

ANALYSIS OF INVENTORIES

Study Session 9

EXAM FOCUS

This topic review discusses specific analytical processes for inventory. The complication in analyzing inventory is that firms can use three different methods to account for inventory—FIFO, LIFO, and average cost. You should memorize the basic inventory relationship, $EI = BI + P - COGS$, and be able to algebraically convert this equation to solve for its other components (i.e., solve for COGS given the

other three). You should also know how to calculate inventory balances and COGS using all three methods and how to convert inventory or COGS data derived from FIFO into LIFO and from LIFO into FIFO. Finally, you should know and be able to explain why LIFO accounting produces a better measure of COGS and why FIFO accounting produces a better measure of inventory value.

INVENTORY ACCOUNTING

The choice of accounting method used to account for inventory affects the firm's income statement, balance sheet, and related financial ratios. More importantly, the choice of inventory accounting method affects cash flow because taxes paid by the firm are affected by the choice of inventory method. Unlike depreciation methods, inventory accounting methods must be the same for taxes as for financial reporting.

U.S. Generally Accepted Accounting Principles (GAAP) require inventory valuation on the basis of *lower of cost or market* (LCM). If replacement cost is rising, the gains in the value of inventory are ignored, and the inventory is valued at cost. However, losses in the value of inventory due to obsolescence, deterioration, etc., are recognized, and inventory is written down to its new market value. Remember, LCM is applied regardless of the inventory costing method used.

In general, *cost* represents reasonable and necessary costs to get the asset in place and ready to use.

- Merchandise inventories include costs of purchasing, transportation, receiving, inspecting, etc.
- Manufactured inventories include costs of direct materials, direct labor, and manufacturing overhead (i.e., all other indirect costs).

A basic inventory formula relates the beginning balance, purchases, and cost of goods sold (COGS) to the ending balance. Memorize and understand the relationships in the following equation:

$$\text{ending inventory} = \text{beginning inventory} + \text{purchases} - \text{COGS}$$

This equation is rearranged for several purposes, such as:

$$\text{purchases} = \text{ending inventory} - \text{beginning inventory} + \text{COGS}$$

$$\text{or COGS} = \text{purchases} + \text{beginning inventory} - \text{ending inventory}$$

$$\text{or COGS} + \text{ending inventory} = \text{beginning inventory} + \text{purchases}$$

- LOS 40.a: Compute ending inventory balances and cost of goods sold using the LIFO, FIFO, and average cost methods to account for product inventory and explain the relationship among and the usefulness of inventory and cost of goods sold data provided by the LIFO, FIFO, and average cost methods when prices are 1) stable or 2) changing.

Three methods of inventory accounting are:

First In, First Out (FIFO):

- The cost of inventory first acquired (beginning inventory and early purchases) is assigned to the cost of goods sold for the period.
- The cost of the most recent purchases is assigned to ending inventory.

Last In, First Out (LIFO):

- The cost of inventory most recently purchased is assigned to the cost of goods sold for the period.
- The costs of beginning inventory and earlier purchases go to ending inventory.
- Note that in the U.S., companies using LIFO for tax purposes must also use LIFO in their financial statements.

Average cost:

Under the average cost method, cost per unit is calculated by dividing cost of goods available by total units available. This average cost is used to determine both cost of goods sold and ending inventory.

Figure 1: Inventory Method Comparison

Method	Assumption	Cost of goods sold consists of...	Ending inventory consists of...
FIFO	The items first purchased are the first to be sold.	first purchased	most recent purchases
LIFO	The items last purchased are the first to be sold.	last purchased	earliest purchases
Weighted average cost	Items sold are a mix of purchases.	average cost of all items	average cost of all items

Example: Inventory costing

Use the inventory data in Figure 2 to calculate the cost of goods sold and ending inventory under each of the three methods.

Figure 2: Inventory Data

January 1 (beginning inventory)	2 units @ \$2 per unit =	\$4
January 7 purchase	3 units @ \$3 per unit =	9
January 19 purchase	5 units @ \$5 per unit =	25
Cost of goods available	10 units	<u>\$38</u>
Units sold during January		<u>7 units</u>

Answer:

FIFO cost of goods sold (value the seven units sold at unit cost of first units purchased). Start with the earliest units purchased and work down as illustrated in Figure 3.

Figure 3: FIFO COGS Calculation

From beginning inventory	2 units @ \$2 per unit =	\$4
From first purchase	3 units @ \$3 per unit =	9
From second purchase	2 units @ \$5 per unit =	10
FIFO cost of goods sold	7 units	<u>\$23</u>
Ending inventory	3 units @ \$5 =	\$15

LIFO cost of goods sold (value the seven units sold at unit cost of last units purchased). Start with the most recently purchased units and work up as illustrated in Figure 4.

Figure 4: LIFO COGS Calculation

From second purchase	5 units @ \$5 per unit	\$25
From first purchase	2 units @ \$3 per unit	6
LIFO cost of goods sold	7 units	<u>\$31</u>
Ending inventory	2@ \$2 + 1@ \$3	\$7

Average cost of goods sold (value the seven units sold at the average unit cost of goods available).

Figure 5: Weighted Average COGS Calculation

Average unit cost	\$38 / 10	\$3.80 per unit
Weighted average cost of goods sold	7 units @ \$3.80 per unit	\$26.60
Ending inventory	3 units @ \$3.80 per unit	\$11.40

Figure 6: Summary

<i>Inventory system</i>	<i>COGS</i>	<i>Ending Inventory</i>
FIFO Costing	\$23.00	\$15.00
LIFO Costing	\$31.00	\$7.00
Average Costing	\$26.60	\$11.40

Note that prices and inventory levels were rising over the period and that the costs of purchases during the period are the same for all costing methods.

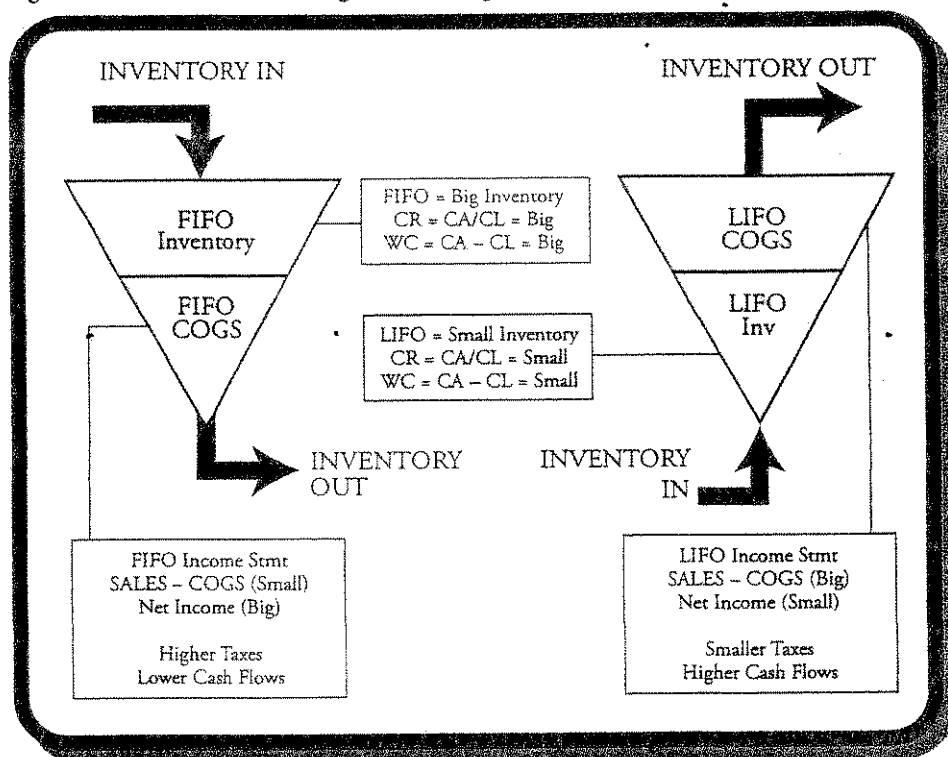
The Relationship Between LIFO and FIFO

During periods of rising prices, LIFO cost of goods sold is greater than FIFO cost of goods sold. Therefore, LIFO net income will be less than FIFO net income. Consistently, LIFO inventory is less than FIFO inventory because items remaining in inventory are taken to be those acquired earlier at lower prices. Average cost methods yield COGS, net income, and balance sheet inventory values between the other two.

This should make intuitive sense because during periods of rising prices, the last units purchased are more expensive. Under LIFO, the last in (more costly) is the first out (to cost of goods sold). This results in LIFO profitability ratios being smaller than under FIFO. When prices are rising, LIFO inventory is smaller than under FIFO, the firm's current ratio will be lower and inventory turnover will be higher.

If financial statements are compared for firms using different cost flow assumptions, then adjustments have to be made to achieve comparability. Consider the following diagram in Figure 7 to help you visualize the FIFO-LIFO difference during periods of *rising prices* and growing inventory levels. Remember, it's not that older or newer inventory items are being sold. The difference is only in the costs we assign to the units sold and those remaining in inventory.

Figure 7: LIFO and FIFO Diagram—Rising Prices and Growing Inventory Balances



During periods of rising prices, LIFO results in higher COGS, lower net income, and lower inventory levels. This decreases the current ratio (CA / CL) and increases inventory turnover ($COGS / \text{average inventory}$). If prices do not change, then the different inventory valuation methods do not affect the financial statements.

Professor's Note: For the exam, you should understand that if prices are decreasing (deflation), then the opposite relationships between FIFO and LIFO hold. Also, when you are finished with this review, please take the time to look at these graphs and relationships again to solidify the concepts in your mind.

By decreasing inventory to levels below normal levels, thus dipping into the old "cheap" inventory, a firm's management can increase profits for the period under LIFO. When this strategy is employed, COGS under LIFO

will be lower, and profits higher than if more inventory were purchased and inventory levels not drawn down. This is called a LIFO liquidation.

If there is LIFO liquidation (e.g., the firm sells more items than it purchased during the period), LIFO, COGS and, hence, income are distorted. COGS does not reflect current costs.

Most U.S. firms use LIFO on their statements because the Internal Revenue Code states that if firms use LIFO on their tax returns, they must use LIFO on their general-purpose statements. (This is an exception to the general rule that firms can use different methods in computing tax and financial income.) During the last forty years of rising prices, firms have saved money by using LIFO on their tax returns, since their reported net income is lower than if they had used FIFO. This results in the peculiar situation where *lower income is associated with a higher cash flow from operations*.

