Book 5 – Fixed Income, Derivative, and Alternative Investments

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FORMULAS

full price = clean price + accrued interest

$$\text{duration} = -\frac{\text{percentage change in bond price}}{\text{yield change in percent}}$$

value of a callable bond = value of an option-free bond − value of the call

$$\text{TIPS coupon payment} = \text{inflation-adjusted par value} \times \frac{\text{stated coupon rate}}{2}$$

absolute yield spread = yield on the higher-yield bond − yield on the lower-yield bond

$$\text{relative yield spread} = \frac{\text{absolute yield spread}}{\text{yield on the lower-yield bond}} = \frac{\text{higher yield}}{\text{lower yield}} - 1$$

$$\text{yield ratio} = \frac{\text{higher yield}}{\text{lower yield}}$$

$$\text{after-tax yield} = \text{taxable yield} \times (1 - \text{marginal tax rate})$$

$$\text{taxable-equivalent yield} = \frac{\text{tax-free yield}}{(1 - \text{marginal tax rate})}$$

$$\text{bond equivalent yield} = \left[(1 + \text{monthly CFY})^6 - 1\right] \times 2$$

spot rate from forward rates:

$$S_3 = \left[(1 + {}_1f_0)(1 + {}_1f_1)(1 + {}_1f_2)\right]^{\frac{1}{3}} - 1$$

forward rate from spot rates:

$${}_1f_2 = \frac{(1 + S_3)^3}{(1 + S_2)^2} - 1$$

$$\text{effective duration} = \frac{(\text{bond price when yields fall} - \text{bond price when yields rise})}{2 \times (\text{initial price}) \times (\text{change in yield in decimal form})} = \frac{V_- - V_+}{2V_0(\Delta y)}$$

percentage change in bond price = −effective duration × change in yield in percent portfolio duration = $w_1 D_1 + w_2 D_2 + \ldots + W_N D_N$

percentage change in price = duration effect + convexity effect

$$= \left\{ \left[-\text{duration} \times (\Delta y) \right] + \left[\text{convexity} \times (\Delta y)^2 \right] \right\} \times 100$$

price value of a basis point = duration × 0.0001 × bond value

$$\text{value of a long FRA at settlement: } (\text{notional principal}) \frac{(\text{floating} - \text{forward})\left(\frac{\text{days}}{360}\right)}{1 + (\text{floating})\left(\frac{\text{days}}{360}\right)}$$

intrinsic value of a call: $C = \text{Max}[0, S - X]$

intrinsic value of a put: $P = \text{Max}[0, X - S]$

option value = intrinsic value + time value

lower and upper bounds for options:

Option	*Minimum Value*	*Maximum Value*
European call	$c_t \geq \text{Max}[0, S_t - X / (1 + RFR)^{T-t}]$	S_t
American call	$C_T \geq \text{Max}[0, S_t - X / (1 + RFR)^{T-t}]]$	S_t
European put	$p_t \geq \text{Max}[0, X / (1 + RFR)^{T-t} - S_t]$	$X / (1 + RFR)^{T-t}$
American put	$P_t \geq \text{Max}[0, X - S_t]$	X

put-call parity: $c + X / (1 + RFR)^T = S + p$

put-call parity with asset cash flows: $C + X / (1 + RFR)^T = (S_0 - PV_{CF}) + P$

plain-vanilla interest rate swap:

$$(\text{net fixed-rate payment})_t = (\text{swap fixed rate} - \text{LIBOR}_{t-1})\left(\frac{\text{number of days}}{360}\right)(\text{notional principal})$$

income method for real estate:

$$\text{appraisal price} = \frac{\text{net operating income}}{\text{market cap rate}}$$

net operating income = gross potential income – collections and vacancy losses – total operating expenses