Problem Set 10 Solution: Valuation and Market Efficiency.

I. Equity Valuation, Asset Composition and Leverage.

A. Know
\[ \beta_{SIBX} = \frac{V_{IBX}}{S_{IBX}} \beta_{VIBX} = \frac{6}{(6-1)} \times 1.3 = 1.56. \]

Using the SML,
\[ E[R_{SIBX}] = R_f + \beta_{SIBX} \{E[R_M] - R_f \} = 10% + 1.56 \times \{18% - 10%\} = 22.48\% \]

Use the constant growth DDM
\[ p_{SIBX,ex} = \frac{D_{SIBX,ex}}{E[R_{SIBX}]} \left(1+g_{SIBX}\right) / \left\{E[R_{SIBX}]-g_{SIBX}\right\} = 3.76 \left(1.0648\right) / \left\{0.2248 - 0.0648\right\} = 25. \]

B. \[ n_{IBX} = \frac{S_{IBX}}{p_{SIBX}} = \frac{5M}{25} = 0.2 \text{ M shares}. \]

II. Equity Valuation, the Dividend Discount Model and ROE.

A. ROE = 16%; \( b = 0.5; E[E_1] = 2; E[R] = 12\% \).

1. So
\[ P_0 = \frac{E[D_1]}{E[R] - g} = \frac{E[E_1](1-b)}{E[R] - b \times \text{ROE}} = 2 \times (1 - 0.5) / \{0.12 - 0.5 \times 0.16\} = 25. \]

2. \[ g = b \times \text{ROE} = 0.5 \times 0.16 = 0.08. \]
\[ E[D_1] = E[E_1](1-b) = 2 \times (1 - 0.5) = 1 \]
\[ E[D_3] = E[D_1] \left(1+g\right)^3 = 1 \times 1.08^3 = 1.2597. \]
\[ E[P_3] = E[D_3] / \{E[R] - g\} = 1.2597 / \{0.12 - 0.08\} = 31.49. \]

B. Constant growth DDM model says
\[ P_0 = \frac{E[D_1]}{E[R] - g} \]
which implies
\[ E[R] = \left\{E[D_1] / P_0\right\} + g = 0.60/20 + 0.08 = 0.11. \]

C. \[ 1. P_0 = \frac{E[D_1]}{E[R] - g} = 8 / \{0.1 - 0.05\} = 160. \]

2. Know
\[ 1 - b = E[D_1] / E[E_1]; \]
and so
\[ b = 1 - E[D_1] / E[E_1] = 1 - 8/12 = 1/3. \]
Also know
g = ROE x b
and so
ROE = 0.05/{1/3} = 0.15 or 15%.

3.
If the firm set b = 0 and paid out all future earnings as dividends, share price would be
E[E_{1}]/E[R] = 12/0.1 = 120.

Thus, the present value of growth opportunities is given by
160 - 120 = 40.

III. Market Efficiency. Answer.

A. No. The price may fully reflect all information contained in past prices and be
weak form efficient even though price does not reflect all information in IBM’s
annual report.

B. Yes. Since IBM’s annual report is publicly available after its release date, price
does not fully reflect all publicly available information and so the market is not
semi strong form efficient.

C. Yes. If the price does not reflect all publicly available information then it does
not reflect all existing information. Thus, the market is not strong form efficient.