

Study Unit One

Liquidity, Solvency, and Leverage Ratios

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This study unit is the **first of three** on **financial statement analysis**. The relative weight assigned to this major topic in Part 2 of the exam is **20%**. The three study units are

- **Study Unit 1: Liquidity, Solvency, and Leverage Ratios**
- Study Unit 2: Profitability and Per-Share Ratios
- Study Unit 3: Activity Ratios and Earnings Quality

This study unit discusses basic financial statement analysis as well as liquidity, solvency, and leverage. Topics covered include

Liquidity Ratios	Solvency Ratios
Current ratio	Total debt-to-total-capital ratio
Quick (acid-test) ratio	Debt to equity ratio
Cash ratio	Long-term debt to equity ratio
Net working capital ratio	Debt to total assets ratio
	Times interest earned ratio
	Earnings to fixed charges ratio
	Cash flow to fixed charges ratio

1.1 Common-Size Financial Statements

Percentages and Comparability

Analyzing the financial statements of steadily growing firms and firms of different sizes within an industry presents certain difficulties. To overcome this obstacle, common-size statements restate financial statement line items in terms of a percentage of a given amount, such as total assets for a balance sheet or net sales for an income statement.

Items on common-size financial statements are expressed as percentages of sales (on the income statement) or total assets (on the balance sheet). The base amount is assigned the value of 100%.

- On an income statement, sales is valued at 100%. All other amounts are a percentage of sales.
- On the balance sheet, total assets are 100%, as is the total of liabilities and stockholders' equity. Each line item can be interpreted in terms of its proportion of the baseline figure.

Example 1-1 Income Statement -- 2-Year Analysis

<u>External reporting format</u>			<u>Common-size format</u>		
	<u>Current Year</u>	<u>Prior Year</u>		<u>Current Year</u>	<u>Prior Year</u>
Net sales	\$1,800,000	\$1,400,000	Net sales	100.0%	100.0%
Cost of goods sold	(1,650,000)	(1,330,000)	Cost of goods sold	(91.7%)	(95.0%)
Gross profit	150,000	70,000	Gross profit	8.3%	5.0%
Selling expenses	(50,000)	(15,000)	Selling expenses	(2.8%)	(1.1%)
General & admin. expenses	(15,000)	(10,000)	General & admin. expenses	(0.8%)	(0.7%)
Operating income	85,000	45,000	Operating income	4.7%	3.2%
Other revenues and gains	20,000	0	Other revenues and gains	1.1%	0.0%
Other expenses and losses	(35,000)	(10,000)	Other expenses and losses	(1.9%)	(0.7%)
Income before taxes	70,000	35,000	Income before taxes	3.9%	2.5%
Income taxes (40%)	(28,000)	(14,000)	Income taxes (40%)	(1.6%)	(1.0%)
Net income	\$ 42,000	\$ 21,000	Net income	2.3%	1.5%

Example 1-2 Balance Sheet -- 2-Year Analysis

<u>External reporting format</u>			<u>Common-size format</u>		
	<u>Current Year End</u>	<u>Prior Year End</u>		<u>Current Year End</u>	<u>Prior Year End</u>
Assets:			Assets:		
Current assets	\$ 760,000	\$ 635,000	Current assets	42.2%	39.7%
Noncurrent assets	1,040,000	965,000	Noncurrent assets	57.8%	60.3%
Total assets	\$1,800,000	\$1,600,000	Total assets	100.0%	100.0%
Liabilities & stockholders' equity:			Liabilities & stockholders' equity:		
Current liabilities	\$ 390,000	\$ 275,000	Current liabilities	21.7%	17.2%
Noncurrent liabilities	610,000	675,000	Noncurrent liabilities	33.9%	42.2%
Total liabilities	\$1,000,000	\$ 950,000	Total liabilities	55.6%	59.4%
Stockholders' equity	800,000	650,000	Stockholders' equity	44.4%	40.6%
Total liabilities and stockholders' equity	\$1,800,000	\$1,600,000	Total liabilities and stockholders' equity	100.0%	100.0%

Common-size statements simplify analysis of differences among companies of various sizes or comparisons between a similar company and an industry average.

- For example, comparing the efficiency of a company with \$1,800,000 of revenues with a company with \$44 billion in revenues is difficult unless the numbers are reduced to a common denominator.

