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Highland Capital
MANAGEMENT, LLC
An Argent Company

Foundations of Fixed Income

Introduction to Bonds:

What is a bond?

A debt security issued by a government or corporation with stated interest rate and defined dates when principal and interest must be paid. Short term debt is also referred to as a money market instrument.

Features of Debt Instruments

- **Dates**: Issue, Maturity and Call
- **Coupon**: Contractual rate of interest payments
- **Pay Frequency**: Contractual amount of pay periods a year for P&I
- **Optionality**: Callable, Prepay
- **Adjustable Rate Features**: Reset Date, Index + Margin, Caps, Floors

Key Terms and Concepts

Par value: nominal underlying value of a bond the issuer pays the bondholder at maturity

Coupon: the underlying rate on the bond, coupon * par value represents the annual interest income payment received

Yield: annualized internal rate of return of the investment based on coupon interest payments, the bond's purchase/ market price and maturity

Maturity: date the last coupon and principal payment is paid

Market Value: current price for a bond in the open market

Key Terms and Concepts

Premium: difference between the price paid for a bond and its par value when price is higher than par ($100)

Discount: difference between the price paid for a bond and its par value when price is lower than par ($100)

Spread: difference in yield on different debt instruments, usually bonds compared to a benchmark treasury with a similar maturity

Explicit Guarantee – issuer's debt backed by full, faith and credit of the US.

Implicit Guarantee – Government sponsored enterprise (GSE) backed by implied guarantee from the federal government.

Types of Fixed Income Securities

Government Bonds

Treasuries	Agencies	Agency MBS+CMO	Agency CMBS
Direct obligations of US Gvmt	Implicit guarantee by US Gvmt	Implied guarantee by US Gvmt (GNMA explicit guarantee)	Implied guarantee by US Gvmt (GNMA explicit guarantee)

Types of Fixed Income Securities

Credit Bonds

| Municipals	Corporates	Non-Agency RMBS+CMO+CMBS	ABS
Backed by issuer and may have insurance	Backed by Corporation	Lack Gvmt Gtd; secured by residential+commercial loans	Lack Gvmt Gtd (SBA explicit gtd); secured by income generating assets

US Fixed Income Market Size

Market size matters. It affects liquidity, pricing quality, portfolio scalability and risk management, especially in periods of market volatility. Generally, the larger the market the more efficient it operates. The US has the largest bond market globally, with Treasuries serving as the "risk-free" rate.

US Fixed Income Issuance by Sector
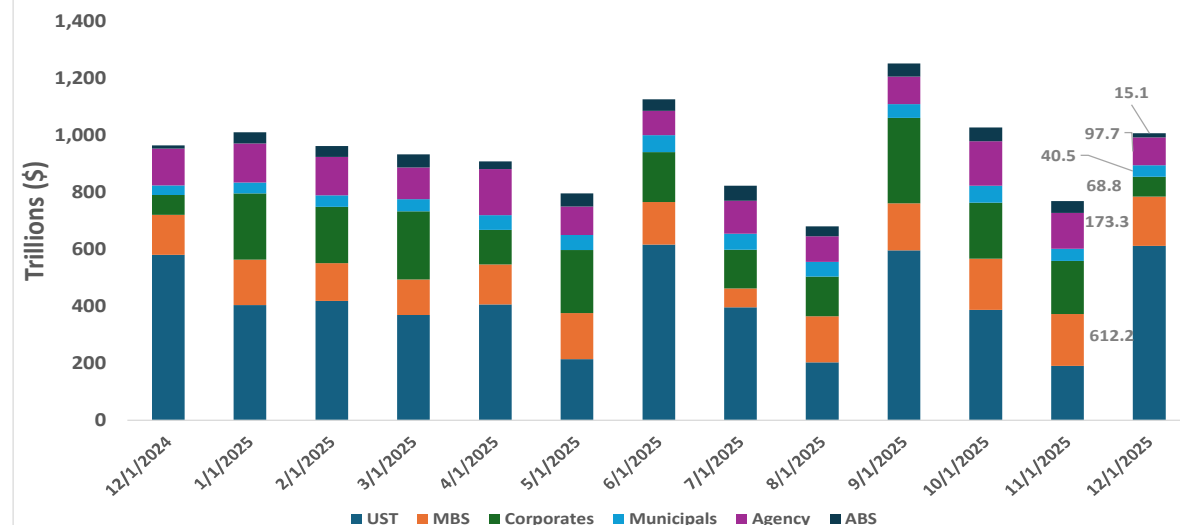
US Fixed Income Debt Outstanding by Sector
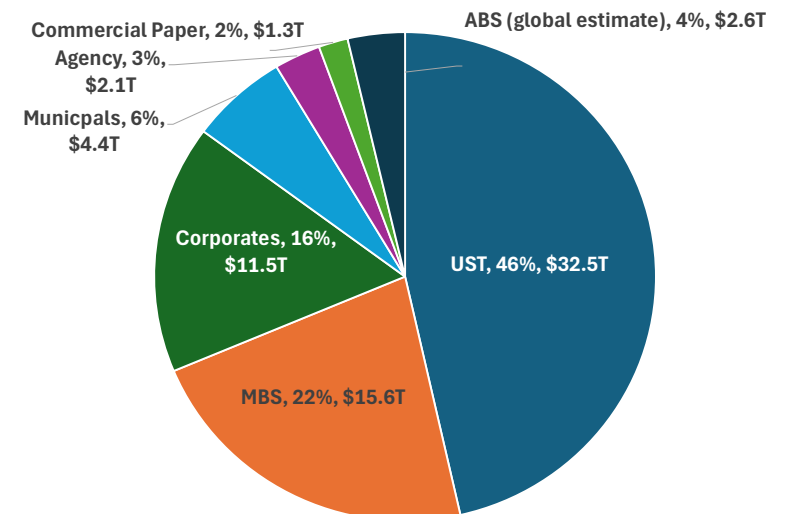
Inverse Relationship: Price & Yield

