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# Estimating Growth

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# Ways of Estimating Growth in Earnings

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- 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
  - Ultimately, all growth in earnings can be traced to two fundamentals - how much the firm is investing in new projects, and what returns these projects are making for the firm.

# I. Historical Growth in EPS

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- 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
- In using historical growth rates, the following factors have to be considered
  - how to deal with negative earnings
  - the effect of changing size

# 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%

# Cisco: Linear and Log-Linear Models for Growth

Year	EPS		ln(EPS)
1991	\$	0.01	-4.6052
1992	\$	0.02	-3.9120
1993	\$	0.04	-3.2189
1994	\$	0.07	-2.6593
1995	\$	0.08	-2.5257
1996	\$	0.16	-1.8326
1997	\$	0.18	-1.7148
1998	\$	0.25	-1.3863
1999	\$	0.32	-1.1394

- $EPS = -.066 + 0.0383 (t)$ : EPS grows by \$0.0383 a year  
Growth Rate =  $\$0.0383/\$0.13 = 30.5\%$  (\$0.13: Average EPS from 91-99)
- $\ln(EPS) = -4.66 + 0.4212 (t)$ : Growth rate approximately 42.12%

# A Test

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- 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?
  - ❑ -600%
  - ❑ +600%
  - ❑ +120%
  - ❑ Cannot be estimated

# Dealing with Negative Earnings

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- 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

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<i>Year</i>	<i>Net Profit</i>	<i>Growth Rate</i>
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

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<i>Year</i>	<i>Net Profit</i>
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.

## II. Analyst Forecasts of Growth

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- While the job of an analyst is to find under and over valued 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

Study	Time Period	Analyst Forecast Error	Time Series Model
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?

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- 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

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- **Tunnel Vision:** Becoming so focused on the sector and valuations within the sector that they lose sight of the bigger picture.
- **Lemmingitis:** Strong urge felt by analysts to change recommendations & revise earnings estimates when other analysts do the same.
- **Stockholm Syndrome**(shortly to be renamed the Bre-X 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

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- **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).

### III. Fundamental Growth Rates

$$\begin{array}{l} \begin{array}{l} \text{Investment} \\ \text{in Existing} \\ \text{Projects} \\ \$ 1000 \end{array} \times \begin{array}{l} \text{Current Return on} \\ \text{Investment on} \\ \text{Projects} \\ 12\% \end{array} = \begin{array}{l} \text{Current} \\ \text{Earnings} \\ \$120 \end{array} \\ \\ \begin{array}{l} \text{Investment} \\ \text{in Existing} \\ \text{Projects} \\ \$1000 \end{array} \times \begin{array}{l} \text{Next Period's} \\ \text{Return on} \\ \text{Investment} \\ 12\% \end{array} + \begin{array}{l} \text{Investment} \\ \text{in New} \\ \text{Projects} \\ \$100 \end{array} \times \begin{array}{l} \text{Return on} \\ \text{Investment on} \\ \text{New Projects} \\ 12\% \end{array} = \begin{array}{l} \text{Next} \\ \text{Period's} \\ \text{Earnings} \\ 132 \end{array} \\ \\ \begin{array}{l} \text{Investment} \\ \text{in Existing} \\ \text{Projects} \\ \$1000 \end{array} \times \begin{array}{l} \text{Change in} \\ \text{ROI from} \\ \text{current to next} \\ \text{period: } 0\% \end{array} + \begin{array}{l} \text{Investment} \\ \text{in New} \\ \text{Projects} \\ \$100 \end{array} \times \begin{array}{l} \text{Return on} \\ \text{Investment on} \\ \text{New Projects} \\ 12\% \end{array} = \begin{array}{l} \text{Change in Earnings} \\ = \$ 12 \end{array} \end{array}$$

# Growth Rate Derivations

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

$$\begin{array}{rclcl}
 \frac{\text{Investment in New Projects}}{\text{Current Earnings}} & \times & \text{Return on Investment} & = & \frac{\text{Change in Earnings}}{\text{Current Earnings}} \\
 \frac{100}{120} & \times & 12\% & = & \frac{\$12}{\$120} \\
 \text{Reinvestment Rate} & \times & \text{Return on Investment} & = & \text{Growth Rate in Earnings} \\
 83.33\% & \times & 12\% & = & 10\%
 \end{array}$$

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:

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



# I. Expected Long Term Growth in EPS

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- 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  
$$g_{\text{EPS}} = \text{Retained Earnings}_{t-1} / \text{NI}_{t-1} * \text{ROE}$$
$$= \text{Retention Ratio} * \text{ROE}$$
$$= b * \text{ROE}$$
- Proposition 1: The expected growth rate in earnings for a company cannot exceed its return on equity in the long term.