Vertical and Horizontal Analysis

The common-size statements provided are an example of **vertical analysis** (i.e., the percentages are based on numbers above or below in the same column).

Another concept is **horizontal analysis**. It states the amounts for several periods as percentages of a base-year amount. These are often called trend percentages.

- One period is designated the base period, with which the other periods are compared. Each line item of the base period is thus 100%.

Example 1-3 Horizontal Analysis

Income statement External reporting format			
	Current Year	Prior Year	2nd Prior Year
Net sales	\$1,800,000	\$1,400,000	\$1,500,000
Cost of goods sold	(1,650,000)	(1,330,000)	(1,390,000)
Gross profit	\$ 150,000	\$ 70,000	\$ 110,000

Income statement Trend analysis			
	Current Year	Prior Year	2nd Prior Year
Net sales	120.0%	93.3%	100.0%
Cost of goods sold	118.7%	95.7%	100.0%
Gross profit	136.4%	63.6%	100.0%

Even though sales and cost of goods sold declined only slightly from the base year to the next year, gross profit plunged (on a percentage basis). By the same token, when sales recovered in the current year, the gain in gross profit was (proportionally) greater than the increases in its two components.

Trend analysis compares financial information for balances and amounts across statement periods. It allows financial analysts to identify patterns in data from year to year and make comparisons with competitors and industry benchmarks. This type of trend analysis also is used for business decisions.

There is also a form of horizontal analysis that does not use common sizes. This method is used to calculate the growth (or decline) of key financial line items.

- For example, if a company's sales increased from \$100,000 to \$120,000, there would be a column showing the percentage increase, which was 20% in this case.
- This is another form of **management by exception**. Managers can look at the percentage change column and see which accounts have experienced the most change since the previous period.

Example 1-4 Percentage Change

	Current Year	Prior Year	Dollar Change	Percentage Change
Net sales	\$1,800,000	\$1,400,000	\$400,000	28.6%
Cost of goods sold	1,650,000	1,330,000	320,000	24.1%
Selling expenses	50,000	15,000	35,000	233.3%
General & admin. expenses	15,000	10,000	5,000	50.0%

1.2 Liquidity

Liquidity is a firm's ability to pay its **current obligations** as they come due and thus remain in business in the short run. Liquidity reflects the ease with which assets can be converted to cash.

- Liquidity ratios measure this ability by relating a firm's liquid assets to its current liabilities.