Usefulness of Inventory and Cost-of-Goods-Sold Data Provided by the LIFO, FIFO, and Average Cost Methods

Professor's Note: The presumption in this section is that inventory quantities are stable or increasing.

During periods of stable prices, all three inventory valuation processes will yield the same results for inventory, COGS, and earnings. During periods of changing prices, the key point to remember is that *FIFO will provide the most useful estimate of the inventory value and LIFO will provide the most useful estimate of the cost of goods sold*. This is a crucial point.

Inventory Value

When prices are changing, FIFO inventory costing provides the best balance sheet information on the value of inventory. If prices are steadily rising, FIFO inventory is valued at the more recent purchase prices, which are higher and provide a better estimate of the replacement value of the inventory. If prices are steadily falling, FIFO inventory valuation is still preferred from a balance sheet perspective, since the value of existing inventory is based on the new, lower replacement cost.

U.S. GAAP require that inventory be valued at the lower of cost or market (LCM), where “market” is usually taken to mean replacement cost. If replacement cost is falling, the usefulness of LIFO-based carrying values for inventory is improved by applying LCM. Without LCM and with price declines, LIFO inventory values will be high compared to economic value or replacement cost. When the LCM method is also applied, units of inventory acquired earlier, at higher cost, are revalued downward, reducing the overstatement in LIFO inventory carrying values. Since inventory carrying values are not revalued upward for changes in replacement cost, the usefulness of LIFO-based inventory values is not improved by the LCM adjustment during periods of rising prices. LCM cannot be used for tax purposes if the firm is using LIFO.

Cost of Goods Sold

By the same logic applied in the previous section, LIFO provides the better measure of the cost of goods sold when prices are either rising or falling. Viewing the firm as an ongoing concern, the economic profit is best approximated by using the replacement cost of inventory items. While LIFO inventory costing may fall short of this goal, it provides a better estimate of the replacement cost of goods sold than does FIFO. If prices are falling, inventory replacement cost is falling, and the most recently acquired inventory items will be closer to replacement cost than items purchased earlier. For calculating earnings, the FIFO cost of goods sold will overstate replacement cost. The same logic holds if prices are rising. LIFO costing will produce a cost of goods sold much closer to replacement cost than FIFO costing, which will understate the replacement cost and overstate income.

FIFO, LIFO, and average cost inventory accounting will all produce the same inventory value and COGS when prices are stable. When prices are changing, the average cost method will produce values of COGS and ending inventory between those of FIFO and LIFO.

The previous discussion assumes the value for purchases is known, but this too may be affected by management choice. For example, in a manufacturing business with raw materials, work in process, and finished goods inventories, the allocation of overhead such as rent, depreciation, supervisor salaries, maintenance expenses, and utilities to various classes of inventory is subject to management discretion.

At higher production levels, less of a particular fixed cost (such as factory rent) is allocated to each unit produced. However, if more units are produced than sold, then some of the allocated overhead ends up in ending inventory. If all the units produced were sold, then all of the fixed costs would be in COGS and expensed in the current period.

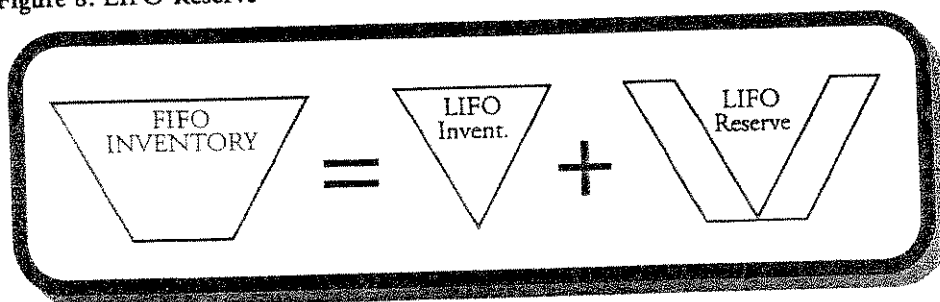
Firms may choose different inventory methods for different product lines, business segments, or geographical locations. FIFO inventory accounting is the primary method outside the United States. Information about inventory accounting methods should be available in the footnotes to financial statements and information is available that allows the analyst to restate financial statements using an alternative inventory accounting method.

LOS 40.b: Analyze the financial statements of companies using different inventory accounting methods to compare and describe the effect of the different methods on cost of goods sold and inventory balances, discuss how a company's choice of inventory accounting method affects other financial items such as income, cash flow, and working capital, and compute and describe the effects of the choice of inventory method on profitability, liquidity, activity, and solvency ratios.

Often, an analyst wants to compare a company to other companies in the same industry. When two companies use different methods of accounting for inventory, one of the firms' inventories must be adjusted in order to make the comparison relevant. There are two types of conversion: LIFO to FIFO and FIFO to LIFO.

The *LIFO to FIFO conversion* is relatively simple because U.S. GAAP require all companies that use LIFO to also report a *LIFO reserve*, which is the difference between what ending inventory would have been under FIFO accounting and its value under LIFO.

Figure 8: LIFO Reserve



$$\text{current cost of inventory (FIFO)} = \text{LIFO inventory} + \text{LIFO reserve.}$$

If you add the LIFO reserve to the LIFO inventory, you will get the FIFO inventory. An alternative expression is:

$$\text{LIFO reserve} = \text{FIFO inventory} - \text{LIFO inventory}$$

The LIFO reserve is typically shown in the footnotes to the financial statements.

To convert LIFO inventory balances to a FIFO basis, simply add the LIFO reserve to the LIFO inventory:

$$\text{Inv}_F = \text{Inv}_L + \text{LIFO reserve}$$

To convert COGS from LIFO to FIFO use the formula:

$$\begin{aligned}\text{COGS}_{\text{FIFO}} &= \text{COGS}_{\text{LIFO}} - \text{change in the LIFO reserve} \\ &= \text{COGS}_{\text{LIFO}} - (\text{LIFO reserve}_{\text{ENDING}} - \text{LIFO reserve}_{\text{BEGINNING}})\end{aligned}$$

Remember that during a period of rising prices $\text{COGS}_{\text{FIFO}}$ is too low (below replacement costs). Also the LIFO reserve is increasing when prices are rising. This increase in the LIFO reserve is exactly the difference between $\text{COGS}_{\text{LIFO}}$ and $\text{COGS}_{\text{FIFO}}$. During a period of falling prices we would still subtract the change in the LIFO reserve from $\text{COGS}_{\text{LIFO}}$ to get $\text{COGS}_{\text{FIFO}}$, but the change is a negative number and $\text{COGS}_{\text{FIFO}}$ will be the larger of the two measures.

We can derive the above relation by using the basic inventory equation:

$$\text{COGS}_{\text{FIFO}} = \text{purchases} + \text{BEG INV}_{\text{FIFO}} - \text{END INV}_{\text{FIFO}}$$

We know the relation between FIFO and LIFO inventory balances is:

$$\text{BEG INV}_{\text{FIFO}} = \text{BEG INV}_{\text{LIFO}} + \text{LIFO Reserve}_{\text{BEG}}$$

$$\text{END INV}_{\text{FIFO}} = \text{END INV}_{\text{LIFO}} + \text{LIFO Reserve}_{\text{END}}$$

Substituting we get:

$$\text{COGS}_{\text{FIFO}} = [\text{purchases} + \text{BEG INV}_{\text{LIFO}} - \text{END INV}_{\text{LIFO}}] - [\text{LIFO Reserve}_{\text{END}} - \text{LIFO Reserve}_{\text{BEG}}]$$

Which is:

$$\bullet \text{COGS}_{\text{FIFO}} = [\text{COGS}_{\text{LIFO}}] - [\text{change in LIFO reserve}], \text{ as previously shown}$$

Example: Converting from LIFO to FIFO

Sipowitz Company, which uses LIFO, reported end-of-year inventory balances of \$500 in 2005 and \$700 in 2006. The LIFO reserve was \$200 for 2005 and \$300 for 2006. COGS during 2006 was \$3,000. Convert 2006 ending inventory and COGS to a FIFO basis.

Answer:

Inventory:

$$\text{Inv}_F = \text{Inv}_L + \text{LIFO reserve} = \$700 + \$300 = \$1,000$$

COGS:

$$\begin{aligned}\text{COGS}_F &= \text{COGS}_L - (\text{LIFO reserve}_E - \text{LIFO reserve}_B) \\ &= \$3,000 - (\$300 - \$200) = \$2,900\end{aligned}$$

FIFO to LIFO conversions are typically not done for inventory, since inventory under LIFO is not a reflection of current value. However, it may be useful to consider what COGS would be under LIFO. The adjustment process is completely different than the process of converting COGS from LIFO to FIFO. There is no precise calculation; an analyst must estimate what the costs would have been under LIFO.

The estimate of COGS is equal to:

$$\text{COGS}_L = \text{COGS}_F + (\text{BI}_F \times \text{inflation rate})$$

The inflation rate should not be a general inflation rate for the economy but should be an inflation rate appropriate for the firm or industry. It can be determined two ways:

- Industry statistics.
- The increase in the LIFO reserve for another company in the same industry divided by that company's beginning inventory level converted to FIFO accounting.

An analyst can also estimate what the COGS would have been under the LIFO method for a company that uses the average cost method. The logic is that because the average cost method always reports inventory values and costs of goods sold *between* values reported under LIFO and FIFO, the adjustment for the COGS estimate should be half of the adjustment used for FIFO accounting:

$$\text{COGS}_L = \text{COGS}_W + 1/2 \times (\text{BI}_W \times \text{inflation rate})$$

where:

COGS_W = the COGS under the average cost method

BI_W = the beginning inventory under the average cost method

Example: FIFO to LIFO conversion

Logan Company is in the same industry as Sipowitz Company from the previous example. Logan uses FIFO accounting and has COGS of \$2,000, ending inventory of \$500, and beginning inventory of \$350. Estimate Logan's COGS under LIFO accounting.

Answer:

First estimate the inflation rate using data from Sipowitz. The increase in the LIFO reserve for Sipowitz is $\$300 - \$200 = \$100$. The beginning inventory converted to FIFO is $\$500 + \$200 = \$700$. That means the inflation rate is $\$100 / \$700 = 14.3\%$.

