

## RATIO ANALYSIS-OVERVIEW

### Ratios:

1. Provide a method of standardization
2. More important - provide a profile of firm's economic characteristics and competitive strategies.

		<u>C Company</u>	
Sales		\$ 100,000	\$ 125,000
Costs and Expenses		<u>\$ 80,000</u>	<u>\$ 85,000</u>
Profit		\$ 20,000	\$ 40,000
		20.0%	32.0%
		<u>L Company</u>	
Sales		\$ 100,000	\$ 125,000
Costs and Expenses		<u>\$ 80,000</u>	<u>\$ 90,000</u>
Profit		\$ 20,000	\$ 35,000
		20.0%	28.0%

- Although extremely valuable as analytical tools, financial ratios also have limitations. They can serve as screening devices , indicate areas of potential strength or weakness, and reveal matters that need further investigation.
- Should be used in combinations with other elements of financial analysis.
- There is no one definitive set of key ratios; there is no uniform definition for all ratios; and there is no standard that should be met for each ratio.
- There are no "rules of thumb" that apply to the interpretation of financial ratios.

### *Caveats:*

- *economic assumptions - linearity assumption*
- *benchmark*
- *manipulation - timing*  
*accounting methods*
- *negative numbers*

## Common Size Financial Statements

Differences in firm size may confound cross sectional and time series analyses. To overcome this problem, common size statements are used.

**A common size balance sheet** expresses each item on the balance sheet as a percentage of total assets

**A common size income statement** expresses each income statement category as a percentage of total sales revenues

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
Sales	\$ 101,840	\$ 109,876	\$ 115,609	\$ 126,974
COGS	\$ 78,417	\$ 83,506	\$ 85,551	\$ 93,326
SG&A	<u>\$ 20,368</u>	<u>\$ 24,722</u>	<u>\$ 27,168</u>	<u>\$ 31,109</u>
PROFIT	\$ 3,055	\$ 1,648	\$ 2,890	\$ 2,539

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
Sales	100.0%	100.0%	100.0%	100.0%
COGS	77.0%	76.0%	74.0%	73.5%
SG&A	<u>20.0%</u>	<u>22.5%</u>	<u>23.5%</u>	<u>24.5%</u>
PROFIT	3.00%	1.50%	2.50%	2.00%

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
Sales	100%	108%	114%	125%
COGS	100%	106%	109%	119%
SG&A	100%	121%	133%	153%
PROFIT	100%	54%	95%	83%

## Ratios and Industry Effects

A. Aerospace	D. Computer Software	G. Consumer Finance
B. Airline	E. Consumer Foods	H. Newspaper Publishing
C. Chemicals & Drugs	F. Department Stores	I. Electric Utility

### Common size statements

#### Balance Sheet

<u>Company</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>
Cash and short-term investments	2 %	13 %	37 %	1 %	1 %	3 %	1 %	22 %	6 %
Receivables	17	8	22	28	23	5	11	16	8
Inventory	15	52	15	23	14	2	2	-	5
Other current assets	<u>6</u>	<u>-</u>	<u>5</u>	<u>1</u>	<u>4</u>	<u>2</u>	<u>2</u>	<u>1</u>	<u>-</u>
Current assets	40 %	73 %	79 %	53 %	42 %	12 %	16 %	39 %	19 %
Gross property	86	40	26	44	63	112	65	1	106
Less: Accumulated depreciation	<u>(50)</u>	<u>(19)</u>	<u>(8)</u>	<u>(15)</u>	<u>(23)</u>	<u>(45)</u>	<u>(28)</u>	<u>-</u>	<u>(34)</u>
Net property	36 %	21 %	18 %	29 %	40 %	67 %	37 %	1 %	72 %
Investments	3	1	-	-	3	14	16	55	-
Intangibles and other	<u>21</u>	<u>5</u>	<u>3</u>	<u>18</u>	<u>15</u>	<u>7</u>	<u>31</u>	<u>5</u>	<u>9</u>
<b>Total assets</b>	<b><u>100 %</u></b>	<b><u>100 %</u></b>	<b><u>100 %</u></b>	<b><u>100 %</u></b>	<b><u>100 %</u></b>	<b><u>100 %</u></b>	<b><u>100 %</u></b>	<b><u>100 %</u></b>	<b><u>100 %</u></b>
Trade payables	11	21	22	13	26	7	11	-	20
Debt payable	4	-	3	6	4	6	2	46	4
Other current liabilities	<u>9</u>	<u>43</u>	<u>-</u>	<u>-</u>	<u>1</u>	<u>4</u>	<u>1</u>	<u>16</u>	<u>8</u>
Current liabilities	24 %	64 %	25 %	19 %	31 %	17 %	14 %	62 %	32 %
Long-term debt	20	5	12	27	23	34	24	27	21
Other liabilities	<u>16</u>	<u>-</u>	<u>1</u>	<u>21</u>	<u>16</u>	<u>12</u>	<u>13</u>	<u>5</u>	<u>12</u>
Total liabilities	60 %	69 %	38 %	67 %	70 %	63 %	51 %	94 %	65 %
Equity	<u>40</u>	<u>31</u>	<u>62</u>	<u>33</u>	<u>30</u>	<u>37</u>	<u>49</u>	<u>6</u>	<u>35</u>
<b>Total liabilities &amp; equity</b>	<b><u>100 %</u></b>	<b><u>100 %</u></b>	<b><u>100 %</u></b>	<b><u>100 %</u></b>	<b><u>100 %</u></b>	<b><u>100 %</u></b>	<b><u>100 %</u></b>	<b><u>100 %</u></b>	<b><u>100 %</u></b>

