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Rolling down the yield curve in up and down markets

Through active management, institutional investors in municipal bonds can employ professional strategies that seek to overcome market complexities and take advantage of profitable opportunities. One such strategy, which may be difficult for individual investors to implement due to transaction costs, is called "rolling down the yield curve."

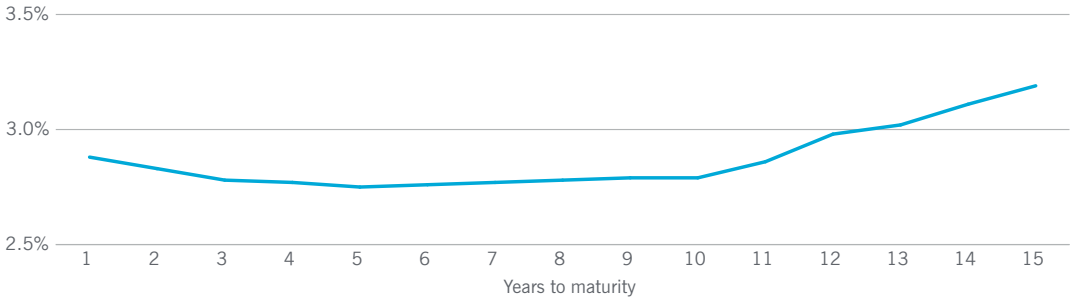
Returns may be enhanced by selling a bond at its peak price and rolling into a longer maturity bond. Two principles make this strategy viable:

1. Bonds with longer maturities typically have higher yields to compensate investors for a longer period of uncertainty.
2. Bonds with lower yields have higher prices, assuming coupon rates and maturity remain the same.

THE YIELD CURVE

The first principle can be visualized by plotting a yield curve. If one charts yields on the Y-axis, and time to maturity on the X-axis, the resulting line will usually slope upward to the right. However, aggressive increases in the fed funds rate by the U.S. Federal Reserve in 2022 and 2023 have inverted the yield curve. Interest rates on bonds due in five years are lower than those for bonds due in earlier years (Figure 1). For our analysis, what matters is that the yield curve slopes upward between 5 and 15 years.

Figure 1: The yield curve, an example



Data source: Securities Evaluations, Inc. (a subsidiary of Intercontinental Exchange, Inc.), 31 Jul 2024.

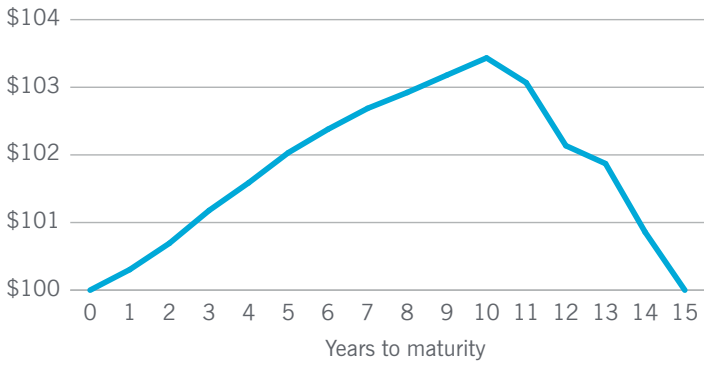
THE PRICE OF A BOND

The second principle implies that the price of a bond will, for a time, rise as it approaches maturity because it will be priced to progressively lower yields. At some point, however, the price will start to decline because the need to amortize the premium over shorter and shorter periods outweighs the effect of pricing to lower yields.

If a bond with a 2.50% coupon is priced to yield 2.00% (as a result, for example, of a change in interest rates or because the bond is now being priced to a shorter maturity), the bond will be priced above par. The difference between the coupon rate and the yield (in this case 0.50%) will be roughly the amount by which the premium declines each year.

Thus, if the bond has four years until maturity, the dollar price will be about 102. But if the same bond has only two years to maturity, the dollar price will be about 101, since, at 0.50% per year, the one point premium will be fully amortized in two years. For the price to stay at 102 with two years until maturity, the yield would have to fall to 1.50%, which would be 1.00% lower than the coupon rate so that about 1.00% of premium would be amortized each year. Assuming that the yield curve remains unchanged, Figure 2 shows how the price of a bond changes over time simply as a result of rolling down the yield curve depicted in Figure 1.