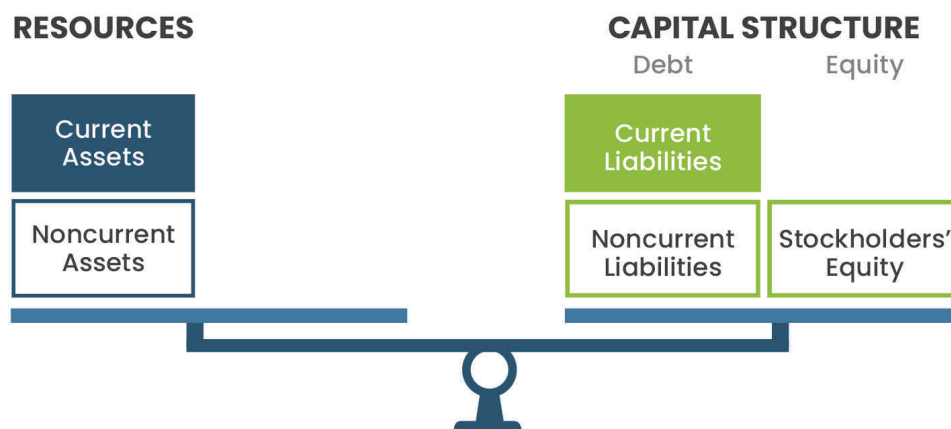


Figure 1-1

Example 1-5 Balance Sheet

RESOURCES			FINANCING		
	Current Year End	Prior Year End		Current Year End	Prior Year End
CURRENT ASSETS:			CURRENT LIABILITIES:		
Cash and equivalents	\$ 325,000	\$ 275,000	Accounts payable	\$ 150,000	\$ 75,000
Available-for-sale securities	165,000	145,000	Notes payable	50,000	50,000
Accounts receivable (net)	120,000	115,000	Accrued interest on note	5,000	5,000
Notes receivable	55,000	40,000	Current maturities of L.T. debt	100,000	100,000
Inventories	85,000	55,000	Accrued salaries and wages	15,000	10,000
Prepaid expenses	10,000	5,000	Income taxes payable	70,000	35,000
Total current assets	\$ 760,000	\$ 635,000	Total current liabilities	\$ 390,000	\$ 275,000
NONCURRENT ASSETS:			NONCURRENT LIABILITIES:		
Equity-method investments	\$ 120,000	\$ 115,000	Bonds payable	\$ 500,000	\$ 600,000
Property, plant, & equipment	1,000,000	900,000	Long-term notes payable	90,000	60,000
Less: Accum. depreciation	(85,000)	(55,000)	Employee-related obligations	15,000	10,000
Goodwill	5,000	5,000	Deferred income taxes	5,000	5,000
Total noncurrent assets	\$1,040,000	\$ 965,000	Total noncurrent liabilities	\$ 610,000	\$ 675,000
			Total liabilities	\$1,000,000	\$ 950,000
			STOCKHOLDERS' EQUITY:		
			Preferred stock, \$50 par	\$ 120,000	\$ 0
			Common stock, \$1 par	500,000	500,000
			Additional paid-in capital	110,000	100,000
			Retained earnings	70,000	50,000
			Total stockholders' equity	\$ 800,000	\$ 650,000
Total assets	<u>\$1,800,000</u>	<u>\$1,600,000</u>	Total liabilities and stockholders' equity	<u>\$1,800,000</u>	<u>\$1,600,000</u>

Example 1-6 Income Statement

	Current Year	Prior Year
Net sales	\$1,800,000	\$1,400,000
Cost of goods sold	(1,450,000)	(1,170,000)
Gross profit	\$ 350,000	\$ 230,000
SG&A expenses	(160,000)	(80,000)
Operating income	\$ 190,000	\$ 150,000
Other revenues and losses	(40,000)	(25,000)
Earnings before interest and taxes	\$ 150,000	\$ 125,000
Interest expense	(15,000)	(10,000)
Earnings before taxes	\$ 135,000	\$ 115,000
Income taxes (40%)	(54,000)	(46,000)
Net income	<u>\$ 81,000</u>	<u>\$ 69,000</u>



Author's Note

The balance sheet and income statement above provide inputs for the examples throughout this study unit.

Current assets are the most liquid. They are expected to be converted to cash, sold, or consumed within 1 year or the operating cycle, whichever is longer. Ratios involving current assets thus measure a firm's ability to continue operating in the short run.

- Current assets include, in descending order of liquidity, cash and equivalents; marketable securities; receivables (net of allowance for credit losses); inventories; and prepaid items.

Current liabilities, by the same token, are ones that must be settled the soonest. Specifically, they are expected to be settled or converted to other liabilities within 1 year or the operating cycle, whichever is longer.

- Current liabilities include accounts payable, notes payable, current maturities of long-term debt, unearned revenues, taxes payable, wages payable, and other accruals.

Net working capital reports the resources the company would have to continue operating in the short run if it had to liquidate all of its current liabilities at once.

$$\text{Net working capital} = \text{Current assets} - \text{Current liabilities}$$

Example 1-7 Change in Working Capital

Current Year: $\$760,000 - \$390,000 = \$370,000$
 Prior Year: $\$635,000 - \$275,000 = \$360,000$

Although the company's current liabilities increased, its current assets increased by \$10,000 more.

Current Ratio

The **current ratio** is the most common measure of liquidity.

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}$$

Example 1-8 Current Ratio

Current Year: $\$760,000 \div \$390,000 = 1.949$
 Prior Year: $\$635,000 \div \$275,000 = 2.309$

Although working capital increased in absolute terms (\$10,000), current assets now provide less proportional coverage of current liabilities than in the prior year.

- A low ratio indicates a possible solvency problem. A firm with a low current ratio may become insolvent. Therefore, care should be taken when determining whether to extend credit to a firm with a low ratio.
- An overly high ratio indicates that management may not be investing idle assets productively.

- The quality of accounts receivable and merchandise inventory should be considered before evaluating the current ratio.
 - Obsolete or overvalued inventory or receivables can artificially inflate the current ratio.
- The general principle is that the current ratio should be proportional to the operating cycle. Thus, a shorter cycle may justify a lower ratio.
 - For example, a grocery store has a short operating cycle and can survive with a lower current ratio than could a gold mining company, which has a much longer operating cycle.