Bond prices have inverse relationship with market interest rates:

As interest rates **rise**, prices of existing bonds **fall**

As interest rates **fall**, prices of existing bonds **rise**

Bond Price

Market Interest Rates/ Bond Market Yield

Inverse Relationship: Bond Price vs Yield
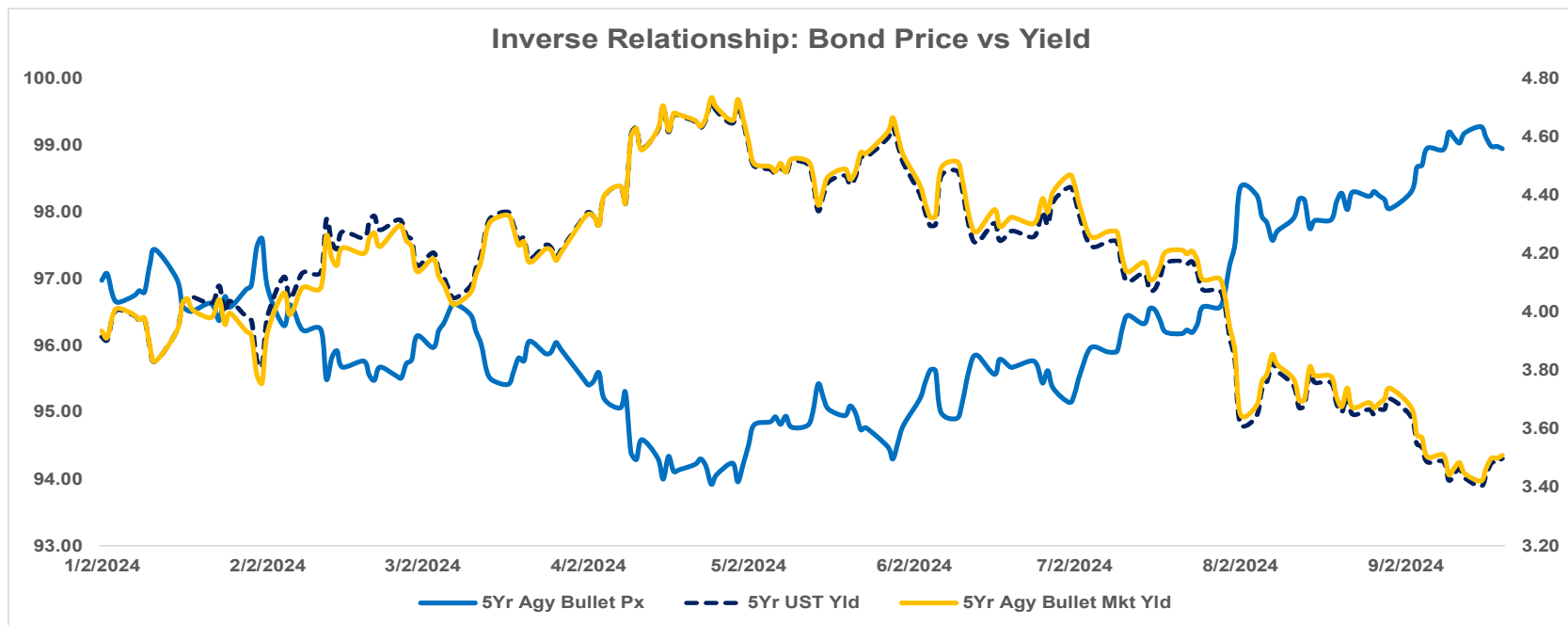
Premium and Discount Dollar Prices

