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Rolling Down the Interest-Rate Yield Curve

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When you invest in bonds, you have the potential to achieve a total return made up of a) yield, and b) capital appreciation. The metric yield-to-maturity (YTM) is the all-inclusive measure of a bond's annualized total return, assuming you hold to maturity, there is no default, and interest income is reinvested at YTM. YTM facilitates comparison among bonds with different maturities and creditworthiness.

When a bond is first issued and brought to market, it typically starts trading at 100 (a.k.a. par). Over time, the bond will trade either under 100 (discount bond) or over 100 (premium bond) before being redeemed for par at maturity (absent any default).

Since most bonds pay periodic fixed interest income, the yield component of the total return is predictable. The potential capital gain component, if any, is much more unpredictable. Bonds appreciate when a) their creditworthiness improves, and/or b) interest rates decline. Declining rates generally have a stronger positive impact than credit upgrades on bond prices. How much bonds appreciate in reaction to rate declines depends on what is happening to the "interest rate yield curve," which plots yields for bonds of equal creditworthiness and different maturities. A normal yield curve is upward slopping, showing that bonds with longer maturities offer higher yields. This makes sense because both default risk and interest rate risk are higher as maturity (duration) lengthens. Derived from maturity, duration is a more precise measure of price sensitivity to interest rate movements. Longer duration bonds will appreciate more than shorter duration bonds in reaction to the same drop in rates.

Even if you are certain that interest rates are going to drop, it is still tricky to predict how much your bond might appreciate. The gain depends on which part of the yield curve you predict will drop. Will it be a parallel shift down of the entire curve (in which case the shape of the yield curve does not change) or a decline of only portions of the curve (in which case the shape of the yield curve will change)?

It is widely accepted that a bond needs to rely solely on credit upgrades to generate capital gains if a) interest rates do not drop (no parallel shifts down in yield curve), and b) shape of yield curve does not change favorably. We explain below why this is wrong.

Even in the absence of downward parallel shifts or favorable changes in the shape of the yield curve, a bond (especially discount bonds) will appreciate by "riding down an up-

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ward sloping yield curve" towards maturity. To generate capital appreciation, you should isolate and buy into the steepest parts of the yield curve – namely the area of the steepest ***drops*** in yields over the shortest period of time. This is because bond prices move ***inversely*** to yields/rates. This strategy works best for discount bonds because they have longer duration than premium bonds with the same maturities. Accordingly, discount bonds will appreciate more than premium bonds in reaction to the same drop in rates along the yield curve from one time period to another. Premium bonds are less ideal than discount bonds for executing this strategy also because premium bonds will depreciate towards par as they approach maturity.

Here's an example to illustrate how the above strategy works. Let's assume that you intend to invest and hold a bond for one year before selling, and you expect no change to the level or shape of the yield curve in the coming 12 months. Conventional, widely held wisdom asserts that you are not going to be able to generate capital gains. This is wrong. Let's say you identify the steepest portion of the yield curve to be between 6-year bonds (yielding 4%) and 7-year bonds (yielding 5%). To execute the strategy of rolling down the yield curve, you buy a 7-year bond yielding 5%. One year later, your bond will functionally become a 6-year bond with 6 years to maturity. Consistent with then market yields, your bond will yield 4% like all other 6-year bonds of same creditworthiness. Since the annual interest rate paid by your original 7-year bond does not change with the passage of time, the price of your bond must go up during your 12-month holding period to produce a lower yield that equals the market yield for 6-year bonds.

Using a discount bond to execute this strategy of rolling down the interest rate curve is preferable than using a premium bond of comparable maturity because the discount bond has longer duration. The discount bond will go up in price more than the premium bond. You can then realize this capital gain by selling your bond after one year in this example.

While premium bonds will produce lower capital gain than discount bonds when riding down the yield curve, premium bonds will insulate better against any ***unexpected*** parallel rise in yield curve rates or unfavorable changes in shape of the curve on account of their shorter duration. Premium bonds therefore can be viewed as offering less upside but also less downside than discount bonds when using them to ride down the yield curve.

