Week 4: FNCE10002 Principles of Finance

THE UNIVERSITY OF MELBOURNE

Valuation of Equity Securities

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4. Valuation of Equity Securities

1. Examine the characteristics and pricing of ordinary shares
2. Examine the characteristics and pricing of preference shares
3. Analyze the relation between earnings, dividends and share prices
4. Examine the role of information in determining share prices

Required Readings: Weeks 4 – 5

- *Week 4*
  - GRAH, Ch. 5 (Sec 5.1 – 5.2, 5.4b and 5.5)
- *Week 5*
  - GRAH, Ch. 6 and Ch. 7 (Sec 7.1 – 7.2)

4.1 Pricing of Ordinary Shares

- Ordinary shares (or common stock) represent ownership in the issuing company's cash flows (earnings and dividends)
- Publicly-listed firms issue new shares and sell them to investors in the *primary market* typically via an initial public offering (IPO)
  - *Example:* The Snap, Inc IPO on the NYSE (see next slide)
- Once listed, the shares trade among market participants on *secondary markets* such as the Australian Securities Exchange (ASX) and the New York Stock Exchange (NYSE)

Case Study 1A: Snap It Up?

- Snap Inc's (*NYSE:* SNAP) initial public offering (IPO) on Thursday, March 2, 2017 was one of the most anticipated tech IPOs on the NYSE. The company refers to itself as a "camera company". It offers Snapchat, a camera application that helps people to communicate through short videos and images. The company also provides a suite of content tools for partners to build, edit, and publish snaps and attachments based on editorial content; and Spectacles, which are sunglasses that capture video from a human perspective
- The shares were issued to investors at US$17.00 per share and closed at US$24.48 per share for a return of 44% [= (24.48 – 17.00)/17.00] at the end of the day!
  - A positive return on the first day of trading is often referred to as the *underpricing* of an IPO ?

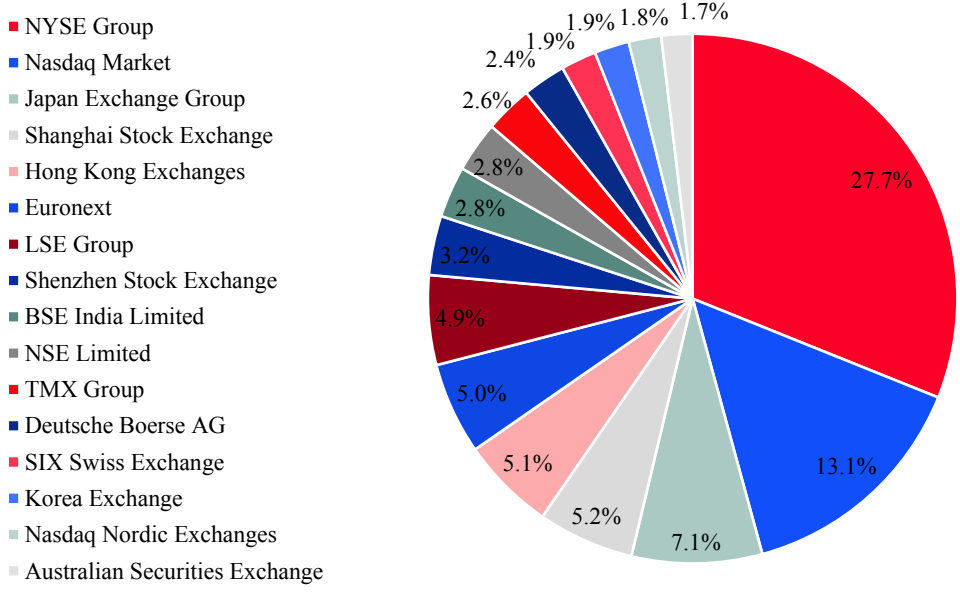
Case Study 1A: Snap It Up?

- The price movement over the next two days was as follows…
  - *March 2:* First day return = (24.48 – 17.00)/17.00 = +44.0%
  - *March 3:* Day 2 return = (27.09 – 24.48)/24.48 = +10.7%
  - *March 2 – 3:* Two-day return = (27.09 – 17.00)/17.00 = +59.4%!
- At the time of the IPO, the total market value of the company's shares (or market cap) was US$19.7 billion
  - Based on the share price on March 3 its market cap was US$31.4 billion!
- By Friday, March 10 the price of Snap, Inc had "settled down" to US$22.07 indicating a total return and market cap of…
- Total return over March 2 – 10 = (22.07 – 17.00)/17.00 = +29.8%
- Total market cap on March 10 = US$25.6 billion
- *How would one price an IPO like Snap, Inc?*

