Chapter 13: Equity Valuation

We agree on the following rules for successful investments with mispriced assets.

Buy undervalued assets

Sell/short overvalued assets

Undervalued assets

Expected RoR > Required RoR ← equivalent to: **alpha > 0**

Market price < Intrinsic value

Overvalued assets

Expected RoR < Required RoR ← equivalent to: **alpha < 0**

Market price > Intrinsic value

- Chapter 7 (Capital Asset pricing Model) covered the approach to comparing the expected return and the required return.
- Chapter 13 (Equity Valuation) covers the approach to comparing market price and intrinsic value.

TOPICS

I. Present Value of Growth Opportunities

II. Valuation using P/E ratio

III. Enterprise valuation and equity valuation

IV. Dividend Discount Model

I. Present Value of Growth Opportunities

Growth opportunity embedded in the stock price

The present value of the growth opportunities (PVGO)

$$\boldsymbol{PVGO = Stock\ price - \frac{EPS}{r_S}}$$

If a firm has no growth opportunities and has a certain perpetual EPS, then the firm will not retain any money beyond a certain required level. Hence, the firm will be optimal to pay out all the earnings. EPS = DPS. Then the value of stock is:

$$P_0 = \frac{EPS}{r_S}$$

Example: Wells Fargo paid out the dividend of $0.7 per share in year 1998 when it had the EPS of $1.17. The stock price was $40 in April 1999 (before stock split). Assume that investors use the 10-year T- rate as the benchmark risk-free rate. In 1999 was around 5.4%. The return on S&P500 was around 12%. Decompose the stock price ($40) into the price under no growth and the price caused by growth opportunities.

Assuming no growth opportunities,

$$P_0 = \frac{EPS}{r_S} = \frac{\$1.17}{0.1107} = \$10.6$$

$$beta = 0.86\ (as\ of\ 2013, assumed\ to\ be\ same\ in\ 1998, Yahoo\ Finance)$$

$$r_f = 5.4\%\ \text{(10 year T-note yields)}$$

$$r_m = 12\%$$

$$r_S = 5.4\% + 0.86(12\% - 5.4\%) = 11.08\%$$

Under no growth assumption, the Wells Fargo stock price = $**10.6**
Why then, in April 1999, the Wells Fargo stock price = $40?

But, the actual stock price in April 1999 was $40. Hence, The present value of the growth opportunities (PVGO)

$$\boldsymbol{PVGO} = \$40 - \$10.6 = \$29.4$$

In general,

$$\boldsymbol{Stock\ price = \frac{EPS}{r_S} + PVGO}$$

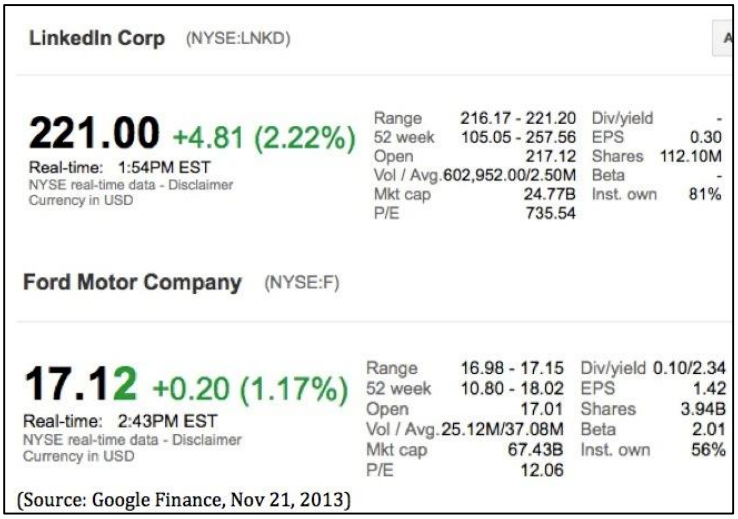
$$\$40 \quad = \$10.6 + \$29.4$$

II. P/E Multiple method

$$\textbf{Price-earnings ratio } \left(\frac{P}{E}\right) = \frac{Market\ price}{EPS}$$

The stock price of GE as of Jan 2, 2012 was $21.34 and its EPS was $1.47. How do you interpret the value?

Example: P/E ratios of LinkedIn and Ford



LinkedIn Corp (NYSE:LNKD)

221.00 +4.81 (2.22%)
Real-time: 1:54PM EST
NYSE real-time data - Disclaimer
Currency in USD

Range	216.17 - 221.20	Div/yield	-
52 week	105.05 - 257.56	EPS	0.30
Open	217.12	Shares	112.10M
Vol / Avg.	602,952.00/2.50M	Beta	-
Mkt cap	24.77B	Inst. own	81%
P/E	735.54		

Ford Motor Company (NYSE:F)

17.12 +0.20 (1.17%)
Real-time: 2:43PM EST
NYSE real-time data - Disclaimer
Currency in USD

Range	16.98 - 17.15	Div/yield	0.10/2.34
52 week	10.80 - 18.02	EPS	1.42
Open	17.01	Shares	3.94B
Vol / Avg.	25.12M/37.08M	Beta	2.01
Mkt cap	67.43B	Inst. own	56%
P/E	12.06		

(Source: Google Finance, Nov 21, 2013)

Why LinkedIn Corp has much higher P/E ratio than does the Ford Company?

Using P/E as the valuation method

$$\frac{P}{E} \times EPS = Price\ per\ share$$

Example
A start-up firm has the EPS of $0.2. Analysts are trying to value the stock. If there is a firm that has very similar cash flows in the future and has a P/E of 55. Then, what is the stock price of the start-up firm using the P/E multiple as the valuation multiple?

Example: Using P/E multiple for valuation

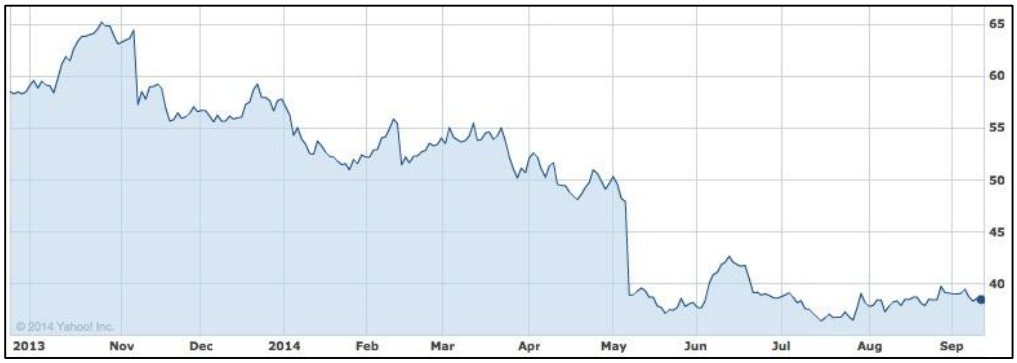
Whole Foods' stock price = $63.69 on Nov 5, 2013.
Was the stock over-/under-valued?

Name	P/E	Sales (mil)	NI (mil)	EPS
The Kroger Co.	13.98	96,751.00	1,497	$3
Safeway Inc.	21.71	44,206.50	564.6	$1.56
Koninklijke Ahold N.V. (ADR)	20.57	32,841.00	827.0	$0.87
Whole Foods Market, Inc.	38.39	12,917.00	551.0	$1.47
Ingles Markets, Incorporated	51.18	3,709.40	43.4	$0.51
Sprouts Farmers Market Inc.	144.2	1,794.80	19.5	$0.27
Village Super Market, Inc.	23.05	1,476.50	25.8	$1.55
The Fresh Market Inc.	35.17	1,329.10	64.1	$1.43

(Answer)
Average of P/E ratios from the comparable peer firms (the first three firms) = 18.75.