#### Income statement

<u>Company</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>
Revenues	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Cost of goods sold	58	81	58	63	52	-	59	-	-
Operating expenses	21	7	24	28	33	84	29	55	91
Research & development	7	5	9	-	1	-	-	-	-
Advertising	<u>3</u>	<u>-</u>	<u>3</u>	<u>2</u>	<u>5</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>2</u>
Operating income	11 %	7 %	6 %	7 %	9 %	16 %	12 %	45 %	7 %
Net interest expense	<u>1</u>	<u>(1)</u>	<u>-</u>	<u>2</u>	<u>2</u>	<u>6</u>	<u>3</u>	<u>41</u>	<u>1</u>
<b>Income from continuing Operations before tax</b>	<b><u>10 %</u></b>	<b><u>8 %</u></b>	<b><u>6 %</u></b>	<b><u>5 %</u></b>	<b><u>7 %</u></b>	<b><u>10 %</u></b>	<b><u>9 %</u></b>	<b><u>4 %</u></b>	<b><u>6 %</u></b>

Four categories of ratios to be covered are:

1. **Activity ratios** - the liquidity of specific assets and the efficiency of managing assets
2. **Liquidity ratios** - firm's ability to meet cash needs as they arise;
3. **Debt and Solvency ratios** - the extent of a firm's financing with debt relative to equity and its ability to cover fixed charges; and
4. **Profitability ratios** - the overall performance of the firm and its efficiency in managing investment (assets, equity, capital)

These categories are not distinct as we shall see

activity -----> liquidity  
activity -----> profitability  
solvency <-----> profitability

## A. ACTIVITY RATIOS: ASSET MANAGEMENT & EFFICIENCY

### 1. Short-term (operating) activity ratios:

#### **Inventory Turnover Ratio** (COGS)/(Average inventory)

Measures the efficiency of the firm in managing and selling inventory. Inventory does not languish on shelves. High ratio represent fewer funds tied up in inventories -- efficient management. High inventory can also represent understocking and lost orders. Low turnover can also represent legitimate reasons such as preparing for a strike, increased demand, etc. Ratio depends on industry -perishable goods etc.)

**Average # of days inventory in stock =  $365 / (\text{Inventory Turnover Ratio})$**

#### **Receivable Turnover Ratio** Sales/(Average receivable)

How many times receivables are turned into cash Relatively low turnover may indicate inefficiency, cutback in demand, or earnings manipulations.

**Average # of days receivable are outstanding =  $365/(\text{Receivable Turnover})$**

(When available, the figure for credit sales can be substituted for net sales since credit sales produce the receivables.)

Provides information about the firm's credit policy. Should be compared with the firm's stated policy (i.e., if firm policy is 30 days and average collection period is 60 days, company is not stringent in collection effort.)

High/low relative to the industry should be examined (i.e., low might indicate loss sales to competitors).

