

Treasury Markets

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BUSI 448: Investments

Where are we?

Last time:

- Empirical facts about equities

Today:

- Treasury market basics
- Term structure
- Spot rates

Treasury Securities

Bills

- Bills
 - Maturity of 1 year or less (1, 3, 6, 12 months)
 - Usually issued as **discount** securities
 - Taxes – exempt from state and local income taxes
 - Small denomination – can purchase in \$100 increments from **Treasury Direct**

Bonds and Notes

- Notes
 - Maturity between 2 years and 10 years (2, 3, 5, 7, 10 years)
 - Coupon securities (semiannual)
- Bonds
 - Maturity greater than 10 years (20, 30 years)
 - Coupon securities

TIPS and STRIPS

- Treasury inflation protection securities (TIPS)
 - Principal is indexed to consumer price index
 - Maturities of 5, 10, 30 years
- STRIPS (Separate Trading of Registered Interest and Principal Securities)
 - Allows individual component of Treasuries to be traded
 - Improves liquidity for zero-coupon Treasury markets

Historical yields

- can pull data from FRED at St. Louis Fed
- 3-month Tbill series

```
1 import pandas as pd
2 from pandas_datareader import DataReader as pdr
3 y3mo = pdr("TB3MS", "fred", start="1929-12-01")
```

Treasury Curve

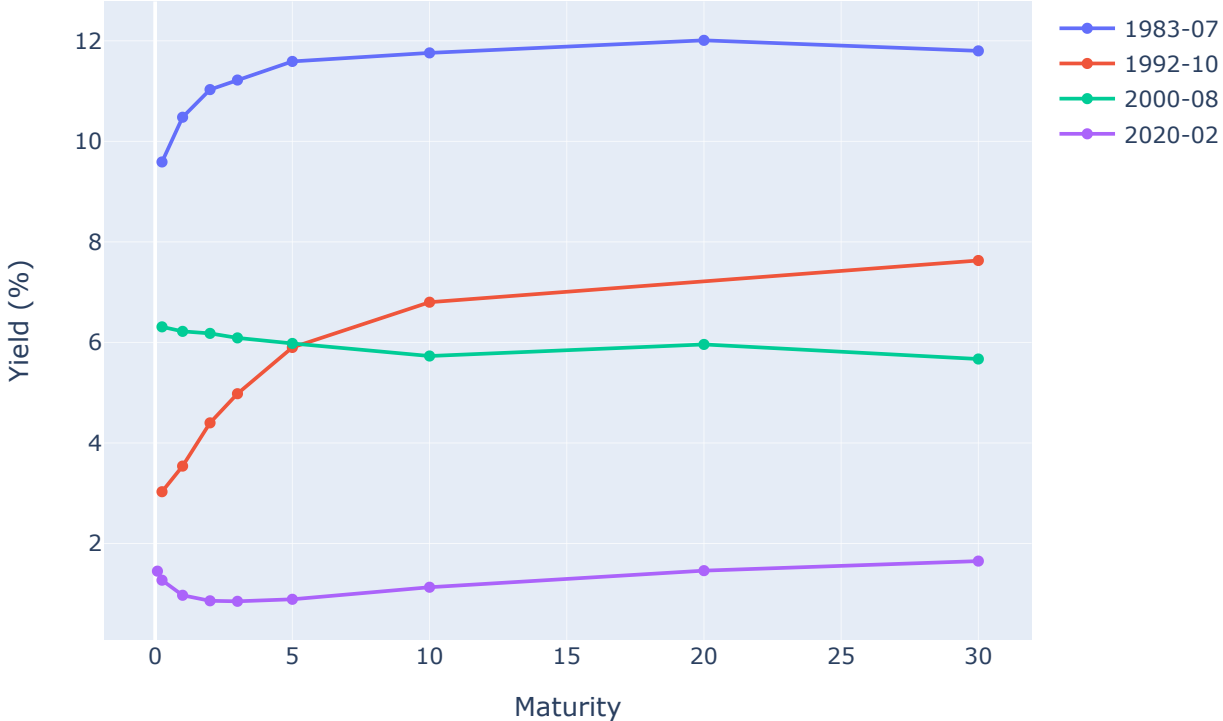
Term structure of rates

- Interest rates (yields) of different maturity bonds are generally different
 - For instance, 10-year bond may have a different yield than a 2-year note
- The **yield curve** is the plot of yields as a function of time to maturity
- The **term structure of rates** is the relation between yields and maturity