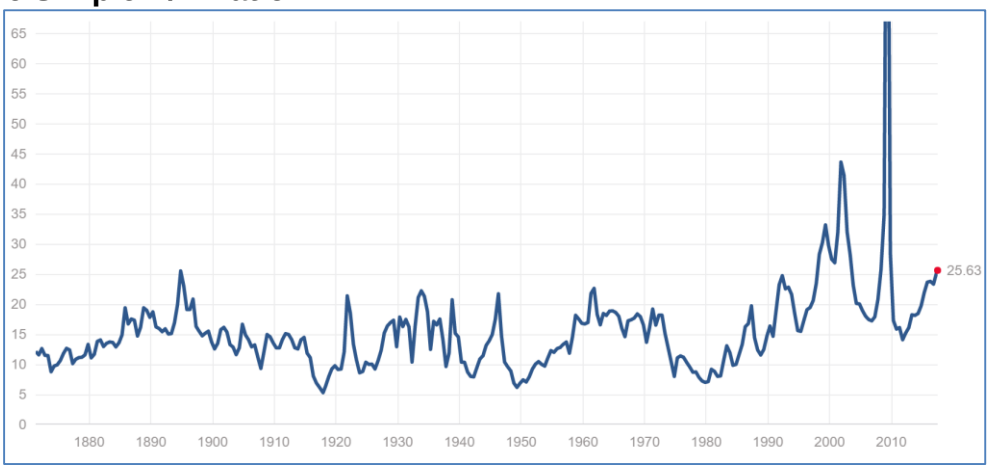
(P/E)*EPS = 18.75*1.47 = $27.57 < $63.69

<Whole Foods Market stock price>



The P/E ratio of S&P 500 index

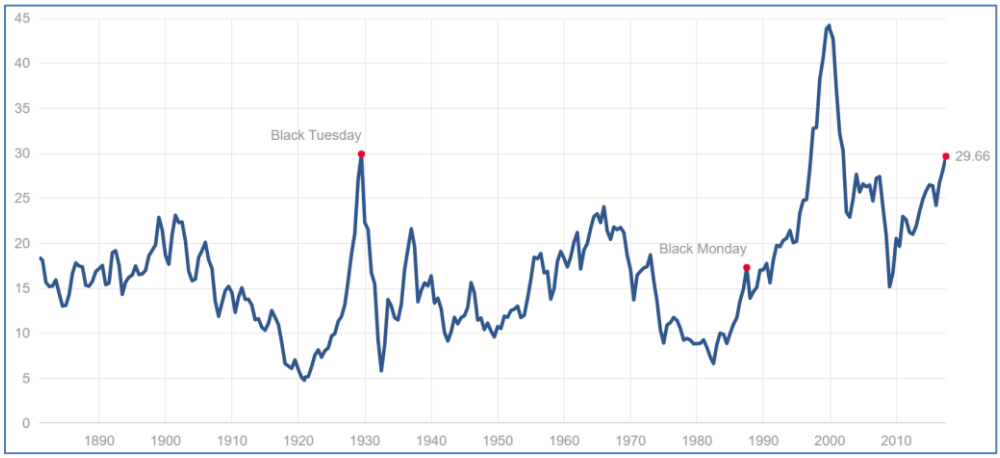
[1] The Simple P/E Ratio



What is the issue in the simple P/E ratios?

(As of June 30, 2017)	Simple P/E	Shiller P/E
Mean	15.66	16.76
Median	14.65	16.12
MIN	5.31 (DEC 1917)	4.78 (DEC 1920)
MAX	123.73 (May 2009)	44.19 (DEC 1999)

[2] Shiller P/E Ratio



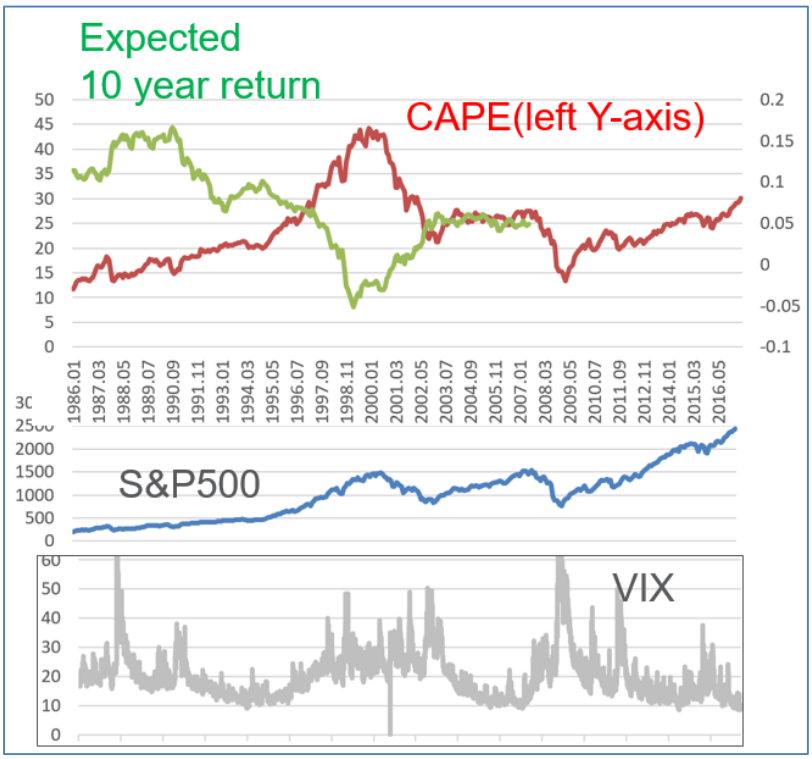
The graph above shows Shiller's price-to-earnings (or P/E) ratio, or CAPE for the S&P 500. The graph also shows its average.
The Shiller P/E ratio measures the current price of an index or security relative to **its average earnings over the past ten years**.

P/E ratio, Growth Opportunities and Risk

A firm's PE ratio is positively related to growth opportunities and negatively related to risk (r_S). See the equation below.

Given $P_0 = \frac{EPS}{r_S} + PVGO$

$$\frac{P}{E} = \frac{P_0}{EPS} = \frac{1}{r_S} + \frac{PVGO}{EPS}$$



Whenever the risk aversion rises → risk premium rises → likely that required return > expected return →demand falls → prices fall →as the price drops P/E ratio drops and the expected return goes up [after prices fell] to match the required return.
[See the rise in VIX in 2002→CAPE fell →What happened to the expected return?]

Whenever the risk aversion falls → risk premium falls → likely that required return < expected return →demand rises → prices rises → as the price goes up P/E ratio rises and the expected return goes down [after prices rose] to match the required return.

(Guides to successful investing)

(Reference: "Stocks for the Long-Run" by Jeremy Siegel)

Keep your expectations in line with history.

Historically stocks have returned between 6 and 7 percent after inflation over the last two centuries and have sold at an average P/E ratio of about 15. A 6.5 percent annual real return, which includes reinvested dividends, will nearly double the purchasing power of your stock portfolio every decade.