Low turnover ratios may imply

- firm's income overstated
- future production cutbacks
- future liquidity problems

2. Long-term (investment) activity ratios:

**Fixed Assets Turnover Ratio** = Sales/ Average fixed assets

**Total Assets Turnover Ratio** = Sales/ Average total assets

As an alternative, one can use **Plant-Asset Turnover Ratio** (Revenues/Average plant assets). Plant-Asset Turnover is a measure of the relation between sales and investments in long-lived assets.

When the asset turnover ratios are low, relative to the industry or historical record, either the investment in assets is too heavy and/or sales are sluggish. There may, however, be plausible explanations: the firm may have taken an extensive plant modernization.

## B. LIQUIDITY RATIOS: SHORT TERM SOLVENCY

Short-term liquidity analysis compares the firm's cash resources with its cash obligations. Cash resources can be measured by either:

1. the sum of the current cash balance and potential sources of cash, or
2. (net) cash flows from operations

Cash obligations can be measured by either:

1. Current obligations requiring cash, or
2. Cash outflows arising from operations

The following table summarizes the ratios commonly used to measure the relationship between resources and obligations:

	Numerator	Denominator
	Cash Resources	Cash Obligations
Level	Current assets	Current liabilities
Flow	Cash flow from operations	Cash outflows for operations

Conceptually, the ratios differ in whether *levels* (amounts shown on the balance sheet or *flows* (cash inflows and outflows) are used to gauge the relationship .

These ratios measure short term solvency -- the ability of the firm to meet its debt requirements as they come due.

*Three ratios compare levels of cash resources with current liabilities as the measure of cash obligations:*

**Current Ratio:** Current assets / Current liabilities

**Quick Ratio:** (Cash + Marketable securities + Receivable)/Current liabilities

**Cash Ratio:** (Cash + Marketable securities)/Current liabilities

*Two other ratios combine flows with resources/obligations*

**Cash Flow From Operations Ratio =** CFO / Current liabilities

**Defensive Interval =**

$$365 \times \frac{\text{Cash} + \text{Marketable Securities} + \text{Accounts Receivable}}{\text{Projected Expenditures}}$$

## Length of the Cash Cycle - Net Trade Cycle

The Length of cash cycle (i.e., the number of- days a company's cash is tied up by its current operating cycle) for a merchandise company is calculated as follows:

Operating cycle

(1) the number of days inventory is in stock  $[365/\text{inventory turnover}]$

**PLUS**

(2) the of days receivable are outstanding  $[365/\text{Receivable turnover}]$

**MINUS**

(3) the # of days accounts payable are outstanding  $(365 \text{ Average accounts payable})/\text{Purchases}]$ .

where purchases are approximated by:

