Bond Basics I
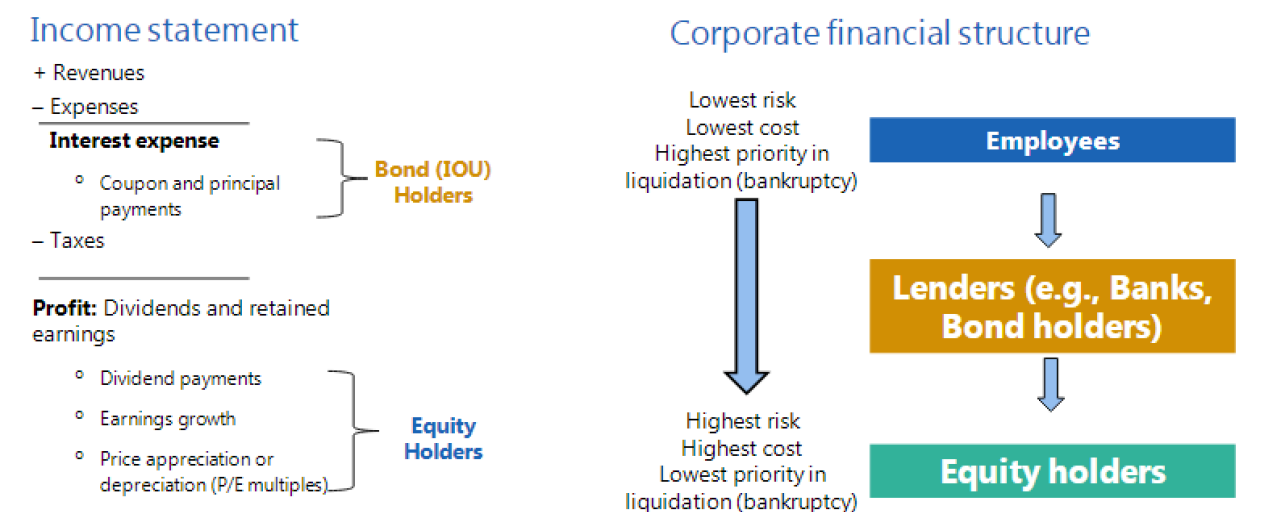
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1. What is bond?

