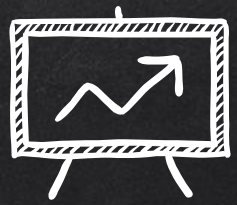

# Capital Market

## Class 3: Fixed income

# Outline

- ✘ Return (yield) calculation
- ✘ Exercise, simple return calculation
- ✘ Introduce fixed income structure
- ✘ Different types of fixed income (issuer, corp, muni, treasury, agency, MBS TBA/pools)
- ✘ Treasury bill/bond/note, TIPS
- ✘ Cash flow
- ✘ Dirty price = clean price + accrued interest
- ✘ Relationship between price and return (yield), duration
- ✘ Introduce yield vs interest, compare cash flow and interpret the meaning
- ✘ Revisit the bond price calculation, it's CLEAN price at previous payment date discounting!!!
- ✘ Treasury curve (interest being talked about, how does FED control it?)
- ✘ Forward rate
- ✘ Spot curve
- ✘ Credit risks (default risk, downgrade risk, spread risk) and spread
- ✘ OAS

# Interest, return and yield

- ✘ Interest can be viewed as a type of return, but return (yield) doesn't need to be interest
  - Interest implies lending/borrowing
  - You can earn return (yield) without lending/borrowing

$$r = FV / PV - 1$$

Usually annualized for better idea and comparison

# Interest, return and yield

- ✘ Interest can be viewed as a type of return, but return (yield) doesn't need to be interest
- ✘ Exercise, simple return calculation
  - Example 1: saving account $100, 5% interest

$$FV_n = 100 * (1 + 5\%)^n$$

$$100 = FV_n / (1 + r)^n$$

$$r = 5\%$$

# Interest, return and yield

- ✘ Interest can be viewed as a type of return, but return (yield) doesn't need to be interest
- ✘ Exercise, simple return calculation
  - Example 2: purchased AAPL stock at $100, year 1 end at $105, year 2 end at $81, year 5 end at $200

r1 = 105/100 - 1 = 5%, annualized r = 5%

r2 = 81/100 - 1 = -19%, annualized r = -10%

r5 = 200/100 - 1 = 100%, annualized r = 14.87% (72 rule)

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    r5 = 200/100 - 1 = 100%, annualized r = 14.87% (72 rule)

Q in mind: So far we looked at single time point return calculation, but what about a stream of cash inflow and outflows?
A: Discounted cash flow

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$FV_n = 100 * (1 + 5\%)^n$

$100 = FV_n / (1 + r)^n$

$r = 5\%$


- PV + FV (discounted) = 0

$- PV + FV_n / (1 + r)^n = 0$

# Interest, return and yield

- ✘ Interest can be viewed as a type of return, but return (yield) doesn't need to be interest
- ✘ Exercise, simple return calculation
  - Example 3: made initial business investment of $100, next 3 years $20 each, sold business at year 5 for $200


$$(-100) + (-20)/(1+r) + (-20)/(1+r)^2 + (-20)/(1+r)^3 + 200/(1+r)^5 = 0$$

$r = 5.35\%$

# Interest, return and yield

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- ✘ Exercise, simple return calculation
  - Example 3: made initial business investment of $100, next 3 years $20 each, sold business at year 5 for $200


Q in mind: But what about time points in between time windows?

$$(-100) + (-20)/(1+r) + (-20)/(1+r)^2 + (-20)/(1+r)^3 + 200/(1+r)^5 = 0$$

$r = 5.35\%$

# Fixed income overview

- ✘ Fixed income broadly refers to those types of investment security that pay investors fixed interest or dividend payments until its maturity date. At maturity, investors are repaid the principal amount they had invested.

  -- Investopedia

- ✘ In essence, fixed income products are borrowing/lending products
- ✘ Fixed amount (coupon/principal payment), fixed schedule (pre-determined dates)

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- ✘ Fixed amount (coupon/principal payment), fixed schedule (pre-determined dates)
- ✘ Nothing is really fixed ...

# Fixed income overview

- ✘ Fixed income securities come in different flavors
- ✘ Who, when, how long, how much, on what, for what, options?
- ✘ By issuer - Treasury, Agency, Municipal, Corporate
- ✘ By tenor - 1M, 2M, 3M, 6M, 1Y (T-bills), 2Y, 5Y, 7Y, 10Y (T-notes), 20Y, 30Y (T-bonds)
- ✘ By underlying asset - Credit, collateral (CDO, ABS, MBS)
- ✘ By embedded options - early redemption is a call option

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Q in mind: There are so many ways to look at the fixed income securities, is there a single metric to evaluate them from investment perspective?
A: A flawed single metric – credit rating (based on assessment of capability, willingness)