The underlying coupon and interest rate market movements impact a bond's current market price. A bond with a <u>market yield</u> **below** (above) the <u>current coupon</u> will be <u>priced</u> at a **premium** (discount) to provide the same return as a par bond would to the investor.

	Par	Premium	Discount
Par Value	$ 1,000,000	$ 1,000,000	$ 1,000,000
Maturity	5 Yr	5 Yr	5 Yr
Coupon	5.00%	6.00%	4.00%
Market Interest Rate	5.00%	5.00%	5.00%
Interest	$ 250,000	$ 300,000	$ 200,000
Interest Difference		$ 50,000	$ (50,000)
Premium (+) / Discount (-) Px Adjustment		$ 5.00	$ (5.00)
Market Price	$ 100	$ 105.00	$ 95.00

Premium and Discount Dollar Prices

A bond purchased above (below) par experiences an effect known as "pull to par" whereas the market price moves closer to $100, par, as the maturity nears.

Assuming all other factors remain constant over the term of the bond:

a **premium bond** will continuously **decrease** in price until it reaches par value at maturity

a **discount bond** will continuously **increase** in price to par value until maturity
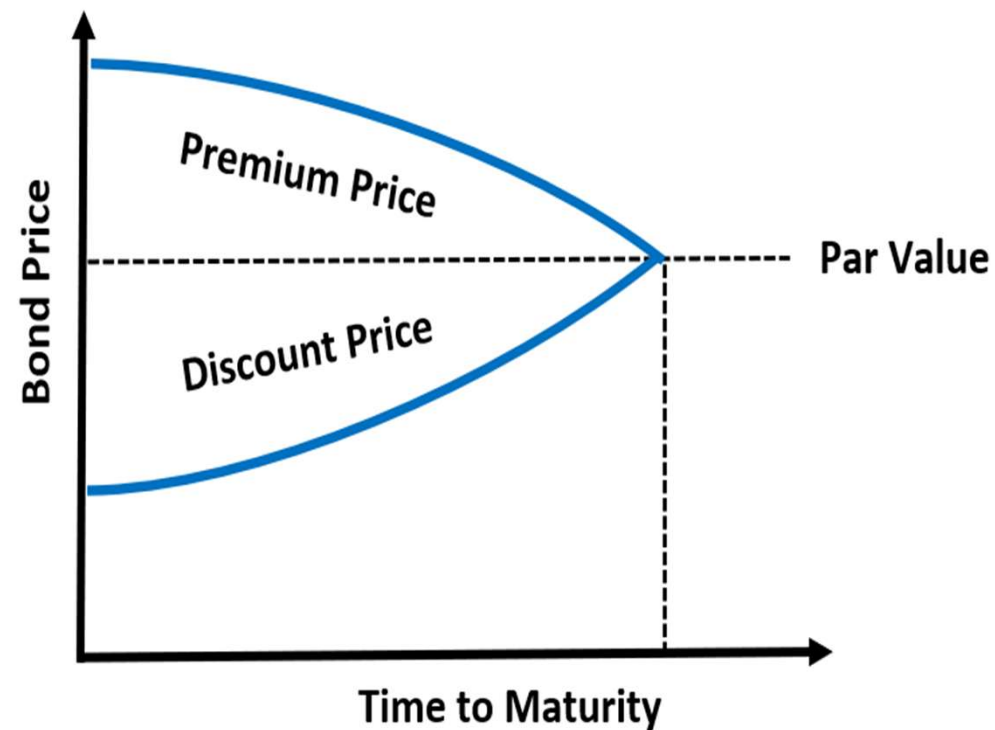
Yield

Yield: The annualized internal rate of return of the investment based on coupon interest payments and the bond's price and maturity.

