The Magical Number: ROIC (or any accounting return) and its limits

Abnormal earnings
Last 12 months might have been unusally good or bad

Accounting Issues
Operating income can be skewed by accounting misclassification (leases and R&D) and by unusual expenses/income.

Life Cycle Effect
Current earnings are not indicative of long term earnings potential for young & infrastructure firms

Computed as operating income in most recent 12 months, net of the effective tax rate paid during those 12 months

$$\textbf{Return on Invested Capital} = \frac{\text{After-tax Operating Income}}{\text{Capital Invested in existing assets}}$$

This is your proxy for returns made on existing assets and for continuing returns from those assets

Accounting Write offs
Writing off mistakes can reduce invested capital & make it look better than it should.

Invested Capital = Book value of equity + Book value of debt - Cash & Cross holdings

Inflation
If asset book value is not adjusted for inflation, capital invested in older assets will be understated.

Accounting misclassification
When capital expenses (R&D) and financial expenses (leases) are miscategorized as operating expenses, invested capital will be understated.

IV. Operating Income Growth when Return on Capital is Changing

- When the return on capital is changing, there will be a second component to growth, positive if the return on capital is increasing and negative if the return on capital is decreasing.
- If ROC_t is the return on capital in period t and ROC_{t+1} is the return on capital in period t+1, the expected growth rate in operating income will be:

$$\text{Expected Growth Rate} = ROC_{t+1} * \text{Reinvestment rate} + (ROC_{t+1} - ROC_t) / ROC_t$$

- If the change is over multiple periods, the second component should be spread out over each period.

Motorola's Growth Rate

- Motorola's current return on capital is 12.18% and its reinvestment rate is 52.99%.
- We expect Motorola's return on capital to rise to 17.22% over the next 5 years (which is half way towards the industry average)

  Expected Growth Rate

  $= ROC_{New\ Investments} * Reinvestment\ Rate_{Current} + \{[1+(ROC_{In\ 5\ years} - ROC_{Current})/ROC_{Current}]^{1/5} - 1\}$

  = .1722*.5299 +{ [1+(.1722-.1218)/.1218]1/5-1}

  = .1629 or 16.29%
- One way to think about this is to decompose Motorola's expected growth into
  - Growth from new investments: .1722*5299= 9.12%
  - Growth from more efficiently using existing investments: 16.29%-9.12%= 7.17%

Note that I am assuming that the new investments start making 17.22% immediately, while allowing for existing assets to improve returns gradually

The Value of Growth

	Firm 1	Firm 2	Firm 3	Firm 4	Firm 5
Reinvestment Rate	20.00%	100.00%	200.00%	20.00%	0.00%
ROIC on new investment	50.00%	10.00%	5.00%	10.00%	10.00%
ROIC on existing investments before	10.00%	10.00%	10.00%	10.00%	10.00%
ROIC on existing investments after	10.00%	10.00%	10.00%	10.80%	11.00%
Expected growth rate	**10.00%**	**10.00%**	**10.00%**	**10.00%**	**10.00%**

Expected growth = Growth from new investments + Efficiency growth

= Reinv Rate * ROC + $(ROC_t - ROC_{t-1})/ROC_{t-1}$

Assume that your cost of capital is 10%. As an investor, rank these firms in the order of most value growth to least value growth.

Growth IV

Top Down Growth

Estimating Growth when Operating Income is Negative or Margins are changing

- All of the fundamental growth equations assume that the firm has a return on equity or return on capital it can sustain in the long term.
- When operating income is negative or margins are expected to change over time, we use a three step process to estimate growth:
  - Estimate growth rates in revenues over time
    - Determine the total market (given your business model) and estimate the market share that you think your company will earn.
    - Decrease the growth rate as the firm becomes larger
    - Keep track of absolute revenues to make sure that the growth is feasible
  - Estimate expected operating margins each year
    - Set a target margin that the firm will move towards
    - Adjust the current margin towards the target margin
  - Estimate the capital that needs to be invested to generate revenue growth and expected margins
    - Estimate a sales to capital ratio that you will use to generate reinvestment needs each year.

