

Valuing Bonds

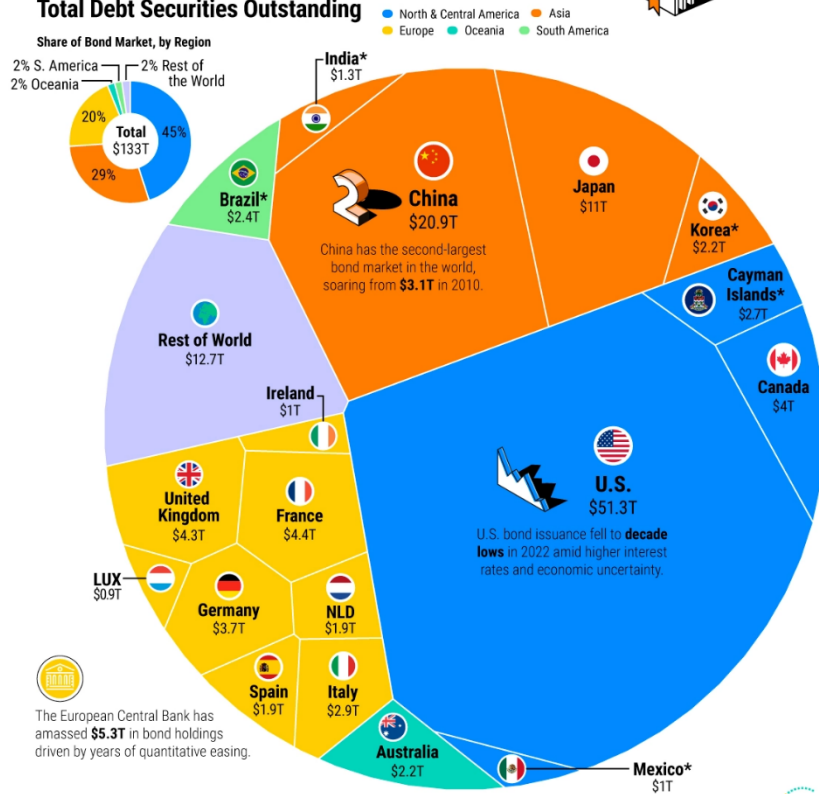
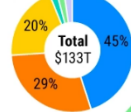
The Global Bond Market

Together, the U.S. and China make up 55% of the global bond market. We show the largest bond markets in the world based on data from the Bank for International Settlements.



Total Debt Securities Outstanding

Share of Bond Market, by Region



The European Central Bank has amassed **\$5.3T** in bond holdings driven by years of quantitative easing.

China has the second-largest bond market in the world, soaring from **\$3.1T** in 2010.

U.S. bond issuance fell to **decade lows** in 2022 amid higher interest rates and economic uncertainty.

*Represent countries where total debt securities were not reported by national authorities. These figures are the sum of domestic debt securities reported by national authorities and/or international debt securities compiled by BIS. Data as of Q3 2022. Source: BIS, Reuters, Eastspring Investments.



The \$109T Global Stock Market IN 2023

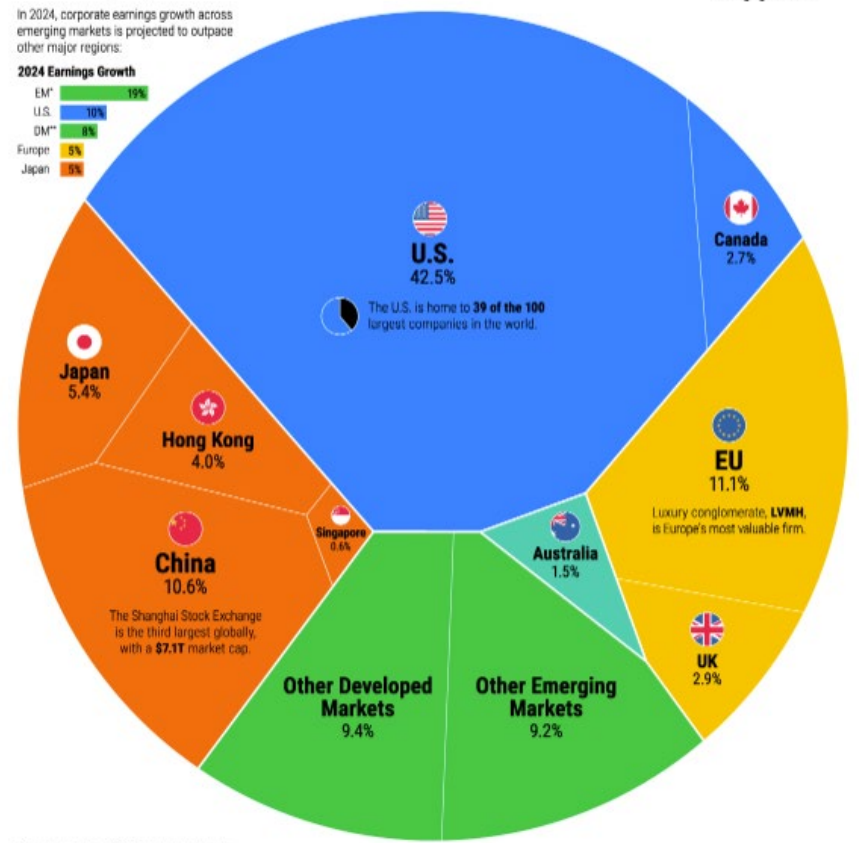
Here's how global equity markets break down in 2023, according to analysis from SIFMA.



Global Equity Market Share as of Q2 2023

North America Asia Europe Oceania Developed & Emerging Markets

In 2024, corporate earnings growth across emerging markets is projected to outpace other major regions:



The U.S. is home to **39 of the 100** largest companies in the world.