Corporate Ownership vs. Corporate Lending

Bond Market

As of 31. December 2017
SOURCE: Securities Industry and Financial Markets Association (SIFMA), European Central Bank (ECB), Japanese Securities Dealers' Association (JSDA)
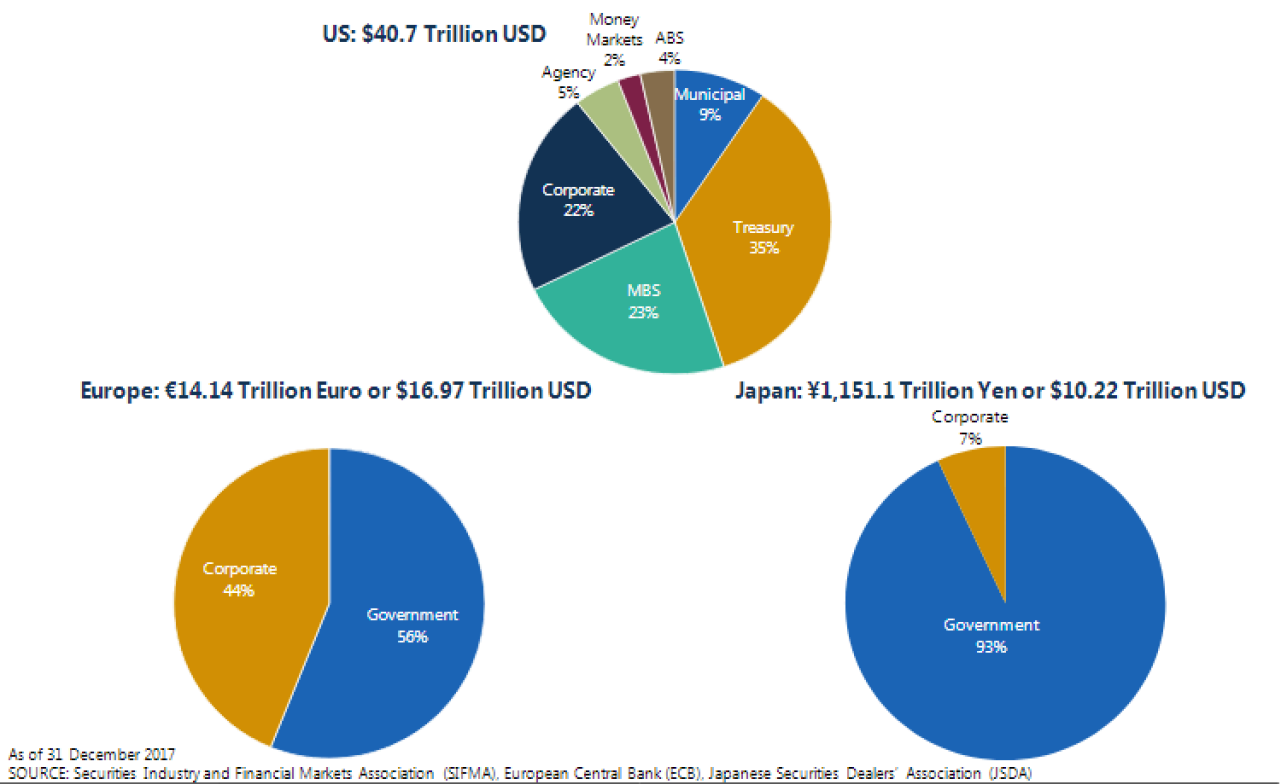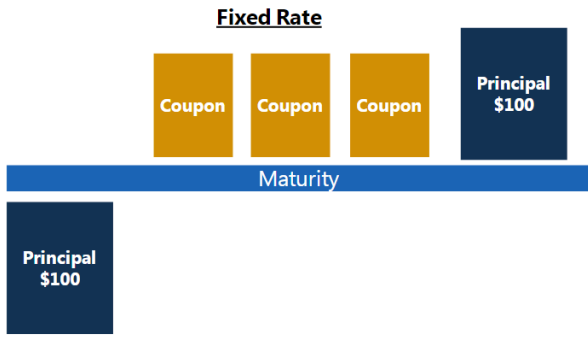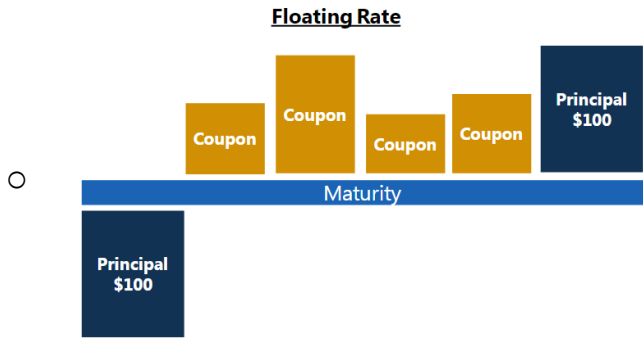
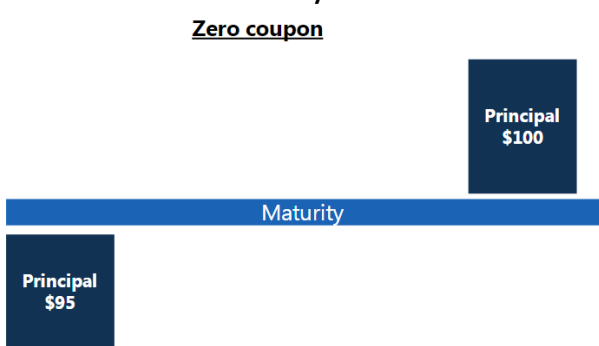## 2. How do bonds work?