To summarize:

Positives for a bond investor:	**Negatives for a bond investor:**
Positive roll yield (when yield curve is "normal" i.e. upward sloping)	Negative roll yield (when yield curve is "inverted" i.e. downward sloping); typically occurs only during recessions
General interest rates drop (parallel shift down in entire yield curve)	General interest rates rise (parallel shift up in entire yield curve)
Shape of yield curve steepens (meaning y/y drop in yields increases)	Shape of yield curve flattens (meaning y/y drop in yields decreases)

Your results investing in bonds by riding down the interest rate yield curve will be in between the two extremes in the above table when there is a combination of positive and negative variables, e.g. positive roll yield is greater than loss from upward shift in yield curve or vice versa.

Futures Curve - Roll Yield

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When you buy a futures contract covering a physical asset (e.g. oil), you enter into an agreement with the seller to pay a pre-determined price *now* to receive physical delivery of the underlying asset *in the future*. Unlike options, you have the obligation to pay and take delivery unless you sell the contract before expiration. Your buy price is fixed today, but the value of the underlying asset will fluctuate with the *spot price*; this is the price at which the underlying asset can be bought or sold for immediate delivery.

If the spot price rises between your purchase and the expiration date of the futures contract, then the intrinsic value (as opposed to the time value) of the derivative or long futures position will rise; the converse is also true (because you also have the obligation to take delivery of a potentially less valuable asset). Unlike option buyers, your potential loss as a futures buyer is not limited to just the option premium. So, the main way for a futures contract buyer (long position) to benefit is for the spot price of the underlying asset to go up over time.

If the underlying asset is physical (like oil), futures contracts are most likely to be settled physically (a.k.a. physical settlement), which entails the futures buyer taking possession of the physical asset at contract expiration. Buyers who are using futures as financial vehicles to make investment profits (rather than actual users of oil) are not interested in taking physical delivery of the underlying asset. So if the spot price rises, they will likely "cash out profits" by selling the more valuable futures contract to neutralize their long position to zero. The futures buyer who wants to zero out its position (a.k.a. futures contract termination) would sell (short) a futures contract covering the same quantity of the underlying asset with the same expiration date to cancel out the long futures contract position, resulting in "flat" or no position.

In contrast, cash settlement typically applies when the underlying asset is not physical (e.g. a stock market index). A buyer of a futures contract with cash settlement does not have to deal with physical delivery and can choose to let the futures contract expire, at which time the trade will be settled *in cash* among the buyer and seller of that contract. One side's loss is the other side's gain.

When the futures curve (which plots prices of futures contracts covering the same asset but different expirations) is flat, the only determinant of returns or losses is the movement of the spot price (other than time value which goes down over time). Investors who are long a futures contract will make money if the spot price rises or lose money if the spot price drops. This is the baseline case.

How does the above discussion apply to investing in oil futures? The oil futures curve is rarely flat. It is either in *backwardation* (downward sloping) or *contango* (upward sloping). Holding the spot price constant, the investor will likely want to continue maintaining its long position by selling the expiring futures contract and "rolling" into a futures contract with a farther expiration date. This is especially true when the futures curve is in backwardation, because the replacement futures contract would sell at a discount to the stable spot price. Even if the spot price does not change, the investor will generate profits because of "roll yield" as the initially lower value of that replacement contract at purchase **appreciates** towards the higher spot price over time. The converse is true with an oil futures curve in contango.

To summarize, an investor who buys an oil futures contract will:

Make money from	**Lose money from**
• Rising spot price, or • Positive roll yield if futures curve in backwardation	• Declining spot price, or • Negative roll yield if futures curve in contango

An investor who is long an oil futures contract will:

Benefit the most if	**Lose the most if**
• Rising spot price, and • Positive roll yield	• Declining spot price, and • Negative roll yield
End up in between the 2 scenarios above if	
• Rising spot price but negative roll yield, or • Declining spot price but positive roll yield Another way of looking at this latter case is that if you roll into a more distant contract at a discount because of backwardation (positive roll yield), you have a margin of safety of still breaking even if the spot price drops towards the future lower discounted contract price (ignoring time value of money).	