The Price:Earnings Ratio (a.k.a PE ratio)
Recasting The PE Ratio Via A Return Model

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In this white paper we will recast the PE ratio via a return model and then calculate the PE ratio and share price for a hypothetical company. To that end we will work through the following hypothetical problem...

Our Hypothetical Problem

We are tasked with estimating the share value of ABC Company. The market averages are the continuous-time equivalents of the market averages from Part I. The following table presents our model assumptions...

Description	Value	Description
Assets ($)	1,000,000	Operating assets at time zero
Number of common shares (#)	100,000	Fully-diluted common shares
Average annual total return (%)	9.52	Market average cost of capital (continuous-time)
Average annual earnings growth rate (%)	4.87	Market average growth rate (continuous-time)
Economic profits (%)	1.50	Company return on capital minus market average

Question 1: What is the theoretical market PE ratio?

Question 2: What is the theoretical market value of each share?

Note: To simplify the model, we will assume that balance sheet assets are funded 100% with common equity capital. This means that the after-tax return on assets and the after-tax return on capital are the same.

Building Our Model

We will define the variable A_t to be operating assets at time t, the variable μ to be the continuous-time assets growth rate, and the variable t to be time in years. The equation for operating assets at time t is...

$$A_t = A_0 \,\text{Exp}\Big\{\mu\, t\Big\} \;\; \text{...where...} \;\; \delta A_t = \mu\, A_0 \,\text{Exp}\Big\{\mu\, t\Big\}\delta t \tag{1}$$

We will define the variable C_t to be annualized cash flow at time t. The equation for annulaized cash flow at time t is...

$$C_t = \text{Net income/(loss)} - \text{Balance sheet investment} \tag{2}$$

We will define the variable π to be the after-tax return on operating assets. Using Equation (1) above, we can rewrite Equation (2) as...

$$C_t = \pi\, A_t\, \delta t - \delta A_t \tag{3}$$

Using Appendix Equation (16) below, the solution to Equation (3) above is...

$$C_t = (\pi - \mu)\, A_0 \,\text{Exp}\Big\{\mu\, t\Big\}\delta t \tag{4}$$

We will define the variable V_t to be company value at time t and the variable κ to be the continuous-time discount rate. Using Equation (4) above, the equation for company value at time zero is...

$$V_0 = \int_0^\infty C_t \,\text{Exp}\Big\{-\kappa\, t\Big\}\delta t \tag{5}$$

Using Appendix Equation (17) below, the solution to Equation (3) above is...

$$V_0 = A_0 \frac{\pi - \mu}{\kappa - \mu} \tag{6}$$

Note that using Equations (1) and (3) above, the equation for annualized, after-tax net income at time zero is...

$$\text{Annualized net income at time zero} = \pi\, A_0 \tag{7}$$

Using Equation (7) above, we can rewrite Equation (6) above as...

$$V_0 = \pi\, A_0 \frac{1 - \mu/\pi}{\kappa - \mu} \tag{8}$$

We will define the variable θ to be the price-to-earnings ratio. Using Equation (8) above, the equation for the trailing PE ratio is...

$$\theta = \text{PE ratio} = \left(1 - \frac{\mu}{\pi}\right) \Big/ \left(\kappa - \mu\right) \tag{9}$$

We will define the variable ω_0 to be after-tax earnings per share at time zero and the variable N_t to be the number of fully-diluted shares at time t. Using Equation (8) above, the equation for earnings per share at time zero is...

$$\omega_0 = \text{Earnings per share} = \frac{\pi\, A_0}{N_0} \tag{10}$$

We will define the variable S_t to be share price at time t. Using Equations (9) and (10) above, the equation for share price at time zero is...

$$S_0 = \text{Earnings per share} \times \text{PE ratio} = \omega_0\, \theta \tag{11}$$

Answers To Our Hypothetical Problem

Using the assumptions in the table above, ABC Company's after-tax return on assets is...

$$\pi = \text{Market average return on capital} + \text{Economic profits} = 9.52\% + 1.50\% = 11.02\% \tag{12}$$

Question 1: What is the the theoretical market PE ratio?

Using Equations (9) and (12) above and the assumptions in the table above, the answer to the question is...

$$\text{PE ratio} = \left(1 - \frac{\mu}{\pi}\right) \Big/ \left(\kappa - \mu\right) = \left(1 - \frac{0.0487}{0.1102i}\right) \Big/ \left(0.0952 - 0.0487\right) = 12.00 \tag{13}$$

Question 2: What is the theoretical market value of each share?

Using Equations (10) and (12) above and the assumptions in the table above, earnings per share is...

$$\text{Earnings per share} = \frac{\pi\, A_0}{N_0} = 0.1102 \times 1,000,000 \div 100,000 = \$1.10 \tag{14}$$

Using Equations (11), (13) and (14) above, the answer to the question is...

$$\text{Share price} = \text{Earnings per share} \times \text{PE ratio} = \$1.10 \times 12.00 = \$13.20 \tag{15}$$

Appendix

A. Using Equation (1) above, the solution to Equation (3) above is...

$$\begin{aligned} C_t &= \pi\, A_t\, \delta t - \delta A_t \\ &= \pi\, A_0\, \text{Exp}\Big\{\mu\, t\Big\}\delta t - \mu\, A_0\, \text{Exp}\Big\{\mu\, t\Big\}\delta t \\ &= (\pi - \mu)\, A_0\, \text{Exp}\Big\{\mu\, t\Big\}\delta t \end{aligned} \tag{16}$$

B. The solution to Equation (5) above is...

$$
\begin{aligned}
V_0 &= \int_0^{\infty} C_t \,\mathrm{Exp}\Big\{ -\kappa\, t \Big\}\delta t \\
&= \int_0^{\infty} (\pi - \mu)\, A_0 \,\mathrm{Exp}\Big\{ \mu\, t \Big\}\,\mathrm{Exp}\Big\{ -\kappa\, t \Big\}\delta t \\
&= (\pi - \mu)\, A_0 \int_0^{\infty} \mathrm{Exp}\Big\{ (\mu - \kappa)\, t \Big\}\delta t \\
&= A_0\, \frac{\pi - \mu}{\mu - \kappa}\Big[\mathrm{Exp}\Big\{ (\mu - \kappa) \times \infty \Big\} - \mathrm{Exp}\Big\{ (\mu - \kappa) \times 0 \Big\}\Big] \\
&= A_0\, \frac{\pi - \mu}{\kappa - \mu}
\end{aligned}
\tag{17}
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References

[1] Gary Schurman, *Part I - The Price:Earnings Ratio - Calculating The PE Ratio,* March, 2026

[2] Gary Schurman, *Whaddadunce.com software - Time series*