



# ESTIMATING GROWTH

Growth can be good, bad or neutral...

# THE VALUE OF GROWTH

- When valuing a company, it is easy to get caught up in the details of estimating growth and start viewing growth as a “good”, i.e., that higher growth translates into higher value.
- Growth, though, is a double-edged sword.
  - The good side of growth is that it pushes up revenues and operating income, perhaps at different rates (depending on how margins evolve over time).
  - The bad side of growth is that you have to set aside money to reinvest to create that growth.
  - The net effect of growth is whether the good outweighs the bad.

# WAYS OF ESTIMATING GROWTH IN EARNINGS

- Look at the past
  - The historical growth in earnings per share is usually a good starting point for growth estimation
- Look at what others are estimating
  - Analysts estimate growth in earnings per share for many firms. It is useful to know what their estimates are.
- Look at fundamentals
  - With stable margins, operating income growth can be tied to how much a firm reinvests, and the returns it earns.
  - With changing margins, you have to start with revenue growth, forecast margins and estimate reinvestment.



# GROWTH I

Historical Growth

Aswath Damodaran

# HISTORICAL GROWTH

- Historical growth rates can be estimated in a number of different ways
  - Arithmetic versus Geometric Averages
  - Simple versus Regression Models
- Historical growth rates can be sensitive to
  - The **period used in the estimation** (starting and ending points)
  - The **metric** that the growth is estimated in..
- In using historical growth rates, you have to wrestle with the following:
  - How to deal with **negative earnings**
  - The effects of **scaling up**

# MOTOROLA: ARITHMETIC VERSUS GEOMETRIC GROWTH RATES

	Revenues	% Change	EBITDA	% Change	EBIT	% Change
1994	\$ 22,245		\$ 4,151		\$ 2,604	
1995	\$ 27,037	21.54%	\$ 4,850	16.84%	\$ 2,931	12.56%
1996	\$ 27,973	3.46%	\$ 4,268	-12.00%	\$ 1,960	-33.13%
1997	\$ 29,794	6.51%	\$ 4,276	0.19%	\$ 1,947	-0.66%
1998	\$ 29,398	-1.33%	\$ 3,019	-29.40%	\$ 822	-57.78%
1999	\$ 30,931	5.21%	\$ 5,398	78.80%	\$ 3,216	291.24%
Arithmetic Average		7.08%		10.89%		42.45%
Geometric Average		6.82%		5.39%		4.31%
Standard deviation		8.61%		41.56%		141.78%

# A TEST

- You are trying to estimate the growth rate in earnings per share at Time Warner from 1996 to 1997. In 1996, the earnings per share was a deficit of \$0.05. In 1997, the expected earnings per share is \$ 0.25. What is the growth rate?
  - a. -600%
  - b. +600%
  - c. +120%
  - d. Cannot be estimated



# DEALING WITH NEGATIVE EARNINGS

- When the earnings in the starting period are negative, the growth rate cannot be estimated. ( $0.30/-0.05 = -600\%$ )
- There are three solutions:
  - Use the higher of the two numbers as the denominator ( $0.30/0.25 = 120\%$ )
  - Use the absolute value of earnings in the starting period as the denominator ( $0.30/0.05=600\%$ )
  - Use a linear regression model and divide the coefficient by the average earnings.
- When earnings are negative, the growth rate is meaningless. Thus, while the growth rate can be estimated, it does not tell you much about the future.



# THE EFFECT OF SIZE ON GROWTH: CALLAWAY GOLF

Year	Net Profit	Growth Rate
1990	1.80	
1991	6.40	255.56%
1992	19.30	201.56%
1993	41.20	113.47%
1994	78.00	89.32%
1995	97.70	25.26%
1996	122.30	25.18%

- Geometric Average Growth Rate = 102%

# EXTRAPOLATION AND ITS DANGERS

Year	Net Profit
1996	\$ 122.30
1997	\$ 247.05
1998	\$ 499.03
1999	\$ 1,008.05
2000	\$ 2,036.25
2001	\$ 4,113.23

- If net profit continues to grow at the same rate as it has in the past 6 years, the expected net income in 5 years will be \$ 4.113 billion.



# GROWTH II

Analyst Estimates

Aswath Damodaran

# ANALYST FORECASTS OF GROWTH

- While the job of an analyst is to find under and overpriced stocks in the sectors that they follow, a significant proportion of an analyst's time (outside of selling) is spent forecasting earnings per share.
  - Most of this time, in turn, is **spent forecasting earnings per share** in the next earnings report
  - While **many analysts forecast expected growth in earnings per share over the next 5 years**, the analysis and information (generally) that goes into this estimate is far more limited.
- Analyst forecasts of earnings per share and expected growth are widely disseminated by services such as Zacks and IBES, at least for U.S companies.

# HOW GOOD ARE ANALYSTS AT FORECASTING GROWTH?

- Analysts forecasts of EPS tend to be closer to the actual EPS than simple time series models, but the differences tend to be small

<i>Study</i>	<i>Group tested</i>	<i>Analyst Error</i>	<i>Time Series Model Error</i>
Collins & Hopwood	Value Line Forecasts	31.7%	34.1%
Brown & Rozeff	Value Line Forecasts	28.4%	32.2%
Fried & Givoly	Earnings Forecaster	16.4%	19.8%

- The advantage that analysts have over time series models
  - tends to **decrease with the forecast period** (next quarter versus 5 years)
  - tends to be **greater for larger firms** than for smaller firms
  - tends to be **greater at the industry level** than at the company level
- Forecasts of growth (and revisions thereof) tend to be highly correlated across analysts.

