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Investments & Portfolio Management

Equity Valuation Models

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Market price

- The price at which a security is being transacted in the marketplace (e.g. NYSE).
- Aggregate the views of all market participants (i.e. private valuations).

Fundamental or intrinsic value (as determined by 'fundamental analysis')

- The value the analyst places on a security, using whatever data and analytical technique(s) the analyst deem appropriate. Basically, it is a well-informed opinion.

Book value of the firm (unrelated to current value of assets and liabilities)

- Net worth as reported on the balance sheet (historical data).

Liquidation value (the firm is no longer a going concern)

- The value of the firm if sold piecemeal ('fire price').

Replacement cost of a firm (as if a firm is simply a bundle of assets...)

- Replacement cost of assets less liabilities.

The different valuation models are using different data and perspectives, buy with the same core ideas (time value of money, optionality and return commensurate with the risk borne).

Dividend discount models

- ‘Dividend’ here are the cash payouts to shareholders, under the form of dividend, share repurchases or otherwise.
- Value of equity equals the present value of future dividends.

Free cash flow valuation

- Value of equity equals the present value of expected future free cash flow to equity.

Price-earning ratio (the most commonly used valuation multiple)

- Value of equity equals the forecast of EPS multiplied by the predicted P/E multiple.

Over an investment horizon of a year, you expect to receive a dividend (ED_1) and the proceeds from selling the stock (EP_1), your private valuation (V_0) is the present value of these two cash flows using your required rate of return (k). Idem for the investor buying the stock from you. By recursive substitution, your valuation is the sum of the present values of all future dividends. If you expect the dividend to growth at a constant rate (g), you get the Gordon growth model.

$$V_0 = \frac{ED_1 + \boldsymbol{EP_1}}{1+k} \rightarrow V_1 = \boldsymbol{EP_1} = \frac{ED_2 + EP_2}{1+k} \rightarrow V_0 = \sum_{t=1}^{\infty} \frac{ED_t}{(1+k)^t} = \frac{D_0\,(1+g)}{k-g}$$

For the market as a whole, the market price P_0 needs to equal V_0, an aggregate of the private valuations of all market participants, which in turn reflects the consensus estimate of ED_1 and EP_0 as well as k, the market consensus of the required rate of return (aka the market capitalization rate). For your private valuation to disagree with the market price, you need to disagree with the consensus of at least one of ED_1, EP_1 or k (k or g for Gordon growth model).

The dividends are the future cash flows and k is the time value of money plus a risk premium.

$$\uparrow ED \rightarrow \uparrow V \qquad \uparrow g \rightarrow \uparrow V \qquad \uparrow k \rightarrow \downarrow V$$

Stock valuation is expected to grow at the same rate as dividends (so growth is important!).

$$V_1 = \frac{D_2}{k-g} = \frac{D_1(1+g)}{k-g} = \frac{D_1}{k-g}(1+g) = V_0(1+g)$$

For a stock priced at its fair value (i.e. $P_0 = V_0$), its holding period return will comprise of a dividend yield ($\frac{ED_1}{P_0}$) and a capital gains yield (g).

$$Er = \frac{ED_1 + (EP_1 - P_0)}{P_0} = \frac{ED_1}{P_0} + \frac{(EP_1 - P_0)}{P_0} = \frac{ED_1}{P_0} + g$$

Assuming $P_0 \neq V_0$, can you expect the stock price to converge toward its valuation? From what we have seen it could be possible that the discrepancy could simply increase by g.