Luxury conglomerate, **LVMH**, is Europe's most valuable firm.

The Shanghai Stock Exchange is the third largest globally, with a **\$7.1T** market cap.

*Represented by the MSCI Emerging Markets Index.
 **Represented by the MSCI World Index which measures the performance of developed market equities.
 Source: World Federation of Exchanges, SIFMA estimates, Forbes, Bloomberg, JP Morgan, MSCI. Numbers may not total 100 due to rounding. Largest companies in the world based on Forbes 2020 methodology that accounts for market value, sales, profits, and assets.



Bond Cash Flows, Prices, and Yields

Bond Terminology

- Face Value
 - It is the principal value underlying the bond
 - It is the amount payable by the borrower to the last holder at maturity
 - It is the amount on which the periodic interest payments are calculated

- Term to Maturity
 - It is the time remaining in the life of the bond
 - It represents the length of time for which interest has to be paid as promised
 - It represents the length of time after which the face value will be repaid

Bond Cash Flows, Prices, and Yields

■ Coupon

- The coupon payment is the periodic interest payment that has to be made by the borrower.
- The coupon rate when multiplied by the face value gives the dollar value of the coupon.
- Most bonds pay coupons on a semi-annual basis.

Consider a bond with a face value of \$1000. The coupon rate is 8% per annum paid semi-annually. So the bond holder will receive

$$\frac{1000 \times 0.08}{2} = \$40 \text{ every six months.}$$

Bond Cash Flows, Prices, and Yields

Yield to Maturity (YTM)

- the rate of return for an investor if he buys the bond at the prevailing market price and holds it till maturity.

At any point in time the YTM may be

- Greater than
- Less than or
- Equal to the Coupon Rate

YTM is the IRR of a bond

Value of a Bond

A bond holder gets a stream of contractually promised payments.

The value of the bond is the value of this stream of cash flows.

However, you cannot simply add up cash flows arising at different points in time.

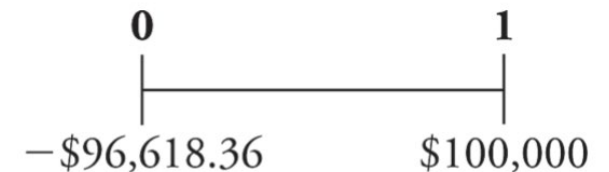
- Cash flows have to be discounted before being added.

Zero-Coupon Bonds

- does not make coupon payments
- sells at a discount (a price lower than face value), so they are also called pure discount bonds
- Treasury Bills are U.S. government zero-coupon bonds with a maturity of up to one year.

Eg: Suppose that a one-year, risk-free, zero-coupon bond with a \$100,000 face value has an initial price of \$96,618.36.

Although the bond pays no “interest,” your compensation is the difference between the initial price and the face value.



Zero-Coupon Bonds

Yield to Maturity – The discount rate that sets the present value of the promised bond payments equal to the current market price of the bond.

Price of a Zero-Coupon bond

$$P = \frac{FV}{(1 + YTM_n)^n}$$

$$96,618.36 = \frac{100,000}{(1 + YTM_1)}$$

$$1 + YTM_1 = \frac{100,000}{96,618.36} = 1.035$$

YTM for the one year zero coupon bond is 3.5%

Zero-Coupon Bonds

Yield to Maturity of an n-Year Zero-Coupon Bond

$$YTM_n = \left(\frac{FV}{P} \right)^{1/n} - 1$$

Yields for Different Maturities

Problem

Suppose the following zero-coupon bonds are trading at the prices shown below per \$100 face value. Determine the corresponding yield to maturity for each bond.

Maturity	1 year	2 years	3 years	4 years
Price	\$96.62	\$92.45	\$87.63	\$83.06

Yields for Different Maturities

$$YTM_1 = (100 / 96.62) - 1 = 3.50\%$$

$$YTM_2 = (100 / 92.45)^{1/2} - 1 = 4.00\%$$

$$YTM_3 = (100 / 87.63)^{1/3} - 1 = 4.50\%$$

$$YTM_4 = (100 / 83.06)^{1/4} - 1 = 4.75\%$$

Coupon Bonds

Coupon Bonds

- Pay face value at maturity
- Pay regular coupon interest payments

Notes

- coupon security with original maturities of 1–10 years

Bonds

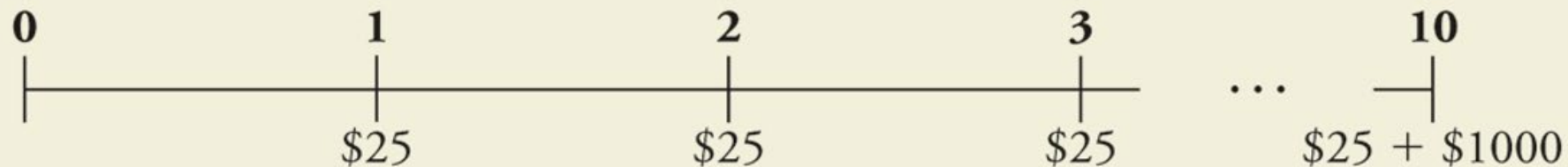
coupon security with original maturities over 10 years

Example

The Cash Flows of a Coupon Bond

Problem

The U.S. Treasury has just issued a five-year, \$1000 bond with a 5% coupon rate and semi-annual coupons. What cash flows will you receive if you hold this bond until maturity?



Note that the last payment occurs five years (ten six-month periods) from now and is composed of both a coupon payment of \$25 and the face value payment of \$1000.