# ARE SOME ANALYSTS MORE EQUAL THAN OTHERS?

- A study of All-America Analysts (chosen by Institutional Investor) found that
  - There is **no evidence that analysts who are chosen for the All-America Analyst team were chosen because they were better forecasters of earnings.** (Their median forecast error in the quarter prior to being chosen was 30%; the median forecast error of other analysts was 28%)
  - However, in the **calendar year following** being chosen as All-America analysts, **these analysts become slightly better forecasters** than their less fortunate brethren. (The median forecast error for All-America analysts is 2% lower than the median forecast error for other analysts)
  - Earnings revisions made by All-America analysts tend to **have a much greater impact on the stock price** than revisions from other analysts
  - The recommendations made by the All-America analysts have a greater impact on stock prices (3% on buys; 4.7% on sells). For these recommendations the price changes are sustained, and they continue to rise in the following period (**2.4% for buys; 13.8% for the sells**).

# THE FIVE DEADLY SINS OF AN ANALYST

- **Tunnel Vision:** Becoming so focused on the sector and valuations within the sector that you lose sight of the bigger picture.
- **Lemmingitis:** Strong urge felt to change recommendations & revise earnings estimates when other analysts do the same.
- **Stockholm Syndrome:** Refers to analysts who start identifying with the managers of the firms that they are supposed to follow.
- **Factophobia** (generally is coupled with delusions of being a famous story teller): Tendency to base a recommendation on a “story” coupled with a refusal to face the facts.
- **Dr. Jekyll/Mr.Hyde:** Analyst who thinks his primary job is to bring in investment banking business to the firm.



# PROPOSITIONS ABOUT ANALYST GROWTH RATES

- **Proposition 1:** There is far less private information and far more public information in most analyst forecasts than is generally claimed.
- **Proposition 2:** The biggest source of private information for analysts remains the company itself which might explain
  - why there are more buy recommendations than sell recommendations (information bias and the need to preserve sources)
  - why there is such a high correlation across analysts forecasts and revisions
  - why All-America analysts become better forecasters than other analysts after they are chosen to be part of the team.
- **Proposition 3:** There is value to knowing what analysts are forecasting as earnings growth for a firm. There is, however, danger when they agree too much (lemmingitis) and when they agree to little (in which case the information that they have is so noisy as to be useless).



# GROWTH III

Sustainable growth and Fundamentals

Aswath Damodaran

# FUNDAMENTAL GROWTH RATES

$$\begin{array}{|c|} \hline \text{Investment} \\ \text{in Existing} \\ \text{Projects} \\ \hline \$ 1000 \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{Current Return on} \\ \text{Investment on} \\ \text{Projects} \\ \hline 12\% \\ \hline \end{array} = \begin{array}{|c|} \hline \text{Current} \\ \text{Earnings} \\ \hline \$120 \\ \hline \end{array}$$

$$\begin{array}{|c|} \hline \text{Investment} \\ \text{in Existing} \\ \text{Projects} \\ \hline \$1000 \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{Next Period's} \\ \text{Return on} \\ \text{Investment} \\ \hline 12\% \\ \hline \end{array} + \begin{array}{|c|} \hline \text{Investment} \\ \text{in New} \\ \text{Projects} \\ \hline \$100 \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{Return on} \\ \text{Investment on} \\ \text{New Projects} \\ \hline 12\% \\ \hline \end{array} = \begin{array}{|c|} \hline \text{Next} \\ \text{Period's} \\ \text{Earnings} \\ \hline 132 \\ \hline \end{array}$$

$$\begin{array}{|c|} \hline \text{Investment} \\ \text{in Existing} \\ \text{Projects} \\ \hline \$1000 \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{Change in} \\ \text{ROI from} \\ \text{current to next} \\ \text{period: } 0\% \\ \hline \end{array} + \begin{array}{|c|} \hline \text{Investment} \\ \text{in New} \\ \text{Projects} \\ \hline \$100 \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{Return on} \\ \text{Investment on} \\ \text{New Projects} \\ \hline 12\% \\ \hline \end{array} = \begin{array}{|c|} \hline \text{Change in Earnings} \\ \hline = \$ 12 \\ \hline \end{array}$$

# GROWTH RATE DERIVATIONS

In the special case where ROI on existing projects remains unchanged and is equal to the ROI on new projects

$$\frac{\text{Investment in New Projects}}{\text{Current Earnings}} \times \text{Return on Investment} = \frac{\text{Change in Earnings}}{\text{Current Earnings}}$$

$$\frac{100}{120} \times 12\% = \frac{\$12}{\$120}$$

$$\text{Reinvestment Rate} \times \text{Return on Investment} = \text{Growth Rate in Earnings}$$

$$83.33\% \times 12\% = 10\%$$

in the more general case where ROI can change from period to period, this can be expanded as follows:

$$\frac{\text{Investment in Existing Projects} * (\text{Change in ROI}) + \text{New Projects (ROI)}}{\text{Investment in Existing Projects} * \text{Current ROI}} = \frac{\text{Change in Earnings}}{\text{Current Earnings}}$$

For instance, if the ROI increases from 12% to 13%, the expected growth rate can be written as follows:

$$\frac{\$1,000 * (.13 - .12) + 100 (13\%)}{\$ 1000 * .12} = \frac{\$23}{\$120} = 19.17\%$$