Now	Next Year
$V_0 = \$50$	$V_1 = V_0 \times (1+g) = \$50 \times (1+0.04) = \$52.00$
$P_0 = \$48$	$P_1 = P_0 \times (1+g) = \$48 \times (1+0.04) = \$49.92$
$V_0 - P_0 = \$2$	$V_1 - P_1 = \quad \$2 \times (1+0.04) = \$2.082$

But the holding period rate of return at the current price will exceed its required rate of return.

$$Er = \frac{ED_1}{P_0} + g = \frac{\$4}{\$48} + 0.04 = 12.33\% > Er = \frac{ED_1}{V_0} + g = \frac{\$4}{\$50} + 0.04 = 12\%$$

As the market notices this 0.33% excess return, the price is expected to move accordingly.

$$EP_1 = \frac{D_1\,(1+g)}{k-g} = \frac{\$4 \times (1+0.04)}{0.12-0.04} = \$52 \rightarrow Er = \frac{ED_1}{P_0} + \frac{(EP_1 - P_0)}{P_0} = \frac{\$4}{\$48} + \frac{(\$52 - \$48)}{\$48} = 16.67\%$$

What if growth is expected to vary before eventually settling in at a constant rate?

The two-stage dividend discount model: the firm is expected to experience a growth rate g_1 at first for some time, and then settle in a permanent growth rate of g_2.

$$V_0 = \sum_{t=1}^{T} \frac{ED_t}{(1+k)^t} + \frac{EP_T}{(1+k)^T} = \sum_{t=1}^{T} \frac{D_0\,(1+g_1)^t}{(1+k)^t} + \frac{\frac{D_0(1+g_1)^T(1+g_2)}{(k-g_2)}}{(1+k)^T}$$

The current dividend is \$2.00, growth is expected to be 8% for two years, and then 4% thereafter. The required rate of return is 12%.

$$V_0 = \frac{\$2\,(1.08)^1}{(1.12)^1} + \frac{\$2\,(1.08)^2}{(1.12)^2} + \frac{\frac{\$2(1.08)^2(1.04)}{(0.12-0.04)}}{(1.12)^2} = \$1.929 + \$1.860 + \$24.176 = \$27.96$$

This approach can be extended to as many stages as required.

But the dividends are paid out of what and what is required for dividends to grow?

- Dividends are paid out of earnings, but earnings need to reinvested for the firm to grow!
- The dividend payout ratio is the fraction of earnings paid out as dividends ($p = \frac{D}{E}$);
- The retention ratio ('b') is the fraction of earnings reinvested in the firm ($b = 1 - p$).

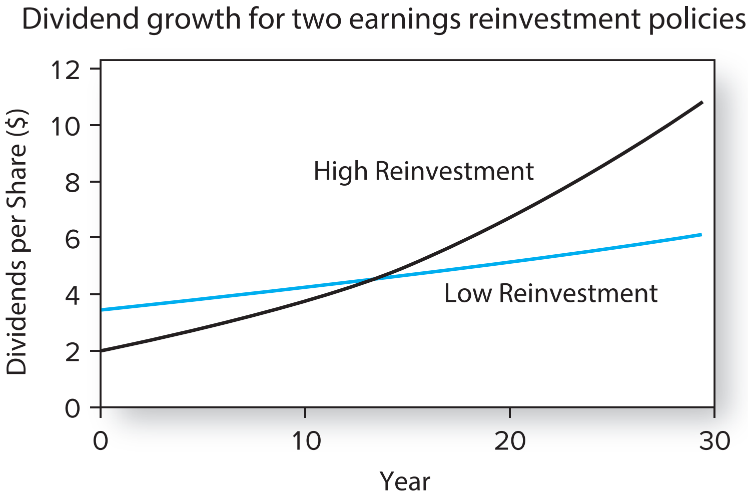
Let assume growth can be inferred from the growth of the book value of the firm.

$$ROE = \frac{EPS}{Book\ Value} \quad b = \frac{EPS - D}{EPS} \rightarrow ROE \times b = \frac{EPS}{Book\ Value} \times \frac{EPS - D}{EPS} = \frac{EPS - D}{Book\ Value} = g$$

Since $g = ROE \times b$, and a higher b requires paying less dividends and vice-versa, there is a built-in issue with a dividend discount model as a higher valuation is driven by higher dividends and higher growth, but one has seemingly to be at the expense of the other.