If inflation stays within the 2 to 3 percent range, nominal stock returns will be 9 percent per year, which doubles the money value of your stock portfolio every eight years.

Despite this excellent long-run record, stock returns are not independent of their valuation. A 6 to 7 percent real return is consistent with a market that trades at about 15 times estimated earnings. But there is no reason why a 15 P/E ratio will always be the "right" ratio for stock prices.

Concept check

- **Rule of 72**

  72/6.5 = 11 years

  72/9 = 8 years

III. Enterprise Valuation Method

Meaning of Enterprise Value

Enterprise value (EV)= Market value of equity
+ Market values of debts and preferred stock
– Excess cash

$= \sum_{t=1}^{T} \frac{FCFF_t}{(1+r)^t} + \frac{TV_T}{(1+r)^T}$ (See below)

(FCFF = Free Cash Flow to the Firm. How to determine? It comes later.)

- Why do we use the FCFF to determine the EV?[i]

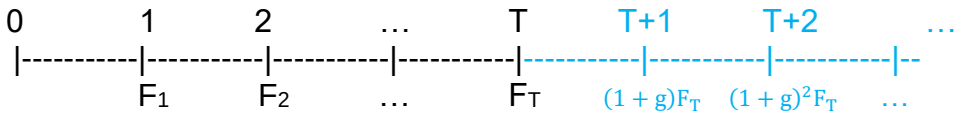
Firm value = Enterprise value + Excess cash

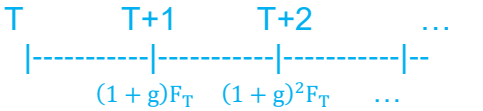
Per-share common stock value =

$$\frac{Firm\ value - Market\ values\ of\ Debts\ and\ Preferred\ stock}{share\ outstanding}$$

Time Line of FCFF

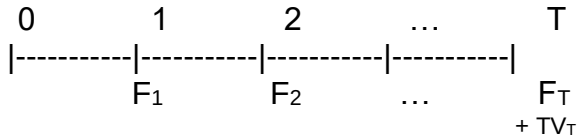
(Below "F" = FCFF)





$TV_T = \frac{(1+g)F_T}{r-g}$ (← Terminal value)

Reduced form of FCFF Stream



$$EV_0 = \sum_{t=1}^{T} \frac{FCFF_t}{(1+r)^t} + \frac{TV_T}{(1+r)^T}$$

(Enterprise vaslue)

Note:

- Excess cash includes non-operating cash and marketable securities.
- Sometimes the entire amount of cash is considered non-operating if determining excess cash is unclear.

- $TV_T = Terminal\ value\ at\ T = \frac{FCFF_T(1+g)}{r-g}$
- $g = Longrun\ growth\ rate\ of\ FCFFs$ (how to determine? It comes later.)
- $r = Weighted\ Average\ Costs\ of\ Capital\ (WACC)$

Determination of Free Cash Flows

$$\boldsymbol{FCFF = EBIT(1 - t_C) - Net\ Reinvestment}$$

$$Net\ Reinvestment = Chg.NWC + (Capital\ Expenditure - Depreciation)$$

- **About $\boldsymbol{EBIT(1 - t_C)}$**
  - $EBIT(1 - t_C) = Net\ operating\ income\ after\ taxes(NOPAT)$
  - If the firm is liquidated, then the market value of it will be distributed to debt- and equity-holders.
  - Hence, the cash flow should include the CFs to debt- and equity-holders: $EBIT(1 - t_C)$ includes the parts of cash flows both to debt- and equity-holders.

- **About Chg. NWC**

$$\boldsymbol{NWC = Op.current\ Assets - Op.current\ Liabilities}$$

OR

$$\boldsymbol{NWC = (Current\ Assets - Excess\ Cash) - Op.current\ Liabilities}$$

Operating current Assets	Operating current liabilities
○ Operating cash ○ Accounts receivables ○ Inventories ○ Prepaid expenses	○ Accounts payable ○ Accrued expenses ○ Deterred income (Unearned revenues)

Caution: in the valuation purpose, exclude excess cash (non-operating cash, marketable securities), notes payable and current portion of long-term debts from the calculations of NWC.

Here, NWC represents the “investments” which are not funded by short-term capital, but were funded by “long-term” capital.
Hence, if the NWC increased, then the incremental NWC implies that more capital (“cash”) is used to fund the incremental investments in the current assets. Simply,

Increase in NWC → Decrease in free cash flow

- **Capital expenditures**

  Capital expenditures includes “net” cash spending on:

  - PPE (property, plants and equipment)
  - Trademarks
  - Patents
  - Good will
  - Cash spent in/earned from acquisitions, liquidations and divestures of fixed assets
  - Other intangible assets
  - Other fixed assets

WACC

This was covered in BUS 170.

Growth Rate of FCFF

$$FCFF = EBIT(1 - t_C) - Net\ reinvestment$$

$$\frac{FCFF}{EBIT(1 - t_C)} = 1 - \frac{Net\ reinvestment}{EBIT(1 - t_C)} = 1 - IR$$

$$FCFF = (1 - IR)EBIT(1 - t_C)$$

$$\textbf{Growth rate of FCFF} = \frac{FCFF_1 - FCFF_0}{FCFF_0}$$
$$= \frac{(1 - IR)EBIT_1(1 - t_C) - (1 - IR)EBIT_0(1 - t_C)}{(1 - IR)EBIT_0(1 - t_C)}$$
$$= \frac{EBIT_1 - EBIT_0}{EBIT_0}$$
$$\approx \textbf{Sales growth rate}\ (or\ EBIT\ growth\ rate)$$

- The long-run growth rate of FCFF is typically based on the expected long-run growth rate of the firm's revenues.

OR, alternatively,

$$\textbf{Growth rate of FCFF} = \textbf{IR} \times \textbf{ROIC}$$

$$Return\ on\ Invested\ capital\ (ROIC) = \frac{EBIT(1 - t_C)}{Invested\ Capital}$$

$$Invested\ Capital$$
$$= [Current\ Asset - Excess\ Cash - Operating\ Liabilities] + Longterm\ assets$$
OR
$$= Longterm\ Debts + Equity - Excess\ Cash$$

Forecasting FCFFs

(There are other methods using more financial ratios. Here we use a simple approach using three financial ratios.)

- Operating margin = EBIT/Sales
- (Capital expenditure – Depreciation)/(Increase in sales)
- (Increase in NWC)/(Increase in sales)

Suppose the growth rate of sales in 2006 was 9%.