# ESTIMATING FUNDAMENTAL GROWTH FROM NEW INVESTMENTS: THREE VARIATIONS

Earnings Measure	Reinvestment Measure	Return Measure
Earnings per share	Retention Ratio = % of net income retained by the company = $1 - \text{Payout ratio}$	Return on Equity = $\text{Net Income} / \text{Book Value of Equity}$
Net Income from non-cash assets	Equity reinvestment Rate = $(\text{Net Cap Ex} + \text{Change in non-cash WC} - \text{Change in Debt}) / (\text{Net Income})$	Non-cash ROE = $\text{Net Income from non-cash assets} / (\text{Book value of equity} - \text{Cash})$
Operating Income	Reinvestment Rate = $(\text{Net Cap Ex} + \text{Change in non-cash WC}) / \text{After-tax Operating Income}$	Return on Capital or ROIC = $\text{After-tax Operating Income} / (\text{Book value of equity} + \text{Book value of debt} - \text{Cash})$

# I. EXPECTED LONG TERM GROWTH IN EPS

- When looking at growth in earnings per share, these inputs can be cast as follows:
  - Reinvestment Rate = Retained Earnings/ Current Earnings = Retention Ratio
  - Return on Investment = ROE = Net Income/Book Value of Equity
- In the special case where the current ROE is expected to remain unchanged

$$\begin{aligned}g_{EPS} &= \text{Retained Earnings}_{t-1} / \text{NI}_{t-1} * \text{ROE} \\ &= \text{Retention Ratio} * \text{ROE} \\ &= b * \text{ROE}\end{aligned}$$

- In 2008, using this approach on Wells Fargo:
  - Return on equity (based on 2008 earnings)= 17.56%
  - Retention Ratio (based on 2008 earnings and dividends) = 45.37%
  - Expected Growth Rate = 0.4537 (17.56%) = 7.97%

# ONE WAY TO PUMP UP ROE: USE MORE DEBT

$ROE = \text{Return on capital} + D/E (\text{ROC} - i (1 - \text{tax rate}))$

where,

$\text{Return on capital} = \text{EBIT}_t (1 - \text{tax rate}) / \text{Book value of Capital}_{t-1}$

$D/E = \text{BV of Debt} / \text{BV of Equity}$

$i = \text{Interest Expense on Debt} / \text{BV of Debt}$

- In 1998, Brahma (now Ambev) had an extremely high return on equity, partly because it borrowed money at a rate well below its return on capital
  - Return on Capital = 19.91%
  - Debt/Equity Ratio = 77%
  - After-tax Cost of Debt = 5.61%
  - Return on Equity =  $\text{ROC} + D/E (\text{ROC} - i(1-t))$ 
    - $= 19.91\% + 0.77 (19.91\% - 5.61\%) = 30.92\%$



## II. EXPECTED GROWTH IN NET INCOME FROM NON-CASH ASSETS

- A more general version of expected growth in earnings can be obtained by **substituting in the equity reinvestment** into real investments (net capital expenditures and working capital) and **modifying the return on equity definition to exclude cash**:
  - Net Income from non-cash assets = Net income – Interest income from cash (1- t)
  - Equity Reinvestment Rate = (Net Capital Expenditures + Change in Working Capital) (1 - Debt Ratio)/ Net Income from non-cash assets
  - Non-cash ROE = Net Income from non-cash assets/ (BV of Equity – Cash)
  - Expected Growth<sub>Net Income</sub> = Equity Reinvestment Rate \* Non-cash ROE
- The equity reinvestment rate, unlike the retention ratio, can be higher than 100%, and if it is, the expected growth rate in net income can exceed the return on equity.

# ESTIMATING EXPECTED GROWTH IN NET INCOME FROM NON-CASH ASSETS: COCA COLA IN 2010

- In 2010, Coca Cola reported net income of \$11,809 million. It had a total book value of equity of \$25,346 million at the end of 2009. Coca Cola had a cash balance of \$7,021 million at the end of 2009, on which it earned income of \$105 million in 2010.
  - Non-cash Net Income =  $\$11,809 - \$105 = \$11,704$  million
  - Non-cash book equity =  $\$25,346 - \$7,021 = \$18,325$  million
  - Non-cash ROE =  $\$11,704 \text{ million} / \$18,325 \text{ million} = 63.87\%$
- Coca Cola had capital expenditures of \$2,215 million, depreciation of \$1,443 million and reported an increase in working capital of \$335 million. Coca Cola's total debt increased by \$150 million during 2010.
  - Equity Reinvestment =  $2215 - 1443 + 335 - 150 = \$957$  million
  - Reinvestment Rate =  $\$957 \text{ million} / \$11,704 \text{ million} = 8.18\%$
- Expected growth rate in non-cash Net Income =  $8.18\% * 63.87\% = 5.22\%$