# Fixed income overview

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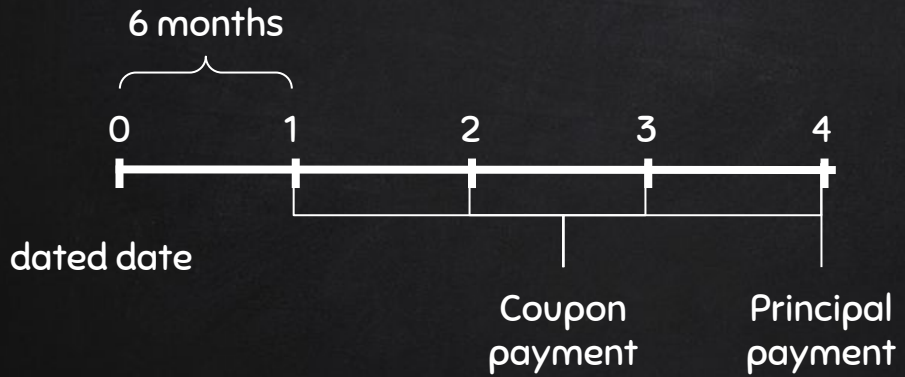
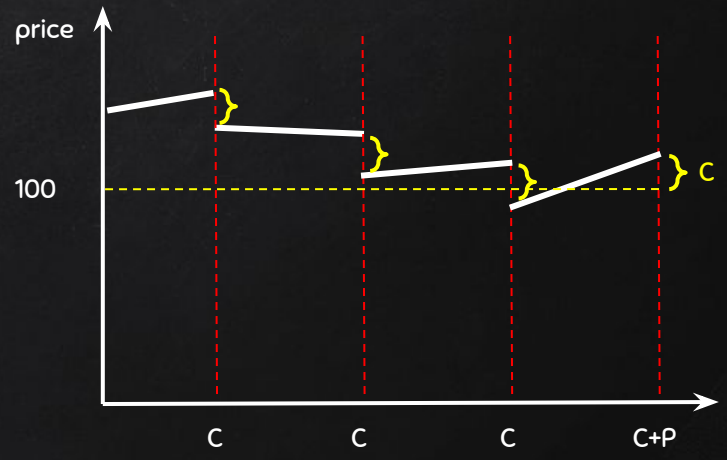
- ✘ Fixed amount (coupon/principal payment), fixed schedule (pre-determined dates)
- ✘ Nothing is really fixed …
- ✘ Amount can be linked to other mechanisms (TIPS, ABS, MBS), schedule can be cut short by early redemption (call option exercise) or even default

# Fixed income as an investment

- ✘ Cash flow example: Treasury 2Y note, 1% coupon rate, $1000 notional amount
- ✘ Key dates: auction date, issue date, dated date, maturity date




4 coupon payments of $5, 1 principal payment of $1000

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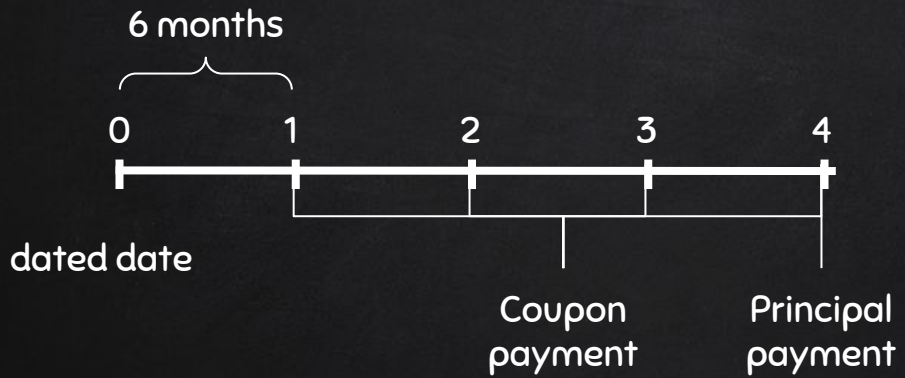
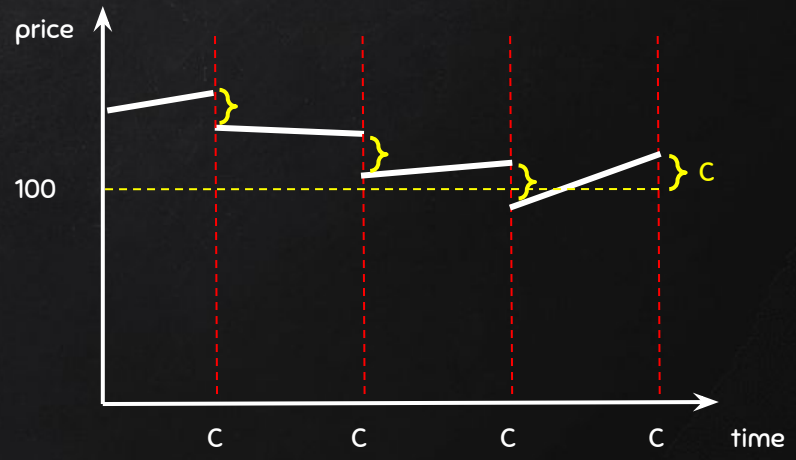