Types of bonds

- Fixed coupon bonds: pay pre-determined, fixed coupon (interest) at specific time until maturity

- Float coupon bonds: pay a variable coupon that is tied to market interest rate (e.g. Fed Funds Rate) plus a spread

- Zero coupon bonds: do not pay periodical coupon, but issued at a discount to par and repay full value at maturity

Key bond terms

- Coupon:
  - Interest payment received by bond holder at specific dates
  - Typically expressed as % of bond principal
- Principal / Face value:
  - The amount that must be repaid at maturity date
- Yield
  - Rate of return received from investing a bond
  - Can be different from coupon
- Price
  - Market price of a bond, quoted in dollars

Calculating Yield to Maturity (YTM)

$$\text{Bond Price} = \frac{\$5}{(1+.01)^1} + \frac{\$5}{(1+.02)^2} + \frac{\$5}{(1+.03)^3} + \frac{\$105}{(1+.04)^4} = \$104$$

| 1y = 1% | 2y = 2% | 3y = 3% | 4y = 4% |

Once the Price (PV) is known, can back into an equivalent flat discount rate by solving for 'X' – the bond's yield

$$\text{Bond Price} = \frac{\$5}{(1+X)^1} + \frac{\$5}{(1+X)^2} + \frac{\$5}{(1+X)^3} + \frac{\$105}{(1+X)^4} = \$104$$

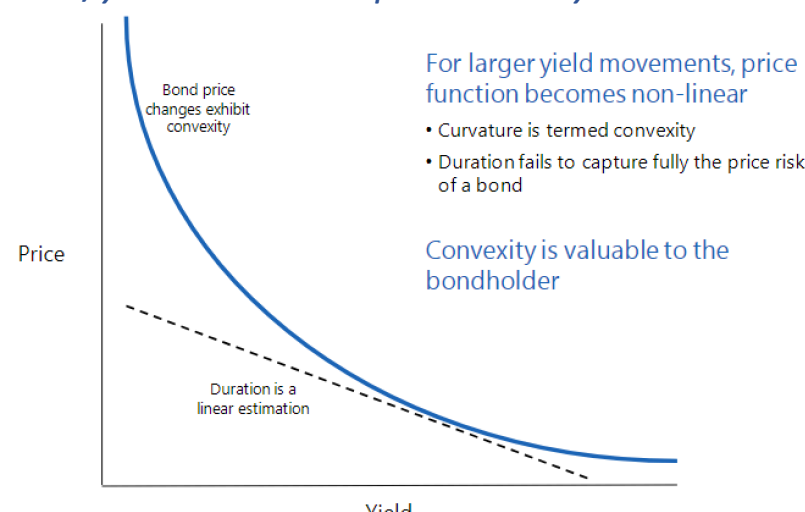X = 3.9%

Duration - measuring interest rate risk

- Estimation of a security or portfolio's price sensitivity to changes in interest rates
- Defined as averaged maturity of a bond, weighted by present value of cashflows

Macaulay Duration (years)

$$\sum_{i=1}^{n} \frac{p \times PVCF_p}{y \times PVTCF}$$

p = period in which cash flow is received
y = number of cash flow periods per year
n = total number of periods in bond life
PVCF = Present value of specific cash flow
PVTCF = Present value of total cash flows

Price/yield relationship - convexity

For larger yield movements, price function becomes non-linear
- Curvature is termed convexity
- Duration fails to capture fully the price risk of a bond

Convexity is valuable to the bondholder

Portfolio Duration

Portfolio Duration Example

	% Mkt Value	Bond Duration (yrs.)	Duration Contribution (yrs.)
Bond A	50%	8.0	4.0
Bond B	25%	4.0	1.0
Bond C	25%	2.0	0.5
	100%		5.5 yrs.

Duration Contribution – A bond's market value multiplied by its duration. Also called Duration Weighted Exposure (DWE)

Portfolio Duration = weighted average duration; sum of duration contributions (DWEs)

Calculating Total Return

Total return = Portfolio Price change + Portfolio income (yield)
- Price returns tend to dominate over short periods
- Income returns tend to dominate over long periods