Now the estimate of COGS can be calculated as:

$$\text{COGS}_L = \text{COGS}_F + (\text{BI}_F \times \text{inflation rate}) = \$2,000 + (\$350 \times 14.3\%) = \$2,050$$

How a Company's Choice of Inventory Accounting Method Affects Other Financial Items

Professor's Note: The presumption in this section is that prices are rising and inventory quantities are stable or increasing. The implications when inventories or prices decline will be discussed later.

In the absence of taxes, there would be no difference in cash flow between LIFO and FIFO. With taxes, however, the higher LIFO COGS causes reported income to be lower, causing taxes (a cash cost) to also be lower. This causes cash flow to be higher. The U.S. tax code requires the same method of inventory accounting to be used in both GAAP and tax accounting. The results in periods of rising prices and stable or increasing inventory quantities are shown in Figure 9.

Figure 9: LIFO and FIFO Comparison—Rising Prices and Stable or Increasing Inventories

<i>LIFO results in...</i>	<i>FIFO results in...</i>
higher COGS	lower COGS
lower taxes	higher taxes
lower net income (EBT and EAT)	higher net income (EBT and EAT)
lower inventory balances	higher inventory balances
lower working capital (CA – CL)	higher working capital (CA – CL)
higher cash flows (less taxes paid out)	lower cash flows (more taxes paid out)

- With rising prices, LIFO is the best choice because it increases after-tax cash flow.
- LIFO firm liquidity measures are misleading because of the understatement of working capital (inventory too low).
- The analyst must be aware that FIFO firms will show higher net income (all else the same).

The effect of taxes is a real effect so that, during a period of rising prices, the choice of LIFO can increase firm value, although lower net income will be reported. In general, when prices are changing, an analyst should use *LIFO-based values for income statement items* and ratios, and *FIFO-based values for balance sheet items* and ratios because of the distortions described in the previous LOS.

The following example illustrates the difference between net income under the FIFO and LIFO methods.

Example: FIFO vs. LIFO and net income

Consider the assumptions in Figure 10.

Figure 10: Assumptions

Beginning inventory	50 units @ \$1.00	= \$50
Purchases:	100 purchased @ \$2.00 150 purchased @ \$3.00	= \$200 + 450 = \$650
Ending inventory	200 units	
Sales	100 units @\$7	

Suggestion: Keep track of the number of units	
Beginning	50
Purchased	+ 100
Purchased	+ 150
Sold	<u>- 100</u>
Ending	200

The COGS and inventory balances under FIFO and LIFO are shown in Figure 11.

Figure 11: COGS and Inventory

	<i>Cost of goods sold</i>	<i>Inventory</i>
FIFO	50 units @ \$1 + 50 @ \$2 = \$150	50 @ \$2 + 150 @ \$3 = \$550
LIFO	100 @ \$3 = \$300	50 @ \$1 + 100 @ \$2 + 50 @ \$3 = \$400

Net income is calculated as shown in Figure 12.

Figure 12: Net Income Under FIFO and LIFO

	FIFO	LIFO	LIFO lower by
Sales	\$700	\$700	\$0
Cost of goods sold	\$150	\$300	\$(150)
Income before tax	\$550	\$400	\$150
Tax @ 40%	\$220	\$160	\$60
Net income	\$330	\$240	\$90 ⇨ LIFO produces lower income.

With taxes \$60 higher under FIFO, cash flow will be \$60 lower.

Choice of Inventory Method and Profitability, Liquidity, Activity, and Solvency Ratios

Professor's Note: The presumption in this section is that prices are rising and inventory quantities are stable or increasing. The implications when inventories or prices decline are discussed later.

Since the choice of inventory accounting method has an impact on income statement and balance sheet items, it will have an impact on ratios as well. In general, *an analyst should use LIFO values when examining profitability or cost ratios and FIFO values when examining asset or equity ratios.*

Profitability

Compared to FIFO, LIFO produces COGS balances that are higher and are a better measure of true economic cost. Consequently, we have seen that LIFO produces income values that are lower than FIFO, and LIFO figures are a better measure of future profitability. Profitability ratios, such as gross margin and net profit margin, are lower under LIFO than under FIFO, and ratios calculated using LIFO figures are better for comparison purposes. For firms that use FIFO, income ratios should be recalculated using estimates of what COGS would be under LIFO.

Liquidity

Compared to LIFO, FIFO produces inventory figures that are higher and are a better measure of economic value. LIFO inventory figures use prices that are outdated and have less relevance to the economic value of inventory. Liquidity ratios, such as the current ratio, are higher under FIFO than under LIFO, and ratios calculated using FIFO figures are better for comparison purposes. For firms that use LIFO, liquidity ratios should be recalculated using inventory balances that have been restated using the LIFO reserve.

Activity

Inventory turnover makes little sense for firms using LIFO due to the mismatching of costs (the numerator is largely influenced by current or recent past prices, while the denominator is largely influenced by historical prices). Using LIFO when prices are rising causes the inventory turnover ratio to trend higher even if physical turnover does not change. FIFO-based inventory ratios are relatively unaffected by price changes and are a better approximation of actual turnover. However, the ratio itself can still be misleading because the numerator does not reflect COGS as well as LIFO accounting does. The preferred method of analysis is to use LIFO COGS and FIFO average inventory. In this way, current costs are matched in the numerator and denominator. This method is called the *current cost method*.

Some firms use an economic order quantity (EOQ) model to determine optimal inventory ordering policies. For these firms the level of sales will greatly influence inventory turnover; the lower the sales, the lower turnover will be. Some firms are adopting just-in-time inventory policies and keep no inventory (at most, very little) on hand. This results in very large inventory turnover ratios. For these firms, there would be virtually no differences due to the choice between the LIFO and FIFO methods.

LIFO firms tend to carry larger quantities of inventory than comparable FIFO firms. This can most likely be explained by the tax advantages (i.e., lower taxes due to higher COGS) of LIFO.

Solvency

FIFO produces higher inventory values that are more relevant than LIFO inventory values. To reconcile the balance sheet, stockholders' equity must also be adjusted by adding the LIFO reserve. Solvency ratios such as the debt ratio and debt-to-equity ratio will be lower under FIFO because the denominators are larger. For firms that use LIFO, equity, and therefore assets, should be increased by adding the LIFO reserve.

Professor's Note: It may seem inconsistent to use LIFO figures for net income and FIFO figures for stockholders' equity. Nonetheless, that is exactly what an analyst should do.

Example: Converting LIFO to FIFO

Figure 13 shows a balance sheet for a company for 2005 and 2006, along with its income statement for 2006.

Figure 13: Sample Balance Sheet

Year	2006	2005
Assets		
Cash	\$105	\$95
Receivables	205	195
Inventories	310	290
Total current assets	620	580
Gross property, plant, and equipment	\$1,800	\$1,700
Accumulated depreciation	360	340
Net property, plant, and equipment	1,440	1,360
Total assets	\$2,060	\$1,940
Liabilities		
Payables	\$110	\$90
Short-term debt	160	140
Current portion of long-term debt	55	45
Current liabilities	\$325	\$275
Long-term debt	\$610	\$690
Deferred taxes	105	95
Common stock	300	300
Additional paid in capital	400	400
Retained earnings	320	180
Common shareholders equity	1,020	880
Total liabilities and equity	\$2,060	\$1,940

Year	2006
Sales	\$4,000
Cost of goods sold	3,000
Gross profit	51,000
Operating expenses	650
Operating profit	350
Interest expense	50
Earnings before taxes	300
Taxes	100
Net income	200
Common dividends	\$60

* Footnote: The company uses the LIFO inventory cost-flow assumption to account for inventories. As compared to FIFO, inventories would have been \$100 higher in 2006 and \$90 higher in 2005.

Part A: Convert inventory for 2005 and 2006 and COGS for 2006 into FIFO.

Part B: Calculate the net profit margin, current ratio, inventory turnover, and long-term debt-to-equity ratio using the accounting figures that are most appropriate to compare to industry norms.

Answer:

Part A:

$$2005: \text{Inv}_F = \text{Inv}_L + \text{LIFO reserve} = 290 + 90 = 380$$

$$2006: \text{Inv}_F = \text{Inv}_L + \text{LIFO reserve} = 310 + 100 = 410$$

$$\text{COGS}_F = \text{COGS}_L - (\text{LIFO reserve}_E - \text{LIFO reserve}_B) = 3,000 - (100 - 90) = 2,990$$

Part B:

$$\text{net profit margin} = \frac{\text{net income under LIFO}}{\text{sales}} = \frac{200}{4,000} = 5.0\%$$

$$\text{current ratio} = \frac{\text{current assets under FIFO}}{\text{current liabilities}} = \frac{\text{current assets under LIFO} + \text{LIFO reserve}}{\text{current liabilities}} = \frac{620 + 100}{325} = 2.2$$

$$\text{inventory turnover} = \frac{\text{COGS under LIFO}}{\text{average inventory under FIFO}} = \frac{3,000}{\frac{(380 + 410)}{2}} = 7.6$$

$$\text{debt-to-equity} = \frac{\text{long-term debt}}{\text{equity under FIFO}} = \frac{\text{long-term debt}}{\text{equity under LIFO} + \text{LIFO reserve}} = \frac{610}{1,020 + 100} = 54.5\%$$

When calculating FIFO equity, we have added the entire LIFO reserve without any adjustment for taxes. Note the difference between the questions: What would retained earnings (COGS, net income) have been if the company had used FIFO instead of LIFO? and, How should an analyst adjust retained earnings (assets, equity) for a firm using LIFO to get more meaningful ratios for analysis? In the first case (assuming rising prices), if the firm had used FIFO, then earnings before tax, taxes, net income and retained earnings would all have been

higher. In the second case, we are not asking the effects of a different inventory accounting method, but are adjusting ratios to make them more meaningful. The fact that the LIFO firm has an artificially low inventory value is corrected by adding the LIFO reserve to both inventory and retained earnings (equity). Unless there is a reason to believe the firm will actually have a LIFO liquidation, there is no reason to subtract taxes that have been avoided in adjusting the inventory value, retained earnings, and stockholders' equity of LIFO firms.

LOS 40.c: Discuss the reasons that a LIFO reserve might decline during a given period and discuss the implications of such a decline for financial analysis.

