Security Valuation

Present values

and

Market values

Securities

- Bonds
- Preferred Stock
- Common Stock

Bond Valuation

- Determinants
  - cash flow
    - coupon
    - face value
  - Timing
    - semi-annual or annual coupons
    - maturity
  - Riskiness
    - interest rate risk
    - default risk

– Other features
  - convertibility
  - callability

Bond Valuation

- Price (P) is present value of coupon (C) and principle (F) payments, using a discount rate (r) appropriate for the bond

- For following examples, assume appropriate discount rate (interest rate) is 8%

Bond Examples

- Zero coupon bond
  - C=0
  - F=1000
  - T=20

P = 1000/1.08^20 = 214.55

Examples

- 7.5% coupon bond
  - C = 75
  - annual payments
  - T = 20
  - F = 1000

P = 75/1.08 + … + 75/1.08^20 + 1000/1.08^20 = 950.91

Example

- Fully amortizing 7.5% mortgage bond
  - T=20
  - C+F = 98.09 (= pmt(.075,20,1000))

P = 98.09/1.08 + … + 98.09/1.08^20

= 963.08

Example

- 7.5% consul
  - C = 75
  - T = ∞
  - F = 0

P = 75/.08 = 937.50

Yield to Maturity

- Yield to Maturity is the IRR of the project "buy a bond at its current price, and hold to maturity"
- yield to maturity is the discount rate that makes the present value of cash flows equal to the current price
- Given discount rate, find price (PV)
- Given price find yield to maturity (IRR)

Preferred Stock

- Promised dividends
- no maturity

Price = DIV/r

DIV: promised dividend

r: appropriate discount rate

Preferred Example

- DIV = 2.70
- r = 9%

P = 2.70/.09 = 30

Equity

- Equity cash flows
  - dividends
  - future selling price
- Discount rate determined by riskiness of cash flows

Equity Valuation

- Have required rate of return--r
- Have expectations about future dividends
  - div(1),div(2),div(3),…

$$P(0) = div(1)/(1+r) + P(1)/(1+r)$$

$$P(1) = div(2)/(1+r) + P(2)/(1+r)$$

$$P(0) = div(1)/(1+r) + div(2)/(1+r)^2 + P(2)/(1+r)^2$$

Equity Valuation

$P(0) = div(1)/(1+r) + div(2)/(1+r)^2 + div(3)/(1+r)^3 + P(3)/(1+r)^3$

etc

$P(0) = div(1)/(1+r) + div(2)/(1+r)^2 + div(T)/(1+r)^T + P(T)/(1+r)^T$

P(0) = present value of expected dividends to T + present value of residual value @ T

Special Case

- Dividends grow at constant rate g
  - div(t) = (1+g)div(t-1)

P(0) = div(1)/(r-g) as long as g < r

Source of growth

- Dividends grow because earnings grow
- Earnings grow because firm reinvests some of earnings

Let b be the plowback ratio--the proportion of earnings retained by the firm

(1-b) is proportion of earnings paid out as dividends

RIRR: reinvestment rate of return--ROE on new investments

Growth

- earnings(2) = earnings(1) + b*earnings(1)*RIRR
  = earnings(1)*(1+b*RIRR)
- dividend(2) = (1-b)*earnings(2)

P(0) = EPS(1)*(1-b)/(r - b*RIRR)

Examples

- Suppose that r = RIRR
  - firm invests in NPV = 0 projects
- P(0) = EPS(1)/r
  - independent of plowback ratio
  - dividends grow at rate b*r = g
  - firm can pick g by picking b, but does not affect the price
- If RIRR > r, then price will be higher

Examples

- EPS(1) = 9, b = .4, r = 15%, RIRR = 25%

  P(0) = 9*.6/(.15 - .4*.25) = 108

- EPS(1) = 9, b = .4, r = 15%, RIRR = 15%

  P(0) = 9*.6/(.15 - .4*.15) = 60

  = 9/.15 = EPS(1)/r

- EPS(1) = 9, b = .5, r = 15%, RIRR = 25%

  P(0) = 9*.6/(.15 - . 5*.25) = 180

Plowback and RIRR

b RIRR	0	0.3	0.4	0.5
10%	60 (0)	52.5 (3%)	49.1 (4%)	45 (5%)
15%	60 (0)	60 (4.5%)	60 (6%)	60 (7.5%)
25%	60 (0)	84 (7.5%)	108 (10%)	180 (12.5%)

Capital Gains

- If dividends grow at constant rate g, what do you expect next year's price to be?

$$P(1) = D(2)/(r-g) = D(1)(1+g)/(r-g)$$

$$= P(0)(1+g)$$

- g is growth rate in dividends, and is expected capital gains return

- If RIRR exceeds r, then price exceeds EPS(1)/r
- The extra amount in the price is the Present Value of Growth Opportunities (PVGO)
- PVGO represents the extra value that the market places on the stock because of anticipated profitable future investments

$$P(0) = EPS(1)/r + PVGO$$

PVGO

- Each period, reinvest b*EPS, and receive RIRR*EPS*b in perpetuity
- The Net Present Value of this investment is EPS*RIRR*b/r - EPS*b = NPV
- EPS grows at rate g = b*RIRR
- PVGO = NPV(1)/(r-g)

Example

- EPS(1) = 9, r = .15, b = .4, RIRR = .25
- PVGO = NPV(1)/(r-g)
- NPV(1) = 9*.4*.25/.15 - .4*9

  = 2.4
- g = .4*.25 = .1
- PVGO = 2.4/(.15-.10) = 48
- P(0) = 9/.15 + 48 = 60 + 48 = 108

EVA™ and valuation

- EVA (Economic Value Added) is the income on an investment, after a deduction for using the required capital
  - EVA = RIRR*investment - r*investment
- Note, the present value of EVA is
  - EVA/r = RIRR*Investment/r - Investment

  = NPV of investment
- PVGO = PV of future EVA growth

EVA is a registered trademark of Stern Stewart & Co.

EVA

- BES: book value of equity per share

$P(0) = BES(0) + EPS(ROE-r)/r + PVGO$

$= BES(0) +$ pv of current EVA + pv of future EVA growth

Use of formula

- Be careful of high growth rates relative to required return, r--values “explode”
- High growth means high plowback combined with high RIRR
- Can high RIRR remain forever?
- As competition increases, RIRR will drop

Using formula

- High RIRR may last for some time, then expect revert to normal RIRR
- div(1) = 5, b = .4, RIRR = 25% for 3 periods, then RIRR = 15%, r = .15

div(1) = 5, div(2) = 5.50, div(3) = 6.05

div(4) = 6.655, after grow at 6%=.4*.15

P(3) = div(4)/(.15 - .06) = 73.95

example

$$P(0) = 5/1.15 + 5.50/1.15^2 + 6.05/1.15^3 + 73.95/1.15^3$$

$$= 61.10$$

Summary

- Value of a security is the present value of its expected future cash flows discounted at the required rate of return
- bonds: discount coupon and principle payments at yield to maturity of comprable bonds
- Preferred Stock: discount promised dividend in perpetuity at required rate

Summary

- Equity: discount expected future dividends at required rate of return
- price = present value of assets in place + PVGO

  = EPS(1)/r + PVGO

  = div(1)/(r-gd) gd: dividend growth rate

  = eps(1)(1-b)/(r-ge) ge:growth rate in earnings

Summary

- Price = eps(1)(1-b)/(r-b*RIRR)
- price = book + pv of current EVA + pv of future EVA growth