Year	2005 (current)	2006 (forecast)	2007 (forecast)
Sales	518	518*(1+9%) = 564.62	Same way under the forecasted sales growth in 2007
EBIT		9%*564.62 = 50.8	
Tax		37%*50.8 = 18.8	
Net capital expenditure		8%*(564.62 – 518) = 3.7	
Increase in NWC		10%*(564.62 – 518) = 4.7	
FCFF		50.8 – 18.8 – 3.7 – 4.7 = 23.62	

Example: Enterprise valuation approach

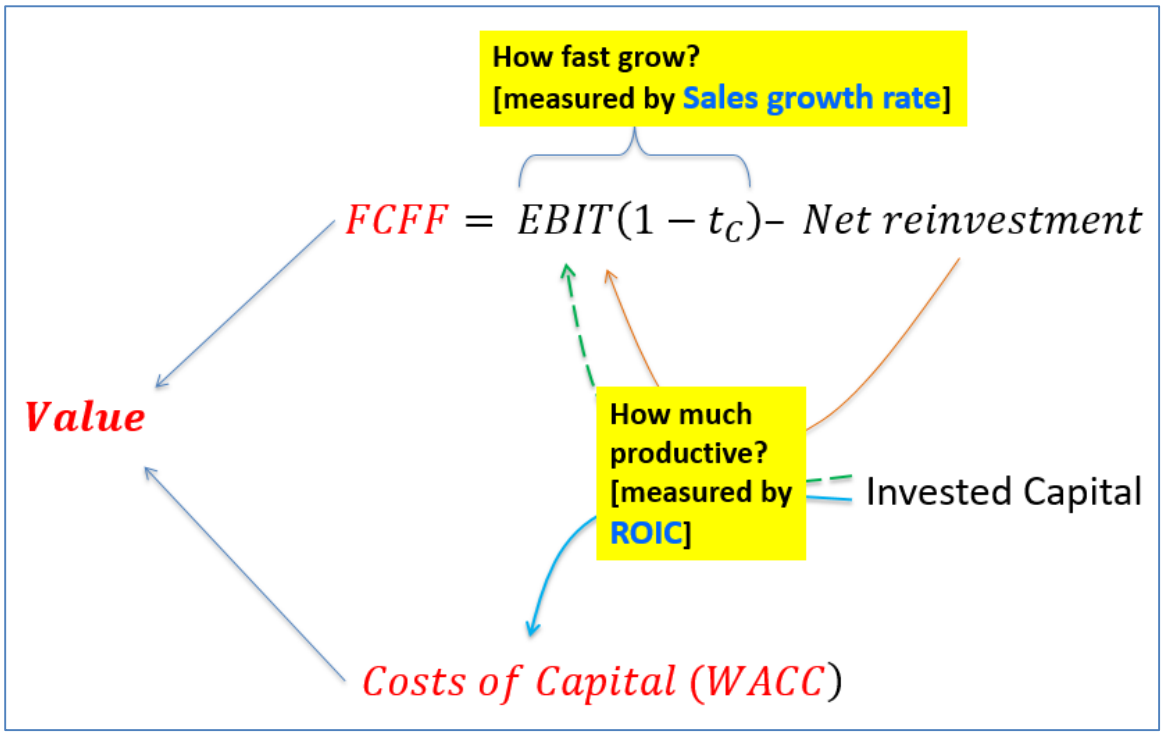
Ginger Ale had sales of $518 million in 2005. Suppose you expect its sales to grow at a 9% rate in 2006, but that this growth rate will slow by 1% per year to a long-run growth rate for the apparel industry of 4% by 2011. Based on Ginger's past profitability and investment needs, you expect EBIT to be 9% of sales, Net capital expenditure (=capital expenditure – depreciation) to be 8% of any increase in sales, and increases in net working capital requirements to be 10% of any increase in sales. The invested capital is expected to $130 million in 2011. If Ginger has $100 million in non-operating cash, the current market value of debt of $3 million, 21 million shares outstanding, a tax rate of 37%, and a weighted average cost of capital of 11%, what is your estimate of the value of Ginger's stock in early 2006?

	Year		2005	2006	2007	2008	2009	2010	2011
FCF Forecast ($millions)									
1 Sales			518.00	564.62	609.79	652.47	691.62	726.20	755.25
2 *growth vs. prior year*				9.00%	8.00%	7.00%	6.00%	5.00%	4.00%
3 EBIT	9.00%	of sales		50.8	54.9	58.7	62.2	65.4	68.0
4 Less: Income Tax	37.00%	of EBIT		(18.8)	(20.3)	(21.7)	(23.0)	(24.2)	(25.1)
5 Less: Net capital expenditure	8.00%	of Δ sales		(3.7)	(3.6)	(3.4)	(3.1)	(2.8)	(2.3)
6 Less: Increase in NWC	10.00%	of Δ sales		(4.7)	(4.5)	(4.3)	(3.9)	(3.5)	(2.9)
7 Free Cash Flow				23.62	26.44	29.31	32.17	34.95	37.59
8 Long-term growth rate ("g")									0.04
9 WACC									0.11
10 Terminal Value									558.54
11 PV of Free Cash Flows = Enterprise value			424.83						

IR = (2.3 + 2.9)/ (68 – 25.1) = 0.12143
ROIC = (68 – 25.1)/130 = 0.3294
g of FCFF = 0.12143x0.3294 = 0.04 (4%)

Enterprise value = 424.8 million
Firm value = 424.8 + 100 = 524.8 million
Stock price = (424.8 + 100 – 3)/21 = $24.85

What Companies Create More Value?

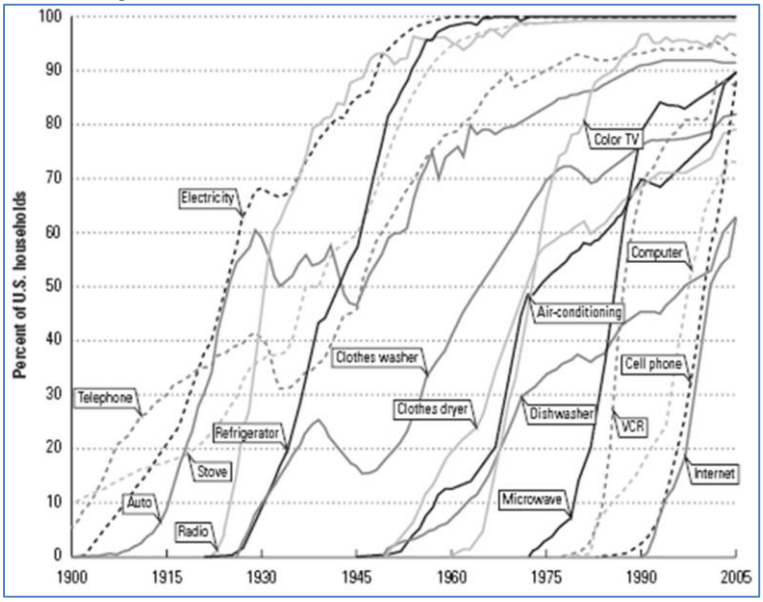


- **As we can see in the above figure, value creating companies have a good combination of Growth and ROIC.**

What Companies Create More Value?- ***Sales (revenue) growth***

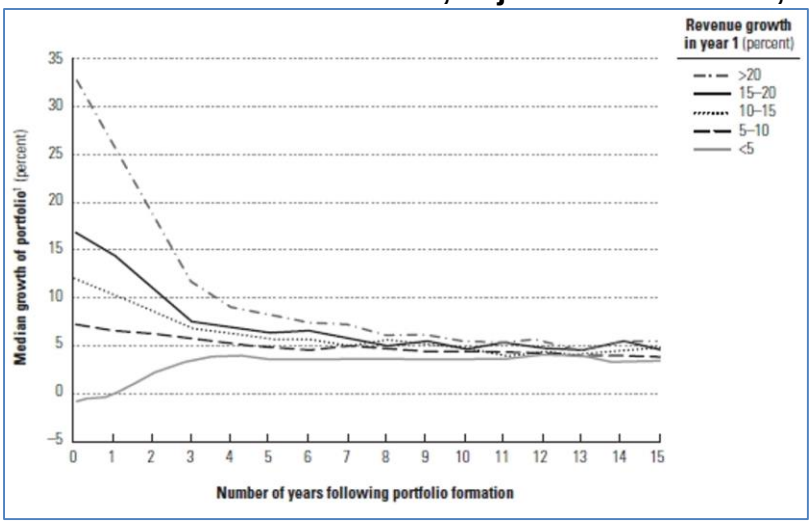
Sustaining high growth is difficult. Because most products have natural life cycles, the only way to achieve lasting high growth is to continue introducing new products at an increasing rate—which is just about impossible. Then, how do they maintain growth?