Using the Present Value Formula to Value Bonds

$$PV = \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2} + \dots + \frac{1,000 + C_N}{(1+r)^N}$$

Using the Present Value Formula to Value Bonds

Example

- What is the value of the following bond? An IBM bond pays \$115 every June for five years. In June 2029, it pays an additional \$1,000 and retires the bond. The bond is rated AAA. YTM is 7.5%.

$$\begin{aligned} PV &= \frac{115}{1.075} + \frac{115}{(1.075)^2} + \frac{115}{(1.075)^3} + \frac{115}{(1.075)^4} + \frac{1,115}{(1.075)^5} \\ &= \$1,161.84 \end{aligned}$$

Using the Present Value Formula to Value Bonds

Another Example: Japan

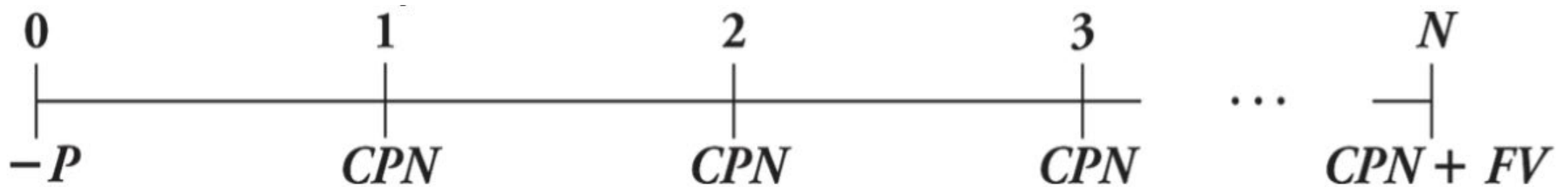
- In Dec 2024 you purchase 200 yen of bonds in Japan which pay an 8% coupon every year. If the bond matures in 2029 and the YTM is 4.5%, what is the value of the bond?

$$PV = \frac{16}{1.045} + \frac{16}{(1.045)^2} + \frac{16}{(1.045)^3} + \frac{16}{(1.045)^4} + \frac{216}{(1.045)^5}$$

$$= \text{¥}230.73$$

Coupon Bonds

Yield to Maturity – The YTM is the single discount rate that equates the present value of the bond's remaining cash flows to its current price.



– Yield to Maturity of a Coupon Bond

$$P = CPN \times \frac{1}{y} \left(1 - \frac{1}{(1 + y)^N} \right) + \frac{FV}{(1 + y)^N}$$

Example

Computing the yield to maturity of a coupon bond

Consider the five-year, \$1000 bond with a 5% coupon rate and semi-annual coupons. If this bond is currently trading for a price of \$957.35, what is the bond's yield to maturity?

Solution

Because the bond has ten remaining coupon payments, we compute its yield y by solving:

$$957.35 = 25 \times \frac{1}{y} \left(1 - \frac{1}{(1 + y)^{10}} \right) + \frac{1000}{(1 + y)^{10}}$$

We can solve it by trial-and-error or by using the annuity spreadsheet:

	NPER	RATE	PV	PMT	FV	Excel Formula
Given	10		-957.35	25	1,000	
Solve for Rate		3.00%				=Rate(10,25,-957.35,1000)

Therefore, $y = 3\%$. Because the bond pays coupons semiannually, this yield is for a six-month period. We convert it to an APR by multiplying by the number of coupon payments per year. Thus the bond has a yield to maturity equal to a 6% APR with semiannual compounding.