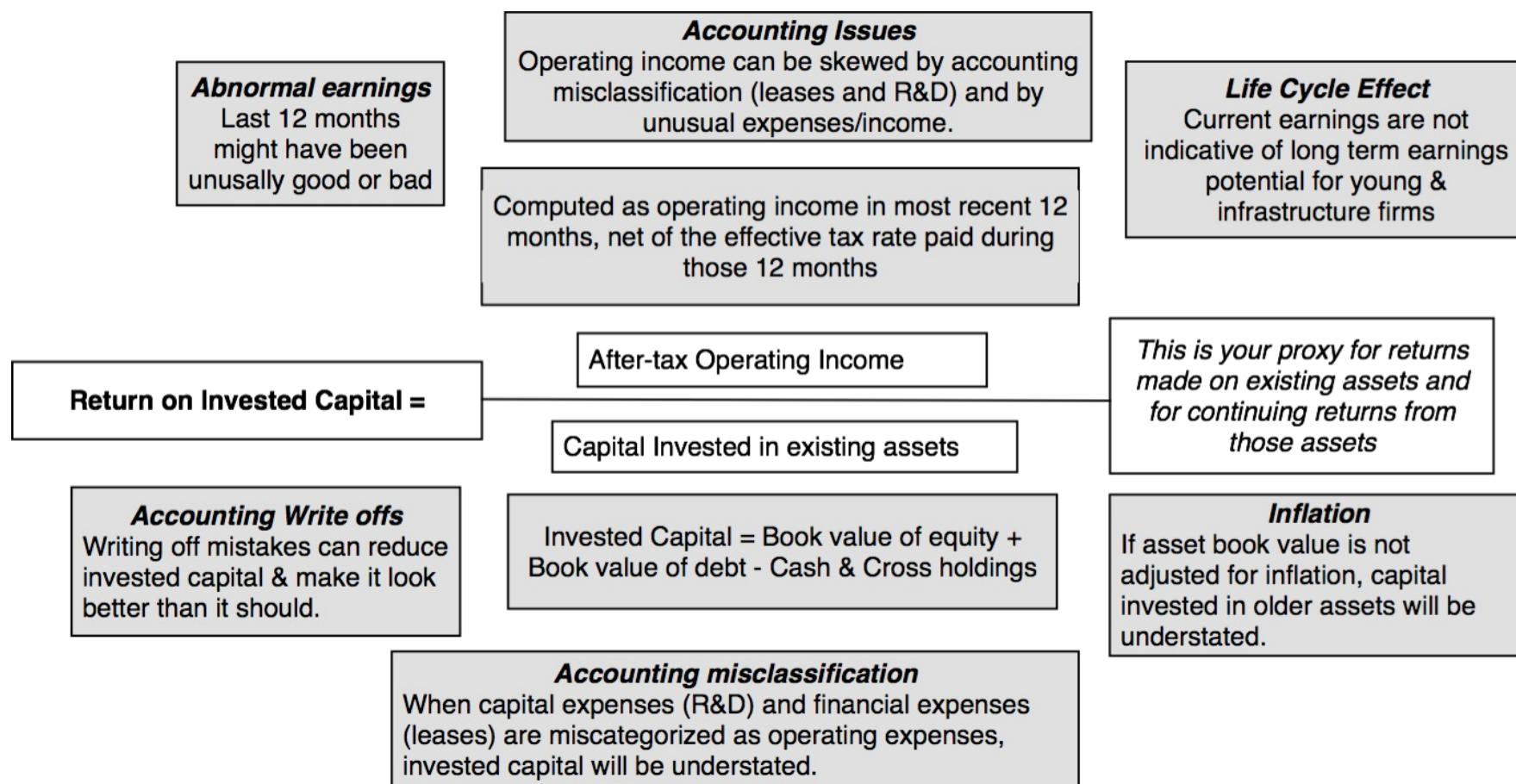
### III. EXPECTED GROWTH IN EBIT AND FUNDAMENTALS: STABLE ROC AND REINVESTMENT RATE

- When looking at growth in operating income, the definitions are
  - Reinvestment Rate =  $(\text{Net Capital Expenditures} + \text{Change in WC}) / \text{EBIT}(1-t)$
  - Return on Investment = ROC =  $\text{EBIT}(1-t) / (\text{BV of Debt} + \text{BV of Equity-Cash})$
- Reinvestment Rate and Return on Capital  
Expected Growth rate in Operating Income  
=  $(\text{Net Capital Expenditures} + \text{Change in WC}) / \text{EBIT}(1-t) * \text{ROC}$   
= Reinvestment Rate \* ROC
- **Proposition:** The net capital expenditure needs of a firm, for a given growth rate, should be inversely proportional to the quality of its investments.

# ESTIMATING GROWTH IN OPERATING INCOME, IF FUNDAMENTALS STAY LOCKED IN...

- In 1999, Cisco's fundamentals were as follows:
  - Reinvestment Rate = 106.81%
  - Return on Capital = 34.07%
  - Expected Growth in EBIT =  $(1.0681)(.3407) = 36.39\%$
- As a potential investor in Cisco, what would worry you the most about this forecast?
  - a. That Cisco's return on capital may be overstated (why?)
  - b. That Cisco's reinvestment comes mostly from acquisitions (why?)
  - c. That Cisco is getting bigger as a firm (why?)
  - d. That Cisco is viewed as a star (why?)
  - e. All of the above

# THE MAGICAL NUMBER: ROIC (OR ANY ACCOUNTING RETURN) AND ITS LIMITS





## 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:

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

- In general, if return on capital and margins are changing and/or expected to change at a company, you are better off not using any of the sustainable growth equations to estimate growth.

# 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%
<b>Expected growth rate</b>	<b>10.00%</b>	<b>10.00%</b>	<b>10.00%</b>	<b>10.00%</b>	<b>10.00%</b>

$$\begin{aligned} \text{Expected growth} &= \text{Growth from new investments} + \text{Efficiency growth} \\ &= \text{Reinv Rate} * \text{ROC} + (\text{ROC}_t - \text{ROC}_{t-1}) / \text{ROC}_{t-1} \end{aligned}$$

**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

Aswath Damodaran

# 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.

# 1. REVENUE GROWTH

## Revenue Growth and Magnitude

### Market Size and Growth

1. *Current Market size*: The size of the market for the company's products & services, given geography it is targeting and product type.
2. *Expected Growth in Market*: Growth in total market, as technology and market conditions change.