Quick Ratio

The **quick (acid-test) ratio** excludes inventories and prepaids from the numerator, recognizing that those assets are difficult to liquidate at their stated values. The quick ratio is thus a more conservative measure than the basic current ratio.

$$\text{Quick (acid-test) ratio} = \frac{\text{Cash} + \text{Marketable securities} + \text{Net receivables}}{\text{Current liabilities}}$$

- This ratio measures the firm's ability to easily pay its short-term debts and avoids the problem of inventory valuation.

Example 1-9 Quick (Acid-Test) Ratio

Current Year: $(\$325,000 + \$165,000 + \$120,000 + \$55,000) \div \$390,000 = 1.705$
 Prior Year: $(\$275,000 + \$145,000 + \$115,000 + \$40,000) \div \$275,000 = 2.091$

In spite of its increase in total working capital, the company's position in its most liquid assets deteriorated significantly.

	Current Ratio	Quick Ratio
 Type	 Liquidity ratio	 Liquidity ratio
 Formula	$\frac{\text{Current assets}}{\text{Current liabilities}}$	$\frac{\text{Cash} + \text{Marketable securities} + \text{Net receivables}}{\text{Current liabilities}}$
 Focus	Measures ability to pay current liabilities using current assets	More conservative than current ratio since measures ability to pay current liabilities without selling inventory

Figure 1-2

Other Liquidity Ratios

The **cash ratio** is an even more conservative variation of the quick ratio.

$$\text{Cash ratio} = \frac{\text{Cash} + \text{Marketable securities}}{\text{Current liabilities}}$$

Example 1-10 Cash Ratio

Current Year: $(\$325,000 + \$165,000) \div \$390,000 = 1.256$
 Prior Year: $(\$275,000 + \$145,000) \div \$275,000 = 1.527$

In this working capital measure, the company's position declined, but coverage is still positive; i.e., the ratio is greater than 1.

The **cash flow ratio** reflects the significance of cash flow for settling obligations as they become due.

$$\text{Cash flow ratio} = \frac{\text{Cash flow from operations}}{\text{Current liabilities}}$$

Example 1-11 Cash Flow Ratio

The company's cash flows from operations for the two most recent years were \$382,000 and \$291,000, respectively. This information would be found on the company's statement of cash flows.

Current Year: $\$382,000 \div \$390,000 = 0.979$
 Prior Year: $\$291,000 \div \$275,000 = 1.058$

Unlike the prior year, the cash flows generated by the company in the most recent year were not sufficient to cover current liabilities.

The **net working capital ratio** is the most conservative of the working capital ratios.

$$\text{Net working capital ratio} = \frac{\text{Current assets} - \text{Current liabilities}}{\text{Total assets}}$$

Example 1-12 Net Working Capital Ratio

Current Year: $(\$760,000 - \$390,000) \div \$1,800,000 = 0.206$

Prior Year: $(\$635,000 - \$275,000) \div \$1,600,000 = 0.225$

Current liabilities are taking a bigger “bite” out of working capital than in the prior year.

Liquidity of Current Liabilities

The liquidity of current liabilities is the ease with which a firm can issue new debt or raise new structured (convertible, puttable, callable, etc.) funds.

- The liquidity of current liabilities indicates the ease of funding or availability of sources of funding. A firm's ability to borrow in the financial markets is generally a function of its size, reputation, creditworthiness, and capital levels.
- Raising liquidity during an adverse situation often requires a combination of both asset liquidity and liability liquidity.

1.3 Solvency

Solvency is the ability of a business to meet its long-term obligations. This ability is related to the relative extent of use of debt and equity financing. Solvency is a function of capital structure and degree of leverage (covered in Subunit 1.4).

A firm's **capital structure** includes its sources of financing, both long- and short-term. These sources may be in the form of debt (external sources) or equity (internal sources).

- Capital structure decisions affect the **risk profile** of a firm.
 - For example, a company with a higher percentage of debt is riskier than a firm with a higher percentage of equity. Thus, equity investors will demand a higher rate of return compared with other providers of capital to compensate for the risk related to a higher use of financial leverage.
 - But a company with a high level of equity will be able to borrow at lower rates. Debt holders will accept lower interest in exchange for the lower risk because of the equity cushion.