The analysis above assumed that prices and inventory were stable or rising. Stable or rising prices and stable or increasing inventory quantities are a typical situation for a business. In these cases, the LIFO reserve will not decline. However, the *LIFO reserve will decline if*:

- Inventory quantity is falling.
- Prices are falling.

A **LIFO liquidation** refers to a declining inventory balance for a company using LIFO (i.e., units available for sale are declining). In this case, the prices for goods being sold are no longer recent prices and can be many years out of date. This would make COGS appear to be very low and gross and net profits to be artificially high. An analyst must adjust COGS for the decline in the LIFO reserve that is caused by the decline in inventory quantity. This amount is typically listed in the footnotes of the financial statements.

If *prices decline*, the differences in the values of inventory and COGS under LIFO and FIFO are the opposite of what was stated before. Specifically:

- If prices are declining, the value of inventory under FIFO will be lower than the value of inventory under LIFO (more recently purchased goods have a lower value relative to goods purchased earlier).
- If prices are declining, the COGS under LIFO will be lower than the COGS under FIFO.

However, even when prices decline, FIFO still provides a more accurate estimate of the economic value of inventory, and LIFO still provides a more accurate estimate of the economic COGS. The decline in the LIFO reserve does *not* mean COGS has to be adjusted if it occurs because of a price decline.

LOS 40.d: Discuss how inventories are reported in the financial statements and how the lower of cost or market principle is used and applied.

U.S. GAAP requires that inventories be reported on the financial statements using the lower of historical cost or market (LCM) principle. This is consistent with the broader accounting concept of conservatism as it will prevent the overstatement of inventories on the balance sheet (and the related income statement effects). Under normal circumstances, inventories are reported at historical cost, and even if market value is higher than historical cost, inventory is not written up above the historical cost. However, if the realizable market value or cost to replace inventory is less than historical cost, a writedown is required.

Inventory gains are not realized until items are sold, but losses prior to sale may be realized on the financial statements as they occur.

Cost is calculated using the actual purchase prices of the items, and the calculation follows one of the three cost-flow assumptions (FIFO, LIFO, or weighted-average) that were discussed earlier.

Market is calculated using the replacement cost of the inventory at a particular point in time. However, the replacement cost must fall within a range of values. The higher end of the range is the **net realizable value** (NRV). NRV is generally equal to the selling price of the inventories less the selling costs. The lower end is NRV less normal profit margin.

So if replacement cost is greater than NRV, then market = net realizable value. If replacement cost is less than NRV less a normal profit margin, then market = net realizable value minus normal profit margin.

Professor's Note: Think of lower of cost or "market" where market cannot be outside a range of values. That range is from net realizable value less a normal profit margin to net realizable value. So the size of this range is normal profit margin in dollars. "Net" means net of the selling costs.

KEY CONCEPTS

1. The three methods of accounting for inventory are FIFO, LIFO, and average cost, and the basic formula for inventory calculations is:

$$\text{ending inventory} = \text{beginning inventory} + \text{purchases} - \text{COGS}.$$
2. When prices are changing, FIFO provides the more useful estimate of inventory and balance sheet information, while LIFO provides the more useful estimate of COGS and operating income.
3. Adjusting LIFO inventory balances to FIFO balances requires adding the LIFO reserve to inventory; adjusting LIFO COGS to FIFO requires subtracting the difference between the ending and beginning LIFO reserve.
4. Adjusting FIFO COGS to LIFO requires estimating the inflation rate for the firm and adding the product of the inflation rate and the beginning inventory to the reported FIFO COGS.
5. In periods of rising prices and stable or increasing inventory quantities, LIFO and FIFO result in the following:

<i>LIFO results in:</i>	<i>FIFO results in:</i>
higher COGS	lower COGS
lower taxes	higher taxes
lower net income (EBT and EAT)	higher net income (EBT and EAT)
lower inventory balances	higher inventory balances
lower working capital	higher working capital
higher cash flows (less taxes paid out)	lower cash flows (more taxes paid out)
lower net and gross margins	higher net and gross margins
lower current ratio	higher current ratio
higher inventory turnover	lower inventory turnover
D/A and D/E higher	D/A and D/E lower

6. The LIFO reserve may decline because:
 - Inventory is falling (a LIFO liquidation)—adjust COGS for decrease in LIFO reserve.
 - Prices are declining—no need to adjust COGS for LIFO firms—FIFO still provides a better estimate of inventory value.
7. Under U.S. GAAP, inventory values are written down to replacement cost when that is lower than historical cost, or to NRV if that is lower than replacement cost, but not to less than NRV minus a normal profit margin in any case.

CONCEPT CHECKERS: ANALYSIS OF INVENTORIES

1. The choice of inventory accounting method has cash flow effects because it affects:
 - A. purchases.
 - B. sales.
 - C. taxes.
 - D. the turnover ratio.

2. An analyst gathered the following information about a company:

• Beginning inventory	\$40,000
• Purchases over the accounting period	\$55,000
• COGS	\$60,000

Ending inventory will be:

 - A. \$35,000.
 - B. \$45,000.
 - C. \$50,000.
 - D. cannot determine without knowing inventory method.

3. An analyst gathered the following information about a company:

• Beginning inventory	\$2.8 million
• Purchases	\$11.2 million
• Ending inventory	\$3.0 million

COGS is:

 - A. \$5.4 million.
 - B. \$5.8 million.
 - C. \$11 million.
 - D. \$14 million.

4. If COGS is overstated by \$2,000, and purchases and beginning inventory are correct, ending inventory will be:
 - A. unaffected.
 - B. understated by \$2,000.
 - C. overstated by \$2,000.
 - D. cannot determine without knowing inventory method.

5. If beginning inventory is overstated by \$2,000 and ending inventory is understated by \$3,000, the firm's before tax income will be:
 - A. overstated by \$1,000.
 - B. overstated by \$5,000.
 - C. understated by \$1,000.
 - D. understated by \$5,000.

6. An analyst gathered the following information about a firm:
- Beginning inventory \$15,000
 - Net purchases \$25,000
 - Ending inventory \$17,000
- COGS is:
- A. \$15,000.
 - B. \$23,000.
 - C. \$25,000.
 - D. \$27,000.
7. When a firm uses first in, first out (FIFO) accounting, COGS reflects the cost of items purchased:
- A. first and ending inventory reflects the value of the items purchased first.
 - B. first and ending inventory reflects the cost of the most recent purchases.
 - C. most recently and ending inventory reflects the cost of items purchased most recently.
 - D. most recently and ending inventory reflects the cost of items purchased first.

Use the following data to answer Questions 8 through 13.

<i>Purchase</i>	<i>Sales</i>
40 units at \$30	13 units at \$35
20 units at \$40	35 units at \$45
90 units at \$50	60 units at \$60

Assume beginning inventory was zero.

8. Inventory value at the end of the period using FIFO is:
 - A. \$1,200.
 - B. \$2,100.
 - C. \$2,400.
 - D. \$6,000.
9. Inventory value at the end of the period using LIFO is:
 - A. \$1,200.
 - B. \$1,280.
 - C. \$2,100.
 - D. \$2,400.
10. Using LIFO and information for the entire period, gross profit at the end of the period is:
 - A. \$360.
 - B. \$410.
 - C. \$990.
 - D. \$1,230.
11. Using FIFO and information for the entire period, gross profit is:
 - A. \$360.
 - B. \$410.
 - C. \$990.
 - D. \$1,230.

12. Inventory value at the end of the period using the weighted average method is:
A. \$1,540.
B. \$1,820.
C. \$2,100.
D. \$4,680.
13. Using the weighted average cost method for the entire period, gross profit at the end of period is:
A. \$950.
B. \$1,230.
C. \$2,100.
D. \$3,810.
14. During periods of rising prices and stable or increasing inventory levels:
A. LIFO COGS > weighted average COGS > FIFO COGS.
B. LIFO COGS < weighted average COGS < FIFO COGS.
C. LIFO COGS = weighted average COGS = FIFO COGS.
D. weighted average COGS > LIFO COGS > FIFO COGS.
15. During periods of falling prices:
A. LIFO income > weighted average income > FIFO income.
B. LIFO income < weighted average income < FIFO income.
C. LIFO income = weighted average income = FIFO income.
D. LIFO COGS < weighted average COGS > FIFO COGS.
16. From an analyst's perspective, inventories based on:
A. LIFO are preferable since they reflect historical cost.
B. FIFO are preferable since they reflect current cost.
C. weighted averages are preferable since they reflect normal results.
D. all three methods are equivalent because the equity account is unaffected by the accounting method.
17. From an analyst's perspective:
A. LIFO provides a better measure of current income because it allocates recent costs to COGS.
B. FIFO provides a better measure of current income because it allocates historical costs to COGS.
C. weighted average is best because it allocates average costs to COGS and requires no flow assumptions.
D. any method provides the same value because the equity account is unaffected by the accounting method.
18. In periods of rising prices and stable or increasing inventory quantities, LIFO (as compared to FIFO) results in:
A. lower COGS, higher taxes, lower net income, and lower cash flows.
B. lower COGS, higher taxes, lower inventory, and higher COGS.
C. higher COGS, lower taxes, lower inventory, and lower cash flows.
D. higher COGS, lower taxes, lower inventory, and higher cash flows.
19. If prices are rising and two firms are identical except for inventory methods, the firm using FIFO will have:
A. higher net income.
B. lower inventory.
C. lower net income.
D. higher total cash flow.