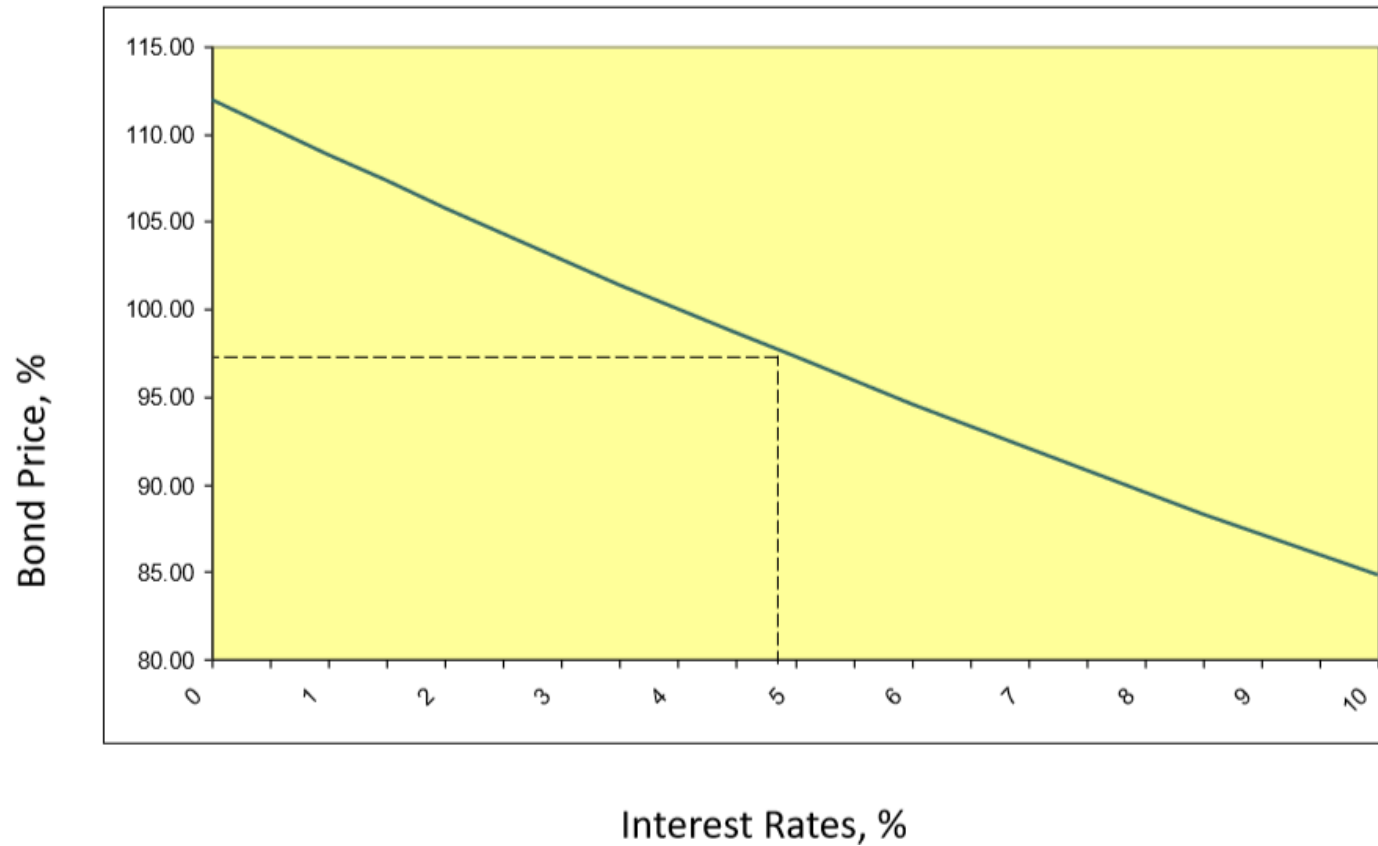
Example

Consider the five-year, \$1000 bond with a 5% coupon rate and semi-annual coupons. If the YTM is 6.30% (expressed as an APR with semi-annual compounding). What price is the bond trading now?

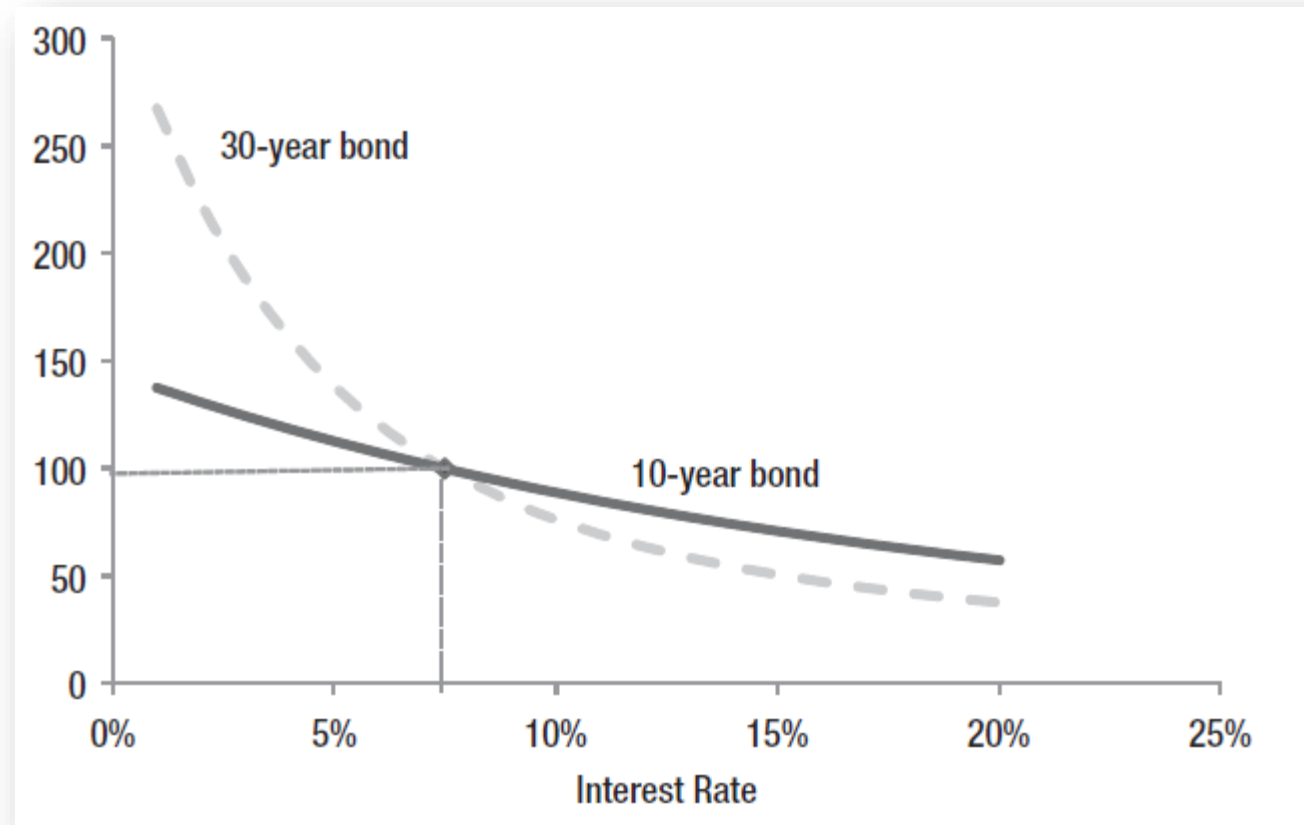
Note that 6.30% APR is equivalent to a semi-annual rate of 3.15%.