Pricing of Ordinary Shares

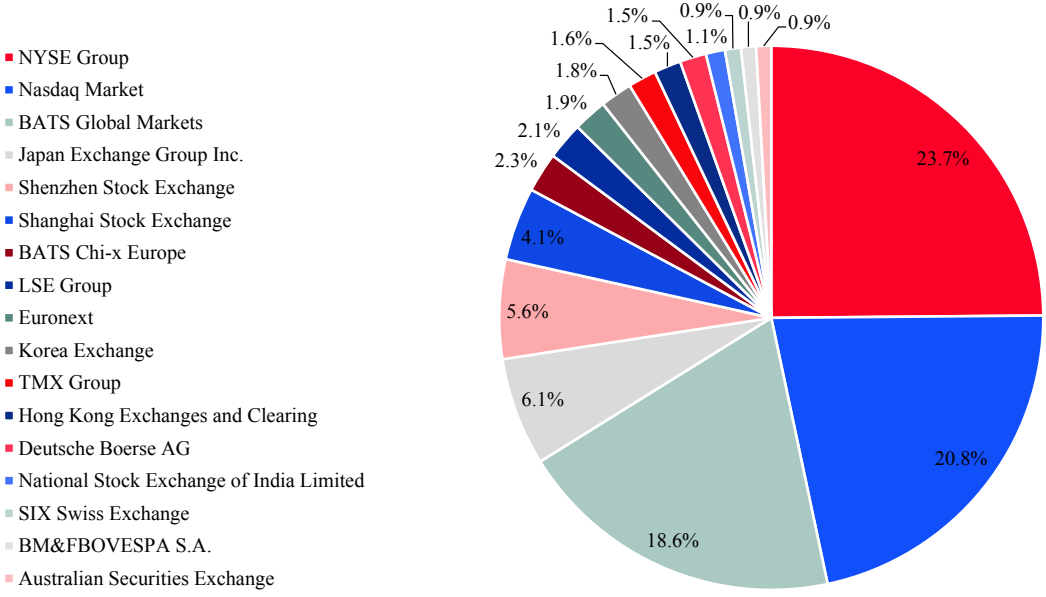
- After listing, ordinary shares trade on *secondary markets* such as the Australian Securities Exchange (ASX) and the New York Stock Exchange (NYSE)
- The following slide shows the largest organized exchanges around the world
- Note that the largest markets by total market value (or market capitalization) of listed shares are *not* the same as the largest markets by average daily trading volume
  - Market value (or market cap) = Share price × Shares outstanding
  - Trading volume = Share price × Shares traded

Largest Equity Markets by Market Value



Source: Compiled from www.world-exchanges.org. Percent of market value (in US dollars) relative to the market value of global equity markets at the end of 2018. The total market value across all markets was US$74,662,848 million.

Largest Equity Markets by Dollar Trading Volume



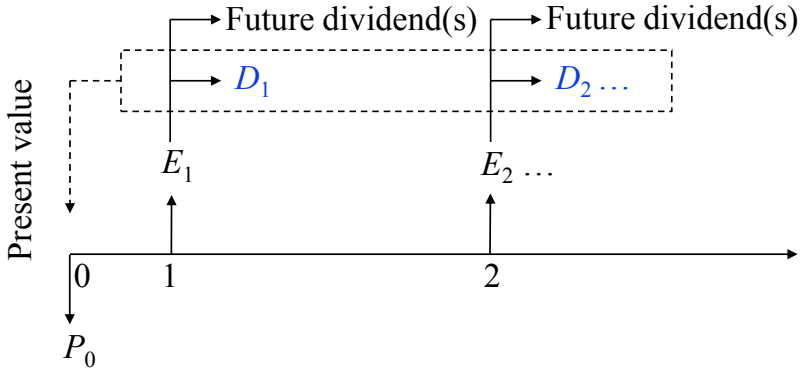
Source: Compiled from www.world-exchanges.org. Percent of average daily trading volume (in US dollars) relative to the average daily trading volume in global equity markets at the end of 2018. The average daily trading volume across all markets was US$7,870,459 million.

The Valuation Principle

- Recall that the valuation principle states…
  - *The price of ordinary shares today is the present value of all future expected cash flows discounted at the "appropriate" required rate of return (or discount rate)*
- *In an informationally efficient market what is the NPV of an investment in ordinary shares?* $\Rightarrow = 0$ you are paying what you will receive in the future
- Ordinary shares typically provide investors with an infinite stream of *uncertain* earnings ($E_1, E_2, \ldots, E_n, \ldots$) and dividends ($D_1, D_2, \ldots, D_n, \ldots$)
- *What cash flows are relevant – Earnings or Dividends?*

Why Dividends and Not Earnings?

- Shareholders care about what cash flows *they* receive, *not* what a firm earns
- A firm's earnings are typically *not* all paid out as dividends to shareholders so we need to consider the dividends (and *not* earnings) when valuing ordinary shares



Market Quote and Market Depth

Code	*Bid*	*Offer*	*Close*	*Open*	*High*	*Low*	*Volume*	*Trades*
CPU	17.250	17.260	17.300	17.190	17.395	17.130	148,107	8,193

- The above quote is for Computershare Ltd (*ASX:* CPU) from an online broker on March 11, 2019 around 3.00 pm
- The *Bid* and *Offer* prices are the broker's buying and selling prices, respectively
- The *Close* and *Open* prices are the previous day's closing price and today's opening price, respectively
- The *High* and *Low* prices are for the trading day
- *Volume* is the trading volume during the day
- *Trades* is the number of trades during the day
- The next slide shows the market depth