Key aspects of the term structure

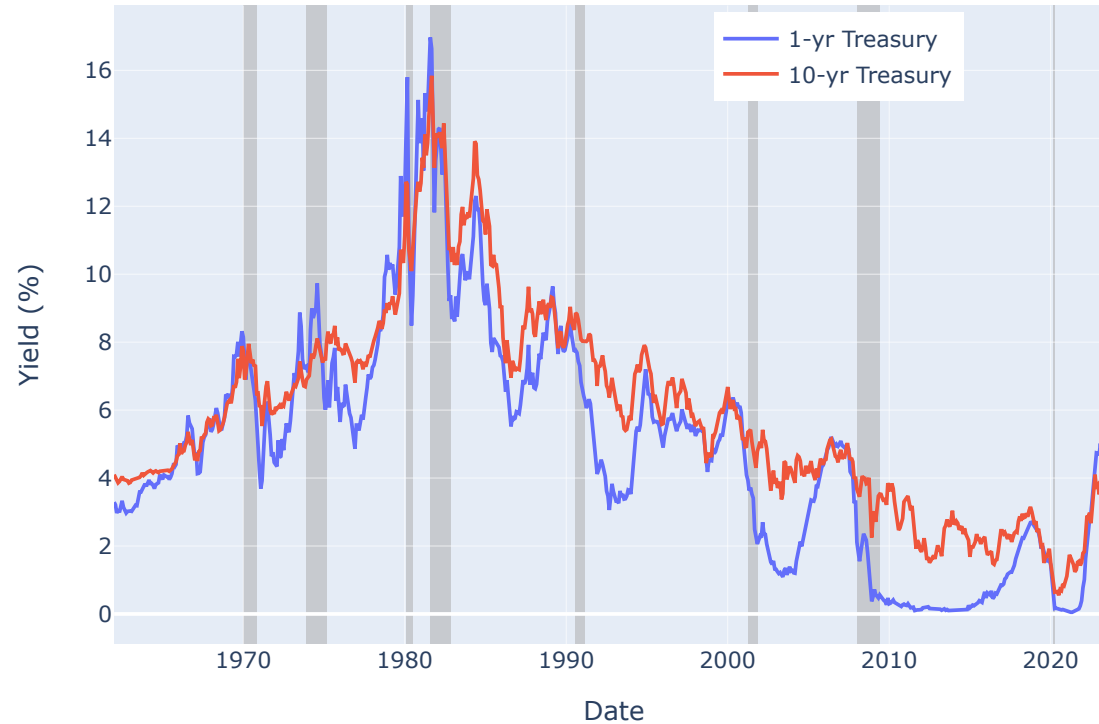
1. Level
2. Slope
3. Curvature

Historical Yield Curves



- dashboard: yield curves

Time-series of yields



- What do you notice prior to the shaded recessions?

Some fixed income empirical facts

Size of the market

- [SIFMA link](#)

Stocks, bonds, and gold returns

- dashboard: [stocks/bonds/gold](#)

Spot rate curve

Spot rates

- **Spot rates** are the discount rates associated with CFs of a particular maturity.

Two methods to get them:

- Use zero-coupon bonds (i.e., Tbills or STRIPS)
- Bootstrap them from coupon bonds

Bond pricing revisited

If z_1, z_2, \dots, z_T are maturity-specific riskless spot rates, then the bond price is:

$$P(\mathbf{z}) = \frac{C/m}{(1+z_1)} + \frac{C/m}{(1+z_2)^2} + \dots + \frac{C + FACE}{(1+z_T)^T}$$

$$P(\mathbf{z}) = \sum_{t=1}^T \frac{C/m}{(1+z_t)^t} + \frac{FACE}{(1+z_T)^T}$$

where

- C/m is the periodic coupon payment
- m is the compounding periods per year
- T is the total number of payments (# years $\cdot m$)

Spot rates from zero-coupon bonds

- A zero-coupon bond pays no coupons

$$P(z_t) = \frac{FACE}{(1 + z_t)^t}$$

- Using traded prices, we can solve for z_t

$$z_t = \left(\frac{Face}{P(z_t)} \right)^{1/t} - 1$$

Spot rates from coupon bonds

- **Bootstrapping:** method of extracting spot rates from coupon bond prices.
- Iterative procedure: 1st solve for z_1 , then z_2 using $z_1 \dots$
- To get spot rate z_t , we must know z_1, z_2, \dots, z_{t-1} :

$$z_t = \left(\frac{CF_t}{PV(CF_t)} \right)^{1/t} - 1$$

- $PV(CF_t) = P_t - \sum_{i=1}^{t-1} \frac{CF_i}{(1+z_i)^i}$
- P_t is the price of the coupon bond maturing at time t .

Example

Bond	Price	Coupon Rate	Maturity	Face Value
A	97.5	0%	0.5	100
B	95	0%	1.0	100
C	955	2.5%	1.5	1,000
D	1,000	5.75%	2	1,000

Assume semiannual coupon payments and no credit risk.

1. Determine the spot rates for the four periods
2. What is the fair price of a 2-year 10% coupon bond with a face value of \$1,000 if it pays annual coupons?

For next time: Arbitrage