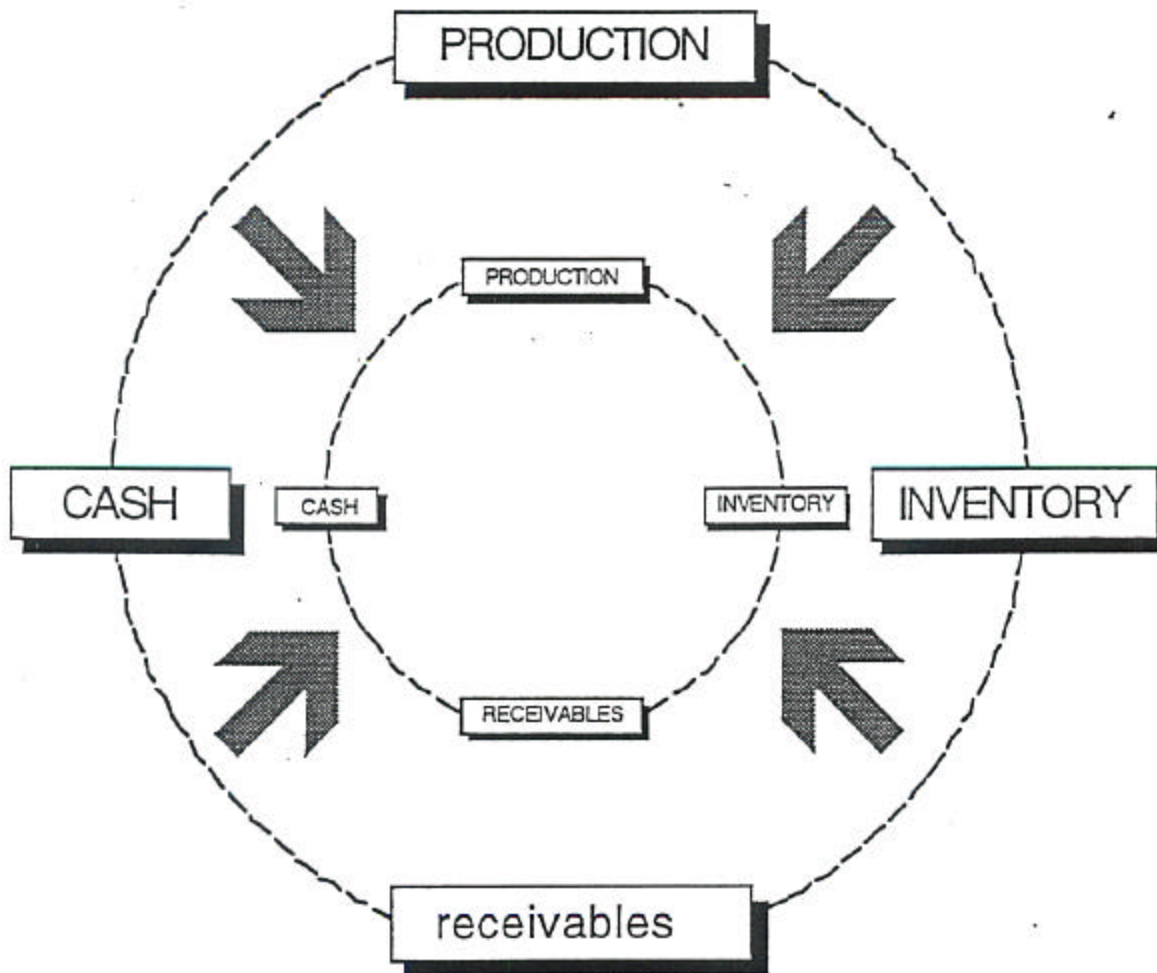
$\text{COGS plus ending inventories less beginning inventories.}$

Please note that for a manufacturing company, the length of the cash cycle must also consider the time that money is tied up by production. (Box 3-1)