20. Which of the following is *likely* to occur under a LIFO liquidation?
 - A. An increase in the gross profit margin.
 - B. A sharp increase in inventory.
 - C. A sharp increase in accounts receivable.
 - D. All of the above.
21. In periods of falling prices, firms using FIFO will:
 - A. report higher earnings than equivalent firms using LIFO.
 - B. report lower earnings than equivalent firms using LIFO.
 - C. report identical earnings as equivalent firms using LIFO.
 - D. cannot tell without knowing the timing of the price decline.
22. Which of the following statements about inventory accounting is FALSE?
 - A. If a U.S. firm uses LIFO for tax reporting, it must use LIFO for financial reporting.
 - B. During periods of rising prices, LIFO income will be lower than FIFO income.
 - C. During periods of rising prices, LIFO cash flows will be higher than FIFO cash flows.
 - D. During periods of rising prices, FIFO-based current ratios will be smaller than LIFO-based current ratios.
23. An analyst is evaluating a company after a period of time when prices have fallen. The company uses LIFO accounting. Which of the following is TRUE?
 - A. The analyst must restate COGS because it is lower than what it would be under FIFO accounting.
 - B. Income will be lower than it would have been under FIFO accounting.
 - C. Inventory need not be restated because the LIFO reserve will have decreased.
 - D. COGS need not be restated because LIFO COGS is always an accurate measure of current cost as long as inventory quantity does not decline.
24. Assuming no LIFO layer liquidation, a LIFO firm reports higher net income than an otherwise identical FIFO firm. Prices must be:
 - A. steady.
 - B. rising.
 - C. falling.
 - D. falling first and then rising.
25. In periods of rising prices and stable or increasing inventory levels, compared to FIFO accounting for inventories, LIFO accounting will give:
 - A. lower profitability ratios.
 - B. lower inventory levels.
 - C. a lower current ratio.
 - D. all of the above.
26. If all else holds constant in periods of rising prices and inventory levels, which of the following statements is TRUE?
 - A. FIFO firms have higher debt-to-equity ratios than LIFO firms.
 - B. LIFO firms have higher gross profit margins than FIFO firms.
 - C. FIFO firms will have greater stockholder's equity than LIFO firms.
 - D. LIFO firms will have greater current asset balances than FIFO firms.

27. A firm uses LIFO for inventory accounting and reports the following:
- COGS \$125,000
 - Beginning inventory \$25,000
 - Ending inventory \$27,000
 - Footnotes to the financial statements reveal a beginning LIFO reserve of \$12,000 and an ending LIFO reserve of \$15,000.

The COGS on a FIFO basis is:

- A. \$122,000.
- B. \$125,000.
- C. \$128,000.
- D. \$140,000.

Use the following data to answer Questions 28 through 32.

The beginning of period LIFO reserve is \$50,000, and the ending period LIFO reserve is \$60,000. The firm's tax rate is 40%.

28. To adjust end-of-period LIFO inventory to FIFO inventory:
- A. add \$10,000.
 - B. subtract \$10,000.
 - C. add \$60,000.
 - D. subtract \$60,000.
29. To adjust end-of-period owner's equity in order to calculate the debt-to-equity ratio, an analyst should:
- A. make no adjustment.
 - B. add \$10,000.
 - C. add \$36,000.
 - D. add \$60,000.
30. To adjust end-of-period accounts payable from LIFO based to FIFO based:
- A. make no adjustment.
 - B. add \$24,000.
 - C. add \$36,000.
 - D. subtract \$36,000.
31. To adjust COGS from LIFO to FIFO, an analyst should adjust the LIFO COGS by:
- A. increasing it by \$60,000.
 - B. decreasing it by \$60,000.
 - C. increasing it by \$10,000.
 - D. decreasing it by \$10,000.
32. The effect on after-tax income of using FIFO instead of LIFO would be to:
- A. increase it by \$6,000.
 - B. decrease it by \$6,000.
 - C. increase it by \$10,000.
 - D. decrease it by \$10,000.

33. Which of the following statements concerning a firm using FIFO is FALSE?
- A. There is no reason to convert inventory to LIFO because LIFO inventory is less reflective of current value.
 - B. It is impossible to estimate COGS on a LIFO basis.
 - C. If prices are rising and inventory levels are stable, the firm will have higher inventory than a firm using LIFO.
 - D. If prices have been rising and the firm is located in the U.S., taxes would be lower under LIFO than under FIFO.
34. A firm's financial statements were prepared using LIFO. What accounts should be adjusted when the financial statements are restated for the purpose of comparing ratios to industry averages?
- A. Net income.
 - B. Accounts receivable.
 - C. Long-term debt.
 - D. Stockholders' equity.
35. Three analysts are debating about the inflation rate that should be used to adjust a firm's COGS, which was reported using FIFO, to a LIFO basis. The first states that they should use the inflation rate for the economy. The second states that they should use an inflation rate derived from a competitor's LIFO reserve calculations. The third states that they should use figures derived for the industry by a trade association. Which of the three are valid?
- A. First only.
 - B. Third only.
 - C. First and the third.
 - D. Second and the third.
36. Kamp Inc. sells specialized bicycle shoes. At year-end, due to a sudden increase in manufacturing costs, the replacement cost per pair of shoes is \$55. The historical cost is \$43, and the current selling price is \$50. The normal profit margin is 10% of the selling price, and the selling costs are \$3 per pair.
- At which of the following amounts should each pair of shoes be recorded on Kamp's year-end balance sheet?
- A. \$42.
 - B. \$43.
 - C. \$47.
 - D. \$55.

ANSWERS – CONCEPT CHECKERS: ANALYSIS OF INVENTORIES

1. C The choice of inventory accounting method flows through the income statement to ultimately affect taxes.
2. A Beginning inventory + purchases – COGS = \$40,000 + \$55,000 – \$60,000 = \$35,000
3. C Purchases + beginning inventory – ending inventory = \$11.2 + \$2.8 – \$3 = \$11
4. B If COGS is overstated, ending inventory must be understated.
5. D Overstated beginning inventory coupled with understated ending inventory implies that COGS is overstated by \$5,000. If COGS is overstated, income will be understated.
6. B Purchases + beginning inventory – ending inventory = \$25,000 + \$15,000 – \$17,000 = \$23,000
7. B COGS reflects the items purchased first in FIFO accounting. Remember, first in, first out.
8. B 108 units were sold (13 + 35 + 60), and 150 units were available for sale (beginning inventory of 0 plus purchases of 40 + 20 + 90), so there are 150 – 108 = 42 units in ending inventory. Under FIFO, units from the last batch purchased would remain: 42 × \$50 = \$2,100.
9. B Under LIFO, the first 42 units purchased would be in inventory: (40 × \$30) + (2 × \$40) = \$1,280.
10. B Revenue = (13 × \$35) + (35 × \$45) + (60 × \$60) = \$5,630
Purchases = (40 × \$30) + (20 × \$40) + (90 × \$50) = \$6,500
COGS = purchases + beginning inventory – ending inventory = 6,500 + 0 – 1,280 = \$5,220
Gross profit = \$5,630 – \$5,220 = \$410
11. D COGS = purchases + beginning inventory – ending inventory = 6,500 + 0 – 2,100 = \$4,400
Gross profit = \$5,630 – \$4,400 = \$1,230
12. B The average cost of inventory is [(40 × \$30) + (20 × \$40) + (90 × \$50)] / (40 + 20 + 90) = \$43.33
Inventory value = \$43.33 × 42 units = \$1,820
13. A COGS = 43.33 × 108 = 4,680
Gross profit = \$5,630 – \$4,680 = \$950
14. A Weighted average COGS will be always be in the middle of FIFO and LIFO whether prices are rising or falling. If prices are rising, LIFO COGS will be the highest because the most recent goods produced go to COGS.
15. A LIFO COGS will be the lowest of the three methods when prices are falling. That means LIFO income will be the highest.
16. B With FIFO, older inventory is sold first, so current inventory is a better reflection of the current cost it would take to replace that inventory.
17. A Analysts prefer LIFO for the income statement because the COGS is current.
18. D With rising prices, LIFO results in higher COGS. Higher costs mean lower income; lower income means lower taxes; and lower taxes mean higher cash flow.
19. A Firms using FIFO will have lower COGS, which means they will have higher net income when compared to a firm using LIFO when prices are rising.
20. A COGS per unit decline and profit margins increase.
21. B Falling prices for a firm using FIFO mean older, more expensive goods are going to COGS, thus lowering net income.

22. D If prices are rising, FIFO inventories will be higher. Because inventory is a current asset, this will result in a higher current ratio than firms using LIFO.
23. D LIFO COGS is the better measure of economic cost as long as inventory levels have not declined.
24. C If the LIFO firm is reporting higher net income, prices must be falling.
25. D With rising prices, all of the answers apply to LIFO compared to FIFO.
26. C All else equal, the FIFO firm has a higher level of assets due to the higher inventory. Since liabilities are assumed to be equal to total assets, the FIFO must have higher equity to finance those assets.
27. A $\text{FIFO COGS} = \text{LIFO COGS} - (\text{ending LIFO reserve} - \text{beginning LIFO reserve}) = \$125,000 - (\$15,000 - \$12,000) = \$122,000$
28. C LIFO inventory is lower than FIFO, so add the LIFO reserve.
29. D Retained earnings must be increased by LIFO reserve, \$60,000. No tax adjustment is necessary here.
30. A Accounts payable are not affected by inventory accounting methods.
31. D Decrease LIFO COGS by the change in the LIFO reserve.
32. A Because costs decrease by \$10,000, pretax income would increase by \$10,000, and after-tax net income would increase by \$6,000. The change in LIFO reserve, +\$10,000, times $(1 - 0.4) = \$6,000$.
33. B Costs can be estimated by adding the inflation rate multiplied by the beginning inventory.
34. D Inventory would increase, which means assets would increase, which means equity would increase to keep the balance sheet in balance.
35. D Either the change in a competitor's LIFO reserve as a percentage of BI_{FIFO} or industry statistics can be used to estimate the inflation rate.
36. B Market is equal to the replacement cost subject to replacement cost being within a specific range. The upper bound is net realizable value (NRV), which is equal to selling price (\$50) less selling costs (\$3) for an NRV of \$47. The lower bound is NRV (\$47) less normal profit (10% of selling price = \$5) for a net amount of \$42. Since replacement cost (\$55) is greater than NRV (\$47), market equals NRV (\$47). Additionally, we have to use the lower of cost (\$43) or market (\$47) principle, so the shoes should be recorded at the cost of \$43.

LONG-TERM ASSETS

Study Session 9

EXAM FOCUS

Long-term assets have a useful life of greater than one year and are used for production of the company's goods or services. The key to this topic review is recognizing how costs for long-term assets are allocated according to the matching principle (reporting expenses in the same period as the revenues earned as a result of those expenses). Depreciation, the

process of allocating the cost of an asset to expense over time, can be done in a number of different ways depending on how rapidly or slowly a company wants to write off the asset's cost. For the Level I exam, candidates should be prepared for questions requiring depreciation of an asset using any of the different methods.

LOS 41.a: Describe the factors that distinguish long-term assets from other assets and identify the common types of long-term assets and how carrying value is determined on the balance sheet.