Market Quote and Market Depth

Buyers				*Sellers*		
Number	*Quantity*	*Price*	#	*Price*	*Quantity*	*Number*
14	1,627	17.25	1	17.26	919	7
23	2,964	17.24	2	17.27	3,313	30
20	3,340	17.23	3	17.28	3,524	25
16	3,362	17.22	4	17.29	2,538	12
11	3,786	17.21	5	17.30	2,611	13
7	1,839	17.20	6	17.31	2,161	8
6	5,086	17.19	7	17.32	6,899	8
4	1,431	17.18	8	17.33	2,286	9
158 buyers for 82,801 units				229 sellers for 133,823 units		

Pricing Ordinary Shares

- Over any *one year*, the share price is equal to the sum of the expected dividend and price *next* year discounted at the appropriate required return on equity (r_E)

$$P_0 = \frac{D_1 + P_1}{1 + r_E} \quad \text{and} \quad P_1 = \frac{D_2 + P_2}{1 + r_E} \quad \text{and} \quad P_n = \frac{D_{n+1} + P_{n+1}}{1 + r_E}$$

- Over any period, the required return on equity (r_E) is…

$$r_E = \frac{D_{n+1} + P_{n+1}}{P_n} - 1 = \frac{D_{n+1}}{P_n} + \frac{P_{n+1} - P_n}{P_n}$$

- r_E = Expected dividend yield + Expected percent price change
  - *Note:* D_{n+1}/P_n is the *expected* dividend yield while D_n/P_n is the *current* dividend yield

Pricing Ordinary Shares

- The share price in periods 0, 1 and 2 can be written as…

$$P_0 = \frac{D_1 + P_1}{1 + r_E} \quad \text{and} \quad P_1 = \frac{D_2 + P_2}{1 + r_E} \quad \text{and} \quad P_2 = \frac{D_3 + P_3}{1 + r_E}$$

- Substituting P_2 and P_1 recursively, we get P_0 as…

$$P_0 = \frac{D_1}{(1 + r_E)^1} + \frac{D_2}{(1 + r_E)^2} + \frac{D_3 + P_3}{(1 + r_E)^3}$$

- Note that the *current* dividend (D_0) is *not* relevant to our estimate of the current price as the estimated price is assumed to be the *ex-dividend* price
  - The ex-dividend price is the price right *after* the current period's dividend has been paid

The General Dividend Discount Model

- Extending the above process to *n* periods, we get the general dividend discount model as…

$$P_0 = \frac{D_1}{(1+r_E)^1} + \frac{D_2}{(1+r_E)^2} + \ldots + \frac{D_n}{(1+r_E)^n} + \frac{P_n}{(1+r_E)^n}$$

$$P_0 = \sum_{t=1}^{n}\left(\frac{D_t}{(1+r_E)^t}\right) + \frac{P_n}{(1+r_E)^n}$$

$$As\ n \to \infty, PV(P_n) \to 0$$

$$P_0 = \sum_{n=1}^{\infty} \frac{D_n}{(1+r_E)^n}$$

- Market analysts typically make simplifying assumptions about future expected dividends

The Constant Dividend Growth Model

- The simplest assumption is that dividends grow at a *constant* growth rate (g) forever, implying…

$$D_2 = D_1(1+g),\ D_3 = D_1(1+g)^2,\ \ldots,\ D_n = D_1(1+g)^{n-1}$$

- This is a growing perpetuity, implying a price of…

$$P_0 = \frac{D_1}{r_E - g} \qquad \text{where } r_E > g$$

- More generally, at any point in time n, we have…

$$P_n = \frac{D_{n+1}}{r_E - g}$$

Note: $n+1$, *not* n! looking ahead, we need the future dividend

- *When can the above model be used to price ordinary shares?*

The Constant Dividend Growth Model

- Assuming that r_E and g are expected to remain unchanged over time, the constant dividend growth model can be used to estimate the required return on equity (r_E) and growth in dividends (g)
- In year 0 (today)…

$$r_E = \frac{D_1}{P_0} + g \quad \text{and} \quad g = r_E - \frac{D_1}{P_0}$$

- More generally, at any point in time n…

$$r_E = \frac{D_{n+1}}{P_n} + g \quad \text{and} \quad g = r_E - \frac{D_{n+1}}{P_n}$$

- What *other* interpretation could one associate with g?