## *Importance of Working Capital*

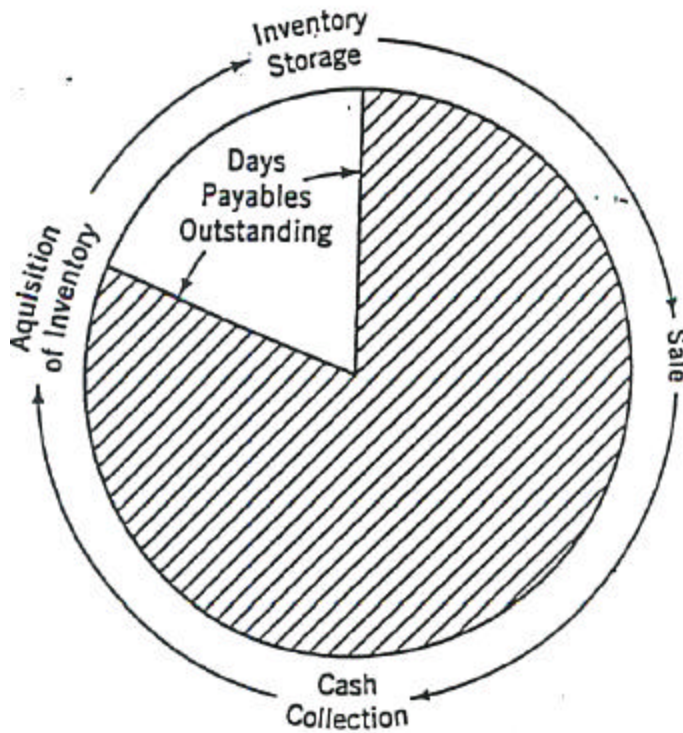
### Operating Cycle

## Shorten the Cycle



# Cash Cycle

## Operating and Cash Cycles



**Cash Cycle = Circumference of Shaded Area**

## GENERAL ELECTRIC CO.

### Working Capital Trends - Cash Flow 1991 -- 1994

	<i>1991</i>	<i>1992</i>	<i>1993</i>	<i>1994</i>
<b>Sales</b>	<b>\$ 37,521</b>	<b>\$ 37,843</b>	<b>\$ 37,822</b>	<b>\$ 39,530</b>
<b>A/R</b>	<b>7,560</b>	<b>7,462</b>	<b>9,561</b>	<b>7,807</b>
<b>Inventories</b>	<b>5,321</b>	<b>4,574</b>	<b>3,824</b>	<b>3,880</b>
<b>A/P</b>	<b>2,207</b>	<b>2,217</b>	<b>2,331</b>	<b>3,141</b>

#### 1991=100

	<i>1991</i>	<i>1992</i>	<i>1993</i>	<i>1994</i>
<b>Sales</b>	<b>100</b>	<b>100.9</b>	<b>100.8</b>	<b>105.3</b>
<b>A/R</b>	<b>100</b>	<b>98.7</b>	<b>113.2</b>	<b>103.3</b>
<b>Inventories</b>	<b>100</b>	<b>86.0</b>	<b>71.9</b>	<b>72.9</b>
<b>A/P</b>	<b>100</b>	<b>100.4</b>	<b>105.6</b>	<b>142.3</b>

## C. DEBT & SOLVENCY RATIOS: DEBT FINANCING AND COVERAGE

- The use of debt involves risk because debt carries. fixed commitment (interest charges & principal repayment).
- While debt implies risk, it also introduces the potential for increased benefits to the firm's owners (leverage effect illustrated below).
- There are other fixed commitments, such as lease payments, that are similar to debt and should be considered

**Debt-Capital Ratio** =  $\text{Debt}/(\text{Debt} + \text{Equity})$

**Debt - Assets Ratio** =  $\text{Debt}/\text{Total assets}$

**Debt-Equity Ratio** =  $\text{Debt}/\text{Shareholders' equity}$

Debt can include trade debt -- usually it does not

**Coverage Ratios** [Can also be calculated on cash basis]

**Times interest earned** =  $\text{Operating profit(EBIT)}/\text{interest expense}$

**Fixed charge coverage** =  $\frac{\text{Operating profit} + \text{Lease payments}}{\text{Interest expense} + \text{Lease payments}}$

**Note:** Lease payments are added to numerator because they were deducted in order to arrive at operating profits.

**Capital Expenditure** ratio =  $\text{CFO}/\text{Capital expenditures}$

**CFO-debt** =  $\text{CFO}/\text{debt}$

**Debt covenants:** It is important to examine the proximity to a technical violation for two reasons:

- (1) it implies potential costs of renegotiation; and
- (2) it implies potential earnings management.

## **D. PROFITABILITY RATIOS: OVERALL EFFICIENCY & PERFORMANCE**

**Gross Profit Margin =** Gross profit/Sales

Measures the ability of the firm to control costs of inventories and/or manufacturing cost and to pass along price increases through sales to customers.

**Operating Profit Margin =** Operating profit/Sales

Measure of overall operating efficiency.

**Net Profit Margin =** (Net Earnings)/Sales

Measure of overall profitability after all items included (revenues, expenses, tax, interest, etc.). The profit margin ratio is a measure of a firm's ability to control the level of expenses relative to revenues generated.

### ***ROI measures***

**Rate of return on assets (ROA) =**

$$\frac{\text{Net income} + \text{Interest expense (net of income tax savings)}}{\text{Average total assets}}$$

By adding back interest expense, we actually measure the rate of return on assets as if the firm is fully financed with equity. This ratio provides a performance measure that is independent of the financing of the firm's assets.