X

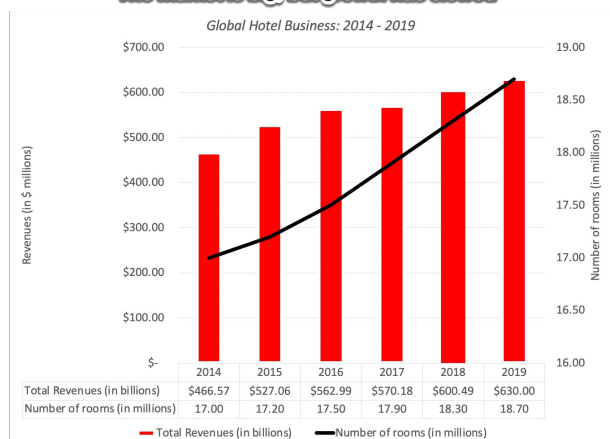
### Market Share

1. *Company's current market share*: If company's current market share is low, potential for growth in market share at expense of competition.
2. *Industry economics*: Nature of the business ( a few big winners or splintered competition).
3. *Strength of company's competitive advantages*: Stronger and more sustainable competitive advantages should allow for higher market share.

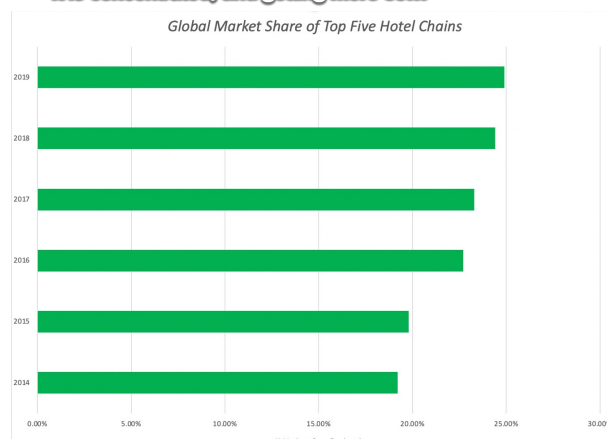
The potential for revenue growth is greater for companies with small revenues (and market share) in a big and growing market, especially if the company has strong competitive advantages in winner-take-all businesses.

# AIRBNB: TOTAL MARKET

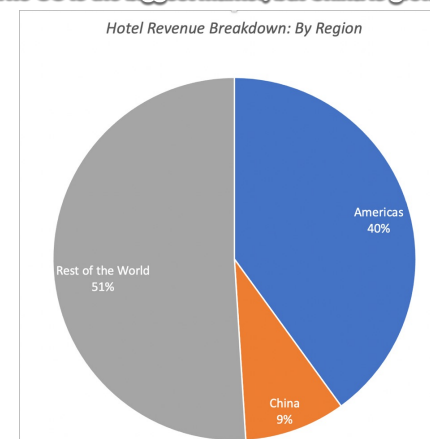
The market is big, but growth has slowed



It is concentrated, and getting more so...



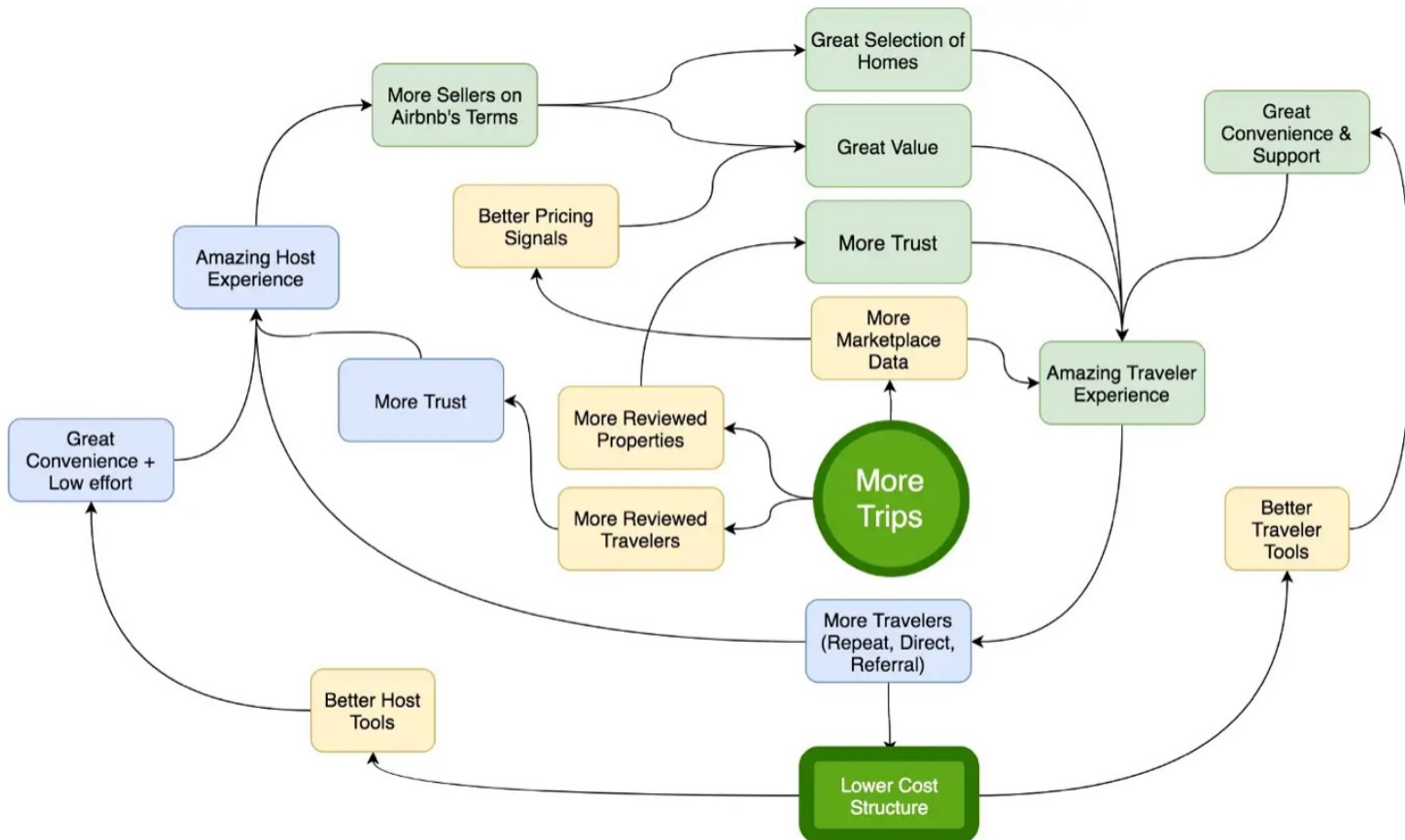
The US is the biggest market, but China is growing.