A **long-term asset** is an asset that is typically employed in the production process of the firm and has a useful life of greater than one year. Long-term assets are not made available for sale to the firm's customers (i.e., they do not represent inventory for sale).

Long-term assets are classified in three main categories:

- *Tangible assets* have a physical existence. Examples include land, buildings, and equipment. The process of allocating the cost of a tangible asset over its useful life is called *depreciation*.
- *Natural resources* are purchased for the economic value that can be taken from the Earth and used up over time. Examples include oil fields, timberland, and mines. The process of allocating the cost of a natural resource according to its use (e.g., cutting timber, pumping oil) is called *depletion*.
- *Intangible assets* have no physical existence, but have a value that is based on rights or advantages that are conferred to the owner. Examples include copyrights, patents, trademarks, franchises, and goodwill. The cost of most intangible assets is allocated to the periods over which it provides benefits through a process called *amortization*.

Professor's Note: Goodwill is an intangible asset that is not amortized under U.S. GAAP. We will discuss accounting for goodwill later in this topic review.

Long-term assets are generally reported at their **carrying value** or **book value** (that is, historical cost less accumulated depreciation or depletion). If, however, the asset has lost its revenue-generating ability, its book value may be reduced. This is referred to as *asset impairment*, in which case the amount of the write-down is recorded as a loss.

The decision to acquire long-term assets is based on some type of present value analysis in which the present value of the asset's cash inflows is compared to the present value of the asset's cash outflows (e.g., initial outlay).

The following are accounting issues pertaining to long-term assets:

- How to spread the cost over the useful life.
- How to represent the remaining value of the asset each period on the balance sheet.

PROPERTY, PLANT, AND EQUIPMENT (PP&E)

A *plant asset* is a tangible asset that is fixed or permanent. Property, plant, and equipment (PP&E) assets are long-lived tangible assets *used in the production or sale of other assets*.

- PP&E versus other assets:
- PP&E assets' long lives distinguish them from prepaid expenses and other current assets. PP&E assets are used and not sold (like inventory) during the business's regular course of operations.
- PP&E assets are not ultimately sold as would be done with interest or dividend-generating investments. PP&E assets' tangible physical existence differentiates them from intangible assets.
- The primary difference between plant assets and inventory is that plant assets are held to be used in operations, whereas inventory is held to be sold.
- The primary difference between plant assets and current assets, in general, is their useful lives.
- The primary difference between plant assets and long-term investments is that plant assets are used in the operations of the business.

LOS 41.b: Determine the costs that are capitalized to property, plant and equipment and determine which costs are expensed as incurred.

The **cost of plant assets** includes all expenditures (e.g., transportation of the asset, insurance while the asset is transported, installation cost, search cost, broker cost, and legal fees to transfer title) that are necessary to acquire the assets and ready them for use. All these expenditures are made prior to (and are necessary for) placing the asset in service.

If the plant is constructed, capitalized costs (added to the purchase cost of the asset) include materials, labor, reasonable amounts of overhead, interest cost during the construction period, and architectural fees.

Included in the cost of land are expenditures such as search cost, real estate commissions, title transfer fees, back property taxes paid, surveying, and landscaping costs.

Examples of costs that would be expensed as incurred, rather than capitalized and depreciated over time are:

- Cost to repair damage during installation.
- Cost to train employees to operate new equipment.
- Interest costs related to the *purchase*, rather than construction, of an asset (these are operating costs).
- Routine and normal maintenance.
- Items of little cost, such as a stapler or coffee pot, will be expensed as "supplies."

LOS 41.c: Explain depreciation accounting (including the reasons for depreciation), calculate depreciation using the straight-line, production (also known as units-of-production), and declining-balance methods, and calculate depreciation after revising the estimated useful life of an asset.

Depreciation is used to allocate the cost of an asset over a period of time. *Depreciation expense* is the amount of this allocation for a given period.

Land represents space for production facilities (real estate) and is not depreciated. Land remains valued at its original cost.

Plant and equipment, however, have limited lives due to wear and tear and/or obsolescence. Because of this, plant and equipment costs must be allocated to expense over the plant and equipment's estimated economic life.

The **straight-line method** allocates the depreciable cost of an asset evenly over the asset's estimated useful economic life. The following is an example of the straight-line method of calculating depreciation.

- A machine has a historical cost of \$12,000.
- The estimated useful life is ten years.
- After ten years, the machine will have an estimated salvage value of \$2,000.
- Cost less salvage value equals the depreciable value (\$12,000 – \$2,000 = \$10,000).

The straight-line depreciation method results in equal depreciation expense each year over the equipment's 10-year life:

$$\text{straight-line depreciation} = \frac{\text{cost} - \text{salvage value}}{\text{useful life}} = \frac{\$12,000 - 2,000}{10} = \$1,000 \text{ per year}$$

After three years of use (accumulated depreciation is \$3,000), the determination is made that the machine can only be used for two more years. To revise the depreciation schedule, the net book value of the machine (\$12,000 – \$3,000 = \$9,000) less the salvage value of \$2,000 will be depreciated over the remaining two years of useful life:

$$\text{straight-line depreciation} = \frac{\text{net book value} - \text{salvage value}}{\text{useful life}} = \frac{\$9,000 - 2,000}{2} = \$3,500 \text{ per year}$$

The production (units-of-production) method allocates the depreciable cost of the asset as a function of the asset's use rather than time. The following is an example of the units-of-production method of calculating depreciation.

- A truck costs \$920,000.
- It has an estimated life of 300,000 miles.
- Salvage value is \$20,000.
- Cost of the truck per mile driven is:

$$\text{depreciation} = \frac{\text{cost} - \text{salvage value}}{\text{estimated miles}} = \frac{\$920,000 - 20,000}{300,000} = \$3.00 \text{ per mile}$$

If the truck is driven for 50,000 miles in year 1, the units-of-production depreciation expense is:

$$\text{depreciation} = (\text{miles driven})(\text{depreciation per mile}) = (50,000 \text{ miles})(\$3.00 \text{ per mile}) = \$150,000$$

Accelerated depreciation speeds up the recognition of depreciation expense in a systematic way so that more depreciation expense is recognized in the earlier years of the asset's life and less is recognized later in the asset's life. Total depreciation expense, however, over the life of the asset will be the same as with straight-line depreciation.

The **declining balance method** (DB) is a method that requires applying a constant rate to a declining book value. The most common declining balance method is the *double declining balance method* (DDB), which uses 200% of the straight-line rate as the rate applied against the declining balance. If an asset's life is 10 years, the straight-line rate is 1/10 or 10%. The DDB rate for this asset is 2/10 or 20%.

$$\text{DDB depreciation} = \left(\frac{2}{\text{useful life}} \right) (\text{cost} - \text{accumulated depreciation})$$

DB does not explicitly use the salvage value in calculations, but depreciation expense will be halted when the cost less salvage value has been depreciated.

The following is an example of declining balance depreciation.

- A machine is purchased on January 1 of year 1 for a cost of \$12,000.
- The estimated useful life is five years.
- Estimated salvage value is \$2,000.

The depreciation expense using the double declining balance method is:

- Year 1: $(2 / 5)(\$12,000 - 0) = \$4,800.00$
- Year 2: $(2 / 5)(\$12,000 - \$4,800) = \$2,880.00$
- Year 3: $(2 / 5)(\$12,000 - \$7,680) = \$1,728.00$

In years 1 through 3, the company has recognized cumulative depreciation expense of \$9,408. Since the total depreciation expense is \$10,000 (\$12,000 – \$2,000 salvage value), the depreciation in year 4 is limited to \$592, rather than the $(2 / 5)(\$12,000 - \$9,408) = \$1,036.80$ using the DDB formula.

Year 5: Depreciation expense is \$0 since the asset is fully depreciated to salvage value.

Note that the rate of depreciation is doubled (2/5) from straight-line, and the only thing that changes from year to year is the base amount upon which depreciation is calculated.

Professor's Note: We've been discussing the "double" declining balance method, which uses a factor of 2 times the straight-line rate. The general method is that of declining balance, and you can compute declining balance depreciation based on any factor, double, 1.5, triple, etc.

LOS 41.d: Describe how to account for the sale, exchange, or disposal of depreciable assets, and determine whether a gain or loss is recorded.

Assets that are worn out or no longer useful may be discarded, sold, or exchanged for another asset.

When an asset is sold or discarded, its market value at the time of sale or disposal will most likely be different from the asset's *book value*. The book value of an asset is equal to its original historical cost minus all accumulated depreciation (including depreciation for partial years) on that asset.

- *Discarded assets* are simply disposed of and the firm receives nothing in return. The market value for the asset is zero. If the asset has been depreciated to zero before being discarded, no gain or loss is recorded. However, if the asset has any remaining book value at the time of disposal, the book value amount is recognized as a *realized loss* on the income statement. When the asset is disposed of, all records of the asset must be removed from the balance sheet.
- When an *asset is sold*, the firm receives a cash payment in exchange for the asset. The asset's book value is compared to the sale price and any difference is recognized as a *realized gain or loss* on the income statement. Please note that realized gains and losses are *always* posted to the income statement.

Example: Asset sold for cash

The Toft Company purchased an automobile three years ago for \$20,000, and its accountants have booked \$12,000 of depreciation against the auto (i.e., using straight-line depreciation methods with zero assumed salvage value, the accountants recorded depreciation expense of \$4,000 each year and increased accumulated depreciation by that same amount). Today, the *book value* of the auto is $\$8,000 = \$20,000 - \$12,000$.

The Toft Company decides to sell this automobile and is able to get \$10,000 for it. The entries that take place upon the sale of the asset are an increase in cash of \$10,000, the removal of accumulated depreciation on the asset (reduced by \$12,000), and the reduction of PPE by the \$20,000 historical asset cost. The \$2,000 excess of the sale price (\$10,000) over the net book value (\$8,000) is recorded as a gain and added to income as “other revenues and expenses.”

Firms also dispose of assets by **exchanging assets** for credit toward the purchase of other (typically newer) assets. If the trade-in allowance received is greater than the book value of the asset being disposed of, the result is a gain; if the trade-in allowance is less than the book value, the result is a loss.

The key to accounting for asset exchanges is whether the asset is being exchanged for a *similar asset* (e.g., a new model of a printing press), or a *dissimilar asset* (e.g., exchanging a printing press for a grain silo).