< Life Cycles of Products and Sales Growth Rate>



- Observe how fast growth of products decay.

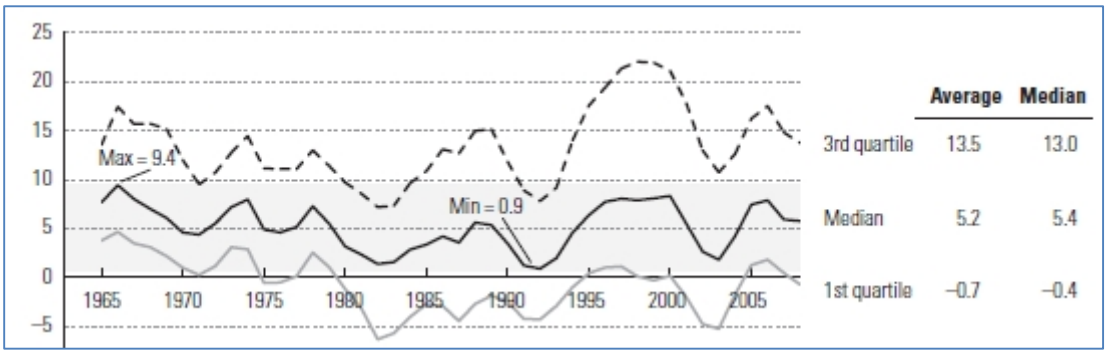
< Decay of annual Sales Growth Rate, adjusted for inflation, Unit: % >



(At year 0, companies are grouped into one of five portfolios based on revenue growth)

- Observe how fast the revenue growth decay and converges to the average.
- Growth rates for even the fastest-growing companies tend to fall back to below 5 percent within 10 years.

< Annual Sales Growth Rate, adjusted for inflation, Unit: % >

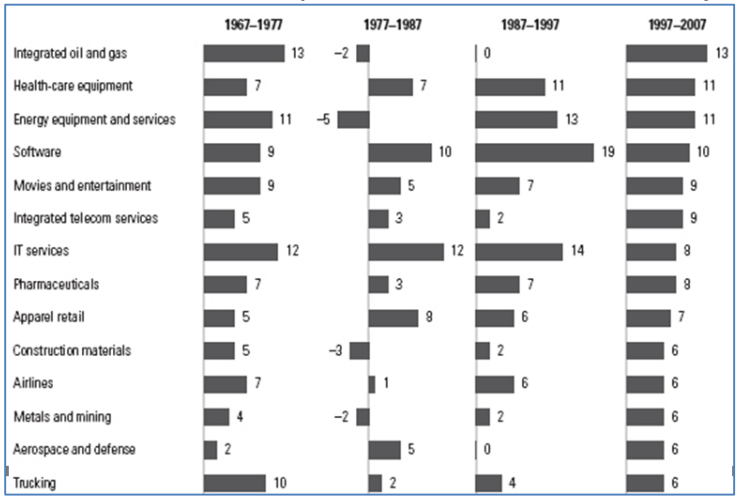


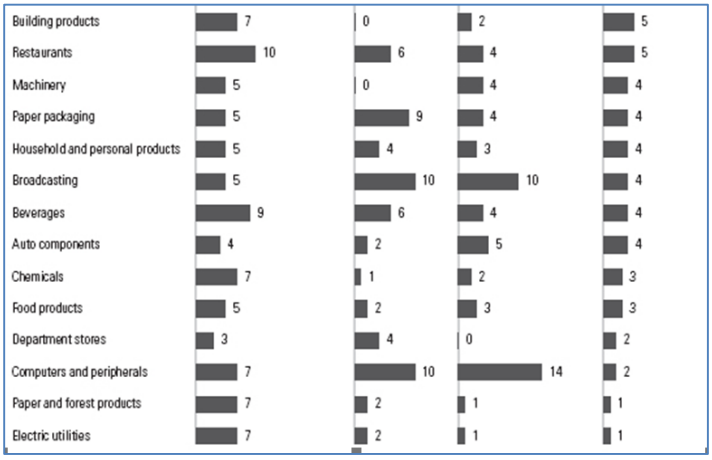
(Source: McKinsey using Compustat data)

- Observe: what longterm growth rate of FCFF do we have to assume in a usual valuation?

< Sales Growth Rate by Industry Sector>

(The median for each industry, adjusted for inflation, unit: %)





- Observe that growth rate for many industries is very volatile.
- Some industries have chronic low growth rates.

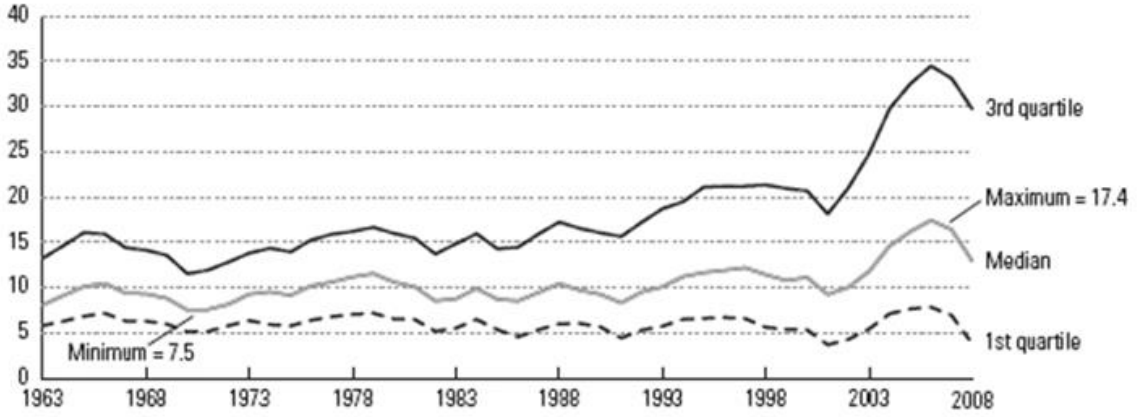
< How Growth Creates Value? >

Value creation	Type of Growth	Rational
↑ Above average ↓	Create new markets through new products	No established competitors; diverts customer spending
	Convince existing customers to buy more of a product	All competitors benefit; low risk of retaliation
	Attract new customers to the market	
↑ Average ↓	Gain market share in fast-growing market	Competitors can still grow despite losing share; moderate risk of retaliation
	Make bolt-on acquisition to accelerate product growth	Moderate acquisition premium relative to upside potential
↑ Below average ↓	Gain share from rivals through incremental innovation	Competitors can replicate and take back customers
	Gain share from rivals through product promotion and pricing	
	Make large acquisitions	High premium to pay; most value diverted to selling shareholders