Case Study 2: Valuing Computershare Ltd

- Computershare Ltd (*ASX:* CPU) provides technology systems and services for the international securities industry. Its core services comprise the provision of shareholder registry services, employee share plans and associated services such as printing and share registry analytical services. Its expected earnings and dividends over 2019-21 have been obtained from an online broker and are shown below. The next two slides show CPU's recent dividend history and monthly prices

	2019	2020	2021
EPS (cents)	98.0	104.2	112.6
DPS (cents)	45.8	50.1	53.2
Payout ratio (α)[1]	46.7%	48.1%	47.2%
Growth in *DPS*	–	9.4%	6.2%
Growth in *EPS*	–	6.3%	8.1%

[1] Payout ratio, $\alpha = DPS/EPS$

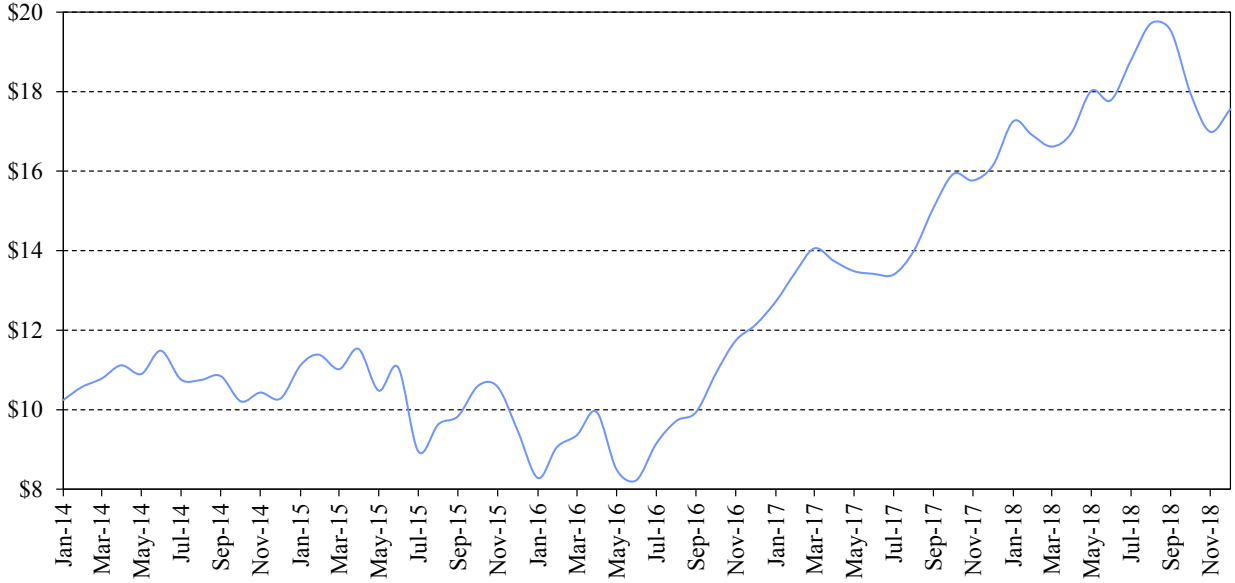
Case Study 2: Valuing Computershare Ltd

- Computershare Ltd's recent annual dividends and monthly prices appear in this and the next slide. Note the variation in both prices and the dividend growth rate over time

Year	*Dividend*	*Growth*
2011	$0.28	
2012	$0.28	0.0%
2013	$0.28	0.0%
2014	$0.28	0.0%
2015	$0.30	7.1%
2016	$0.32	6.7%
2017	$0.34	6.3%
2018	$0.38	11.8%
	Average	4.5%

Source: Adapted from https://www.computershare.com/corporate/investor-relations/financial-information/dividends. The annual growth in dividends are calculated as $(D_t - D_{t-1})/D_{t-1}$

Case Study 2: Valuing Computershare Ltd



Source: The monthly price data during 2014-18 are from https://finance.yahoo.com/quote/CPU.AX?p=CPU.AX

Case Study 2: Valuing Computershare Ltd

- Assume that year 0 is the end of 2018. Computershare is expected to pay annual dividends of $0.458 in 2019 (year 1). Assume that this dividend will grow at an annual rate of 6% in the foreseeable future and investors require a return of 8% p.a. Based on this information, estimate Computershare's price today (end of 2018) and at the end of next year (end of 2019). Based on Computershare's current share price of $17.30 what *constant* dividend growth rate is implied? How sensitive is the price estimate to different assumptions regarding the growth in dividends over time? What happens to the price and the present value of the price as n becomes large?
- The 6% growth rate in dividends is the rounded down *expected* growth rate in dividends in 2021
  - *What are we assuming when using this growth rate?*
- *Where does the r_E of 8% come from?*

Case Study 2: Valuing Computershare Ltd

- *Information given:* $D_1 = 0.458$, $g = 0.06$ and $r_E = 0.08$
- CPU's estimated price today (end of 2018) is…
  - $P_0 = D_1/(r_E - g)$
  - $P_0 = 0.458/(0.08 - 0.06) = \$22.90 >> \$17.30$ (Buy!?)
- CPU's estimated price next year (end of 2019) is…
  - $P_1 = D_2/(r_E - g) = D_1(1 + g)/(r_E - g)$
  - $P_1 = 0.458(1.06)/(0.08 - 0.06) = \$24.27$
- Note that the expected percent change in price equals the growth in dividends, g
  - Percent change in price = $(24.27 - 22.90)/22.90 = 6\%$

Case Study 2: Valuing Computershare Ltd

- What *constant* dividend growth rate (g) is implied by the *current price* of $17.30?
- The growth in dividends is…
  - $g = r_E - D_1/P_0$
  - $g = 0.08 - 0.458/17.30 = 5.35\%$ vs. 6.0% (Estimated growth rate) low difference.
- *How is this information useful?*

Case Study 2: Valuing Computershare Ltd

- *How sensitive is the share price to changes in the (estimated) growth rate of dividends?*
  - See week 4 tutorial question that extends this case study
- *What happens to the price and the present value of the price as n becomes large?*
  - The price over time will grow at a constant rate of g% per annum, $P_n = P_{n-1}(1 + g)$
  - The present value today (year 0) of the price in year n is calculated as, $PV_0(P_n) = P_n/(1 + r_E)^n$
  - See week 4 tutorial question that extends this case study

Is All Growth Profitable?