Tesla in July 2015: Growth and Profitability

Year	Revenues	Revenue Growth	Operating Income	Operating Margin
Base year	$2,013.50		$(21.81)	-1.08%
1	$3,322.28	65.00%	$7.48	0.23%
2	$5,481.75	65.00%	$84.06	1.53%
3	$9,044.89	65.00%	$257.03	2.84%
4	$14,924.07	65.00%	$619.36	4.15%
5	$24,624.72	65.00%	$1,344.12	5.46%
6	$37,565.02	52.55%	$2,541.92	6.77%
7	$52,628.59	40.10%	$4,249.78	8.08%
8	$67,180.39	27.65%	$6,303.78	9.38%
9	$77,391.81	15.20%	$8,274.48	10.69%
10	$79,520.08	2.75%	$9,542.41	12.00%

Revenues in year 10 reflect successful "high end auto" company revenues (Volvo, Audi, BMW etc.)

Pre-tax operating margin in year 10 is at the 75th pecentile of high end auto companies.

Tesla: Reinvestment and Profitability

Operating losses carried forward save taxes in years 3 & 4

Sales/Capital measures revenues generated for every dollar of investment

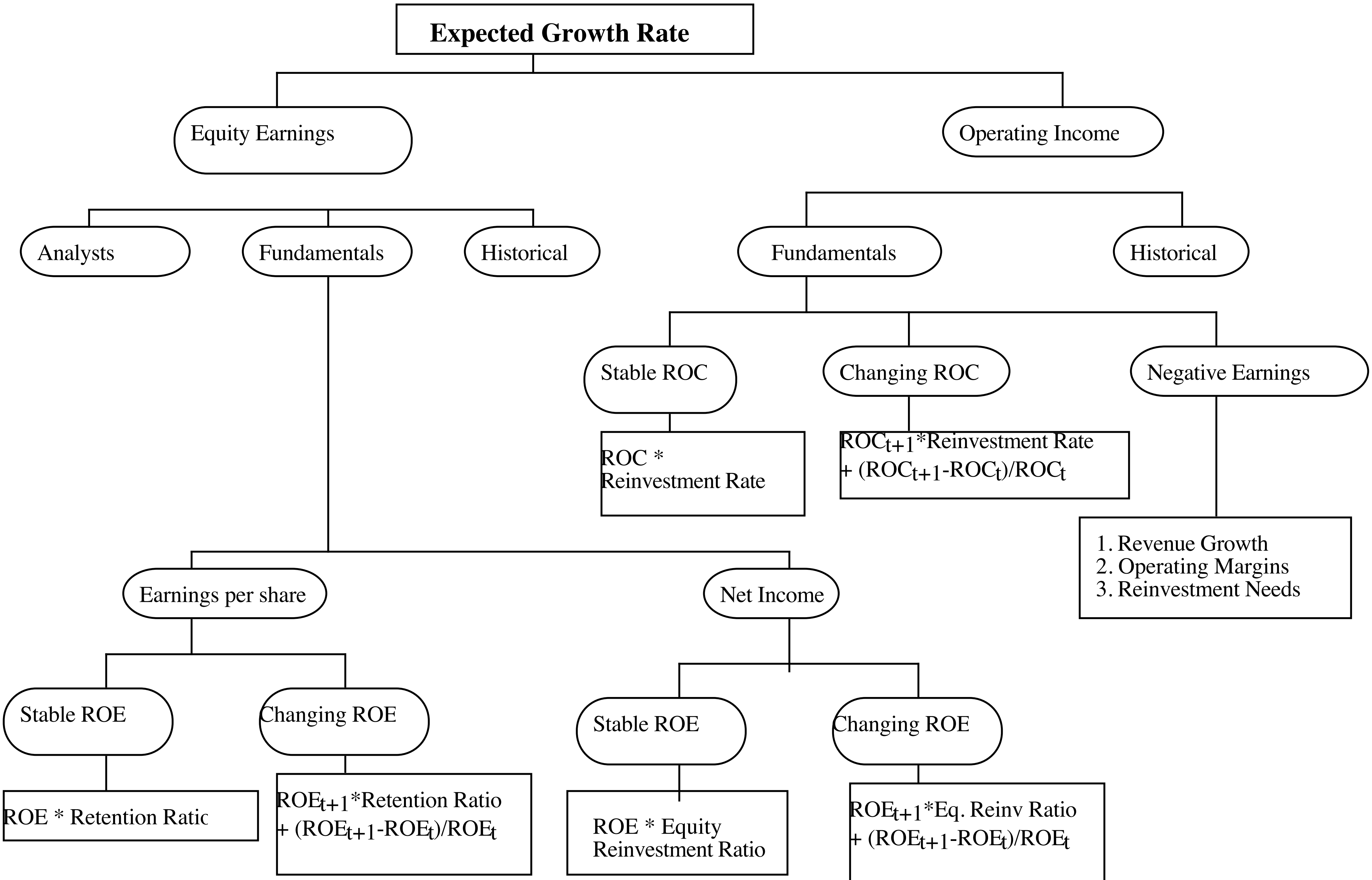
Reinvestment = Change in Revenue/ Sales to capital