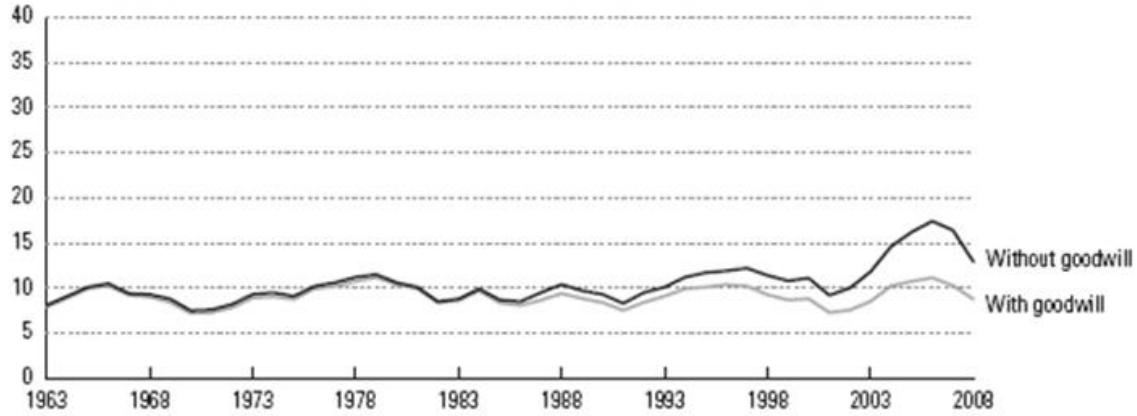
(Source: McKinsey, "Valuation – measuring and managing the value of companies, 5th ed.)

What Companies Create More Value? - *ROIC*

<Annual ROIC without goodwill, unit: % >



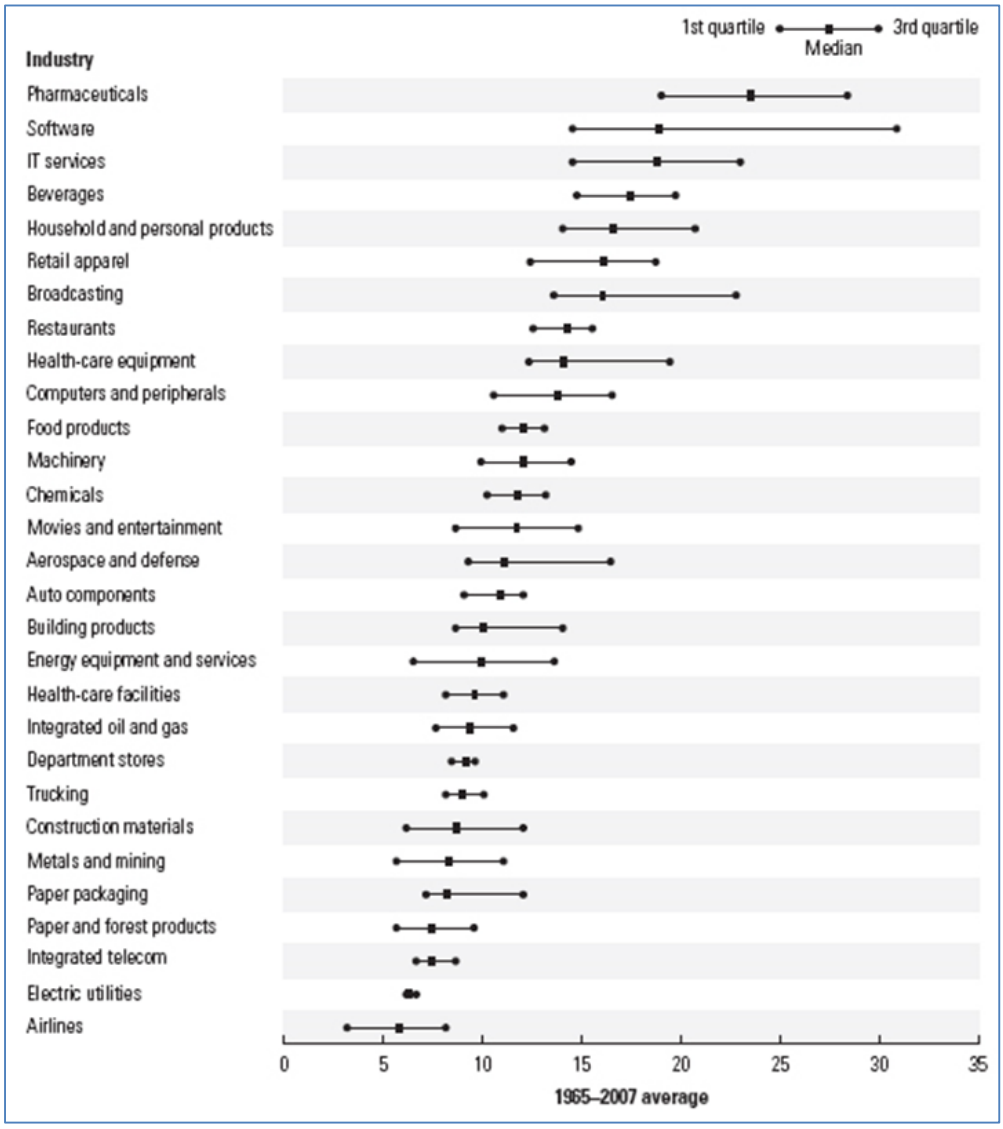
<Median ROIC with / without goodwill, unit: % >



Observe

- The long-run median ROIC is stable at around 10% with the recent value of 13% without goodwill.

< Industry ROIC, unit: % >



Observe

- industry structure is an important but not exclusive determinant of ROIC. Certain industries are biased toward earning either high, medium, or low returns, but there is still significant variation in the rates of return for individual companies within each industry.

< Drivers of ROIC >

Price premium via competitive advantage	Cost and capital efficiency
• Innovative products: Difficult to copy or patented products, services or technologies • Quality • Brand • Customer lock-in	• Innovative business method • Unique resources: Advantage resulting from inherent geological characteristics or unique access to raw materials • Economies of scale • Scalable product/process

Observe

- ***The ROICs are driven by competitive advantages that enable companies to realize price premiums, cost and capital efficiencies, or some combination of these.***

- ***If a company finds a formula or strategy that earns an attractive ROIC, there is a good chance it can sustain that attractive return over time and through changing economic, industry, and company conditions—especially in the case of industries that enjoy relatively long product life cycles. Unfortunately, the converse is also true: If a company earns a low ROIC, that is likely to persist as well.***

IV. Dividend discount model (or, Dividend growth model)

If time is not allowed, then this part will be left to you since the DDM was covered in BUS 170.

$$P_0 = \frac{D_1}{1+r_S} + \frac{D_2}{(1+r_S)^2} + \frac{D_3}{(1+r_S)^3} + \cdots + \frac{D_\infty}{(1+r_S)^\infty}$$

$$D_t = Per\text{-}share\ dividend\ in\ year\ t$$

[1] Constant growth model

With the following assumption, the above DDM is simplified into the constant growth model (or, Gordon model).

$D_{t+1} = D_t(1+g_{Div})$ ← Assumption

Valid only for mature firms, Example: Coca Cola, IBM

$$P_0 = \frac{D_1}{r_S - g} = \frac{D_0(1+g)}{r_S - g}$$

* Historical average of dividend growth rates ("*g*") = 5.4% (nominal) (1927 – 2011)

Difficulties in using the model

(1) Estimates of stock price are very sensitive to input values.
(2) Growth rates of dividends and cost of equity may not be constant.
(3) Only valid for mature firm. In reality, there are not many firms you can just rely only on the constant growth model.