Furthermore, what if the firm is not paying dividends and is not expected to do so for quite a while? Also, growth has to be less than the rate of return (otherwise $k - g < 0$) while the rate of return is assumed to be constant over time irrespective of the timing of the dividends.

Trade-off between current dividends and growth?



A firm raises equity at the beginning of the year (S_{t-1}), invests during the year (I_t), generates some cash flow (CF_t), pays a dividend (D_t), returns all equity at the end of the year (S_t), and then everything starts again. In a given year, the firm invests as follow:

$$I_t = CF_t + S_t - (1+k)\,S_{t-1} - D_t \rightarrow D_t = CF_t + S_t - (1+k)\,S_{t-1} - I_t$$

The dividend being the payout of the residual cash flow of the firm, therefore by substitution:

$$V_0 = \sum_{t=1}^{\infty} \frac{ED_t}{(1+k)^t} = \sum_{t=1}^{\infty} \frac{E\left(CF_t + S_t - (1+k)\,S_{t-1} - I_t\right)}{(1+k)^t} = \sum_{t=1}^{\infty} \frac{E\left(CF_t - I_t\right)}{(1+k)^t} = \sum_{t=1}^{\infty} \frac{EFCF_t}{(1+k)^t}$$

The 'free cash flows' (FCF) are the cash flows generated (CF) less the investments (capex) made (I).

We can get rid of $S_t - (1+k)\,S_{t-1}$, since in expectation:

$$\sum_{t=1}^{\infty} \frac{S_t}{(1+k)^t} = \sum_{t=1}^{\infty} \frac{(1+k)\,S_{t-1}}{(1+k)^t}$$

The valuation of a firm (V_0) will change only if the expectation of future free cash flows or the expectation of risk via the required rate of return change. Dividends per se are irrelevant.

The expected growth of cash flow, one period to the next, is driven by how much cash flow is retained in the initial period and how much return is expected in the second period on that retained cash flow.

$$CF_1 = CF_0\,(1+g) = CF_0 + CF_0 \times b \times ROE \rightarrow g = b \times ROE$$

Assume the free cash flows are expected to grow at a constant rate, the present value of a perpetuity:

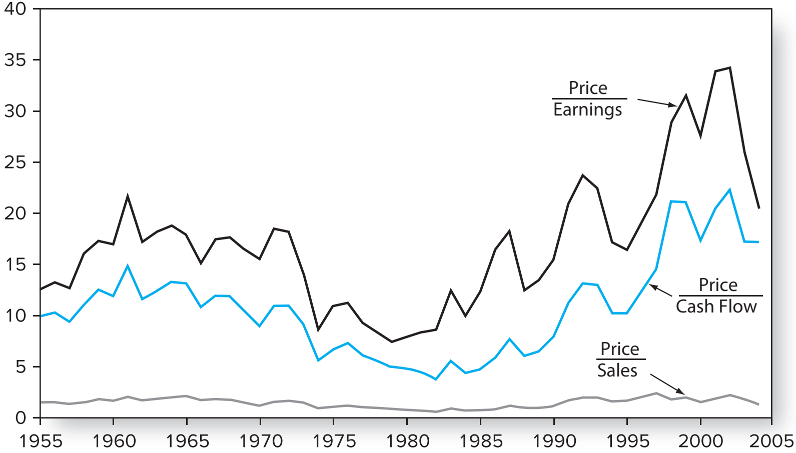
$$V_0 = \frac{FCF_1}{k-g} = \frac{CF_1 - I_1}{k-g} = \frac{CF_1\,(1-b)}{k-g} = \frac{CF_1\left(1-\frac{g}{ROE}\right)}{k-g}$$