$$P = 944.98$$

Bond Prices and Yields



Maturity and Prices



10-Year Government Bond Yields

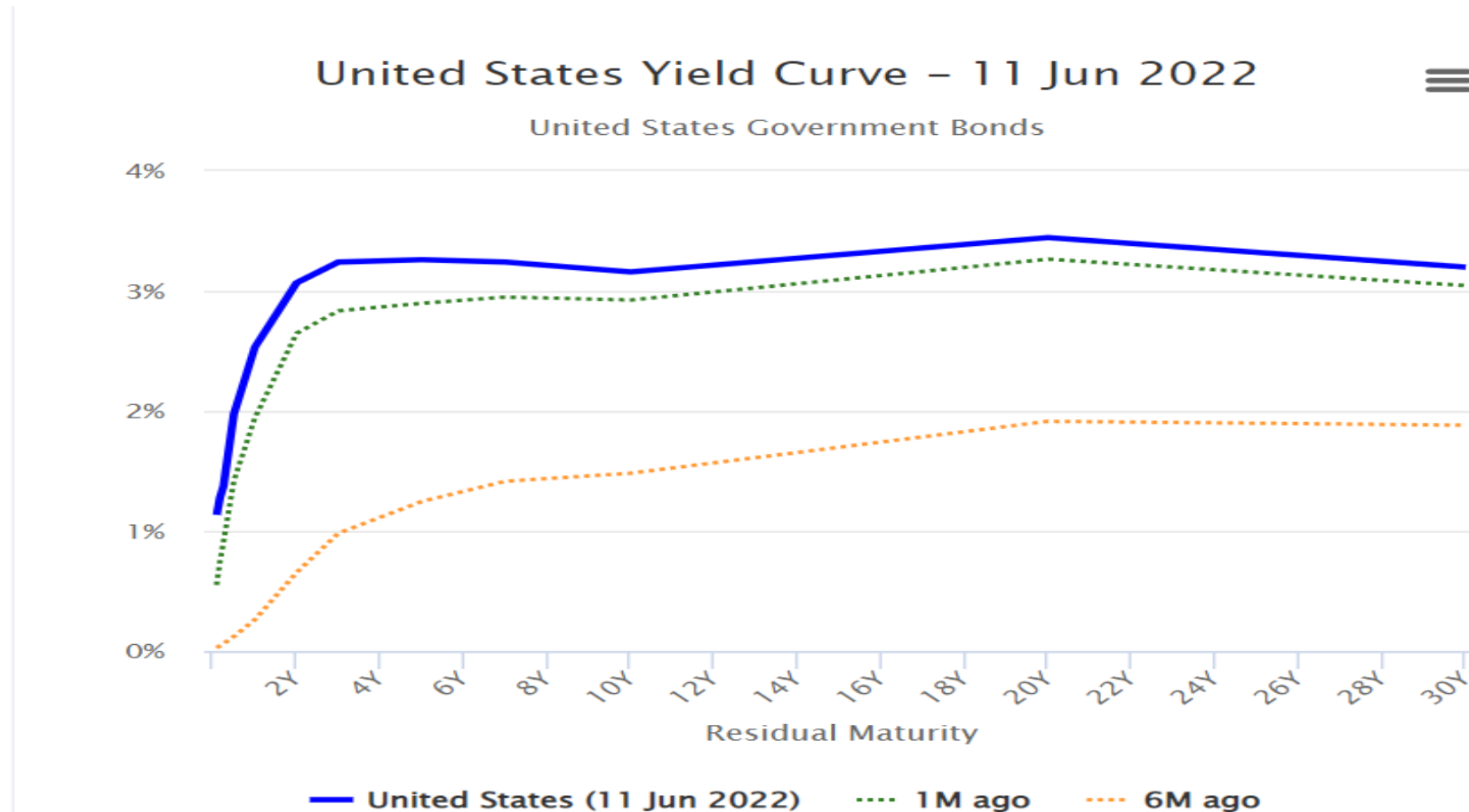
COUNTRY	YIELD
United States	4.32%
Canada	3.15%
Brazil	13.63%
Mexico	9.99%
United Kingdom	4.36%
Australia	4.29%
New Zealand	4.41%
Japan	1.03%
Singapore	2.73%
India	6.74%

The Yield Curve

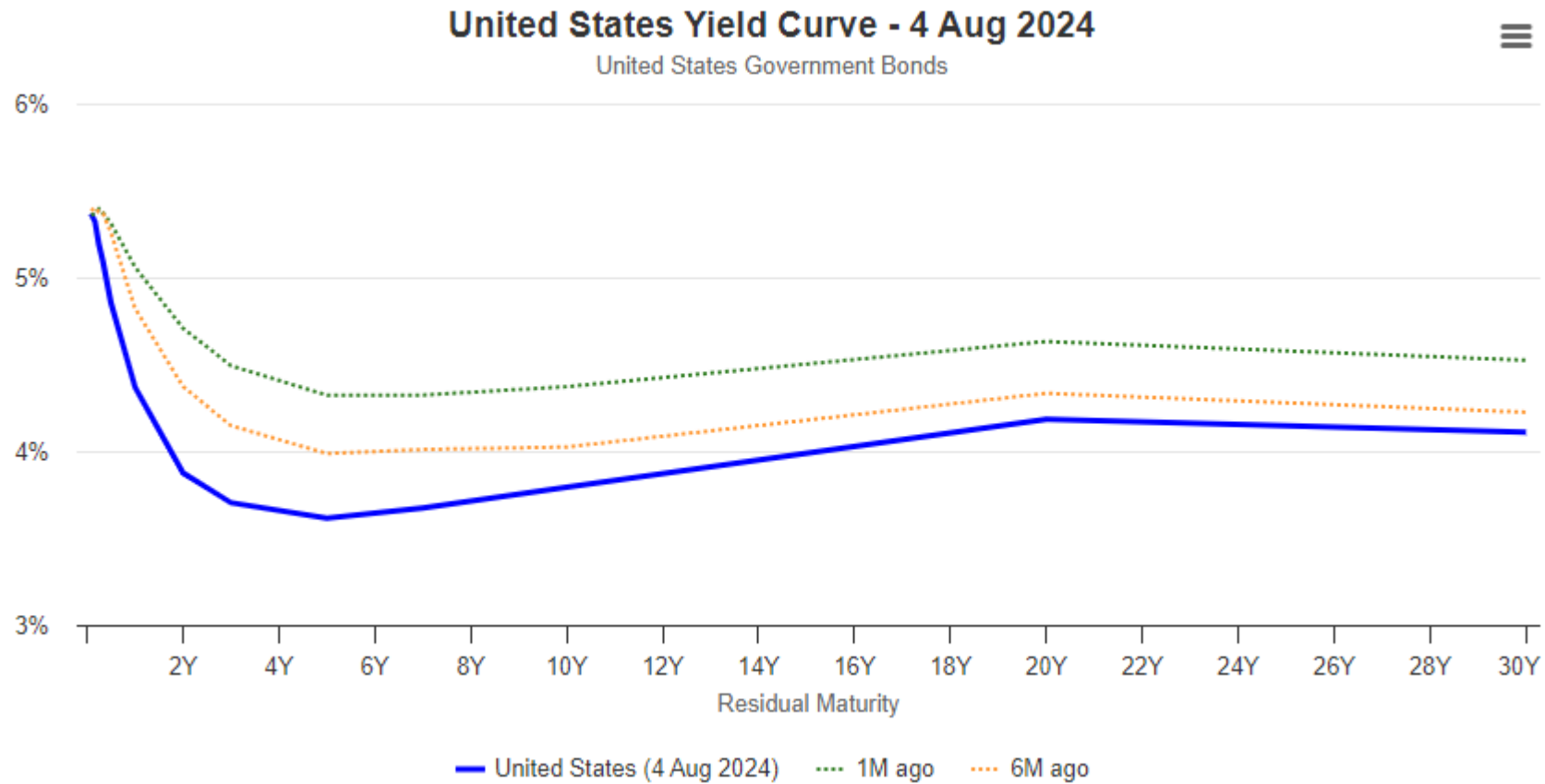
The yield curve displays the relationship between YTM and time to maturity

