Example of the NPVGO model (1)

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Consider a firm that has EPS of $5 at the end of the first year, a dividend payout ratio of 30%, a discount rate of 16%, and a return on retained earnings of 20%. What is the price of a share for this firm?

- Dividend growth model

\[ P = \frac{D}{r - g}, \]

Dividend payout ratio is 30%, then

\[ D = 0.3 \times 5 = 1.5 \]

Retention ratio = 1 - Dividend payout ratio = 1 - 0.3 = 0.7.

Growth rate, \( g \),

\[ g = ROE \times retention \ ratio = 0.2 \times 0.7 = 0.14 \]

Then

\[ P = \frac{D}{r - g} = \frac{1.5}{0.16 - 0.14} = 75 \]

- NPVGO model

1.- Value of a cash-cow firm

\[ p = \frac{EPS}{r} = \frac{5}{0.16} = 31.25 \]

2.- Value of growth opportunities

Time 1: investment is 70%$5 = 3.5, at 20% return
- $3.5 + \frac{3.5 \times 0.2}{1.16} + \frac{3.5 \times 0.2}{(1.16)^2} + \frac{3.5 \times 0.2}{(1.16)^3} + \ldots = -3.5 + \frac{3.5 \times 0.2}{0.16}$

Time 2: investment is 70% $5 = $3.5 that grows at a $g = 14\%$, that is, $3.5 \times 1.14$, at 20% return

\[-3.5 \times 1.14 + \frac{3.5 \times 1.14 \times 0.2}{1.16} + \frac{3.5 \times 1.14 \times 0.2}{(1.16)^2} + \ldots = \left(-3.5 + \frac{3.5 \times 0.2}{0.16}\right) \times 1.14\]

Time 3: investment is 70% $5 = 3.5 \times 1.14$ that grows at a $g = 14\%$, that is, $3.5 \times 1.14^2$, at 20% return

\[-3.5 \times 1.14^2 + \frac{3.5 \times 1.14^2 \times 0.2}{1.16} + \frac{3.5 \times 1.14^2 \times 0.2}{(1.16)^2} + \ldots = \left(-3.5 + \frac{3.5 \times 0.2}{0.16}\right) \times 1.14^2\]

and so on and so forth.

If we sum all the NPV of growing opportunities discounted at time 0 we have

\[
NPV_{GO} = \left(-3.5 + \frac{3.5 \times 0.2}{0.16}\right) + \left(-3.5 + \frac{3.5 \times 0.2}{0.16}\right) \times 1.14 + \left(-3.5 + \frac{3.5 \times 0.2}{0.16}\right) \times 1.14^2 + \ldots
\]

factoring out $\left(-3.5 + \frac{3.5 \times 0.2}{0.16}\right)$, we have

\[
NPV_{GO} = \frac{-3.5 + \frac{3.5 \times 0.2}{0.16}}{1.16} \left[1 + \frac{1.14}{1.16} + \frac{1.14^2}{1.16^2} + \ldots\right] = \\
= \frac{-3.5 + \frac{3.5 \times 0.2}{0.16}}{1.16} \left[1 - \frac{1.14}{1.16}\right] = \frac{-3.5 + \frac{3.5 \times 0.2}{0.16}}{1.16} \left[\frac{1.16}{1.16 - 1.14}\right] = \\
= \frac{-3.5 + \frac{3.5 \times 0.2}{0.16}}{1.16} \left[\frac{1.16}{0.02}\right] = \left(-3.5 + \frac{3.5 \times 0.2}{0.16}\right) \frac{1.16}{0.02} = $43.75
\]

So summing (1) and (2) we obtain

\[P = \frac{EPS}{r} + NPV_{GO} = 31.25 + 43.75 = 75\]