Year	Revenues	EBIT	EBIT (1-t)	Change in Revenues	Sales/Capital	Reinvestment	FCFF	Invested Capital	ROIC	Cost of Capital
Base	$ 2,013.50	$ (21.81)	$ (21.81)					$ 1,045.00	-2.09%	8.74%
1	$ 3,322.28	$ 7.48	$ 7.48	$ 1,308.78	1.55	$ 844.37	$ (836.89)	$ 1,889.37	0.40%	8.74%
2	$ 5,481.75	$ 84.06	$ 84.06	$ 2,159.48	1.55	$ 1,393.21	$(1,309.15)	$ 3,282.58	2.56%	8.74%
3	$ 9,044.89	$ 257.03	$ 254.44	$ 3,563.14	1.55	$ 2,298.80	$(2,044.36)	$ 5,581.38	4.56%	8.74%
4	$ 14,924.07	$ 619.36	$ 402.58	$ 5,879.18	1.55	$ 3,793.02	$(3,390.44)	$ 9,374.40	4.29%	8.74%
5	$ 24,624.72	$ 1,344.12	$ 873.68	$ 9,700.65	1.55	$ 6,258.48	$(5,384.81)	$ 15,632.89	5.59%	8.59%
6	$ 37,565.02	$ 2,541.92	$ 1,652.25	$ 12,940.29	1.55	$ 8,348.58	$(6,696.33)	$ 23,981.46	6.89%	8.44%
7	$ 52,628.59	$ 4,249.78	$ 2,762.36	$ 15,063.57	1.55	$ 9,718.43	$(6,956.08)	$ 33,699.89	8.20%	8.29%
8	$ 67,180.39	$ 6,303.78	$ 4,097.46	$ 14,551.80	1.55	$ 9,388.26	$(5,290.81)	$ 43,088.15	9.51%	8.15%
9	$ 77,391.81	$ 8,274.48	$ 5,378.41	$ 10,211.42	1.55	$ 6,588.01	$(1,209.60)	$ 49,676.17	10.83%	8.00%
10	$ 79,520.08	$ 9,542.41	$ 6,202.57	$ 2,128.27	1.55	$ 1,373.08	$ 4,829.49	$ 51,049.25	12.15%	8.00%

Tesla Story: Tesla will be able to grow efficiently (sales to capital ratio) and continue to generate excess returns as it gets bigger.

Invested Capital in year t = Invested Capital in year t-1 + Reinvestment in year t

Cost of capital decreases as company gets larger and more profitable.


Expected Growth Rate
Equity Earnings
Operating Income
Analysts
Fundamentals
Historical
Fundamentals
Historical
Stable ROC
Changing ROC
Negative Earnings
ROC * Reinvestment Rate
ROC_{t+1}*Reinvestment Rate + $(ROC_{t+1}-ROC_t)/ROC_t$
1. Revenue Growth
2. Operating Margins
3. Reinvestment Needs
Earnings per share
Net Income
Stable ROE
Changing ROE
Stable ROE
Changing ROE
ROE * Retention Ratio
ROE_{t+1}*Retention Ratio + $(ROE_{t+1}-ROE_t)/ROE_t$
ROE * Equity Reinvestment Ratio
ROE_{t+1}*Eq. Reinv Ratio + $(ROE_{t+1}-ROE_t)/ROE_t$

CLOSURE IN VALUATION

The Big Enchilada

Getting Closure in Valuation

- A publicly traded firm potentially has an infinite life. The value is therefore the present value of cash flows forever.

$$\text{Value} = \sum_{t=1}^{t=\infty} \frac{CF_t}{(1+r)^t}$$

- Since we cannot estimate cash flows forever, we estimate cash flows for a "growth period" and then estimate a terminal value, to capture the value at the end of the period:

$$\text{Value} = \sum_{t=1}^{t=N} \frac{CF_t}{(1+r)^t} + \frac{\text{Terminal Value}}{(1+r)^N}$$

Ways of Estimating Terminal Value

Terminal Value

Liquidation Value

Most useful when assets are separable and marketable

Multiple Approach

Easiest approach but makes the valuation a relative valuation

Stable Growth Model

Technically soundest, but requires that you make judgments about when the firm will grow at a stable rate which it can sustain forever, and the excess returns (if any) that it will earn during the period.