For financial accounting purposes:

- For exchanges of dissimilar assets, both gains and losses are recognized on the income statement.
- For similar assets, only losses are recognized. If a “gain” results from the exchange of similar assets, the book value of the old asset (which is lower than the trade-in allowance) is added to the cash paid to determine the recorded cost of the new asset. This will result in a lower cost basis than would have been recorded for the new asset if the whole trade-in allowance was added to cash paid. The “gain” is thus effectively postponed until the new asset is sold or disposed of.

For income tax purposes:

- For exchanges of dissimilar assets, both gains and losses are recognized on the income statement.
- For exchanges of similar assets, no gains or losses are recognized. Gains or losses are effectively postponed to future periods.

LOS 41.e: Identify assets that should be classified as natural resources, determine their carrying values on the balance sheet and calculate depletion.

Natural resources, also known as *wasting assets*, are assets such as timberlands, oil fields, and mineral deposits. Natural resource assets become inventory through the process of cutting timber, pumping oil, or mining for ore. As the resource is extracted from the asset, the carrying value of the asset should be reduced proportionately.

The cost of natural resources is allocated based on units-of-production and is referred to as *depletion*. The amount of depletion in a given period is determined using the units-of-production method.

Example: Depletion

Suppose a firm acquired mineral rights for \$1.5 million. And suppose that it is estimated that the mineral deposits will produce 100,000 tons of ore. If 10,000 tons were extracted during the period, 1/10 of the cost is allocated to this period. The entries to record the depletion are the recognition of depletion expense of \$150,000 on the income statement and an increase of \$150,000 in accumulated depletion on the balance sheet. The carrying value is simply cost minus accumulated depreciation. $\$1,500,000 - \$150,000 = \$1,350,000$ is the carrying value after one year.

LOS 41.f: Identify the types of intangible assets and describe how the accounting treatment for goodwill under U.S. GAAP differs from the accounting treatment for other intangible assets.

Intangible assets have no physical existence, but legal rights confer benefits to the assets' owners. Intangible assets are distinguished from other assets that are classified as current assets (e.g., receivables) because intangibles are investments that are used in operations (e.g., produce products or provide services).

Examples of intangible assets include:

- Trademarks or brand names.
- Copyrights.
- Patents.
- Licenses or franchises.
- Leaseholds or leasehold improvements.
- Technology.
- Non-compete covenants.

Typically, intangible assets are only recorded on the balance sheet when they are purchased from another firm. All costs for developing intangible assets internally are expensed as incurred.

When a company acquires an intangible asset (e.g., buys a patent), an asset is created by debiting the asset account for the acquisition cost. The cost of intangible assets is allocated over the life of the asset (e.g., as prescribed by law) or an estimated life—which typically does not exceed 40 years. This allocation process is referred to as *amortization*. Amortization of intangibles uses the straight-line method.

Example: Amortization of intangibles

Suppose a firm acquired a patent for \$1.5 million. And suppose that the patent was determined to have a useful life of 15 years. The entries to record the amortization are an amortization expense of \$100,000 on the income statement and an increase of \$100,000 in accumulated amortization on the balance sheet.

Professor's Note: Internally developed computer software is an exception to the rule that only intangible assets purchased from another firm are recognized on the balance sheet. Once the software is determined to be technologically feasible, development costs are recorded as an asset and amortized over the software's economic life.

Goodwill is created when a firm purchasing another business pays more than the fair market value of the business's assets if they were purchased individually. If the excess purchase price cannot be attributed to patents, brands, copyrights, or other intangible assets, it is recorded as goodwill. Goodwill reflects the factors that enable a company to earn an above average rate of return such as strong management, manufacturing efficiency, and customer approval.

The process of accounting for goodwill is different from the process for other intangible assets. According to U.S. GAAP, goodwill is not amortized, but is subject to an *annual impairment review*. Each year, a company must estimate the fair market value of its goodwill. If the fair market value is less than the carrying value on the balance sheet, the goodwill is said to be *impaired*. If impairment occurs, the carrying value of the goodwill account is reduced to its fair market value and an impairment charge is recorded on the income statement.

KEY CONCEPTS

1. Long-term assets are used to produce items for resale and have a useful life of greater than one year.
2. The cost of plant assets includes all expenditures necessary to place the asset into service that are made prior to placing the asset in service.
3. The cost of an asset is allocated over time through depreciation. Three main methods are straight-line, units-of-production, and declining-balance.
4. When assets are sold or discarded, a realized gain or loss may result. The gain or loss is equal to sale proceeds minus book (carrying) value.
5. For natural resources, the units-of-production method is the most appropriate method to use because natural resources are depleted as used.
6. Intangible assets do not have a physical existence but they do produce benefits to the assets' owners.

CONCEPT CHECKERS: LONG-TERM ASSETS

1. A trademark is an example of a(n):
 - A. capital asset.
 - B. intangible asset.
 - C. natural resource.
 - D. tangible asset.
2. Which of the following items is NOT included in the cost of purchased plant assets?
 - A. Broker fees.
 - B. Installation costs.
 - C. Title transfer charges.
 - D. Allocated overhead amounts.
3. Rocco Inc. purchases a manufacturing capital asset for a cost of \$170,000. Included in the cost is an amount of \$10,000 relating to the installation. The useful life of the asset is 10 years and the estimated salvage value at the end of 10 years is \$20,000.

Which of the following amounts represents the *difference* between the straight-line and the double-declining methods with regard to calculating Rocco's depreciation expense for the asset in the first year?

- A. \$15,000.
 - B. \$17,000.
 - C. \$19,000.
 - D. \$20,000.
4. Sicsic Music Studios purchased a high-end copier/scanner at a total cost of \$30,000. Estimated useful life and salvage value are 10 years and \$6,000, respectively. After exactly four years, the machine was sold for \$17,000 cash. Sicsic uses the straight-line method of depreciation.

Which of the following amounts represents the gain or loss that Sicsic should record on the exchange?

- A. Loss of \$1,000.
 - B. Gain of \$1,000.
 - C. Loss of \$3,400.
 - D. Gain of \$3,400.
5. Slocan Inc. acquired logging rights at a cost of \$2 million five years ago. The rights allow Slocan to cut down a total of 1 million trees. Slocan has been cutting down trees at a steady rate of 50,000 trees per year.

With regards to the logging rights, which of the following financial statement accounts and amounts is **CORRECT**?

- A. Accumulated depletion or depreciation = \$1.5 million.
 - B. Depletion expense for the year = \$0.5 million.
 - C. Depreciation expense for the year = \$0.5 million.
 - D. Natural resources = \$1.5 million.

6. Three years ago, Nora Inc. developed a breakthrough pharmaceutical drug to treat stroke patients. At that time, it obtained a patent for the drug, which had a legal life of 17 years. However, management at Nora was well aware that the useful life of the patent was five years. Total development costs were \$3.4 million.

According to U.S. GAAP, which of the following is the amount at which Nora should carry the development costs for the patent on its balance sheet?

- A. \$0.
B. \$1.36 million.
C. \$2.04 million.
D. \$2.8 million.
7. Apex Gold has purchased mining rights for \$3 million on a property that it estimates has 6,000 tons of recoverable ore. In the third year of operation Apex removes 800 tons of ore, bringing the total ore extraction to 4,000 tons. The depletion in the third year and carrying value of the mineral rights asset at the end of the third year are closest to:

<u>Depletion</u>	<u>Carrying Value</u>
A. \$315,000	\$2,600,000
B. \$315,000	\$1,000,000
C. \$400,000	\$2,600,000
D. \$400,000	\$1,000,000

ANSWERS – CONCEPT CHECKERS: LONG-TERM ASSETS

1. B Intangible assets are those that cannot be seen or touched (have no physical existence). The value of them is based on rights or advantages conferred to the owner. A trademark (e.g., CFA) clearly demonstrates those qualities so it is a good example of an intangible asset.
2. D Allocated overhead amounts are only considered in the cost if the plant assets are *constructed*. They are not included in the cost of plant assets that are purchased.
3. C Depreciation expense under the straight-line method: $(170,000 - 20,000) / 10 = \$15,000$
Depreciation expense under the double declining-balance method: $(2/10) \times 170,000 = \$34,000$
Difference = $34,000 - 15,000 = \$19,000$
4. C Annual depreciation = $(30,000 - 6,000) / 10 = \$2,400$
Accumulated depreciation for four years = $4 \times 2,400 = \$9,600$
Book value after four years = $30,000 - 9,600 = \$20,400$
Sale proceeds = $\$17,000$
Loss = Sale proceeds – Book value = $17,000 - 20,400 = (\$3,400)$
5. D Annual depletion = $50,000 / 1,000,000 = 5\%$
Depletion expense for the year = $5\% \times 2,000,000 = \$100,000$
Accumulated depletion for five years = $5 \times 100,000 = \$500,000$
Natural resources = cost – accumulated depletion = $2,000,000 - 500,000 = \$1,500,000$
6. A The patent in this situation is an example of an internally-generated intangible asset. Therefore, all costs for the development should be expensed as incurred so that nothing is recorded on the balance sheet. The actual expenditures for legally registering the patent can be capitalized.
7. D Third year depletion is: $\frac{800}{6,000} \times 3 \text{ million} = \$400,000$
Carrying value is: $3 \text{ million} (1 - \frac{4,000}{6,000}) = \1.0 million

ANALYSIS OF LONG-LIVED ASSETS: PART I – THE CAPITALIZATION DECISION

Study Session 9

EXAM FOCUS

Firms must decide to either expense (write off immediately) or capitalize (place on the balance sheet) the costs of acquiring an asset. The decision is typically based on the longevity of the asset in accordance with the matching principle discussed earlier. For the Level 1 exam, know that the expensing versus capitalizing decision affects financial statement components and ratios. Typically, firms that capitalize

costs will have smoother net income, higher profitability in early years (lower in later years), higher cash flows from operations, lower cash flows from investing, and lower leverage ratios. Candidates should understand the circumstances and financial statement effects of capitalizing expenses in general, interest costs during construction, and intangible assets.

LOS 42.a: Compute and describe the effects of capitalizing versus expensing on net income, shareholders' equity, cash flow from operations, and financial ratios including the effect on the interest coverage ratio (times interest earned) of capitalizing interest costs.