Growth Rate of Dividend[ii]

(1) Historical average by arithmetic mean (AM) or geometric mean (GM)
(2) $g = (1 - DPR)ROE$, where $(1 - DPR) = Retention\ rate$("*b*")

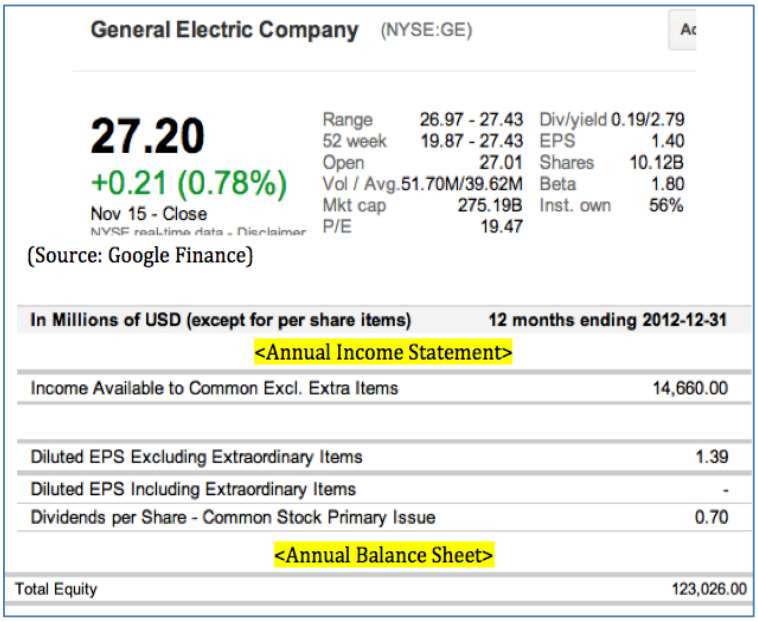
Example: Historical average by arithmetic mean (AM) or geometric mean (GM)

Year	Dividend	Growth rate
2010	$0.90	
2011	$0.93	0.0333
2012	$0.98	0.0538
2013	$1.03	0.0460

AM = 4.44%. GM = 4.43%

$GM=[\ (1+0.0333)*(1+0.0538)*(1+0.046)\ ]^{(1/3)} - 1$

Example



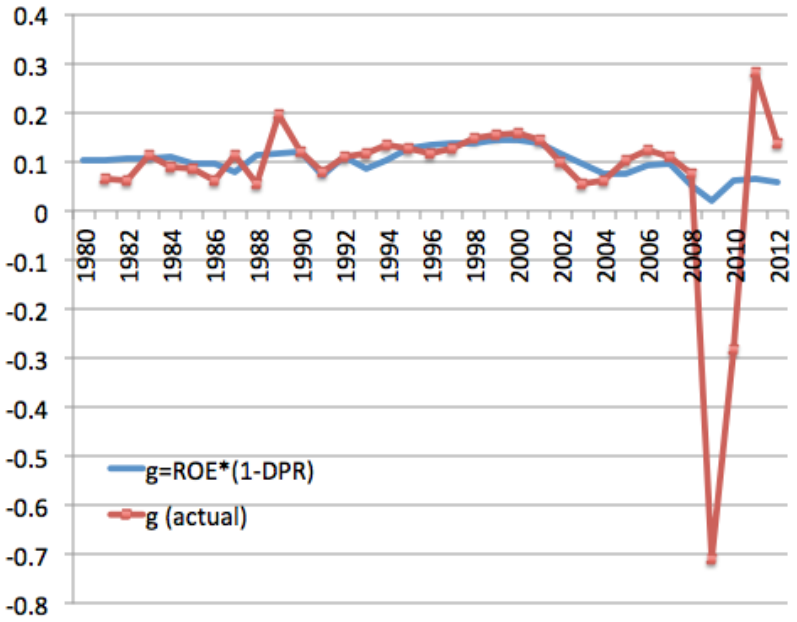
- Growth rate of dividend using the DPR and ROE?
- Expected dividend during year 2013 (D_1)?

$g = (1 - DPR)ROE$ = (1-0.7/1.39)*(14,660/123,026) =0.0592 (5.92%)

$D_1=D_0*(1+g)$ = 0.7*(1+0.0592) = $0.74

Comparison between Averaged growth rate and ROE(1-DPR)

Because the expected growth rate of dividends has to be used, there is a judgmental part in determining the growth rate. For example, the following figure confirms that the estimated growth rate using the retention rate is not always the same as the actual growth rate of dividends for the GE stock.



The average of the estimated and actual growth rate are almost the same as around 0.1085 during year 1980 to 2007. Due to the impacts of recession that started from year 2008, the discrepancy got larger.

The actual growth rate of dividend in year 2012 was 0.1376.
The growth rate estimated by $Retention\ rate \times ROE$ was 0.059228.

A judgmental assumption has to be made such that the dividend growth rate converges back from the actual rate to the long term during coming years.

Constant growth model for Wells Fargo

Year	Dividend Per Share	Earnings Per Share	Realized Growth Rate of Dividend	Realized Growth Rate of Revenue	DPR	ROE	g= (1-DPR)ROE
1990	0.845	0.89	0.1118	0.4158	0.9494	0.058	0.0029
1991	0.94	2.95	0.1124	0.0656	0.3186	0.154	0.1048
1992	1.08	2.83	0.1489	0.0895	0.3816	0.116	0.0717
1993	0.64	2.13	-0.4074	0.0957	0.3005	0.183	0.1281
1994	0.765	2.45	0.1953	0.1432	0.3122	0.208	0.1431
1995	0.9	2.76	0.1765	0.2570	0.3261	0.180	0.1213
1996	1.05	3.07	0.1667	0.1715	0.3420	0.190	0.1252
1997	0.615	1.78	-0.4143	0.0844	0.3455	0.192	0.1259
1998	0.7	1.18	0.1382	1.1264	0.5932	0.094	0.0382
Average	0.837	2.227	0.025	0.272	0.430	0.153	0.096

Suppose $g = 0.054$ ← Market average of dividend growth rates (1927 – 2011)

$$D_{1998} = 0.7$$

$$P_0 = \frac{D_1}{r_S - g} = \frac{D_0(1+g)}{r_S - g} = \frac{\$0.7(1+0.054)}{0.1108 - 0.054} = \$13.0$$

- Why is the estimated stock price **so lower** than the market price of $40?[iii]

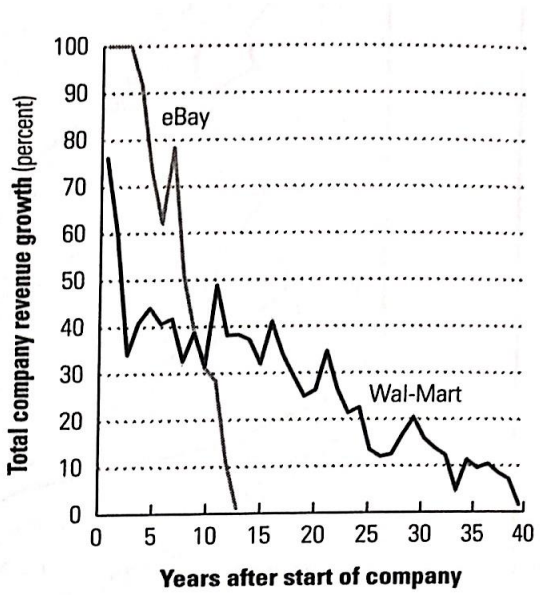
Suppose $g = 0.096$ ← Average of Wells Fargo' dividend growth rates (1990 – 1998)

$$P_0 = \frac{D_1}{r_S - g} = \frac{D_0(1+g)}{r_S - g} = \frac{\$0.7(1+0.096)}{0.1108 - 0.096} = \$51.5$$

- Why is the estimated stock price **so higher** than the market price of $40?[iv]

[2] Non-Constant growth model

(Life cycle of revenue growth)



Point:

- Growth rate of revenue (also, dividend) is high then becomes low.
- The pattern of growth differs depending on the type of industry.