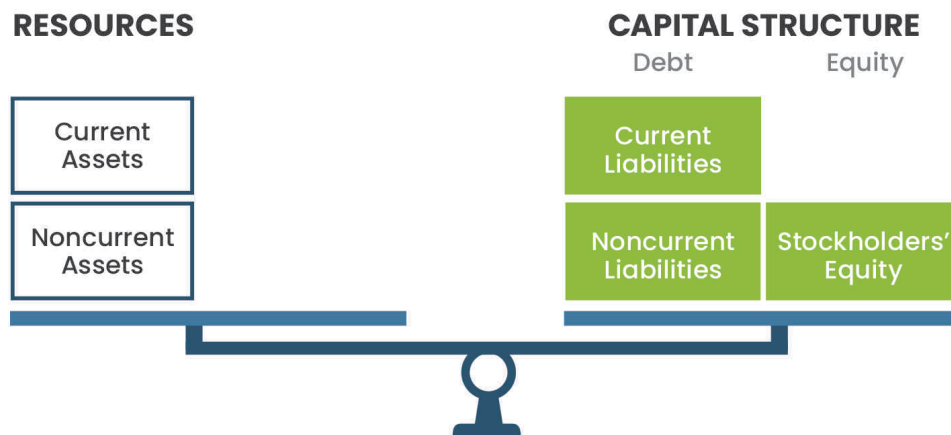


Figure 1-3

Debt is the creditor interest in the firm.

The following are **advantages** of debt to the issuer:

- Interest paid on debt is tax deductible.
- Control of the firm is not shared with debtholders.

The following are **disadvantages** of debt to the issuer:

- Unlike returns on equity investments, the payment of interest and principal on debt is a legal obligation. If cash flow is insufficient, the firm could become insolvent.
- The legal requirement to pay interest and principal increases a firm's risk and reduces its retained earnings. Because shareholders demand increased retained earnings, they are less likely to invest in the firm, thus decreasing the share price.
- Debt may require collateral, specific property pledged to a lender in case of default.
- The amount of debt financing available to the individual firm is limited. Generally accepted standards of the investment community usually require a certain debt-to-equity ratio. Beyond this limit, the cost of debt may rise rapidly or debt may not be available.

Equity is the ownership interest in the firm.

- Equity is the permanent capital of an enterprise, contributed by the firm's owners (shareholders) to obtain a return.
- A return on equity is uncertain because it is a residual interest in the firm's assets, i.e., the claim left after all debt has been satisfied.
- Periodic returns to owners of excess earnings are dividends. The firm may be contractually obligated to pay dividends to preferred shareholders but not to common shareholders.

The following are **advantages** of equity to the corporation:

- Common stock does not require a fixed dividend. Dividends are paid from profits when available.
- Common stock has no fixed maturity date for repayment of capital.
- The sale of common stock increases the creditworthiness of the firm by providing more capital (or money) for the corporation.

The following are **disadvantages** of equity to the corporation:

- Cash dividends on common stock are not tax-deductible and are paid from after-tax profits.
- New common stock sales dilute earnings per share (EPS) available to current shareholders.
- Underwriting costs (e.g., fees to issue new common stock) typically are higher for common stock than for debt.
- Too much equity may raise the average cost of capital of the firm above its optimal level.

Capital adequacy is a term normally used in connection with financial institutions. A bank must be able to pay depositors who demand their money on a given day and still be able to make new loans. Capital adequacy may be discussed in terms of

- Solvency (the ability to pay long-term obligations as they mature).
- Liquidity (the ability to pay for day-to-day ongoing operations).
- Reserves (the specific amount a bank must have available to pay depositors).
- Sufficient capital.

Capital Structure Ratios

Capital structure ratios report the relative proportions of debt and equity in a firm's capital structure at a given reporting date.

The **total debt-to-total-capital ratio** measures the percentage of the capital structure provided by creditors.

$$\text{Total debt-to-total-capital ratio} = \frac{\text{Total debt}}{\text{Total capital}}$$

- When total debt to total capital is low, the firm's capital is supplied by the shareholders. Thus, creditors prefer this ratio to be low as a cushion against losses.

Example 1-13 Total Debt-to-Total-Capital Ratio

Current Year: $\$1,000,000 \div \$1,800,000 = 0.556$
 Prior Year: $\$950,000 \div \$1,600,000 = 0.594$

The company became slightly less reliant on debt in its capital structure during the current year. Although total debt rose, equity rose by a greater percentage. The company is less leveraged than before.