- Recall that the link between earnings and dividends is…
  - $D_n = \alpha E_n$
  - Here α is the dividend payout ratio, that is, the proportion of a firm's earnings paid out as dividends
    - A 0% dividend payout means retaining all the earnings; α = 0%
    - A 100% dividend payout means retaining no earnings; α = 100%
  - If the payout ratio does not change over time, the growth rate in dividends (g) will equal the growth rate in earnings
- Assuming that the number of shares outstanding is constant, a firm can increase its dividends by…
  - Increasing its earnings, E_n *or*
  - Increasing its dividend payout ratio, α
- Note the trade-off between the two alternatives!

Is All Growth Profitable?

- A firm can do one of two things with its earnings…
  - Pay them out to shareholders as dividends, *or*
  - Retain the earnings and reinvest them in the firm
- If *no* investment is made, the firm's earnings would remain at the current level
- Any *increase* in future earnings (that is, ΔEarnings) will result from *new* investments made from earnings retained by the firm
- ΔEarnings = New investment × Return on new investment
  - A $1 of new investment earning a return on investment of 10% will result in an earnings change of $0.10 per share
  - A $1 of new investment earning a return on investment of 20% will result in an earnings change of $0.20 per share

Is All Growth Profitable?

- ΔEarnings = New investment × Return on new investment
- The amount of new investment is determined by what the firm retains…
  - New investment = Earnings × Retention rate
  - Note that the retention rate is the proportion of earnings retained by the firm (that is, 1 – α)
  - If 40% of a $1 earnings is retained then the level of new investment is $0.40, and so on
- Earnings = New investment/Retention rate
- Earnings growth rate, g = ΔEarnings/Earnings
- This implies that the earnings growth rate (g) is…
  - g = Retention rate × Return on new investment

Is All Growth Profitable?

- If a firm wants to increase its share price, should it…
  - Lower its dividend and invest more, *or*
  - Lower its investment and increase its dividend?
- *Illustration:* A retail chain's expected earnings per share next year is $6 and it plans to pay out all its earnings as dividends. Based on these expectations of zero growth market analysts have estimated the firm's share price as $60. Suppose the firm lowers its payout ratio from 100% to 75% for the foreseeable future and use the retained earnings to open new retail outlets. Assume that the return on its new investments is expected to be 12% p.a. If the required return on the shares (r_E) is unchanged, what effect would this new policy have on its share price? How does your answer change if the return on new investments is 8% p.a. rather than 12% p.a.?

Is All Growth Profitable?

- *Base case:* We first need the required return on the shares (r_E) when all earnings are paid out as dividends…
  - $r_E = D_1/P_0 + g$
  - $r_E = 6.00/60.00 + 0 = 10\%$
- Note that we assume that r_E does not change in the two cases
- *Case 1:* Return on new investments is 12%
  - New $D_1 = \alpha E_1 = 0.75(6.00) = \$4.50$
  - New g = Retention rate × Return on new investment
  - New $g = (1 - 0.75) \times 0.12 = 3\%$
  - New $P_0 = 4.50/(0.10 - 0.03) = \$64.29 > \$60.00$
- *Does the new investment have a positive or negative NPV?* positive NPV > 0.

Is All Growth Profitable?

- *Case 2:* Return on new investments is 8%
  - New $D_1 = 0.75(6.00) = \$4.50$
  - New g = Retention rate × Return on new investment
  - New $g = (1 - 0.75) \times 0.08 = 2\%$
  - New $P_0 = 4.50/(0.10 - 0.02) = \$56.25 < \$60.00$
- *Does the new investment have a positive or negative NPV now?*
- *Implication:* Lowering the dividend to increase investment will raise the share price if, and only if, the new investments have a positive *NPV*

The Variable Dividend Growth Model

- It is often more realistic to assume a *variable growth rate* in dividends with higher initial growth in dividends followed by subsequent lower (or even zero) growth in dividends
  - Younger, profitable firms versus older, more mature firms
- The variable growth assumptions can be simple or complex…
  - High growth initially, followed by normal growth forever
  - High growth, followed by lower growth, followed by normal growth forever
  - No growth, followed by low growth, followed by high growth, followed by normal growth forever
  - Initial high, but declining growth, followed by normal growth forever, and so on…

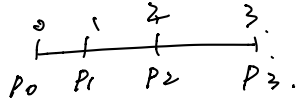
Case Study 3: Revaluing Computershare Ltd