The growth rate has “S” shape pattern.

$$P_0 = \underbrace{\frac{D_1}{(1+r_1)^1} + \cdots + \frac{D_t}{(1+r_t)^t}}_{Stage\ 1} + \underbrace{\frac{D_{t+1}}{(1+r_N)^{t+1}} + \frac{D_{t+2}}{(1+r_N)^{t+2}} + \cdots}_{Stage\ 2}$$

$$P_0 = \underbrace{\frac{D_1}{(1+r_1)^1} + \cdots + \frac{D_t}{(1+r_t)^t}}_{Stage\ 1} + \underbrace{\frac{TV_t}{(1+r_t)^t}}_{Stage\ 2}$$

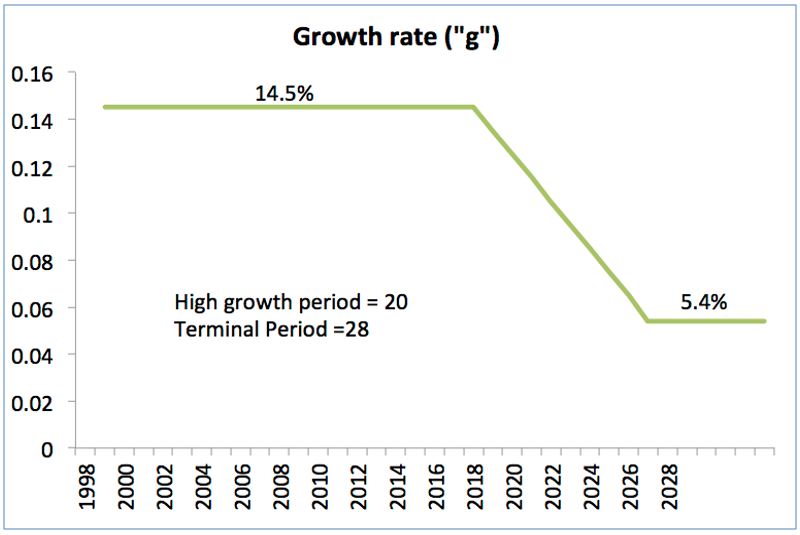
*Stage 1 = variable growth, risk period
*Stage 2 = Constant growth, risk period

Wells Fargo had been paying dividend with the growth rate of around 15% (in arithmetic mean)

Year	Realized Growth Rate of Dividend	g = (1-DPR)ROE
1994	0.1953	0.1431
1995	0.1765	0.1213
1996	0.1667	0.1252
1997	-0.4143	0.1259
1998	0.1382	0.0382

Due to market crash

Assume the following growth rates.



Stage 1 Stage 2

(Non-constant growth stage 1 and 2)

(Beta = 0.86 as of 2013. Before

	Period	Dividend Per Share	Growth rate ("g")	TV	Adj. Beta	Cost of equity	CF	DCF
1998	0	0.7			0.86			
1999	1	0.80	0.145		0.86	0.111	0.80	0.72
2000	2	0.92	0.145		0.86	0.111	0.92	0.74
2001	3	1.05	0.145		0.86	0.111	1.05	0.77
2002	4	1.20	0.145		0.86	0.111	1.20	0.79
2003	5	1.38	0.145		0.86	0.111	1.38	0.81
2004	6	1.58	0.145		0.86	0.111	1.58	0.84
2005	7	1.81	0.145		0.86	0.111	1.81	0.87
2006	8	2.07	0.145		0.86	0.111	2.07	0.89
2007	9	2.37	0.145		0.86	0.111	2.37	0.92
2008	10	2.71	0.145		0.86	0.111	2.71	0.95
2009	11	3.10	0.145		0.86	0.111	3.10	0.98
2010	12	3.55	0.145		0.86	0.111	3.55	1.01
2011	13	4.07	0.145		0.86	0.111	4.07	1.04
2012	14	4.66	0.145		0.86	0.111	4.66	1.07
2013	15	5.34	0.145		0.86	0.111	5.34	1.10
2014	16	6.11	0.145		0.91	0.114	6.11	1.09
2015	17	7.00	0.145		0.94	0.116	7.00	1.08
2016	18	8.01	0.145		0.96	0.117	8.01	1.09
2017	19	9.17	0.145		0.97	0.118	9.17	1.10
2018	20	10.50	0.145		0.98	0.119	10.50	1.11
2019	21	11.92	0.135		0.99	0.119	11.92	1.12
2020	22	13.41	0.125		0.99	0.119	13.41	1.12
2021	23	14.95	0.115		0.99	0.120	14.95	1.11
2022	24	16.52	0.105		1.00	0.120	16.52	1.09
2023	25	18.09	0.095		1.00	0.120	18.09	1.07
2024	26	19.63	0.085		1.00	0.120	19.63	1.03
2025	27	21.10	0.075		1.00	0.120	21.10	0.99
2026	28	22.47	0.065	359.005	1.00	0.120	381.47	15.99
2027	29	23.68	0.054		1.00	0.120		
							Sum	42.50

$$P_0 = \underbrace{\frac{D_1}{(1+r_1)^1} + \cdots + \frac{D_t}{(1+r_t)^t}}_{Stage\ 1} + \underbrace{\frac{TV_t}{(r_N - g_N)^t}}_{Stage\ 2} = \$42.5$$

Observe that the non-constantly growing model gives a lot better estimates.

[i]

The FCFF is the cash flow after a firm spent all necessary costs and investments. Hence, the leftover cash can be distributed to debt- and equity-holders.

[ii]

$$D_t = DPR \times NI_t$$
$$RE_t = NI_t - D_t = NI_t - DPR \times NI_t = (1 - DPR)NI_t$$
$$Growht\ rate\ of\ Net\ Income\ (g_{NI}) = \frac{NI_{t+1} - NI_t}{NI_t}$$
$$ROE = \frac{NI}{Book\ value\ equity}$$

We can find that:

$$\underbrace{\frac{D_{t+1} - D_t}{D_t}}_{g_{Div}} = \frac{DPR \times NI_{t+1} - DPR \times NI_t}{DPR \times NI_t} = \underbrace{\frac{NI_{t+1} - NI_t}{NI_t}}_{g_{NI}}$$

The above shows that the growth rate of dividend can be approximated by that of net income.

Consider the following equation that shows that net income increases by the return on retained earnings.

$$NI_{t+1} - NI_t = RE_t \times ROE$$

The above is true since

RE = Retained NI

ROE = ROR on earnings = ROR on RE

Rearrangement leads to

$$g_{NI} = \frac{NI_{t+1} - NI_t}{NI_t} = (1 - DPR)ROE$$

[iii]

The growth rate is assumed to be too low from the start.

[iv]

The growth rate is assumed to be too high from the start. As we have seen earlier, the growth rate of sales (and hence, growth rate of dividend) can't be higher than 5% for median companies for long run.