The **debt to equity ratio** is a direct comparison of the firm's debt load versus its equity stake.

$$\text{Debt to equity ratio} = \frac{\text{Total debt}}{\text{Stockholders' equity}}$$

- Like the total debt-to-total-capital ratio, the debt to equity ratio reflects long-term debt-payment ability. Again, a low ratio means a lower relative debt burden and thus better chances of repayment of creditors.

Example 1-14 Debt to Equity Ratio

Current Year: $\$1,000,000 \div \$800,000 = 1.25$
 Prior Year: $\$950,000 \div \$650,000 = 1.46$

The amount by which the company's debts exceed its equity stake declined in the current year.

The **long-term debt to equity ratio** reports the long-term debt burden carried by a company per dollar of equity.

$$\text{Long-term debt to equity ratio} = \frac{\text{Long-term debt}}{\text{Stockholders' equity}}$$

- A low ratio means a firm will have an easier time raising new debt (since its low current debt load makes it a good credit risk).

Example 1-15 Long-Term Debt to Equity Ratio

Current Year: $\$610,000 \div \$800,000 = 0.763$
 Prior Year: $\$675,000 \div \$650,000 = 1.038$

The company has greatly improved its long-term debt burden. It now carries less than one dollar of long-term debt for every dollar of equity.

The **debt to total assets ratio** (also called the debt ratio) reports the total debt burden carried by a company per dollar of assets.

$$\text{Debt to total assets ratio} = \frac{\text{Total liabilities}}{\text{Total assets}}$$

- Numerically, this ratio is identical to the debt to total capital ratio.

Example 1-16 Debt to Total Assets Ratio

Current Year: $\$1,000,000 \div \$1,800,000 = 0.556$
 Prior Year: $\$950,000 \div \$1,600,000 = 0.594$

Although total liabilities increased in absolute terms, this ratio improved because total assets increased even more.

	Total Debt-to-Total-Capital Ratio	Debt to Equity Ratio	Long-term Debt to Equity Ratio	Debt to Total Assets Ratio
Type	 Solvency ratio	 Solvency ratio	 Solvency ratio	 Solvency ratio
Formula	$\frac{\text{Total debt}}{\text{Total capital}}$	$\frac{\text{Total debt}}{\text{Stockholders' equity}}$	$\frac{\text{Long-term debt}}{\text{Stockholders' equity}}$	$\frac{\text{Total liabilities}}{\text{Total assets}}$
Focus	Measures percentage of the capital structure provided by creditors	Reflects the long-term debt paying ability	Reports the long-term debt burden carried by a company per dollar of equity	Measures the total debt burden carried by a company per dollar of assets

Figure 1-4

Earnings Coverage Ratios

Earnings coverage ratios are a creditor's best measure of a firm's ongoing ability to generate the earnings that will allow it to service debt.

The **times interest earned ratio** is an income statement approach to evaluating a firm's ongoing ability to meet the interest payments on its debt obligations.

$$\text{Times interest earned ratio} = \frac{\text{Earnings before interest and taxes}}{\text{Interest expense}}$$

- For the ratio to be meaningful, net income cannot be used in the numerator. Since what is being measured is the ability to pay interest, earnings before interest and taxes (EBIT) is appropriate.
- The most accurate calculation of the numerator includes only earnings expected to recur. Consequently, unusual or infrequent items, discontinued operations, and the effects of accounting changes should be excluded.
- The denominator should include capitalized interest.
 - This ratio is also referred to as the interest coverage ratio or interest charged ratio.

Example 1-17 Times Interest Earned Ratio

Current Year: \$150,000 ÷ \$15,000 = 10.00 times
 Prior Year: \$125,000 ÷ \$10,000 = 12.50 times

The company is less able to comfortably pay interest expense. In the prior year, EBIT was twelve and a half times interest expense, but in the current year, it is only ten times.

The **earnings to fixed charges ratio** (also called the fixed charge coverage ratio) extends the times interest earned ratio to include the interest portion associated with long-term lease obligations.

$$\text{Earnings to fixed charges ratio} = \frac{\text{Earnings before fixed charges and taxes}}{\text{Fixed charges}}$$

- Fixed charges include interest, required principal repayments, and leases.
- This is a more conservative ratio since it measures the coverage of earnings over all fixed charges, not just interest expense.