In its prospectus, Airbnb has expanded its estimate of market potential to \$3.4 trillion, as evidenced in this excerpt from the prospectus:

*We have a substantial market opportunity in the growing travel market and experience economy. We estimate our serviceable addressable market (“SAM”) today to be \$1.5 trillion, including \$1.2 trillion for short-term stays and \$239 billion for experiences. We estimate our total addressable market (“TAM”) to be \$3.4 trillion, including \$1.8 trillion for short-term stays, \$210 billion for long-term stays, and \$1.4 trillion for experiences.*

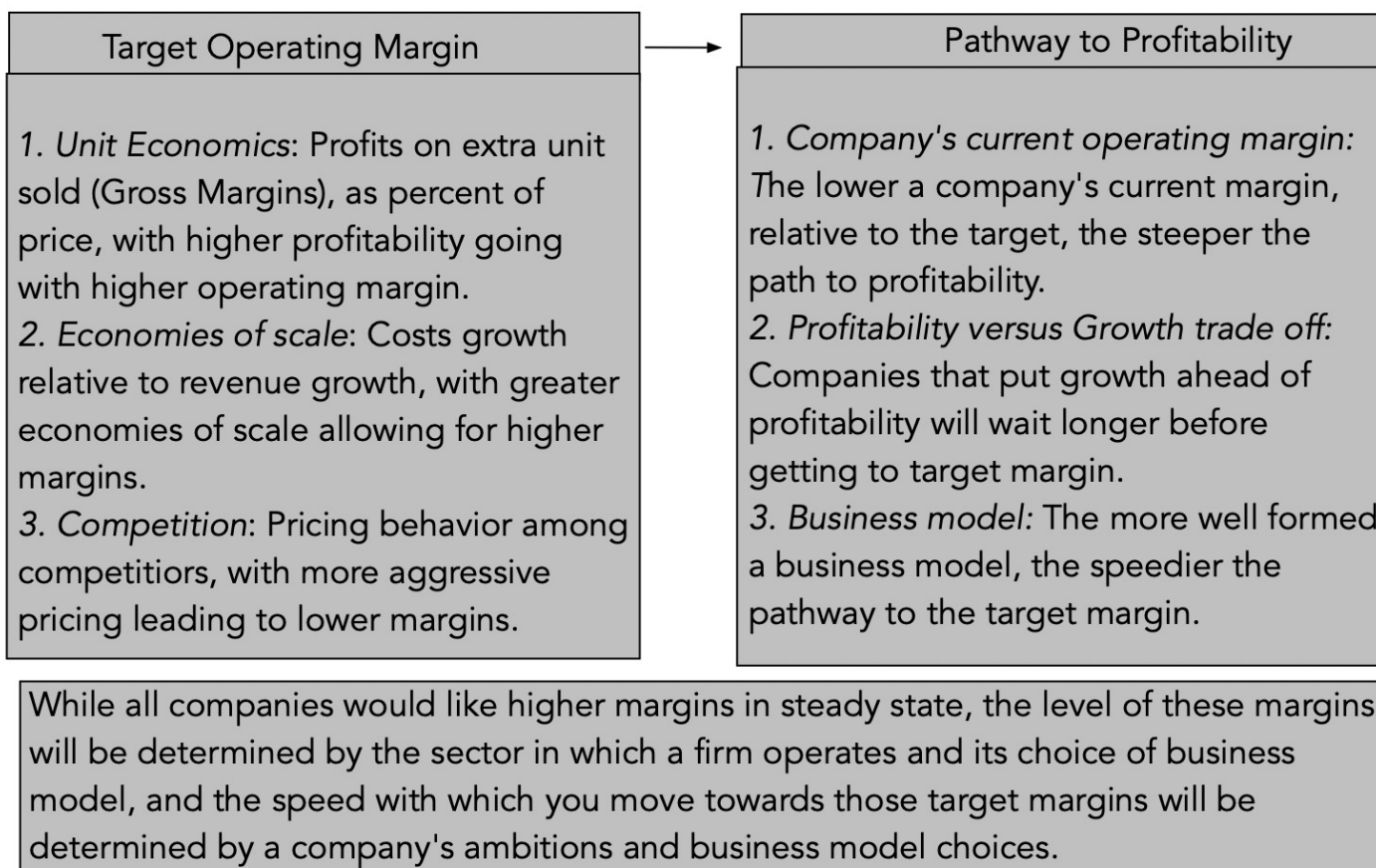
# AIRBNB: MARKET SHARE





## 2. TARGET MARGINS (AND PATH THERE)...

### Operating Margin: Target and Pathway



# AIRBNB IN NOVEMBER 2020: GROWTH AND PROFITABILITY

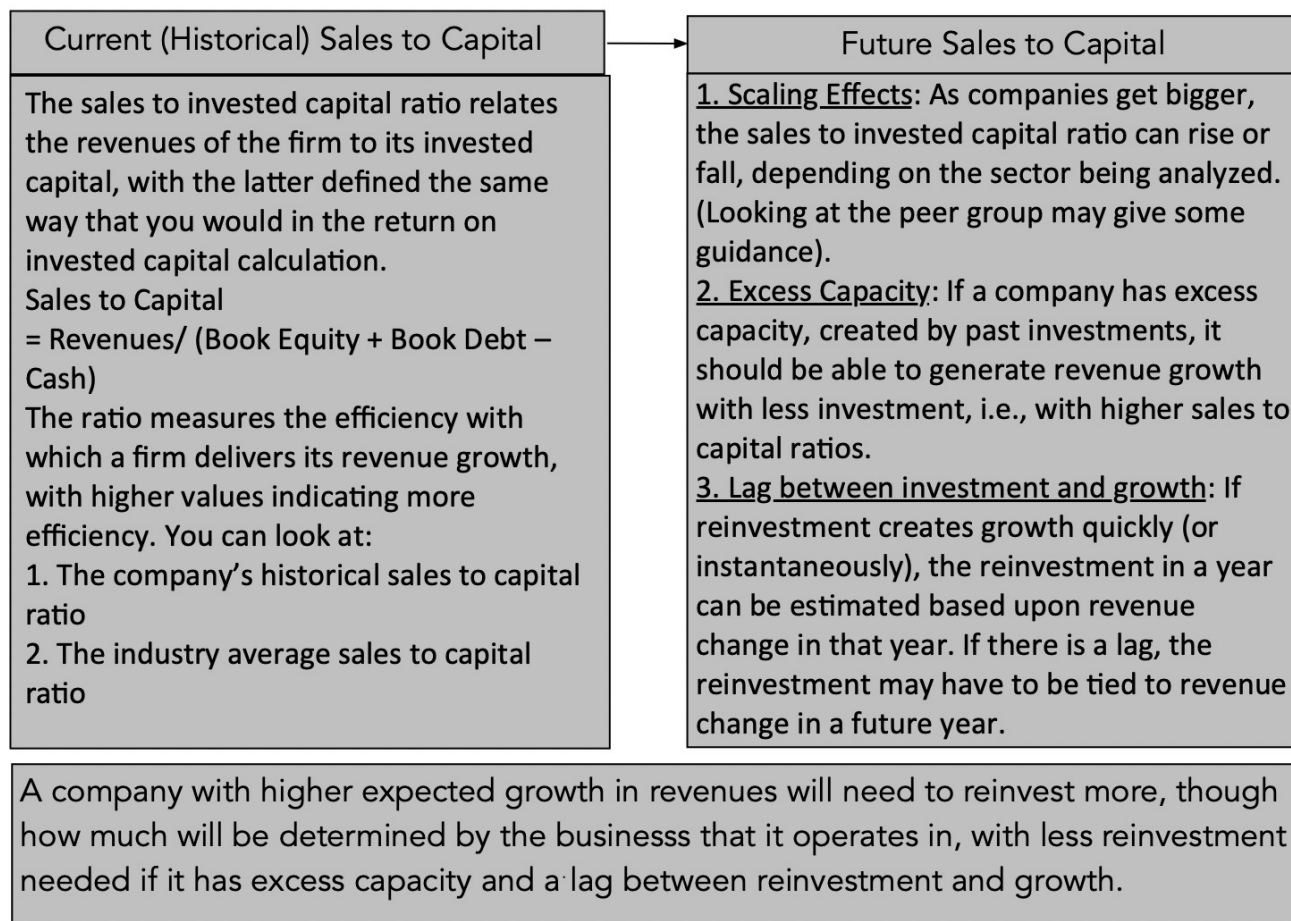
	<i>Gross Bookings</i>	<i>Revenues</i>	<i>Revenue Growth</i>	<i>Operating Margin</i>
<i>LTM</i>	\$ 26,491,803.00	\$ 3,625,731		
1	\$ 37,088,524.20	\$ 4,691,698	40.00%	-10.00%
2	\$ 46,360,655.25	\$ 5,989,797	25.00%	-3.00%
3	\$ 57,950,819.06	\$ 7,565,479	25.00%	0.50%
4	\$ 72,438,523.83	\$ 9,554,641	25.00%	4.00%
5	\$ 90,548,154.79	\$ 12,065,542	25.00%	7.50%
6	\$ 109,019,978.36	\$ 14,674,089	20.40%	9.52%
7	\$ 126,245,134.94	\$ 17,163,026	15.80%	13.39%
8	\$ 140,384,590.06	\$ 19,274,804	11.20%	17.26%
9	\$ 149,649,973.00	\$ 20,748,969	6.60%	21.13%
10	\$ 152,642,972.46	\$ 21,370,016	2.00%	25.00%
Terminal year	\$ 155,695,831.91	\$ 21,797,416	2.00%	25.00%

