15.401 P-set 3

3/6

1. Alpha Corp

$50/share trading

Year 1 $3.6 earning $2 dividends

5% growth

a) Cost of capital

- the required return

$$r = \frac{D_1}{P_0} + g$$

$$= \frac{2}{50} + .05$$

$$= 9.0\%$$

b) PVGO?

Present value of growth opportunity

$$= PV(\text{growth}) - PV(\text{no growth})$$

$$= \frac{P_1}{r-g} - \frac{E}{r}$$

$$= \frac{2}{.09 - .05} - \frac{3.6}{.09}$$

$$= 10$$

(2)

c) ROE:

$$\frac{\text{earnings}}{\text{book value}} = \frac{3.6}{50}$$

$$= .072$$

2. Beta Inc.

dividend .50/share in 1 year
dividend $.30 each year
20% cost of capital
↳ risk free "opportunity cost" + risk premium
Share price: - not easy since divident not percentage

$$PV = \frac{.50}{(1+.20)} + \frac{.80}{(1.2)^2} + \frac{1.1}{(1.2)^3} + \dots$$

$$= \sum_{t=0}^{\infty} \frac{.50 + .30(t-1)}{(1+.20)^t}$$

$$= 10.2$$

3. Gamma Inc
Paid dividend today
$BVPS_0 = 120$
Payout ratio = 70%
ROE = 25%
) for $t = 1, \dots, 5$

(3)

So $EPS_1 = 120 \cdot .25 = 30$

$EPS_t = BVPS_{t-1} \cdot ROE_t$

At 5, payout ratio = 80%

C = 18% (cost of capital)

P_0 = 100 (stock price)

a) What is the long-run ROE? ($t > 5$)

Build a table

Year	t	0	1
EPS	$BVPS_{t-1} \cdot ROE_t$	—	
Investment	$Plowback_1 \cdot EPS_1$	—	
Dividend	$Payat_1 \cdot EPS_1$	—	
$BVPS_t$	$BVPS_{t-1} + Investment_t$	120	

See printout

Oh EPS formula is round about way of finding

But how find EPS if don't know ROE?

$ROE = \frac{\text{earnings}}{\text{book value}}$ ← But what is their earnings? Is it C, the cost of capital? - well that is what we're asking. - do we back it out from price?

← Have

Spreadsheet a1

(4)

I am guessing Find ROE by backing it out from the price

So our dividends are $5 for each of the months (discounted)

(The numbers must have been chosen so it works out - how would you do that?)

Anyway $25 of price is for first 5 years.

So $75 is for other years

Can find long run dividend growth rate

$$g_6 = \frac{r - D_5/P_5}{1 + D_5/P_5}$$

(D5 must be discounted, no third is pre discounted)

$$= \frac{.12 - 12.44/75}{1 + 12.44/75}$$

$$= 2.928\%$$

dividend = earnings · payout

but growth the same, so EPS grows 2.928%/year

But this leads to a(2) price of $142.04 (steel)

(5)

Try discounting

$$\frac{12.44}{(1+.2)^5} = 4.999$$ ← much closer to 5

$$\frac{75}{(1+.2)^5} = 30.14$$

$$g = \frac{.2 - 4.999 / 30.14}{1 + 4.999/30.14}$$

Spreadsheet a2

$= 2.922$ ← no leads to exact same result!

This is not the correct approach!

But is there any growth?

What do I know

$$75 = \sum_{t=6}^{\infty} \frac{D}{(1+.20)^t}$$

← ? or do I want $\frac{75}{(1+.2)^5}$ for year 5 ?
- no think I have it

Solve for d

Wolfram alpha not working - guess + check

D = 37.33

Plowback ratio of 80% means EPS · .8 = 37.33

EPS = 46.6625 So $ROE_6 = \frac{E}{BV} = \frac{46.6625}{298.60} = .1562$

(6)

But won't this fall since BV continues to increase?
Dividend will increase too
But at what rate? g

$$\frac{75}{(1+2)^5} = \frac{D_6}{.20-.0292} \qquad D_6 = 31.87$$

Or should earnings grow at same rate as BV - so ROE never changes

At this D_6 $EPS = \frac{31.87}{.8} = 39.83$

$ROE = \frac{39.83}{298.60} = .133$

So which is right? test in spreadsheet

ROE .1562 gives 113.85 share value
.133 98.63

spreadsheet a3

So real ans is in middle

From guess + check .1354 so likely second model which assumes dividend growth was correct, but rounding errors

(7)

4. Epsilon

Year	1	2	3	4	5	6	7+
ROE	5	10	12	19	25	18	14

$BVOE_0 = 50$

$r = 15\%$

a) Suppose payout = 50%. What is Price?

↑ Make another table

See printout

Stock price = discounted dividends

So for years 1-6 Sum 35.67

and ~~years 7+~~ $P_6 = \frac{D_7}{r-g}$ does not work, still growing extend table

So I did this in Excel because I thought it needed a table, like the previous problem. Still, I only used arathmetic calculations, no pre built functions

Excel posted to stellar since 108 pgs long

Sum = 105.13 = stock price

b) PVGO?

$P_0 = \frac{EPS}{r} + PVGO$

↑ So what is earnings w/ no growth like previous problem

(3)

b) Suppose in absence of plowback

20% ROE $t=1,\dots,5$

8% ROE $t>5$

PVGO difference share price in b vs share price of \$100?

"So all money paid to shareholders"

$D = E = ROE \cdot BV = 120 \cdot .20 = 24$

$ROE = \frac{\text{earnings}}{BV}$ ↗

$P_0 = \frac{EPS}{r} = \frac{24}{.18} = 133.3$

"But this is with certain constant/perpetual assumptions"

$PV = \sum_{t=1}^{\infty} \frac{24}{(1+.18)^t} = 133.33$ ↙ yeah perpetual assumption

"starting at $t=1$ So wrong

$PV = \sum_{t=1}^{5} \frac{24}{(1+.18)^t} + \sum_{t=6}^{\infty} \frac{9.6}{(1+.18)^t}$

↑ 120 · .08

since Book value never changes because nothing is reinvested

$= 75.05 + 23.31 = 98.36$ So PVGO $= 100 - 98.36 = 1.64$

(9)

EPS = BV · ROE = diff each year

$$PO_0 = \sum_{t=0}^{\infty} \frac{BV \cdot ROE_t}{(1+r)^t} \quad \text{↓ stays same}$$

$$= 109.47$$

PVGO = 105.13 − 109.47 = −4.34

; So actually worse;

c) Suppose company will readjust payout in year 7. (w/o changing ROE) What should it do to maximize stock price;

The best policy is to pay out all of the money for a price of 109.84

d) What is best payout policy;

Reinvesting all of the money in first 6 years then paying all of it at after year 7

-; Should have chosen year at a time to find best