1. Obey the growth cap

- When a firm's cash flows grow at a "constant" rate forever, the present value of those cash flows can be written as:

  Value = Expected Cash Flow Next Period / (r - g)

  where,

  r = Discount rate (Cost of Equity or Cost of Capital)

  g = Expected growth rate

- The stable growth rate cannot exceed the growth rate of the economy but it can be set lower.
  - If you assume that the economy is composed of high growth and stable growth firms, the growth rate of the latter will probably be lower than the growth rate of the economy.
  - The stable growth rate can be negative. The terminal value will be lower and you are assuming that your firm will disappear over time.
  - If you use nominal cashflows and discount rates, the growth rate should be nominal in the currency in which the valuation is denominated.
- One simple proxy for the nominal growth rate of the economy is the riskfree rate.

Risk free Rates and Nominal GDP Growth

- **Risk free Rate** = Expected Inflation + Expected Real Interest Rate
- The real interest rate is what borrowers agree to return to lenders in real goods/services.
- **Nominal GDP Growth** = Expected Inflation + Expected Real Growth
- The real growth rate in the economy measures the expected growth in the production of goods and services.

The argument for Risk free rate = Nominal GDP growth

1. In the long term, the real growth rate <u>cannot be lower</u> than the real interest rate, since the growth in goods/services has to be enough to cover the promised rate.
2. In the long term, the real growth rate <u>can be higher</u> than the real interest rate, to compensate risk taking. However, as economies mature, the difference should get smaller and since there will be growth companies in the economy, it is prudent to assume that the extra growth comes from these companies.

Period	*10-Year T.Bond Rate*	*Inflation Rate*	*Real GDP Growth*	*Nominal GDP growth rate*	*Nominal GDP - T.Bond Rate*
1954-2015	5.93%	3.61%	3.06%	6.67%	0.74%
1954-1980	5.83%	4.49%	3.50%	7.98%	2.15%
1981-2008	6.88%	3.26%	3.04%	6.30%	-0.58%
2009-2015	2.57%	1.66%	1.47%	3.14%	0.57%

A Practical Reason for using the Risk free Rate Cap – Preserve Consistency

- You are <u>implicitly making assumptions about nominal growth</u> in the economy, with your risk free rate. Thus, with a low risk free rate, you are assuming low nominal growth in the economy (with low inflation and low real growth) and with a high risk free rate, a high nominal growth rate in the economy.
- If you make an explicit assumption about nominal growth in cash flows that is at odds with your implicit growth assumption in the denominator, you are being inconsistent and bias your valuations:
  - If you assume high nominal growth in the economy, with a low risk free rate, you will over value businesses.
  - If you assume low nominal growth rate in the economy, with a high risk free rate, you will under value businesses.

2. Don't wait too long…

- Assume that you are valuing a young, high growth firm with great potential, just after its initial public offering. How long would you set your high growth period?
  a. < 5 years
  b. 5 years
  c. 10 years
  d. >10 years
- While analysts routinely assume very long high growth periods (with substantial excess returns during the periods), the evidence suggests that they are much too optimistic. Most growth firms have difficulty sustaining their growth for long periods, especially while earning excess returns.

And tie to competitive advantages

- It is not growth per se that creates value but growth with excess returns.
- For growth firms to continue to generate value creating growth, they have to be able to keep the competition at bay.
  - Proposition 1: The stronger and more sustainable the competitive advantages, the longer a growth company can sustain "value creating" growth.
  - Proposition 2: Growth companies with strong and sustainable competitive advantages are rare.

3. Do not forget that growth has to be earned..

- In the section on expected growth, we laid out the fundamental equation for growth:

  Growth rate = Reinvestment Rate * Return on invested capital

  + Growth rate from improved efficiency
- In stable growth, you cannot count on efficiency delivering growth and you have to reinvest to deliver the growth rate that you have forecast.
- Consequently, your reinvestment rate in stable growth will be a function of your stable growth rate and what you believe the firm will earn as a return on capital in perpetuity:
  - Reinvestment Rate = Stable growth rate/ Stable period ROC = g/ ROC
- Your terminal value equation can then be rewritten as:

$$\text{Terminal Value in year n} = \frac{\text{EBIT}_{n+1}\ (1-t)(1-\frac{g}{\text{ROC}})}{(\text{Cost of Capital}-g)}$$