms of risk in the bond market are interest rate risk and credit risk. Interest rate risk refers to the potential gain/loss from changes in market yields. Other things equal, longer maturities have greater interest rate risk.

Credit risk refers to the possible loss from a default. The price of a bond could change as market perceptions of default risk change. The credit rating provides one indication of the potential risk from default.

Table 14 below shows the return performance of different sectors of the bond market for the past 10 years based upon the BofA Merrill Lynch Global Bond Indexes. The first column shows average credit rating. The next column shows the average duration (a measure of interest rate risk, the higher the duration, the greater the potential change in price for a given change in yield. See page 12. The next two columns show the average annualized return for the past 10 years and the volatility of that return as measured by the standard deviation. The final columns show the correlation of the returns with the returns on Treasuries and the returns on the S&P 500.

<table>
<thead>
<tr>
<th>Returns in bond market sectors: March 2007 - March 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Returns</strong></td>
</tr>
<tr>
<td>Avg credit rating</td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>Treasuries</td>
</tr>
<tr>
<td>2 years</td>
</tr>
<tr>
<td>10 years</td>
</tr>
<tr>
<td>30 years</td>
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<tr>
<td>TIPS</td>
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<tr>
<td>GSEs</td>
</tr>
<tr>
<td>MBS</td>
</tr>
<tr>
<td>Corporates</td>
</tr>
<tr>
<td>Investment Grade</td>
</tr>
<tr>
<td>High Yield</td>
</tr>
<tr>
<td>Preferreds</td>
</tr>
<tr>
<td>Municipals</td>
</tr>
<tr>
<td>Investment Grade</td>
</tr>
<tr>
<td>High Yield</td>
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<tr>
<td>Non-US</td>
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<tr>
<td>Sovereign</td>
</tr>
<tr>
<td>Developed Markets</td>
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<tr>
<td>Emerging Markets</td>
</tr>
<tr>
<td>$ denominated</td>
</tr>
<tr>
<td>Local currency</td>
</tr>
<tr>
<td>Corporate</td>
</tr>
</tbody>
</table>

Source: BofA Merrill Lynch Global Bond Indexes, Bloomberg

Returns on bonds with higher yields are generally more volatile.
Both absolute and relative returns will vary over different time periods. In particular, the large returns for the past 10 years in some sectors of the market shown in Table 14 might not be repeated in the future. But some historical relationships tend to hold up fairly well over time:

- The highest quality securities, such as Treasuries, MBS, and GSE debt do best within the bond market during recessions and other periods of financial turmoil when investors seek safety. The returns on high quality securities also tend to have a negative correlation with the returns on stocks, which means that the two asset classes diversify well: when the return on one declines, the return on the other tends to rise or declines by less.

- Lower quality securities, such as high yield bonds, generally do best within the bond market when investors expect economic conditions to improve. They suffer most when the market expects recession. High yield bonds actually behave more like stocks than bonds. Their returns are generally positively correlated with the return on stocks and negative correlated with the return on Treasury securities.

- High yield bonds do not diversify well with stocks.

- Higher-quality securities and lower duration securities tend to have lower and less volatile returns. For example, two-year Treasuries are the highest rated and have the least interest rate risk (lowest duration) of the different entries in Table 14. They also had the lowest volatility in return. In contrast, high yield bonds, the lowest rated among the different sectors, ranked among the most volatile.

- Within the Treasury market, 30-year bonds, which carry the greatest interest rate risk, usually have the most volatile return.

- The magnitude of the returns differed among the sectors. Broadly speaking the most volatile sectors generally have the best returns over time, although with worse down years and better up years.

High yield bonds perform more like stocks than Treasury securities.