**Rate of Return on Common Shareholders' Equity (ROE) =**

$$\frac{\text{Net income}}{\text{Average common equity}}$$

## Disaggregation of ROA/ROE

To simplify matters, we first illustrate ROA on a pre-tax basis.

$$\begin{aligned}
 \text{ROA} &= \frac{\text{EBIT}}{\text{Assets}} \\
 &= \frac{\text{EBIT}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}} \\
 &= \text{Profitability} \times \text{Activity}
 \end{aligned}$$

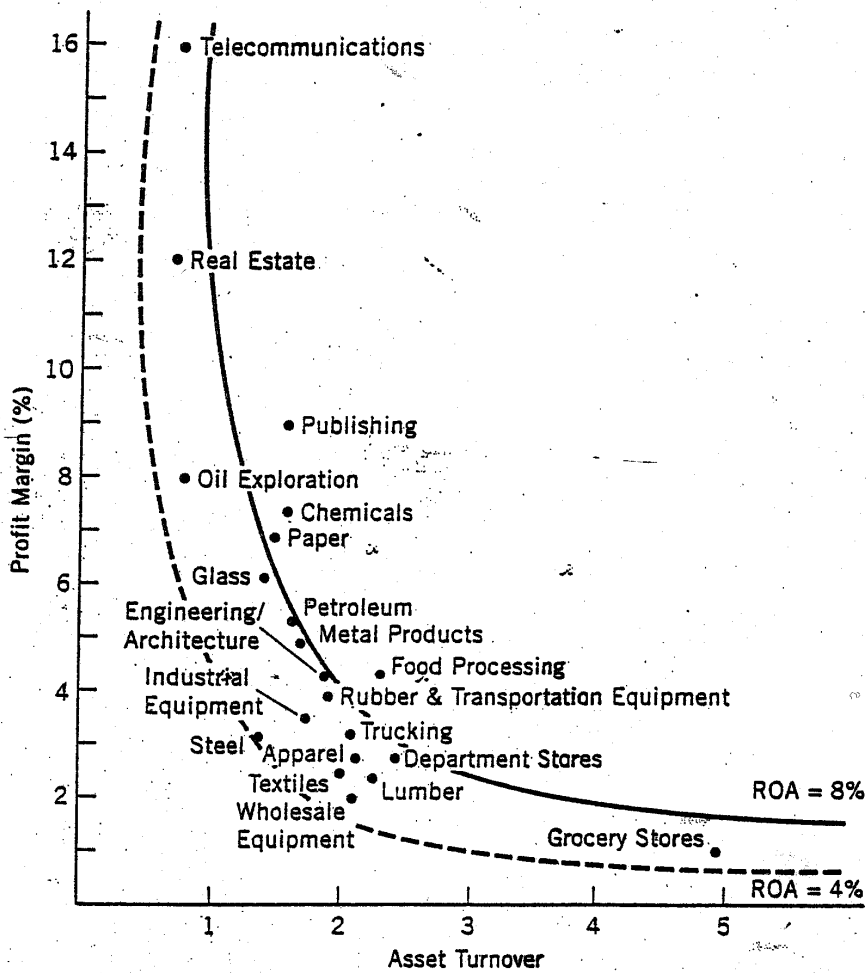


FIGURE 4-5 ROAs of sample firms, 1977-1986.

Source: Thomas Selling and Clyde Stickney, "The Effects of Business Environment and Strategy on a Firm's Rate of Return on Assets," *Financial Analysts Journal*, (Jan.-Feb. 1989), pp. 43-52, Fig. 1, p. 48.

Similarly for ROE we find

$$\begin{aligned}
 \text{ROE} &= \frac{\text{EBT}}{\text{Equity}} \\
 &= \frac{\text{EBT}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}} \times \frac{\text{Assets}}{\text{Equity}} \\
 &= \text{Profitability} \times \text{Activity} \times \text{Solvency}
 \end{aligned}$$

Common Size  
I/S Components
Inventory T/O  
A/R T/O  
Fixed Asset T/O
Debt/Equity  
Debt/Assets

**ON AN AFTER-TAX BASIS**

**THREE COMPONENT DISAGGREGATION OF ROE**

$$\begin{aligned}
 \text{ROE} &= \frac{\text{Net Income}}{\text{Equity}} \\
 &= \frac{\text{Net Income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}} \times \frac{\text{Assets}}{\text{Equity}} \\
 &= \text{Profitability} \times \text{Activity} \times \text{Solvency}
 \end{aligned}$$