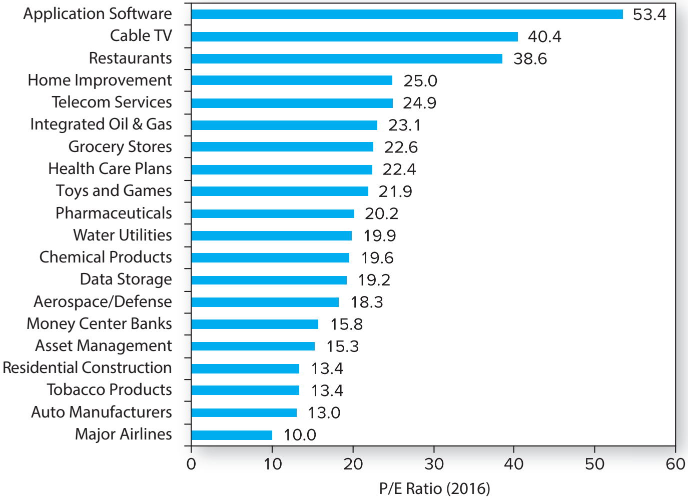
Two firm have different cash flows, but same growth, ROE and required rate of return (i.e. same risk).

$$V_x = \frac{CF_x\left(1-\frac{g}{ROE}\right)}{k-g} \quad V_y = \frac{CF_y\left(1-\frac{g}{ROE}\right)}{k-g} \rightarrow V_y = CF_y \times \frac{V_x}{CF_x} \simeq EPS_y \times \frac{P_x}{EPS_x}$$

The price-to-earnings ratio (P/E), the ratio of stock price to earnings per share, is often used in equity valuation and is helpful in comparing relative values of firms.

High correlation between P/E and P/CF, but multiples fluctuate




Application Software 53.4
Cable TV 40.4
Restaurants 38.6
Home Improvement 25.0
Telecom Services 24.9
Integrated Oil & Gas 23.1
Grocery Stores 22.6
Health Care Plans 22.4
Toys and Games 21.9
Pharmaceuticals 20.2
Water Utilities 19.9
Chemical Products 19.6
Data Storage 19.2
Aerospace/Defense 18.3
Money Center Banks 15.8
Asset Management 15.3
Residential Construction 13.4
Tobacco Products 13.4
Auto Manufacturers 13.0
Major Airlines 10.0
0
10
20
30
40
50
60
P/E Ratio (2016)

What is driving the P/E ratio? (assuming $P_0 = V_0$, using $D_1 = EPS_1(1-b)$ and $g = ROE \times b$)

$$P_0 = \frac{D_1}{k-g} = \frac{EPS_1(1-b)}{k-g} = \frac{EPS_1(1-b)}{k - ROE \times b} \rightarrow \frac{P_0}{EPS_1} = \frac{1-b}{k-g} = \frac{1-b}{k-(ROE \times b)}$$

	Retention Ratio (b)			
	0	**0.25**	**0.50**	**0.75**
ROE	A. Growth Rate (g)			
10%	0	2.5%	5.0%	7.5%
12	0	3.0	6.0	9.0
14	0	3.5	7.0	10.5
ROE	B. P/E Ratio			
10%	8.33	7.89	7.14	5.56
12	8.33	8.33	8.33	8.33
14	8.33	8.82	10.00	16.67

Assumption: k = 12% a year

The P/E ratio increases with the ROE and with the retention ratio (if $ROE > k$).

The market increases the P/E of a firm if it has good investment opportunities (high ROE) which are aggressively exploited while the firm retains more earnings to do so.

However, the market decreases the P/E of a firm as the firm retains more earnings while having a ROE lower that its required rate of return (if $ROE < k$).

The denominator of the P/E ratio, earnings, is an accounting number...