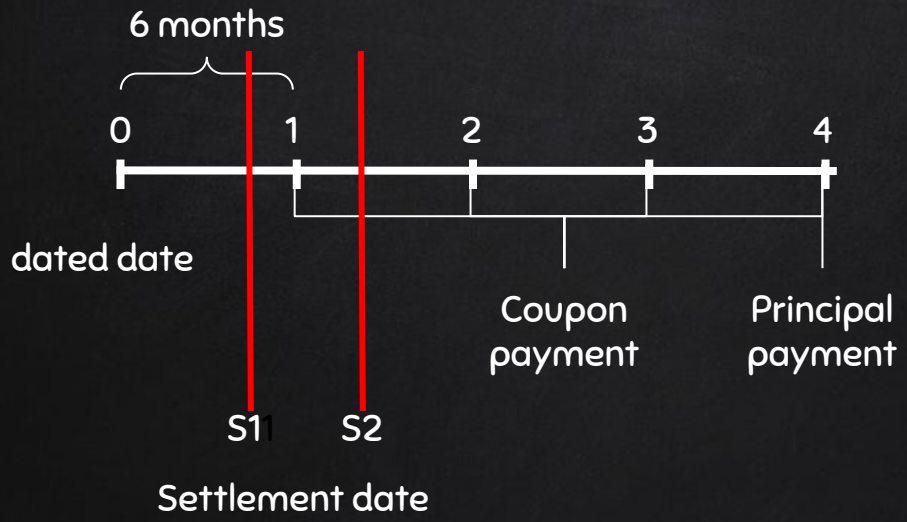

4 coupon payments of $5, 1 principal payment of $1000

Q in mind: what if zero coupon rate?



# Fixed income as an investment

- ✘ Two prices for Treasuries, clean and dirty
- ✘ Dirty price = clean price + accrued interest



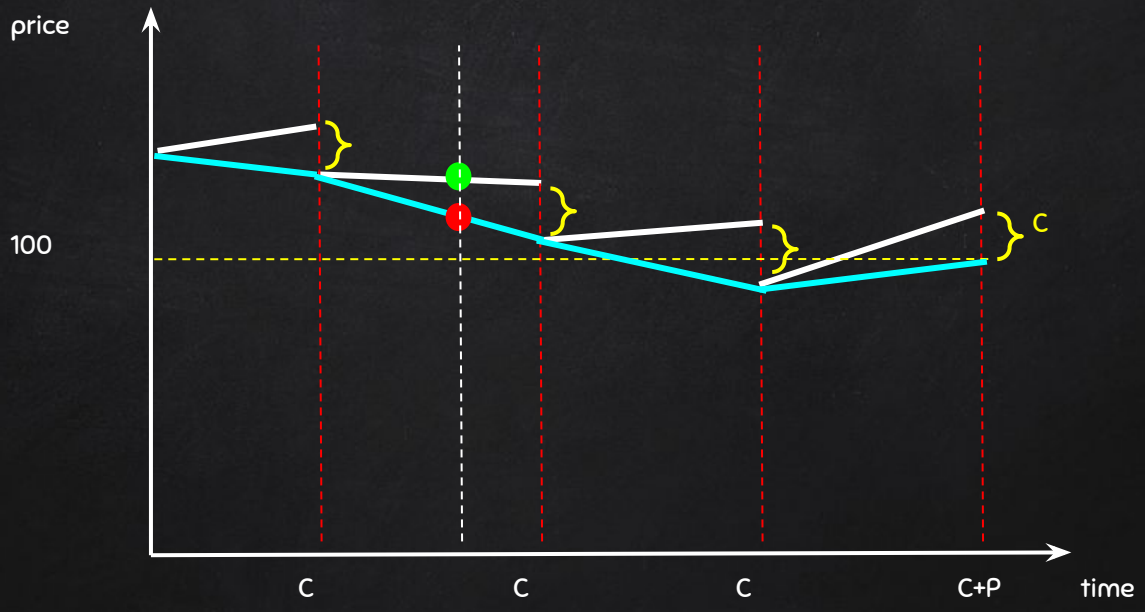

Q in mind: if dirty price is the true transaction price, why bother to have clean price?
A: 1. No need to remember C date for fair price comparison; 2. Remove the impact by accrued interest (cash); 3. Dissect the true mechanism of market forces

# Fixed income as an investment


Current yield: annual coupon income / current value = 100 * coupon rate / quoted price
Yield to maturity (YTM) : discounted cash flow to match market price

Q1 in mind: what market price should be used?
Q2 in mind: again, how to discount back to the time point in between coupon dates?

# Fixed income as an investment



# Fixed income as an investment

- ✘ Cash flow again, at par, discount, premium bond

# Fixed income as an investment

- ✘ Fixed income sensitivity measure: duration