- In the previous case study, assume that Computershare's expected dividend in 2019 of \$0.458 will grow at a rate of 7% in 2020, 6% in 2021 and 5% in 2022 after which time the growth rate will remain at this (lower) level forever. Note that the long run growth rate is similar to the historical growth rate in dividends. What price should the shares sell for today if the required return on equity remains unchanged at 8%?
- We use a three step procedure for estimating P_0
  - *Step 1:* Estimate the dividends up to the point where the growth rate (g) becomes constant forever
  - *Step 2:* Estimate the price at the end of the year after which dividends grow at a constant rate forever
  - *Step 3:* Add the present value of dividends from *Step 1* to the present value of the price from *Step 2* to get P_0

Case Study 3: Revaluing Computershare Ltd

- *Information given:* $D_1 = \$0.458$, $g_1 = 7\%$, $g_2 = 6\%$, $g_3 = 5\%$ (year 4 onwards), $r_E = 8\%$
- *Step 1:* Calculate the dividends up to where g becomes constant
  - $D_1 = \$0.458$
  - $D_2 = 0.458(1.07) = \$0.490$
  - $D_3 = 0.490(1.06) = \$0.519$
  - $D_4 = 0.519(1.05) = \$0.545$
- *Step 2:* Calculate P_n (after which dividend growth is constant)
  - $P_3 = D_4/(r_E - g_3)$
  - $P_3 = 0.545/(0.08 - 0.05) = \$18.18$

$P_3 = \frac{D_4}{(r-g)}$



Case Study 3: Revaluing Computershare Ltd

- *Step 3:* Add the present values of dividends and the present value of the price at time n, P_n to get P_0
  - $P_0 = D_1/(1 + r_E) + D_2/(1 + r_E)^2 + (D_3 + P_3)/(1 + r_E)^3$
  - $P_0 = 0.458/(1.08)^1 + 0.490/(1.08)^2 + (0.519 + 18.18)/(1.08)^3$
  - $P_0 = \$15.69 < \$17.30$
- *What would you do now?* sell the shares.
- *What are the limitations associated with these dividend discount models?*

company may not pay these dividends.

4.2 Pricing of Preference Shares

- *Preference shares* are shares which give their holders preference over ordinary shareholders with regard to payment of dividends (and repayment of capital in case of liquidation)
  - Dividends are fixed over the life of the preference shares
- For *plain vanilla* preference shares the price is simply the present value of a perpetuity of dividends…
  - $P_0 = D_P/r_P$
- *Example:* PBC Ltd has 10%, $10.00 preference shares on issue on which investors require a return of 12% p.a. What is the market price of these shares?
  - $P_0 = D_P/r_P = (0.10 \times 10.00)/0.12 = \$8.33$

4.3 Earnings, Dividends and Prices

- The *P/E ratio* (or P/E multiple) is the ratio of the current market price to expected (or current) earnings per share
  - *Expected* (or forward) P/E ratio: P_0/E_1
  - *Current* (or trailing) P/E ratio: P_0/E_0
- The *expected* P/E ratio is defined as the amount investors are willing to pay now for *$1.00 of future expected earnings*
  - A P/E ratio of 10 means that investors are willing to pay a price of $10 for $1.00 of future expected earnings
  - A P/E ratio of 100 means that investors are willing to pay a price of $100 for $1.00 of future expected earnings!

$\frac{P}{E}$ ↑ ↗ P↑ E_0 ↘ E_0↓ P_0.

Earnings, Dividends and Prices

- Assume α% of earnings is distributed as dividends in year 1
  - $D_1 = \alpha E_1$
  - α = Dividend payout ratio
  - 1 – α = Retention ratio
- Recall that the constant dividend growth model is…

$$P_0 = \frac{D_1}{r_E - g} \quad or \quad P_0 = \frac{D_0(1+g)}{r_E - g}$$

- Substituting for $D_1 = \alpha E_1$ in the constant dividend growth model, we get the price today as…

$$P_0 = \frac{\alpha E_1}{r_E - g} \quad or \quad P_0 = \frac{\alpha E_0(1+g)}{r_E - g}$$

Earnings, Dividends and Prices

- Dividing by E_1 or E_0 we get the expected (or forward) and current (or trailing) P/E ratios as…

$$\frac{P_0}{E_1} = \frac{\alpha}{r_E - g} \quad \textit{and} \quad \frac{P_0}{E_0} = \frac{\alpha(1+g)}{r_E - g}$$

- The expected P/E ratio *rises* as…
  - The payout ratio (α) *rises*
  - The growth rate of dividends (g) *rises*
  - The required return on equity (r_E) *falls*
- Note that the above factors interact with each other!