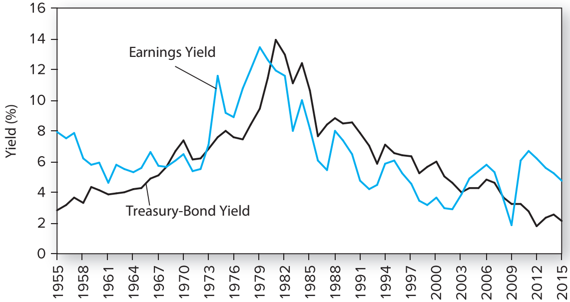
- Accounting standards specify using historical data, notably since historical data can be audited and therefore less susceptible to manipulation by management;
- However, historical costs might get distorted and lose relevance during and after periods of average to high inflation;
- Furthermore, accounting standards still allow for management discretion and judgment that can lead to 'earnings management' (i.e. slightly bending rules to report better earnings when needed);
- EBITDA would be a better metric, but is not used often.

P/E ratios fluctuate significantly over time...

- Per previous graph, the P/E ratio for U.S. equity was between 10 and 35, a fairly wide range.
- This apparent excessive volatility could be explained as being the by-product of the joint effects of the business cycle on the current aggregate earnings and the change in investor sentiment on market prices through lower or higher capitalization rates (i.e. investors putting too much emphasis on the present rather than the future).

The P/E approach can be used to forecast the level of the stock market (e.g. the S&P500).

- Estimate the P/E multiple using a forecast of long-term interest rates;
- Develop a forecast of aggregate corporate earnings;
- The product of these two is the estimate of the end-of-period level for the stock market.



Earnings yield of S&P 500 versus 10-year Treasury-bond yield

The earnings yield (the earnings per share divided by the price per share) is the reciprocal of the P/E ratio.

Through time, the earning yield of the S&P500 and the yield to maturity on 10-year Treasury bonds move together. Such strong correlation suggests using a forecast of the time to maturity yield as a basis to forecast the earning yield.

Process

- Develop forecasts of long-term interest rates according to macroeconomic scenarios;
- Add a spread to get the forecast of earning yields (e.g. +2.6%);
- Assume same aggregate corporate earnings across scenarios (a simplification);
- The product of these two is the estimate of the end-of-period level for the stock market;
- Assign probabilities to each scenario and the weighted average is your forecast of the end-of-period level for the stock market (e.g. S&P500).

	Pessimistic Scenario	Most Likely Scenario	Optimistic Scenario
Treasury bond yield	3.0%	2.5%	2.0%
Earnings yield	5.6%	5.1%	4.6%
Resulting P/E ratio	17.86	19.61	21.74
EPS forecast	118	118	118
Forecast for te S&P500	2,107	2,314	2,565

Learning Objectives covered

- L01 to L06

Concept checks

- Concept checks 1 to 5 (solutions provided at the end of the chapter).

Exercises

- Suggest solving 18-8, 18-9 and 18-15.

k	16%
D1	\$2.00
P1	\$50.00

a) $P_0 = \dfrac{D_1}{k-g} \rightarrow g = k - \dfrac{D_1}{P_0} =$ 12.00%

b) $P_0 = \dfrac{D_1}{k-g} =$ \$18.18

c) Price falls while current EPS says unchanged.
P/E ratio falls (to reflect lower growth prospects)

18-9 Solution

ROE	16%
b	50%
EPS	\$2.00
k	12%

a) $g = ROE \times b =$ 8.00%

$D_1 = EPS \times (1 - b) =$ \$1.00

$P_0 = \dfrac{D_1}{k - g} =$ \$25.00

b) $P_3 = P_1(1 + g)^3 =$ \$31.49

18-15 Solution

g1-3	25%
g4-	5%
k	20%
D0	$1.00

a)

Period	0	1	2	3
D	$1.000	$1.250	$1.563	$1.953
P			$13.021	
P0	$11.169	$1.042	$10.127	

$$P_2 = \frac{D_3}{k - g} = \text{\$13.02}$$

b) Expected dividend yield 11.2%

c)

P1	$12.15
HPR0-1	8.8%

d) The sum of the implied capital gains yield and the expected dividend yield is equal to the market capitalization rate. This is consistent with the DDM.