### Table 15: Indexes used to measure performance

<table>
<thead>
<tr>
<th>Sector</th>
<th>Index name</th>
<th>Ticker</th>
</tr>
</thead>
<tbody>
<tr>
<td>From BofA Merrill Lynch Global Indexes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treasuries</td>
<td>U.S.Treasury, Current 2 yr</td>
<td>GA02</td>
</tr>
<tr>
<td>10 year</td>
<td>U.S. Treasury, Current 10 yr</td>
<td>GA10</td>
</tr>
<tr>
<td>TIPS</td>
<td>U.S. Treasuries, Inflation Linked</td>
<td>G0QI</td>
</tr>
<tr>
<td>Gov’t Sponsored Enterprises</td>
<td>Unsubordinated U.S. Agency Master</td>
<td>G0P0</td>
</tr>
<tr>
<td>Mortgage Backed Securities</td>
<td>Mortgage Master Index</td>
<td>M0A0</td>
</tr>
<tr>
<td>Investment Grade Corporates</td>
<td>U.S. Corporate Master</td>
<td>C0A0</td>
</tr>
<tr>
<td>High Yield Corporates</td>
<td>US High Yield Master II</td>
<td>H0A0</td>
</tr>
<tr>
<td>Preferreds</td>
<td>US Preferred Stock, Fixed Rate</td>
<td>POP1</td>
</tr>
<tr>
<td>Developed Sovereign</td>
<td>Global Gov’t Bond Index II, Excl. US</td>
<td>N0G1</td>
</tr>
<tr>
<td>Emerging Market $</td>
<td>USD Emerging Market Sovereign Plus</td>
<td>IGOV</td>
</tr>
<tr>
<td>Emerging Market Local</td>
<td>Local Debt Markets Plus</td>
<td>LDMP</td>
</tr>
<tr>
<td>Munis</td>
<td>Municipal Master Index</td>
<td>U0A0</td>
</tr>
</tbody>
</table>

Source: BofA Merrill Lynch Global Research
Portfolio strategies: ladders and barbells

Ladders and barbells are two strategies to help shield portfolios from the negative effects of rising yields. Both strategies enable the investor to capture some of the extra yield that comes with extending maturity while still keeping some powder dry to reinvest at possibly higher yields in the future.

Building a ladder

You begin a ladder by combining bonds with different maturities. As each bond matures, it is replaced with the longest maturity in the ladder. For example, a 1-5-10 year ladder begins with bonds with those maturities. A year later, the maturing one-year issue is replaced with the longest maturity in the ladder, 10 years in this case. At the end of year 5, the maturing 5-year security is replaced with a new 10-year security. See Exhibit 2, top left.

The appeal of a ladder when yields rise is that it enables you to reinvest maturing proceeds at the higher yields. Also, the remaining maturities on the other securities shorten over time, reducing the sensitivity of their price to changes in market yields (Exhibit 2).

Barbell: combining short and longer maturities

A barbell is a combination of a short and long maturity and can be thought of as a special version of a ladder. An example is to combine a two-year and 10-year maturity. Exhibit 3, above right, illustrates a simple barbell. In our example, we combine maturities in equal amounts. Other forms of a barbell can choose the weights to match the duration of an intermediate term security.

In times when the yield curve flattens – short-term rates rise more than long-term rates – a barbell will usually outperform the intermediate term maturity.

Our barbell is designed for individual investors who buy and hold to maturity. Both ends of our barbell serve a purpose:

• When the short end of the barbell matures in two years, the investor can redeploy those funds. If market yields have risen, the investor will be able to improve upon the income flow by choosing another two-year obligation or extending to a longer maturity.
• The long end of the ladder enables the investor to take some advantage of the steepness in the yield curve when yields on longer-term maturities exceed yields on short-term maturities.

• A longer-term maturity can also benefit from “rolling down the yield curve”. For example, today’s 10-year maturity would have eight years left two years from now. Other things equal, the decline in yield that comes with the shortening in maturity could soften the impact of a rise in market yields. Also, the price of an 8-year maturity is less sensitive to increases in yield than the price of a 10-year maturity. Together, the roll down the curve and the shortening in duration should limit the price decline that would come from rising yields.

Variations
Investors can create ladders and barbells with a variety of securities. Investors who want shorter maturities could also consider CDs. Investors willing to take on more interest rate risk can use a 15- or 20-year maturity at the long end of the ladder or barbell. Likewise, investors willing to take credit risk can use corporate bonds. Investors could also create a barbell with municipal bonds in order to receive federally-tax free income.
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