The **cash flow to fixed charges ratio** removes the difficulties of comparing amounts prepared on an accrual basis.

$$\text{Cash flow to fixed charges ratio} = \frac{\text{Cash from operations} + \text{Fixed charges} + \text{Tax payments}}{\text{Fixed charges}}$$

- Cash from operations is after-tax.

	Times Interest Earned Ratio	Earnings to Fixed Charges Ratio	Cash Flow to Fixed Charges Ratio
Type	 Solvency ratio	 Solvency ratio	 Solvency ratio
Formula	$\frac{\text{Earnings before interest and taxes}}{\text{Interest expense}}$	$\frac{\text{Earnings before fixed charges and taxes}}{\text{Fixed charges}}$	$\frac{\text{Cash from operations} + \text{Fixed charges} + \text{Tax payments}}{\text{Fixed charges}}$
Focus	Measures firm's ongoing ability to meet interest payments on debt obligations	Extension of times interest earned ratio to include the interest portion associated with long-term obligations	Measures ability to meet interest payments on a cash basis

Figure 1-5

1.4 Leverage



Success Tip

For the purpose of the CMA exam, be sure that you understand and can calculate both leverage ratios. However, calculating these ratios is just one aspect of how you could be tested on this topic. Candidates should be fully prepared to apply these calculations and demonstrate an understanding through multiple-choice or essay questions of how changes in cost structure may affect these ratios. Ensure that you understand what risks and advantages are associated with high operating or financial leverage.

Types of Leverage

Leverage is the relative amount of fixed cost in a firm's overall cost structure. Leverage creates risk because fixed costs must be covered, regardless of the level of sales.

- **Operating leverage** arises from the use of a high level of plant and machinery in the production process, revealed through charges for depreciation, property taxes, etc.
- **Financial leverage** arises from the use of a high level of debt in the firm's financing structure, revealed through amounts paid out for interest.

Although leverage arises from items on the balance sheet, it is measured by examining its effects on the income statement. A general statement of leverage is

$$\text{Degree of leverage} = \frac{\text{Pre-fixed-cost income amount}}{\text{Post-fixed-cost income amount}}$$

Degree of Operating Leverage (DOL)

Calculation of the DOL requires financial information prepared on the variable-costing basis, since variable costing isolates the use of fixed costs in the firm's ongoing operations.

$$\text{DOL (single period)} = \frac{\text{Contribution margin}}{\text{Operating income or earnings before interest and taxes (EBIT)}}$$

Example 1-18 DOL -- Single Period

A firm's DOL varies with the level of sales, as shown below:

Degree of Operating Leverage at Various Levels of Sales					
Sales volume:	100 Units	250 Units	500 Units	750 Units	1,000 Units
Net sales (\$1,000 per unit)	\$ 100,000	\$ 250,000	\$ 500,000	\$ 750,000	\$1,000,000
Variable costs (\$800 per unit)	(80,000)	(200,000)	(400,000)	(600,000)	(800,000)
Contribution margin	\$ 20,000	\$ 50,000	\$ 100,000	\$ 150,000	\$ 200,000
Fixed costs	(100,000)	(100,000)	(100,000)	(100,000)	(100,000)
Operating income (loss)	\$ (80,000)	\$ (50,000)	\$ 0	\$ 50,000	\$ 100,000
Degree of operating leverage (DOL)	(0.25)	(1.00)	Undef.	3.00	2.00

This firm breaks even at sales of 500 units. As the example demonstrates, DOL is not a meaningful measure when the firm incurs an operating loss.

Two versions of DOL are in common use.

1. The version shown on the previous page compares contribution margin and variable-basis operating income in a single reporting period.
2. The percentage-change version of DOL measures the changes in income statement amounts from one period to another.

$$\text{DOL } (\% \Delta) = \frac{\% \Delta \text{ in operating income or EBIT}}{\% \Delta \text{ in sales}}$$

- Note that, in this version, the numerator and denominator are different from those in the single-period version.