Information on expected future short-term rates can be implied from the yield curve

US YIELD CURVE



US YIELD CURVE



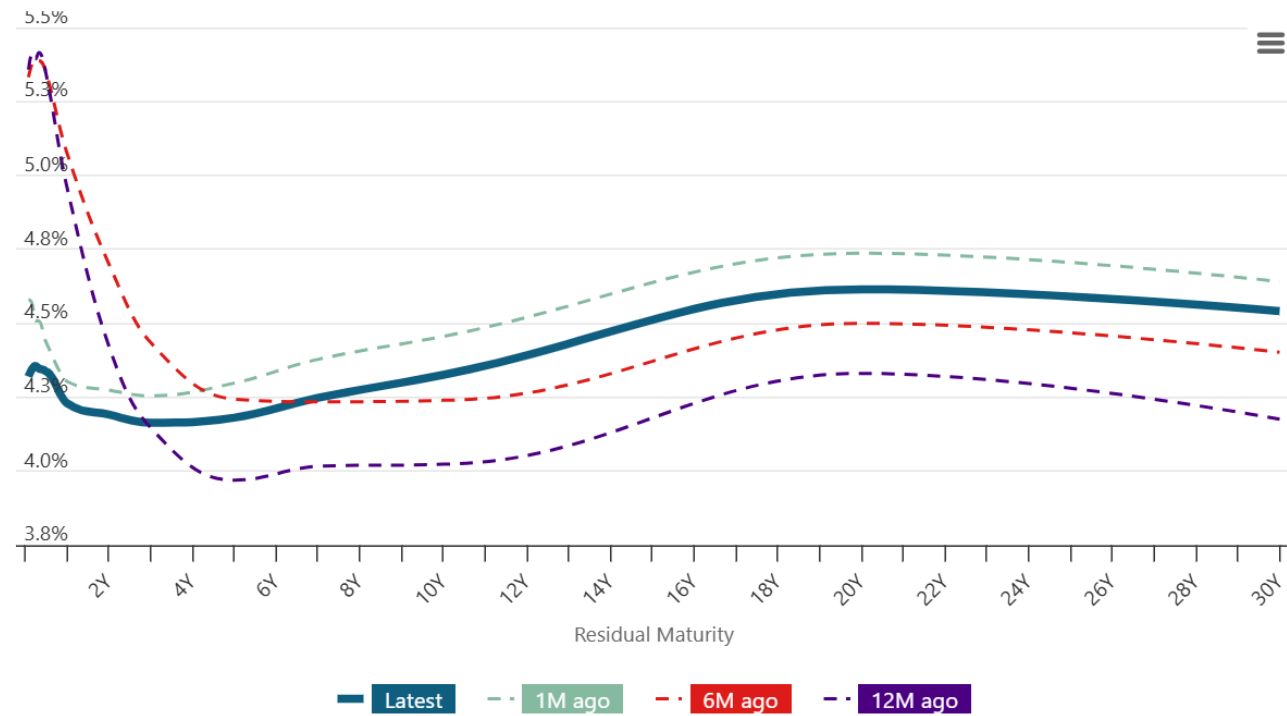
US YIELD CURVE



UNITED STATES YIELD CURVE

United States Government Bonds

13 December 2024



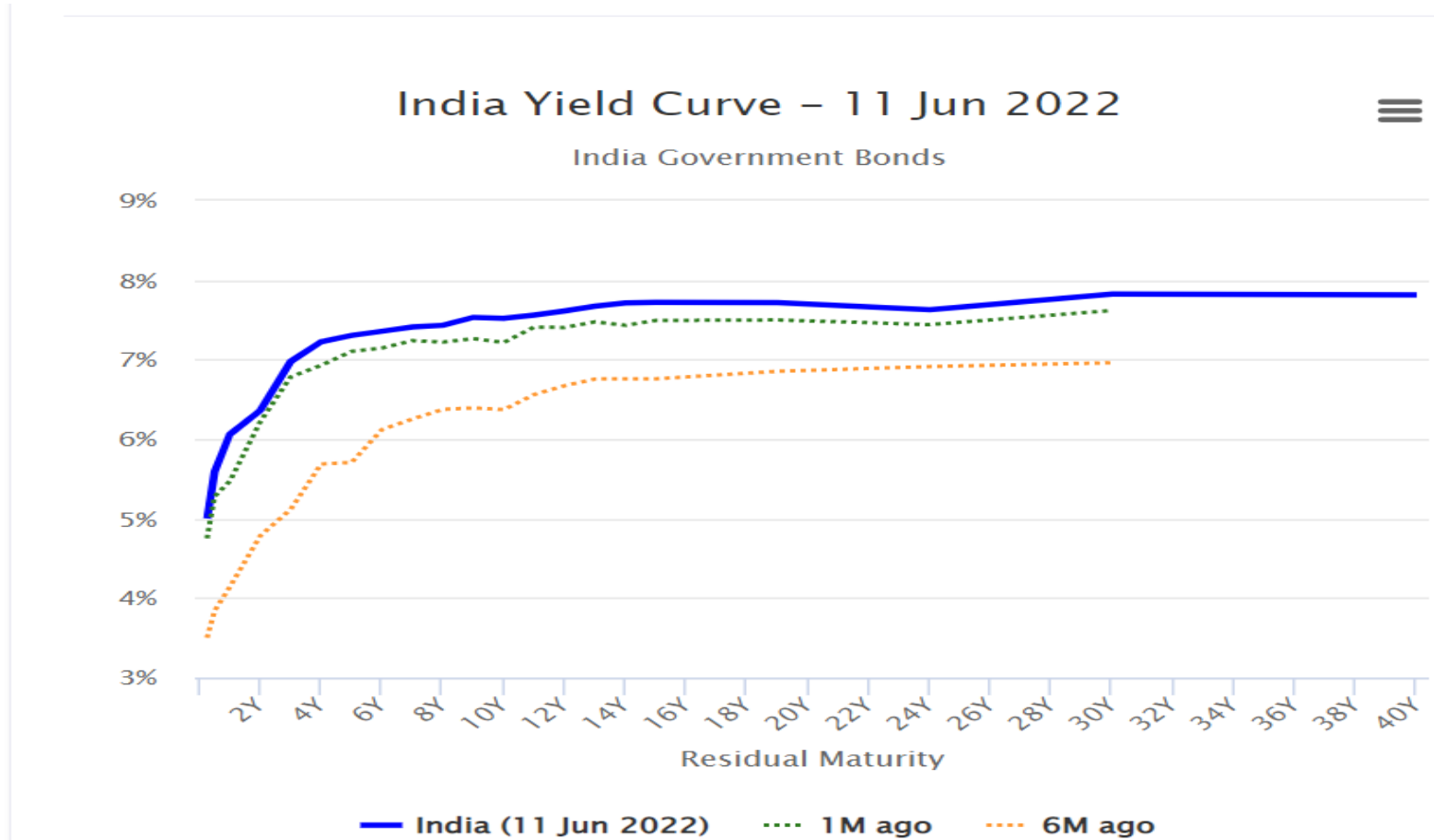
CRUCIAL QUOTE

