Fixed-Income Portfolio Management

- Strategies
  - *Risk Management*
  - *Trade on interest rate predictions*
  - *Trade on market inefficiencies*

Duration

- A measure of the effective maturity of a bond
- The weighted average of the times until each payment is received, *with the weights proportional to the present value of the payment*

- Duration = the 1st-order derivative of bond price with respect to yield.
- Duration = bond's sensitivity to interest-rate risk

Duration Formula

- $$D = \sum_{t=1}^{T} t \times w_t$$

$$w_t = \left[CF_t \big/ (1+y)^t \right] \big/ Price$$

$$CF_t = Cash \quad Flow \quad for \quad period \quad t$$

Properties of Duration

- The longer a bond's maturity, the longer its duration and hence *the more risky*.
- Duration is shorter than maturity for all bonds (*except zero coupon bonds*)
- Duration = maturity, *for zero -coupon bonds*

Duration: Example

8% Bond	Time years	Payment	PV of CF (10%)	Weight	t*Wt
	.5	40	38.095	.0395	.0198
	1	40	36.281	.0376	.0376
	1.5	40	34.553	.0358	.0537
	2.0	1040	855.611	.8871	1.7742
		sum	964.540	1.000	1.8853

Duration/Price Relationship

Price change is proportional to duration and not to maturity

$$\Delta P/P = -D \{\Delta(1+y) / (1+y)\}$$

or,

$$\Delta P/P = -D^* \Delta y$$

where $D^* = D / (1+y)$, *modified duration*

Rules for Duration

Rule 1 The duration of a zero-coupon bond equals its time to maturity

Rule 2 Holding maturity constant, a bond's duration is higher when the coupon rate is lower

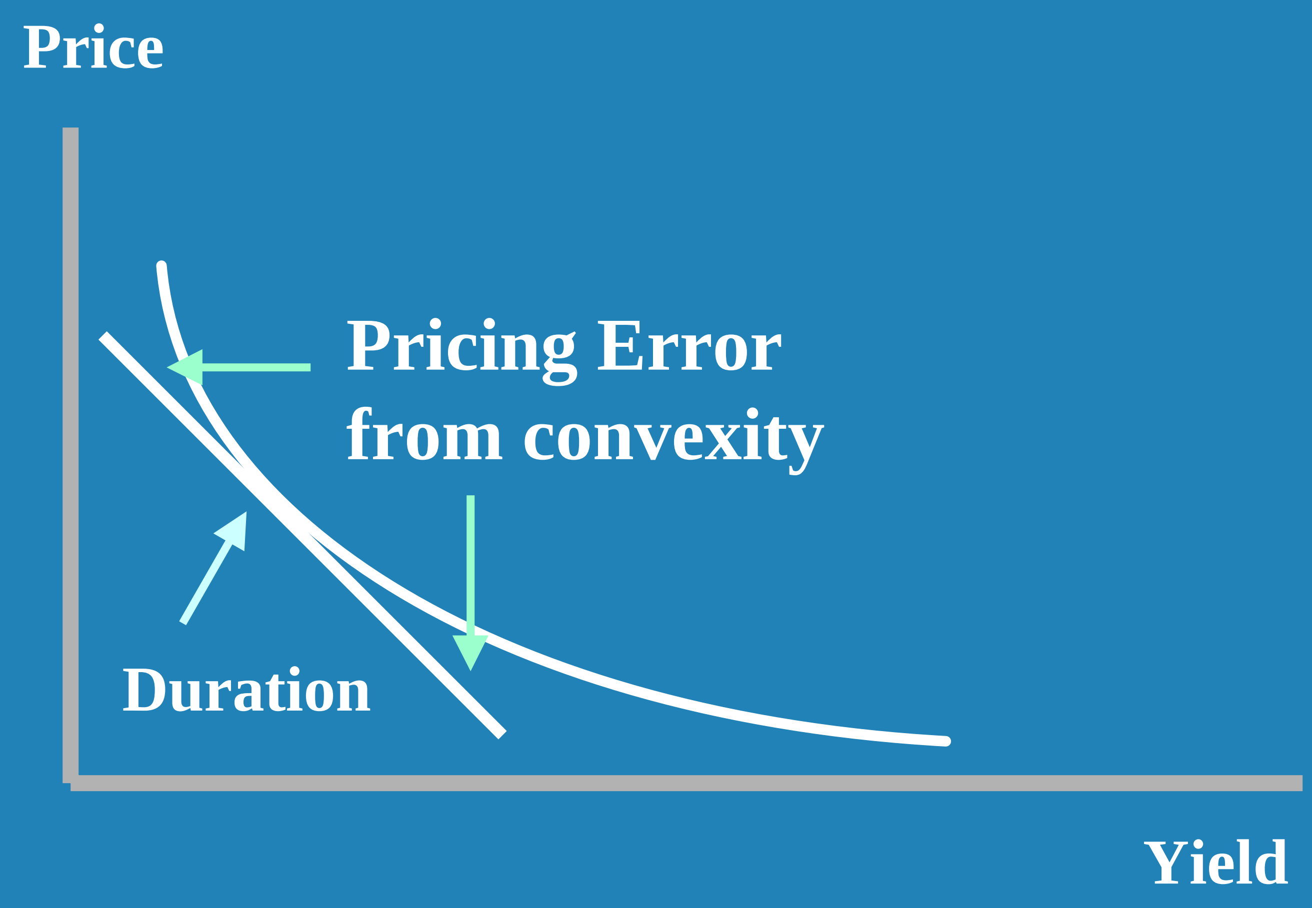
Rule 3 Holding the coupon rate constant, a bond's duration generally increases with its time to maturity

Rule 4 Holding other factors constant, the duration of a coupon bond is higher when the bond's yield to maturity is lower

Passive (Risk) Management

- Bond-Index Funds
- Immunization of interest rate risk
  - Net worth immunization
    - Duration of assets = Duration of liabilities
  - Target date immunization
    - Holding Period matches Duration
- Cash flow matching and dedication

Duration and Convexity



Adjusting for Convexity

$$Convexity = \frac{1}{P \times (1+y)^2} \sum_{t=1}^{n} \left[\frac{CF_t}{(1+y)^t} (t^2 + t) \right]$$

Thus, adjusting for Convexity, we have

$$\frac{\Delta P}{P} = -D * \Delta y + 1/2 [Conveixity \times (\Delta y)^2]$$

Better Risk Management

- For the previous types of funds/portfolios
  - Duration Matching

    duration of assets = duration of liabilities

  - Convexity Matching:

    convexity of assets = convexity of liabilities