Figure 2: Price of a noncallable 15-year municipal bond over the course of its life



Data source: Securities Evaluations, Inc. (a subsidiary of Intercontinental Exchange, Inc.), Nuveen Research, 31 Jul 2024.

Portfolio managers may derive increased value by selling bonds with just a few years to maturity while their prices are still high. That generates more proceeds that can be reinvested into bonds with longer maturities and higher yields. The amount of benefit from this strategy depends on the slope of the yield curve and the timing of purchases and sales.

ILLUSTRATION: HOW IT WORKS

Suppose that on 31 Jul 2024, the AAA rated, noncallable yield curve was as follows:

The yield curve

Years	Yield	Years	Yield	Years	Yield
1	2.88%	6	2.76%	11	2.86%
2	2.83%	7	2.77%	12	2.98%
3	2.78%	8	2.78%	13	3.02%
4	2.77%	9	2.79%	14	3.11%
5	2.75%	10	2.79%	15	3.19%

Further suppose that someone invests $100,000 in a bond with the following characteristics:

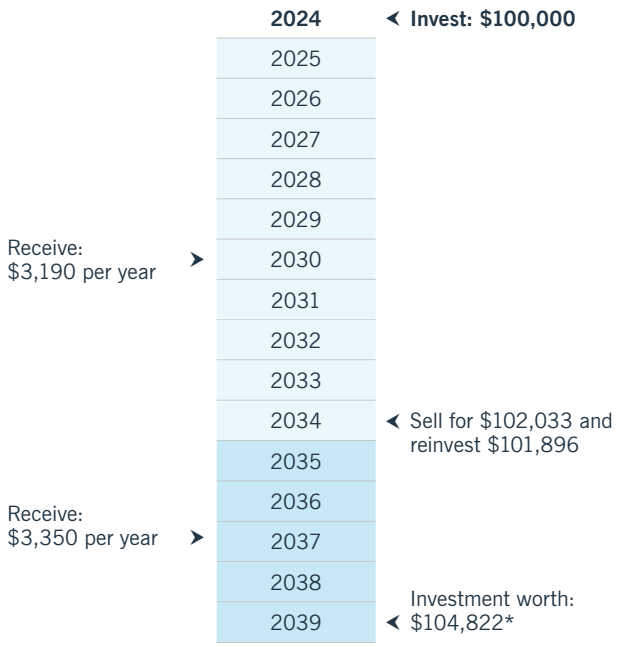
Maturity	Yield	Dollar price	Coupon	Annual income
15 years	3.19%	$100.00	3.19%	$3,190

Ten years later, on 31 Jul 2034, if interest rates remain the same throughout the yield curve, the investor could sell that bond at a dollar price of $102.033 based on the fact that bonds with 5 years to maturity are priced to yield 2.75%. The proceeds of that sale could be used to purchase the new bond shown below (coupon rate rounded to nearest 0.01%).

Maturity	Yield	Dollar price	Coupon	Annual income
15 years	3.19%	$101.896	3.35%	$ 3,350

By selling the original bond for more than par, the investor would be able to buy a premium bond with a higher coupon. Finally, in the year 2039 (15 years after the original investment and five years after the swap) the new bond has a

dollar price of $104.822 (priced to yield 2.79% to maturity in 10 years). To summarize, below is the way the investor's cash flows look:



*Not including interest earned in the final year.

Using these cash flows, we can compute the internal rate of return (IRR) on this investment, which is the interest rate that causes the present value of the amounts received to equal the amount invested. The IRR in this case is 3.48%. If the investor just held the original bond until it matured, the IRR would have been 3.19%, which is the yield at which the bond was purchased. Thus, by selling the bond with 5 years remaining to maturity and reinvesting in another 15-year bond, the investor increases the return by 0.29%.

Internal rate of return if interest RATES REMAIN CONSTANT	
Buy and hold	3.19%
Rolling down the yield curve	3.48%

WHAT HAPPENS IF INTEREST RATES FALL?

Suppose in our example that interest rates had fallen 0.50% sometime in the first 10 years after the bond was purchased and remained there for the rest of the 15-year period. (Since the coupon stream remains constant until the bond is sold in year 10, all that matters is what the yield curve looks like in the last 5 years to maturity.) In 2034, the original bond would be worth $104.412 as it is priced to yield 2.25% (0.50% less than in the original scenario). The proceeds of that sale could be used to purchase the new bond shown below (coupon rate rounded to nearest 0.01%).