**FIVE COMPONENT DISAGGREGATION OF ROE**

$$\begin{aligned}
 \text{ROE} &= \frac{\text{Net Income}}{\text{Equity}} \\
 &= \frac{\text{EBIT}}{\text{Sales}} \times \frac{\text{EBT}}{\text{EBIT}} \times \frac{\text{Net Income}}{\text{EBT}} \times \frac{\text{Sales}}{\text{Assets}} \times \frac{\text{Assets}}{\text{Equity}} \\
 &= \text{Profitability} \times \text{Activity} \times \text{Solvency} \\
 &\quad \text{Operations} \times \text{Financing} \times \text{Taxes}
 \end{aligned}$$

Additional insights into the relationship of ROE & ROA

Note the in the three way disaggregation of ROE, the first two components are ROA calculated on an after interest basis

We can express ROE in terms of ROA directly as (again using pre-tax numbers to simplify matters)

$$\begin{aligned} \text{ROE} &= \frac{\text{EBIT} - \text{Interest}}{\text{Assets}} \times \frac{\text{Assets}}{\text{Equity}} \\ &= \left[ \text{ROA} - \frac{\text{Interest}}{\text{Assets}} \right] \times \frac{\text{Assets}}{\text{Equity}} \end{aligned}$$

This term with some manipulation can be converted to \*

$$\text{ROE} = \text{ROA} + (\text{ROA} - \text{Cost of Debt}) \times [\text{Debt} / \text{Equity}]$$

Leveraging is only profitable if the return on assets is greater than the cost of debt

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\* An obvious parallel to this equation for ROE (return on equity)

$$\text{ROE} = \text{ROA} + (\text{ROA} - \text{Cost of Debt}) \times [\text{Debt} / \text{Equity}]$$

is the equation for the beta of a firm ( $\beta_e$ )

$$\mathbf{b_e = b_a + (b_a - b_d) \times [Debt / Equity]}$$

where  $\beta_a$  and  $\beta_d$  are the unlevered beta and the beta of debt respectively.

## Concept of Leverage

**LEVERAGE IS FOUND WHENEVER FIXED COSTS SUPPORT VARIABLE AMOUNTS OF REVENUES**

**OPERATING LEVERAGE** is introduced when a portion of a firm's operating costs are fixed. Defined as the percentage change in EBIT for a given percentage change in sales.

**FINANCIAL LEVERAGE** A method of financing which involves the borrowing of funds at some fixed rate (bonds, debenture, preferred), expecting eventually to raise the earnings of the firm to the benefit of its shareholders (i.e., fixed financing charges). Measured as the percentage change in NI for a given percentage change in EBIT.

**TOTAL LEVERAGE** is the combination of FL and OL. Measured as the percentage change in NI for a given percentage change in sales.

**Problem 4-16 -- Errata**

	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>
Sales	287.48	295.32	685.36	757.38	790.97	864.60
EBIT	12.57	16.84	56.36	70.68	70.97	74.06
Interest	<u>9.41</u>	<u>9.51</u>	<u>25.51</u>	<u>24.67</u>	<u>17.96</u>	<u>11.44</u>
EBT	3.16	7.33	30.85	46.01	53.01	62.62
Taxes	<u>0.53</u>	<u>3.03</u>	<u>13.18</u>	<u>18.85</u>	<u>20.40</u>	<u>24.31</u>
Net income	2.63	4.30	17.67	27.16	32.61	38.31
Tax rate	16.8%	41.3%	42.7%	41.0%	38.5%	38.8%
<b>Assets</b>	114.09	327.19	380.87	401.11	378.92	407.47
<b>Liabilities &amp; Equity</b>						
Current debt	2.88	18.09	28.33	33.23	26.93	23.86
Trade liabilities	<u>53.77</u>	<u>90.73</u>	<u>105.35</u>	<u>103.16</u>	<u>109.43</u>	<u>122.67</u>
Current liabilities	56.65	108.82	133.68	136.39	136.36	146.53
Long term debt	51.50	191.59	178.76	135.18	74.79	48.34
Other	<u>1.32</u>	<u>0.62</u>	<u>5.51</u>	<u>7.90</u>	<u>11.52</u>	<u>13.82</u>
Total liabilities	109.47	301.03	317.95	279.47	222.67	208.69
Equity	<u>4.62</u>	<u>26.16</u>	<u>62.92</u>	<u>121.64</u>	<u>156.25</u>	<u>198.78</u>
Total lblty & equity	114.09	327.19	380.87	401.11	378.92	407.47