"If you lock your money up for a longer period of time, you almost always get a higher interest rate," Duke University finance professor Campbell Harvey

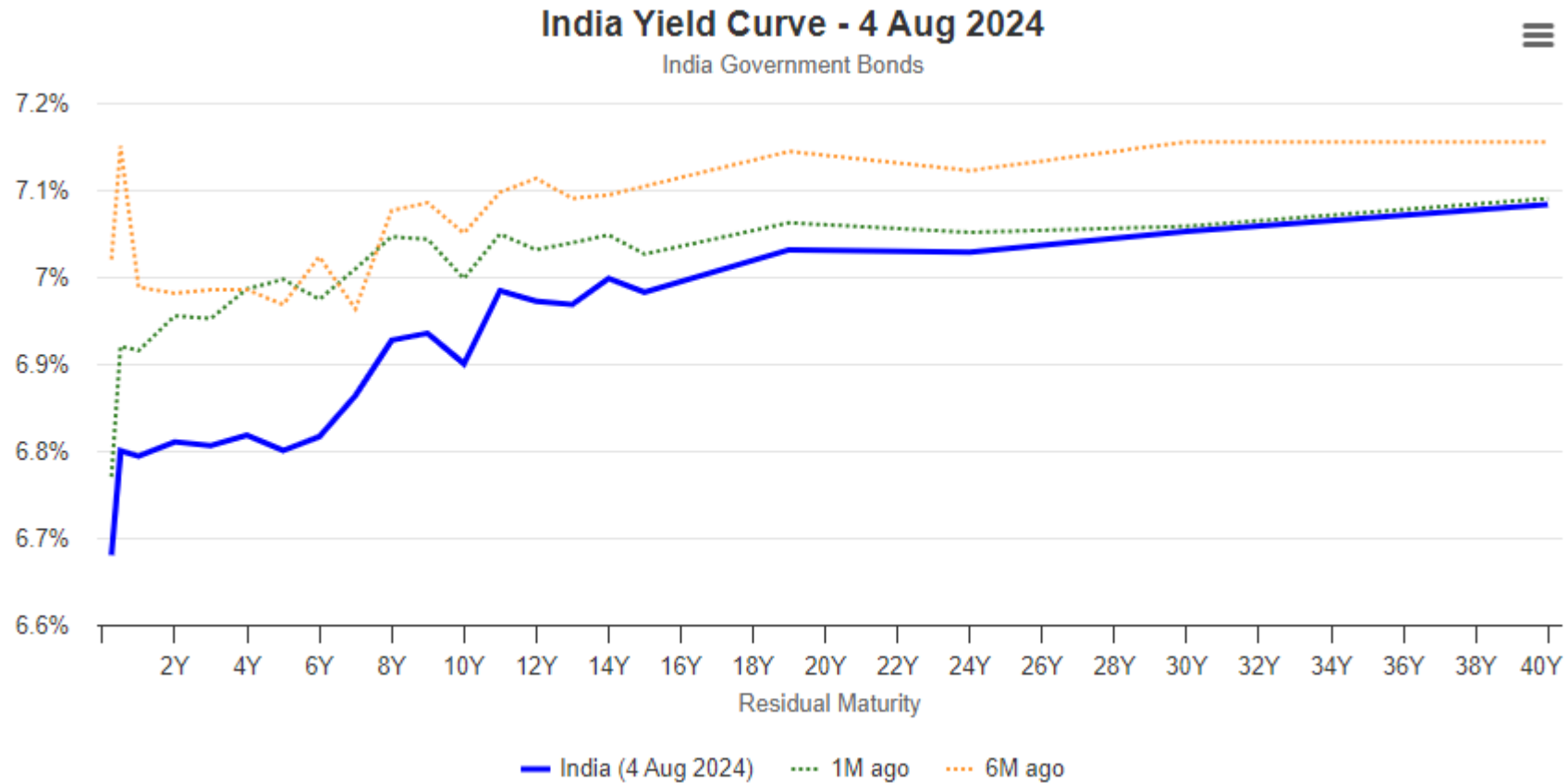
However, things are backwards today - 10-year interest rates are far below short-term rates. This is known as an 'inverted yield curve.'