# Estimating Expected Growth in EPS: ABN Amro

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- Current Return on Equity = 15.79%
- Current Retention Ratio =  $1 - \text{DPS}/\text{EPS} = 1 - 1.13/2.45 = 53.88\%$
- If ABN Amro can maintain its current ROE and retention ratio, its expected growth in EPS will be:

$$\text{Expected Growth Rate} = 0.5388 (15.79\%) = 8.51\%$$

# Expected ROE changes and Growth

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- Assume now that ABN Amro's ROE next year is expected to increase to 17%, while its retention ratio remains at 53.88%. What is the new expected long term growth rate in earnings per share?
  
- Will the expected growth rate in earnings per share next year be greater than, less than or equal to this estimate?
  - greater than
  - less than
  - equal to

# Changes in ROE and Expected Growth

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- When the ROE is expected to change,
$$g_{EPS} = b * ROE_{t+1} + (ROE_{t+1} - ROE_t) / ROE_t$$
- Proposition 2: Small changes in ROE translate into large changes in the expected growth rate.
  - The lower the current ROE, the greater the effect on growth of changes in the ROE.
- Proposition 3: No firm can, in the long term, sustain growth in earnings per share from improvement in ROE.
  - Corollary: The higher the existing ROE of the company (relative to the business in which it operates) and the more competitive the business in which it operates, the smaller the scope for improvement in ROE.

## Changes in ROE: ABN Amro

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- Assume now that ABN's expansion into Asia will push up the ROE to 17%, while the retention ratio will remain 53.88%. The expected growth rate in that year will be:

$$\begin{aligned}g_{\text{EPS}} &= b * \text{ROE}_{t+1} + (\text{ROE}_{t+1} - \text{ROE}_t) / \text{ROE}_t \\ &= (.5388)(.17) + (.17 - .1579) / (.1579) \\ &= 16.83\%\end{aligned}$$

- Note that 1.21% improvement in ROE translates into almost a doubling of the growth rate from 8.51% to 16.83%.

# ROE and Leverage

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- $ROE = ROC + D/E (ROC - i (1-t))$

where,

$$ROC = EBIT_t (1 - \text{tax rate}) / BV \text{ of Capital}_{t-1}$$

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

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

$$t = \text{Tax rate on ordinary income}$$

- Note that  $BV \text{ of capital} = BV \text{ of Debt} + BV \text{ of Equity}$ .

- BV: Book Value

# Decomposing ROE: Brahma

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- Real Return on Capital =  $687 (1-.32) / (1326+542+478) = 19.91\%$ 
  - This is assumed to be real because both the book value and income are inflation adjusted.
- Debt/Equity Ratio =  $(542+478)/1326 = 0.77$
- After-tax Cost of Debt =  $8.25\% (1-.32) = 5.61\%$  (Real BR)
- Return on Equity =  $ROC + D/E (ROC - i(1-t))$   
 $19.91\% + 0.77 (19.91\% - 5.61\%) = 30.92\%$

## Decomposing ROE: Titan Watches (India)

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- Return on Capital =  $713 (1-.25)/(1925+2378+1303) = 9.54\%$
- Debt/Equity Ratio =  $(2378 + 1303)/1925 = 1.91$
- After-tax Cost of Debt =  $13.5\% (1-.25) = 10.125\%$
- Return on Equity =  $ROC + D/E (ROC - i(1-t))$   
 $9.54\% + 1.91 (9.54\% - 10.125\%) = 8.42\%$



## II. Expected Growth in Net Income

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- The limitation of the EPS fundamental growth equation is that it focuses on per share earnings and assumes that reinvested earnings are invested in projects earning the return on equity.
- 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):

$$\text{Equity Reinvestment Rate} = (\text{Net Capital Expenditures} + \text{Change in Working Capital}) (1 - \text{Debt Ratio}) / \text{Net Income}$$

$$\text{Expected Growth}_{\text{Net Income}} = \text{Equity Reinvestment Rate} * \text{ROE}$$