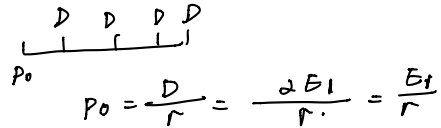
Pricing Growth Opportunities

- Consider the constant dividend growth model once more…

$$P_0 = \frac{D_1}{r_E - g} = \frac{\alpha E_1}{r_E - g}$$

- If a firm's earnings and dividends do not grow ($g = 0$) *and* it pays out all earnings as dividends ($\alpha = 1$), the price is…

$$P_0 = \frac{E_1}{r_E}$$



- The difference between the price with growth and the price without growth can be defined as the *present value of growth opportunities*

Case Study 4: Re-revaluing Computershare Ltd

- Refer back to the original case study related to Computershare, Ltd. Computershare's earnings per share in 2019 is expected to be $0.98. Its dividend payout ratio is expected to be 46.7%. Assume that the payout ratio does not change and that the earnings per share are expected to grow at 6% p.a. forever. Using the required return on Computershare's shares of 8% estimate the firm's current price, its P/E ratio and the (present) value that can be attached to its future growth opportunities

$g = 6\%$. $E_1 = \$0.98$. $d = 46.7\%$.

$r = 8\%$.

$\frac{P}{E} = \frac{d}{r-g} =$

Case Study 4: Re-revaluing Computershare Ltd

- Payout ratio, $\alpha = 0.467$ and growth in dividends, $g = 6\%$

$$P_0 = \frac{\alpha E_1}{r_E - g} = \frac{0.467 \times 0.98}{0.08 - 0.06} = \$22.90$$

- P/E ratio = 22.90/0.98 = 23.4 (*What does this imply?*) willing to pay $23.4 for $1 earning
- Setting $g = 0$ and $\alpha = 1.00$, we have…

$$P_0 = \frac{\alpha E_1}{r_E - g} = \frac{E_1}{r_E} = \frac{0.98}{0.08} = \$12.25$$

- The difference of 22.90 – 12.25 = $10.65 can be attributed to the *present value of growth opportunities* (*PVGO*)
  - Note that this is *our* estimate of the *PVGO*

Case Study 1B: Snap It Up?

- Snap Inc's (*NYSE:* SNAP) initial public offering (IPO) on Thursday, March 2, 2017 was one of the most anticipated tech IPOs on the NYSE. The shares were issued at US$17.00. The financial snapshot of Snap at that time was as follows

Valuation measure	*Snap, Inc.*
Market Capitalization	US$27.5 billion
Trailing P/E ratio (P_0/E_0)	-38.59
Forward P/E ratio (P_0/E_1)	-91.42
Price/Sales ratio	68.01
Price/Book ratio	13.08

Earning is "–" since price will not be "–"

Source: http://finance.yahoo.com/quote/SNAP/key-statistics?p=SNAP. The Price/Sales ratio is the share price divided by the sales revenue per share and the Price/Book ratio is the share price divided by the book value of equity per share

Case Study 1B: Snap It Up?

- According to Snap's IPO prospectus, it has no plans on paying a dividend in the future, it will continue to incur operating losses in the future *and* that it may never achieve or maintain profitability!
- *Can one use the dividend discount models or P/E valuation methods to value Snap, Inc?* no
- *What metric(s) can one use to value Snap, Inc?*
- *Comparing these metrics with two of Snap's competitors, Facebook, Inc. (Nasdaq: FB) and Twitter, Inc. (NYSE: TWTR) what, if anything, can one conclude about the relative value of Snap's ordinary shares?*

Case Study 1B: Snap It Up?

Valuation measure	*Snap, Inc.*
Market Capitalization	US$27.5*b*
Trailing P/E ratio (P_0/E_0)	-38.59
Forward P/E ratio (P_0/E_1)	-91.42
Price/Sales ratio	68.01
Price/Book ratio	13.08

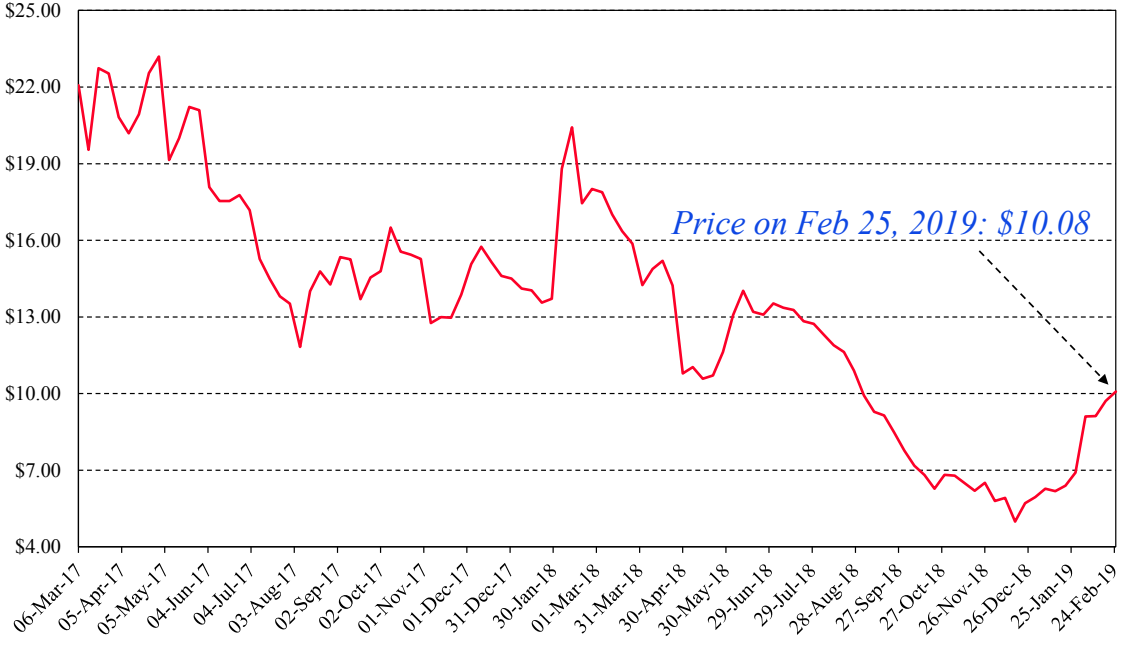
Valuation measure	*Facebook, Inc.*	*Twitter, Inc.*	*Industry Avg.*
Market Capitalization	US$397.14*b*	US$11.04*b*	N/A
Trailing P/E ratio (P_0/E_0)	39.34	-23.90	N/A
Forward P/E ratio (P_0/E_1)	20.57	37.95	43.80
Price/Sales ratio	14.37	4.36	13.44
Price/Book ratio	6.70	2.41	7.45