The **greater** the interest rate risk or credit risk of a bond, the **more** yield investors demand.

Bond market yields generally follow the direction of interest rates.

Types of yield measures to approximate the return of a bond:

YTM	YTC	YTW
Yield-to-Maturity	**Yield-to-Call**	**Yield-to-Worst**
the yield if the bond is held to maturity	the return the bondholder receives if the bond is called on the stated call date	the lower of Yield-to-Maturity and Yield-To-Call

Coupon, Price & Yield Relationship

Discount ($80)

Coupon YTM YTC

Par Value ($100)   Coupon   YTM   YTC

Premium ($120)
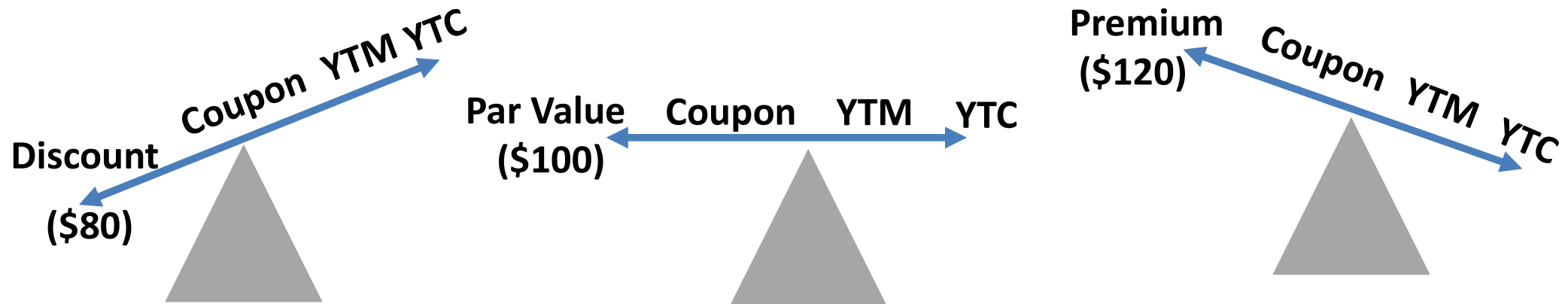
Coupon YTM YTC

YTW for Discount = YTM   YTW for Premium = YTC
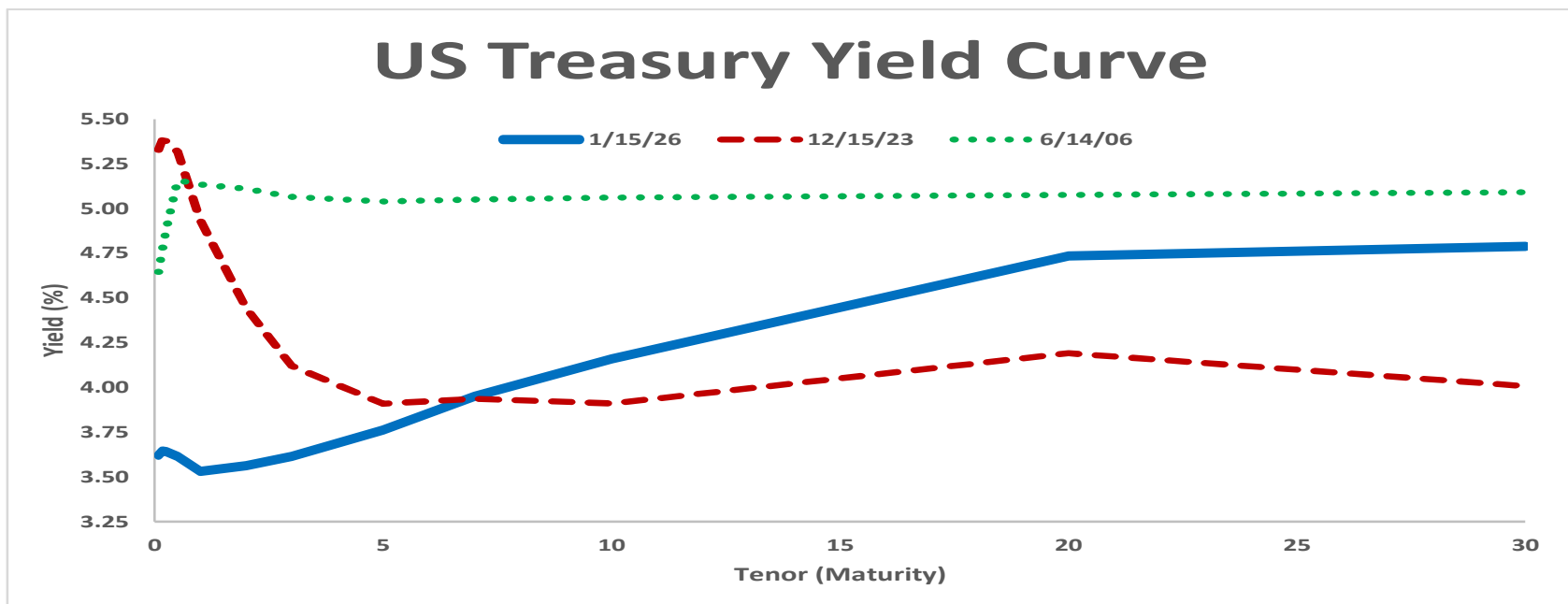
Par: Coupon = YTM = YTC