In the past 50 years, we have seen seven inverted interest rate curves. Each one was followed by a recession.

INDIA YIELD CURVE



INDIA YIELD CURVE

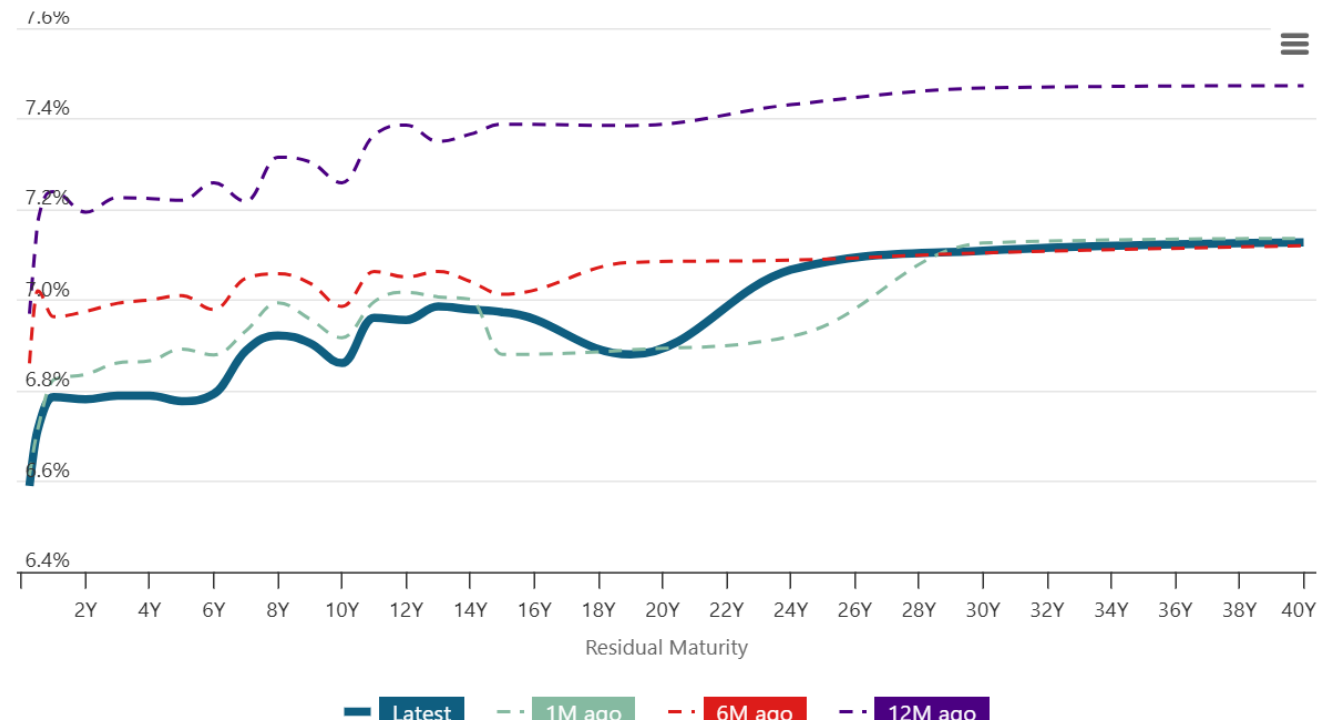


INDIA YIELD CURVE

INDIA YIELD CURVE

India Government Bonds

13 December 2024



Interpreting the Term Structure

The yield curve reflects expectations of future interest rates

The forecasts are clouded by liquidity premiums

An upward sloping curve could indicate:

- Rates are expected to rise

and/or

- Investors require large liquidity premiums to hold long term bonds

The yield curve is a good predictor of the business cycle

- Long term rates tend to rise in anticipation of economic expansion
- Inverted yield curve may indicate that interest rates are expected to fall and signal a recession

The Risk of Default

Corporate Bonds and Default Risk

- Payments promised to bondholders represent best-case scenario
- Most bonds' safety judged by bond ratings

Bond Ratings

The highest-quality bonds are rated triple A.

Bonds rated triple B or above are investment grade.

Lower rated bonds are called high-yield, or junk, bonds.