### III. Expected Growth in EBIT And Fundamentals: Stable ROC and Reinvestment Rate

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- 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 =  $\text{EBIT}(1-t) / (\text{BV of Debt} + \text{BV of Equity})$
- Reinvestment Rate and Return on Capital  
$$g_{\text{EBIT}} = (\text{Net Capital Expenditures} + \text{Change in WC}) / \text{EBIT}(1-t) * \text{ROC}$$
$$= \text{Reinvestment Rate} * \text{ROC}$$
- **Proposition: The net capital expenditure needs of a firm, for a given growth rate, should be inversely proportional to the quality of its investments.**

# No Net Capital Expenditures and Long Term Growth

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- You are looking at a valuation, where the terminal value is based upon the assumption that operating income will grow 3% a year forever, but there are no net cap ex or working capital investments being made after the terminal year. When you confront the analyst, he contends that this is still feasible because the company is becoming more efficient with its existing assets and can be expected to increase its return on capital over time. Is this a reasonable explanation?
  - Yes
  - No
  - Explain.

# Estimating Growth in EBIT: Cisco versus Motorola

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## *Cisco's Fundamentals*

- Reinvestment Rate = 106.81%
- Return on Capital = 34.07%
- Expected Growth in EBIT =  $(1.0681)(.3407) = 36.39\%$

## *Motorola's Fundamentals*

- Reinvestment Rate = 52.99%
- Return on Capital = 12.18%
- Expected Growth in EBIT =  $(.5299)(.1218) = 6.45\%$

## IV. Operating Income Growth when Return on Capital is Changing

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- 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

$$\begin{aligned} &= \text{ROC}_{\text{New Investments}} * \text{Reinvestment Rate}_{\text{current}} + \{ [1 + (\text{ROC}_{\text{In 5 years}} - \text{ROC}_{\text{Current}}) / \text{ROC}_{\text{Current}}]^{1/5} - 1 \} \\ &= .1722 * .5299 + \{ [1 + (.1722 - .1218) / .1218]^{1/5} - 1 \} \\ &= .174 \text{ or } 17.40\% \end{aligned}$$

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:  $17.40\% - 9.12\% = 8.28\%$

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

## V. Estimating Growth when Operating Income is Negative or Margins are changing

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- 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
    - Use historical revenue growth to get estimates of revenue growth in the near future
    - 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.

# Commerce One: Revenues and Revenue Growth

Year	Growth Rate	Revenues	Operating Margin	Operating Income
Current		\$537	-79.62%	-\$428
1	50.00%	\$806	-48.17%	-\$388
2	100.00%	\$1,611	-27.21%	-\$438
3	80.00%	\$2,900	-13.23%	-\$384
4	60.00%	\$4,640	-3.91%	-\$182
5	40.00%	\$6,496	2.30%	\$149
6	35.00%	\$8,770	6.44%	\$565
7	30.00%	\$11,401	9.20%	\$1,049
8	20.00%	\$13,681	11.04%	\$1,510
9	10.00%	\$15,049	12.27%	\$1,846
10	5.00%	\$15,802	13.08%	\$2,068



## Commerce One: Reinvestment Needs

Year	Revenues	Revenues	Sales/Capital	Reinvestment	Capital	ROC
Current	\$537				\$2,744	
1	\$806	\$269	2.20	\$122	\$2,866	-14.14%
2	\$1,611	\$806	2.20	\$366	\$3,232	-15.30%
3	\$2,900	\$1,289	2.20	\$586	\$3,818	-11.87%
4	\$4,640	\$1,740	2.20	\$791	\$4,609	-4.76%
5	\$6,496	\$1,856	2.20	\$844	\$5,452	3.24%
6	\$8,770	\$2,274	2.20	\$1,033	\$6,486	10.36%
7	\$11,401	\$2,631	2.20	\$1,196	\$7,682	16.17%
8	\$13,681	\$2,280	2.20	\$1,036	\$8,718	14.17%
9	\$15,049	\$1,368	2.20	\$622	\$9,340	13.76%
10	\$15,802	\$752	2.20	\$342	\$9,682	14.39%
Industry average =						15%