Discount Price: Coupon < YTM < YTC

Premium Price: Coupon > YTM > YTC

The Yield Curve

The **Yield Curve** displays how much it costs the federal government to borrow money for a given amount of time, revealing relationship between long- and short-term interest rates.

US Treasury Yield Curve

Measuring Risk

Average Life

Weighted average of time until the investor receives their outstanding principal.

Effective Duration

The sensitivity of a bond's price for a change in interest rates. Accounts for embedded option of a security to capture fluctuations in cashflows as interest rates change.

Convexity

Calculates the rate at which the effective duration of a bond changes in response to a percentage point change in yields per year

Price Volatility

Measures how much a price changes in a bond for a change in interest rates.

Measuring Risk

Average Life is used to measure the average length of time that it will take a bond to repay its principal and focused timing of principal cashflows.

A change of interest rates can either reduce or lengthen the average life of a bond with optionality.

Concept Check:

										-100				+100		
Description	Coupon	Maturity	Bk Price	Bk TEY	Avg Life	Eff Dur	Mod Dur	Mcly Dur	Eff Conv	Bk TEY	Avg Life	Mkt Yld	% Prc Chg	Bk TEY	Avg Life	Mkt Yld	% Prc Chg
4Yr/ 1Yr/ 1x Call FHLB - Par	4.00	09/18/2028	100.00	4.00	4.0	1.5	3.7	3.7	-0.4	4.00	1.0	2.89	1.08	4.00	4.0	4.55	-1.99
4.1Yr/ 0.3Mo CC FFCB - Prem	5.34	11/06/2028	100.21	4.81	0.4	0.4	3.7	3.7	-0.1	4.81	0.4	3.80	0.38	4.81	4.1	5.42	-0.48
3.1Yr FFCB Cont Call - Dsct	0.86	10/27/2027	92.32	3.49	3.1	3.0	3.0	3.1	0.0	3.49	3.1	2.50	3.03	3.49	3.1	4.49	-2.95
4.2Yr FHLB AGY Bullet	3.25	11/16/2028	99.19	3.46	4.2	3.8	3.8	3.9	0.1	3.46	4.2	2.46	3.94	3.46	4.2	4.46	-3.77

Measuring Risk

Duration is a key metric commonly used to construct investment strategies by seeking to maximize returns for an expected change in market interest rates. If a portfolio manager is under the thought that interest rates fall (bond prices rise), then the goal will be to lengthen the duration of the portfolio to increase return and lock in yield.

Macaulay Duration

a metric that measures the average time it takes to receive a bond's cash flows, or the weighted average of the time to receive each cash flow

Modified Duration

expands Macauley duration to better reflect the bond's price sensitivity for a single percentage point change in interest rates and is a linear measure

Effective Duration

linear measure of the responsiveness of a bond's price to market interest rate changes for a bond with an embedded option

Measuring Risk

Effective Duration is the **primary** duration metric used to compare both bonds with and without optionality since it captures the expected change in cashflows for a change in interest rates.