Source: http://finance.yahoo.com/. Industry averages are for companies in the internet services and social media sector in March 2017.

Case Study 1B: Snap It Up?

- *What would the price of Snap's shares be (in March 2017) if it were more like the "average" company in the internet services and social media sector?*
- Snap's current sales revenue per share = $0.48
- Snap's current book value of equity per share = $1.82
- Share price based on the industry average P/S ratio of 13.44
  - P_0 = Industry P/S ratio × Snap's sales per share
  - P_0 = 13.44 × 0.48 = $6.45 << $22.07 (Price on Mar 10, 2017)
- Share price based on the industry average P/B ratio of 7.45
  - P_0 = Industry P/B ratio × Snap's book value of equity per share
  - P_0 = 7.45 × 1.82 = $13.56 << $22.07 (Price on Mar 10, 2017)

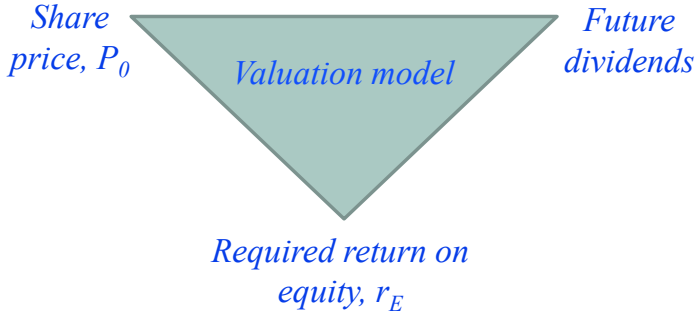
Case Study 1B: Snap It Up?



End of the week prices for SNAP during March 2017 – Feb 2019.

4.4 Information and Stock Prices

- Recall that we defined *capital market efficiency* as the idea that the market prices observed reflect *all relevant* information available at that point in time
- Our valuation models link the firm's future expected cash flows, the required return on equity and its share price. Given information on any two of these metrics lets us make inferences about the third metric (see previous case studies)



Information and Stock Prices

- There are broadly three types of relevant information…
  - Past information which is known to everyone
  - Publicly available information which is widely disseminated and (potentially) known to everyone
  - Non-public or private information which is known to top management and (maybe) a few investors
- *Which information would you expect to be reflected in prices, how and why?*

Key Concepts

- Ordinary shares provide an infinite stream of earnings and dividends and have no maturity date
- In any period, the current price of an ordinary share equals the present value of the expected dividend and price in the next period
- Ordinary shares can be priced based on some assumption about future growth rates in dividends – zero growth, constant growth and variable growth
- A firm's P/E ratio is related to its payout ratio, required return and the growth rate in dividends
- Today's share price can also be viewed as the present value of the expected earnings per share plus the present value of growth opportunities

Formula Sheet

- Share price at time 0

$$P_0 = \sum_{t=1}^{n}\left(\frac{D_t}{(1+r_E)^t}\right) + \frac{P_n}{(1+r_E)^n}$$

- Required return on equity

$$r_E = \frac{D_{n+1}}{P_n} + \frac{P_{n+1} - P_n}{P_n}$$

- Constant dividend growth model

$$P_n = \frac{D_{n+1}}{r_E - g}$$

- Required return on equity (constant growth model)

$$r_E = \frac{D_{n+1}}{P_n} + g$$

Formula Sheet

- Dividend growth rate (constant growth model)

$$g = r_E - \frac{D_{n+1}}{P_n}$$

- Expected and current P/E ratios

$$\frac{P_0}{E_1} = \frac{\alpha}{r_E - g} \quad \textit{and} \quad \frac{P_0}{E_0} = \frac{\alpha(1+g)}{r_E - g}$$

(*Note:* The formula sheets on the mid semester and final exams will contain all the formulas covered in lectures but *without* the descriptions)