Example 1-19 DOL -- Percentage Change

Degree of Operating Leverage Period-to-Period Percentage Change		
	Current Year	Prior Year
Net sales	\$1,800,000	\$1,400,000
Cost of goods sold	(1,450,000)	(1,170,000)
Gross margin	\$ 350,000	\$ 230,000
SG&A expenses	(160,000)	(80,000)
Operating income	\$ 190,000	\$ 150,000
Other income and loss	(40,000)	(25,000)
EBIT	\$ 150,000	\$ 125,000
Interest expense	(15,000)	(10,000)
Earnings before taxes	\$ 135,000	\$ 115,000
Income taxes (40%)	(54,000)	(46,000)
Net income	\$ 81,000	\$ 69,000

Numerator: $\% \Delta \text{ in EBIT} = (\$150,000 - \$125,000) \div \$125,000 = 20.00\%$

Denominator: $\% \Delta \text{ in sales} = (\$1,800,000 - \$1,400,000) \div \$1,400,000 = 28.57\%$

Degree of operating leverage (DOL) = $20.00\% \div 28.57\% = 0.7$

Every 1% change in sales generates a 0.7% change in EBIT.

A firm with high operating leverage necessarily carries a greater degree of risk because fixed costs must be covered regardless of the level of sales. However, such a firm is also able to expand production rapidly in times of higher product demand. Thus, the more leveraged a firm is in its operations, the more sensitive operating income is to changes in sales volume.

Degree of Financial Leverage (DFL)

The DFL also results from a pre-fixed-cost income to post-fixed-cost income comparison, this time on the firm's financing structure.

$$\text{DFL (single period)} = \frac{\text{EBIT}}{\text{Earnings before taxes (EBT)}}$$

- This formula isolates the effects of interest as the only truly fixed financing cost.

Example 1-20 DFL -- Single Period

Degree of Financial Leverage Single-Period Version		
	Current Year	Prior Year
Net sales	\$1,800,000	\$1,400,000
Cost of goods sold	(1,450,000)	(1,170,000)
Gross margin	\$ 350,000	\$ 230,000
SG&A expenses	(160,000)	(80,000)
Operating income	\$ 190,000	\$ 150,000
Other income and loss	(40,000)	(25,000)
EBIT	\$ 150,000	\$ 125,000
Interest expense	(15,000)	(10,000)
Earnings before taxes	\$ 135,000	\$ 115,000
Income taxes (40%)	(54,000)	(46,000)
Net income	\$ 81,000	\$ 69,000

$$\begin{aligned} \text{Degree of financial leverage} \\ \text{Current year: } \$150,000 \div \$135,000 &= \$1.11 \\ \text{Prior year: } \$125,000 \div \$115,000 &= \$1.09 \end{aligned}$$

The company needs \$1.11 of EBIT to generate \$1.00 of EBT. Last year, only \$1.09 of EBIT was needed to generate \$1.00 of EBT.

Two versions of DFL are in common use.

1. The version shown on the previous page compares EBIT and EBT from a single reporting period.
2. The percentage-change version examines the changes in income statement amounts over two periods.

$$\text{DFL } (\% \Delta) = \frac{\% \Delta \text{ in net income}}{\% \Delta \text{ in EBIT}}$$

- Note that in the percentage-change version, the numerator and denominator are different from those in the single-period version.

Example 1-21 DFL -- Percentage Change

Numerator: $\% \Delta \text{ in net income} = (\$81,000 - \$69,000) \div \$69,000 = 17.39\%$

Denominator: $\% \Delta \text{ in EBIT} = (\$150,000 - \$125,000) \div \$125,000 = 20.00\%$

Degree of financial leverage (DFL) = $17.39\% \div 20.00\% = 0.8695$

Every 1% change in EBIT generates a 0.87% change in net income.

A firm with high financial leverage necessarily carries a greater degree of risk because debt must be serviced regardless of the level of earnings. However, if such a firm is profitable, there is more residual profit for the shareholders after debt service (interest on debt is tax-deductible), reflected in higher earnings per share. Furthermore, debt financing permits the current equity holders to retain control.

	Degree of Operating Leverage	Degree of Financial Leverage
Type	 Leverage ratio	 Leverage ratio
Formula	$\frac{\text{Contribution margin}}{\text{Operating income or earnings before interest and taxes (EBIT)}}$	$\frac{\text{EBIT}}{\text{Earnings before taxes (EBT)}}$
Focus	Measures how sensitive operating income (or EBIT) is to a change in sales volume	Measures how sensitive EBT is to changes in operating income (or EBIT)

Figure 1-6