Maturity	Yield	Dollar price	Coupon	Annual income
15 years	2.69%	$104.174	3.03%	$3,030

In 2039, the new bond would be priced to yield 2.29%, producing a price of $106.543. The cash flows would be:

*Not including interest earned in the final year.

Internal rate of return if interest RATES FALL 0.50%	
Buy and hold	3.19%
Rolling down the yield curve	3.48%

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WHAT HAPPENS IF INTEREST RATES RISE?

We obtain similar results if we assume that yields had risen by 0.50%. In that case, the original bond would be priced at a discount of $99.716 after 10 years (priced in 2034 to yield 3.25% to maturity in 2039), given that the 5-year market yield surpassed the bond's coupon. However, this creates an opportune time for the investor to reinvest in a higher coupon environment. The 0.50% increase in interest rates means that a new 15-year bond would yield 3.69%. The sale proceeds of the original bond would be reinvested as follows:

Maturity	Yield	Dollar price	Coupon	Annual income
15 years	3.69%	$99.657	3.66%	$3,660

In 2039, the new bond would be worth $103.097 if priced to yield 3.29% to its maturity in 10 years. Here are the cash flows:

*Not including interest earned in the final year.

Internal rate of return if interest RATES RISE 0.50%	
Buy and hold	3.19%
Rolling down the yield curve	3.48%

EXPLANATION: WHY IT WORKS

At first glance, this strategy sounds like the proverbial "free lunch," but it has a logical explanation. If the investor were to hold the bond to maturity, the investor would have a security whose yield decreases over time. This lower yield reflects the fact that the price volatility of the bond, in other words, its market risk, would also be decreasing.

The principle in operation here is that the maturity of a bond affects how much the price changes in response to changing interest rates: the shorter the maturity, the less the change. By swapping into a longer bond in the tenth year, the investor replaces a lower yielding security with a higher yielding security. This higher yield compensates for the fact that the new bond has greater price volatility.

This trade, however, merely restores the volatility to the level of risk originally chosen by the investor. The investor substantially improves the return by taking advantage of the market's preference for low volatility and by making judicious use of the shape of the yield curve in selecting maturities for sale and purchase.

CONCLUSION

By monitoring the shape of the yield curve and capturing the value produced when bonds ride the yield curve, portfolio managers can enhance the returns that investors receive from their portfolios in up and down markets. Yield curve inversions create a particularly opportune time for portfolio managers to sell bonds with maturities in the lowest parts of the yield curve and reinvest at higher yields out longer on the curve.

	Internal rate of return	IRR with 20% capital gains tax
Hold bond to maturity	3.19%	3.19%
Swap after 10 years, rates unchanged	3.48%	3.41%
Swap after 10 years, rates fall 0.50%	3.48%	3.39%
Swap after 10 years, rates rise 0.50%	3.48%	3.45%

ASSUMPTIONS**

The preceding analysis is based on two assumptions. The first is that the yield curve retains its current slope. If the yield curve were steeper, the benefits of selling, in 10 years, a bond due in 15 years and replacing it with a bond due 25 years from today would be enhanced. On the other hand, a flatter yield curve would reduce the benefit of this strategy.

As noted earlier, the current noncallable municipal yield curve is inverted, and the slope between 5 and 15 years is flatter than in recent years. As of 31 Jul 2024, the spread of 15-year yields over 5-year yields was 0.44% (3.19% - 2.75%), which was less than the average spread of 0.83% over the last 3 years.

The second assumption is that interest rates do not increase between 10 and 15 years. In year 15, the investor in the example would be holding a bond with 10 years remaining to maturity after the swap. Meanwhile, an investor who continued to hold the original bond would then be receiving the principal balance in cash. If rates on 10-year bonds increased between year 10 and year 15, the investor would, in many cases, be better off holding cash at the end of the period than holding a 10-year bond (depending on how high 10-year yields became).

On the other hand, if rates fell, the investor with a 10-year bond would enjoy appreciation not available to the investor who receives a return of principal in year 15. Since these risks are symmetrical, and their impact varies with the interest rate cycle, we believe the effect of changes in rates should average out if the strategy of rolling down the yield curve is consistently followed over time.

** Source: Securities Evaluations, Inc. (a subsidiary of Intercontinental Exchange, Inc.)

The effect of rate changes should average out if the strategy is consistently followed over time.

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Endnotes

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