Concept Check:

Description	Coupon	Maturity	Bk Price	Bk TEY	Avg Life	Eff Dur	Mod Dur	Mcly Dur	Eff Conv	Bk TEY	Avg Life	Mkt Yld	-100 % Prc Chg	Bk TEY	Avg Life	Mkt Yld	+100 % Prc Chg
4Yr/ 1Yr/ 1x Call FHLB - Par	4.00	09/18/2028	100.00	4.00	4.0	1.5	3.7	3.7	-0.4	4.00	1.0	2.89	1.08	4.00	4.0	4.55	-1.99
4.1Yr/ 0.3Mo CC FFCB - Prem	5.34	11/06/2028	100.21	4.81	0.4	0.4	3.7	3.7	-0.1	4.81	0.4	3.80	0.38	4.81	4.1	5.42	-0.48
3.1Yr FFCB Cont Call - Dsct	0.86	10/27/2027	92.32	3.49	3.1	3.0	3.0	3.1	0.0	3.49	3.1	2.50	3.03	3.49	3.1	4.49	-2.95
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Notice the alignment of effective duration to the projected price change, illustrating the gauge of a bonds price sensitivity for a 1% change in interest rates

Measuring Risk

Convexity measures a bond's price sensitivity for a change in interest rates because the relationship is not linear (as effective duration is). A change in rates will accelerate or decelerate the price of a bond but not at a constant rate with the change in interest rates.

The **greater** <u>convexity</u>, the more curvature in shape.

Positive Convexity
―――

The higher or more positive convex a bond is, implies the bond price is less affected by interest rate increases and sees a greater benefit for interest rate decreases.

Negative Convexity
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The greater the negative convexity (greater optionality), the more likely for the cash flows, average life, and effective duration to change

Price

← Positive convexity – non callable bond

Effective Duration

Negative convexity

Yield
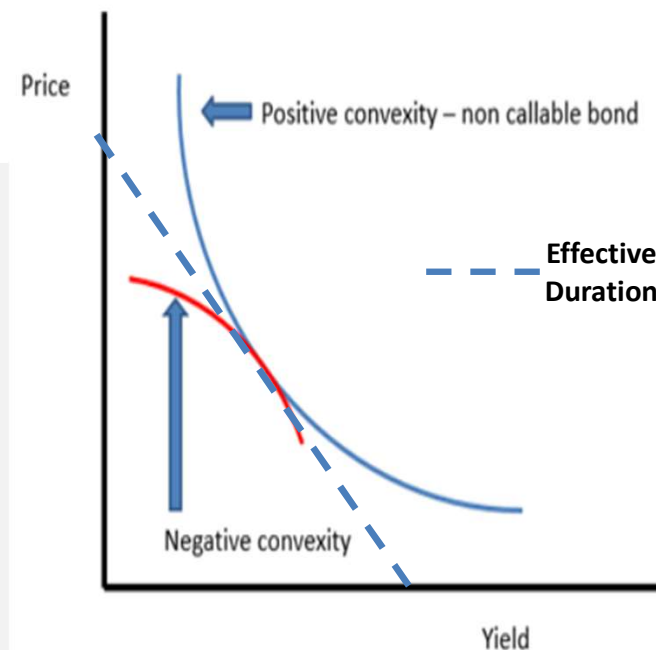
Measuring Risk

Bonds with little- to- no optionality have greater positive convexity, meaning the price change in falling rates is greater than the price change in rising rates.

Bonds with negative convexity show less price change in falling rates versus rising rates.

Concept Check:

Description	Coupon	Maturity	Bk Price	Bk TEY	Avg Life	Eff Dur	Mod Dur	Mcly Dur	Eff Conv	-100				+100			
										Bk TEY	Avg Life	Mkt Yld	% Prc Chg	Bk TEY	Avg Life	Mkt Yld	% Prc Chg
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Measuring Risk

Bond **price volatility** is a measure of how much a bond's price changes in response to interest rate fluctuations**.**

A bond's price volatility is affected by several factors like Coupon and Maturity/ Avg Life. Typically, the lower the coupon and longer the maturity (avg life) the greater the price volatility.

Concept Check:

			Bk Price	Bk TEY	Avg Life	Eff Dur	Mod Dur	Mcly Dur	Eff Conv	-100				+100			
Description	Coupon	Maturity								Bk TEY	Avg Life	Mkt Yld	% Prc Chg	Bk TEY	Avg Life	Mkt Yld	% Prc Chg
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