	Expedia			Booking.com		
	2019	LTM	% Change (Annualized)	2019	LTM	% Change (Annualized)
Gross Bookings	\$ 107,870.00	\$ 52,470.00	-61.75%	\$ 96,400.00	\$ 48,752.00	-59.71%
Revenues	\$ 12,067.00	\$ 7,026.00	-51.38%	\$ 15,066.00	\$ 8,897.00	-50.46%
Operating Income	\$ 961.00	\$ (892.00)	NA	\$ 5,345.00	\$ 1,831.00	-76.03%
Revenues/Gross Bookings	11.19%	13.39%		15.63%	18.25%	
Operating Margin	7.96%	-12.70%		35.48%	20.58%	



# 3. SALES TO INVESTED CAPITAL: A PATHWAY TO ESTIMATING REINVESTMENT

## Sales to Invested Capital: Reinvestment



# AIRBNB: REINVESTMENT AND PROFITABILITY

## Taxes

Note that losses are carried forward and the company starts paying taxes only in year 5. Target tax rate is 25%.

## Reinvestment

$Reinvestment = Net\ Cap\ Ex + Acquisitions + Capitalized\ R\&D + Chg\ in\ Working\ Capital$

To estimate the reinvestment, I divide the change in sales in that year by the sales to invested capital ratio.

Year	Revenues	Operating Margin	EBIT	EBIT (1-t)	Change in Sales	Sales to Capital	Reinvestment	FCFF	Invested Capital	ROIC
	\$ 3,625,731	-13.69%	\$ (496,542)	\$ (496,542)		1.92			\$ 1,370,158	-36.24%
1	\$ 4,691,698	-10.00%	\$ (469,170)	\$ (469,170)	\$ 1,065,967	2.00	\$ 532,984	\$ (1,002,153)	\$ 1,903,142	-24.65%
2	\$ 5,989,797	-3.00%	\$ (179,694)	\$ (179,694)	\$ 1,298,098	2.00	\$ 649,049	\$ (828,743)	\$ 2,552,191	-7.04%
3	\$ 7,565,479	0.50%	\$ 37,827	\$ 37,827	\$ 1,575,683	2.00	\$ 787,841	\$ (750,014)	\$ 3,340,033	1.13%
4	\$ 9,554,641	4.00%	\$ 382,186	\$ 382,186	\$ 1,989,162	2.00	\$ 994,581	\$ (612,395)	\$ 4,334,613	8.82%
5	\$ 12,065,542	7.50%	\$ 904,916	\$ 777,799	\$ 2,510,900	2.00	\$ 1,255,450	\$ (477,651)	\$ 5,590,064	13.91%
6	\$ 14,674,089	9.52%	\$ 1,397,269	\$ 1,047,952	\$ 2,608,547	2.00	\$ 1,304,274	\$ (256,322)	\$ 6,894,337	15.20%
7	\$ 17,163,026	13.39%	\$ 2,298,389	\$ 1,723,792	\$ 2,488,937	2.00	\$ 1,244,469	\$ 479,323	\$ 8,138,806	21.18%
8	\$ 19,274,804	17.26%	\$ 3,327,026	\$ 2,495,269	\$ 2,111,778	2.00	\$ 1,055,889	\$ 1,439,380	\$ 9,194,695	27.14%
9	\$ 20,748,969	21.13%	\$ 4,384,362	\$ 3,288,271	\$ 1,474,165	2.00	\$ 737,082	\$ 2,551,189	\$ 9,931,777	33.11%
10	\$ 21,370,016	25.00%	\$ 5,342,504	\$ 4,006,878	\$ 621,047	2.00	\$ 310,524	\$ 3,696,354	\$ 10,242,301	39.12%

## Invested Capital

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

## Investment Returns

ROIC = EBIT (1-t) / Invested Capital in year t

# AGGREGATE VERSUS MARGINAL VALUES

- While **sustainable growth equations** are stated in terms of returns on capital (equity) or sales to capital the numbers that drive growth are returns on new investments, i.e., **marginal returns on capital (equity) or marginal sales to capital ratios**.
- The marginal returns and sales to capital ratios can be computed by looking at changes from year to year:
  - $$\text{Marginal ROC} = \frac{(\text{Operating Income}_t - \text{Operating Income}_{t-1})}{(\text{Invested Capital}_{t-1} - \text{Invested Capital}_{t-2})}$$
  - $$\text{Marginal ROC} = \frac{(\text{Sales}_t - \text{Sales}_{t-1})}{(\text{Invested Capital}_{t-1} - \text{Invested Capital}_{t-2})}$$
- As companies scale up, **the marginal values for these variables can diverge from the aggregate values**.
  - For companies where there are investing economies to scale, the marginal values can be significantly higher than the aggregate values.
  - For companies that are facing changing competitor or are entering new businesses, the marginal values can be lower than the aggregate values.