The costs (cash price plus all necessary expenditures made before an asset is ready for use) of acquiring resources that provide services over more than one operating cycle are capitalized and carried as assets on the balance sheet. The decision to **capitalize** or **expense** some items depends on management choices, and is subject to manipulation. These choices may affect the balance sheet, income statement, cash flow statement, and related financial ratios for the current period as well as over the life of the asset. When correctly employed, capitalization of expenses allows better matching of revenues with the expenses incurred to generate those revenues.

Issues that arise in capitalization include:

- Which components of cost are capitalized (e.g., interest charges, R&D).
- What method should be used to determine the amount capitalized.

Statement of Financial Accounting Concepts (SFAC) 6 defines accounting assets as those assets that provide probable future economic benefits. However, for the purpose of analysis the term "asset" may represent:

- The initial investment outlays.
- Those parts of a firm that represent "wealth."
- One of the inputs in the production function.

Depending on the purpose of the analysis, the firm's assets may be evaluated by looking at:

- Profitability [by return on assets (ROA)].
- Solvency (protection for creditors).
- Operating efficiency and operating leverage.

Different types of analysis may require asset definitions different from those found in the accounting rules. For example, machinery acquired under an operating lease is not recognized as an asset on the balance sheet, but its recognition as an asset may be appropriate in security analysis. Research and development and advertising expenditures may provide future services, but are expensed when incurred and not recognized as an asset under accounting practices.

How Capitalization Affects Financial Statements and Ratios

The effects of capitalizing expenses on financial statements and ratios stem from the fact that capitalizing reduces current period expenses by the amount capitalized. The amount of capitalized expenses is added to assets, and the related cash flow is treated as an investing cash flow rather than an operating cash flow. The decision to capitalize expenses does not affect debt. Capitalizing expenses will increase equity, by increasing net income and retained earnings in the current period, and increase assets, because of the addition of the capitalized amount. The asset created by capitalizing expenses will be amortized—that is, the capitalized expenses will be spread over a period of years. The asset value is reduced by amortization each year, similar to depreciation of plant and equipment.

Financial statement effects. Although it may make no operational difference, the choice between capitalizing or expensing will affect reported income, cash flow from operations, and leverage ratios. Companies that capitalize expenses will show higher asset balances, greater cash flow from operations and lower cash flow from investing. The capitalized expense is classified as an investing cash flow, rather than as an operating cash flow.

Income variability. Firms that capitalize costs and depreciate them over time *will show smoother reported income*. Firms that expense costs will tend to have greater variance in reported income. The expenditures that are candidates for capitalization are large in magnitude and tend to vary widely from year to year. When these amounts are expensed instead of capitalized, their variability causes a high degree of variability in net income.

Profitability. In the year in which an expense is capitalized, companies that capitalize expenses have higher profitability measures than expensing companies. When a company expenses large purchases, this decreases income. In later years, net income, ROA and ROE will be lower for a company that capitalizes, because profits in later years will be lower than for expensing firms due to continuing depreciation, and because assets will be higher by the capitalized amount. Firms that expense have lower asset levels (and because of this, lower equity levels), so ROA and ROE will typically be higher over time than for firms that capitalize.

Cash flow from operations. Although *net* cash flows are not affected by the choice of capitalization or expensing (ignoring tax effects), the components of cash flow are affected. Because a firm that capitalizes outlays classifies those expenditures as investing cash flows, *cash flow from operations will be higher and investing cash flows will be lower* than that of a firm that expenses.

Leverage ratios. Capitalizing firms have higher asset and equity levels, while expensing firms report lower assets and equity levels. Therefore, *debt to equity and debt to asset ratios will appear worse for expensing firms than for capitalizing firms*.

These financial implications of capitalizing versus expensing are summarized in Figure 1:

Figure 1: Financial Statement Impacts: Capitalizing vs. Expensing

	<i>Capitalizing</i>	<i>Expensing</i>
Income variability	Lower	Higher
Profitability—early years (ROA & ROE)	Higher	Lower
Profitability—later years (ROA & ROE)	Lower	Higher
Total cash flows	Same	Same
Cash flow from operations	Higher	Lower
Cash flow from investing	Lower	Higher
Leverage ratios (debt/equity & debt/assets)	Lower	Higher

Example: Effect of capitalization

Figure 2 is a balance sheet for Soprano Company for 2005 and 2006 and its income statement for 2006.

Figure 2: Soprano Company Balance Sheet and Income Statement

Balance Sheet

	2006	2005
Assets		
Current assets		
Cash	\$105	\$95
Receivables	205	195
Inventories	310	290
Total current assets	\$620	\$580
Noncurrent assets		
Gross property, plant, and equipment	\$1,800	\$1,700
Accumulated depreciation	(360)	(340)
Net property, plant, and equipment	\$1,440	\$1,360
Total assets	\$2,060	\$1,940
Liabilities		
Current liabilities		
Payables	\$110	\$90
Short-term debt	160	140
Current portion of long-term debt	55	45
Total current liabilities	\$325	\$275
Noncurrent liabilities		
Long-term debt	\$610	\$690
Deferred taxes	105	95
Stockholders' equity		
Common stock	\$300	\$300
Additional paid in capital	400	400
Retained earnings	320	180
Common shareholders' equity	1,020	880
Total liabilities & equity	\$2,060	\$1,940

Figure 2: Soprano Company Balance Sheet and Income Statement (Continued)

Income Statement	2006
Sales	\$4,000
Cost of goods sold	\$3,000
Gross profit	1,000
Operating expense	650
Operating profit	350
Interest expense	50
Earnings before taxes	300
Taxes	100
Net income	\$200
Common dividends	\$60

During 2006, the company discovered that \$150 of its operating expenses should have been capitalized, which would also have increased depreciation expense by \$20.

Complete the table in Figure 3, assuming that there will be no impact on taxes:

Figure 3: Soprano Company Answer Template

	Before Capitalization	After Capitalization
Net income	\$200	
Profit margin	5.0%	
Return on capital	12.5%	
Cash flow from operations	220	
Cash flow from investing	(100)	
Total cash flow	10	
Debt/equity	59.8%	

Answer:

Net income: Cash operating expense decreases by \$150, but depreciation increases by \$20. New net income will be $200 + (150 - 20) = \$330$.

Profit margin: $\text{net income/sales} = 330 / 4,000 = 8.3\%$. This ratio increased because the numerator, or net income, increased and the denominator remained constant.

Return on capital: 2006 total assets will increase by \$150 less the depreciation of \$20. New total assets = $2,060 + 150 - 20 = \$2,190$. Return on total capital = $(\text{net income} + \text{interest expense}) / \text{average total capital} = (330 + 50) / [(2,190 + 1,940) / 2] = 18.4\%$. This ratio also increased. As will usually be the case, the relative net income (numerator) effect of the decreased expense was greater than the relative increase in average total capital (equity).

Cash flow from operations: Cash operating expense decreases by \$150, so cash flow from operations will be $220 + 150 = \$370$. This is an increase.

Cash flow from investing: Outflows will increase by \$150, so cash flow from investments will be $-100 - 150 = -\$250$. This is a decrease, or a higher outflow.

Total cash flow will not change and will remain at \$10.

Note: These cash flow calculations ignore any tax impact.

Debt-to-equity: Assets increased by \$130, so equity will now increase by \$130. New equity = $1,020 + 130 = \$1,150$. The debt-to-equity ratio = long-term debt / total equity = $610 / 1,150 = 53.0\%$. This ratio decreased because equity (the denominator) increased by the amount of the capitalized asset, and debt (the numerator) remained unchanged.

CAPITALIZED INTEREST

Capitalized interest is the interest incurred during the construction of long-lived assets. It is included in the initial cost of the asset on the balance sheet instead of being charged off as interest expense on the income statement.

The argument for interest capitalization is that the cost of the self-constructed asset should be identical to the cost of the asset purchased after completion. The argument against the capitalization of interest is that the interest expense is the result of a *financing* decision and not an *operating* or *investment* decision. Internationally, capitalization of interest is optional.

Computation of capitalized interest. In the U.S., Statement of Financial Accounting Standards (SFAS) 34 requires the capitalization of interest costs incurred during the construction period.

- Interest incurred on borrowed funds during construction must be capitalized (i.e., included in cost of asset) and not expensed (SFAS 34), and the amount capitalized must be disclosed.
- If no specific borrowing is identified, the interest is estimated using the weighted average interest rate on outstanding debt up to the amount of the investment. Capitalized interest cannot exceed actual interest paid in any case.

When a firm constructs its own operating facilities (e.g., machinery or a building), then interest costs incurred during the period of construction are capitalized by adding that interest cost to the cost of the facility. To be capitalized, the interest must actually be paid by the firm (no opportunity costs are capitalized). The capitalized interest cost is based upon the average cost of the partially completed facility, first using the interest rate associated with borrowings to directly finance construction. Then the average interest rate of the firm's outstanding debt is applied to the excess of the investment in the project over these project-specific borrowings, if any. Thus, during construction, interest expense is total interest paid less capitalized interest.

Example: Capitalizing interest

During the current year, a firm has been constructing a building to be used for its production facility. The average cost of the building in process is \$1,000,000. The firm has borrowed \$500,000 at 5% interest to finance this construction. It has \$3,000,000 of 10% debentures outstanding. Calculate the amount of interest that should be capitalized and the amount that should be expensed.

Answer:

Interest on construction debt: [\$500,000 (0.05)]	\$25,000
Interest on debentures [\$500,000 (0.10)]	\$50,000
Total capitalized interest	\$75,000

$$\begin{aligned}\text{Total interest expense} &= \text{total interest paid} - \text{capitalized interest} \\ &= \$25,000 + \$300,000 - \$75,000 \\ &= \$250,000\end{aligned}$$

Note: If the firm's only debt were the \$500,000, 5% construction loan, then only the interest paid on that debt (\$25,000) would be capitalized.

The Effects of Capitalizing Interest Costs

- During the current year, capitalized interest decreases interest expense and increases net income. For analysis purposes, capitalized interest should be added to interest expense and taken out of the fixed asset. When the capitalized interest is removed from fixed assets, depreciation expense will be reduced when that asset is placed in operations.
- **Capitalized interest distorts the classification of cash flows.** Interest capitalized as part of fixed assets is reported as a cash flow from investing (CFI), not a cash flow from operations (CFO). So CFO is overstated and CFI is understated. Therefore, cash flows should be adjusted by adding the capitalized interest back to the CFI and deducting it with the other interest payments from the CFO.
- For firms in an expansion phase, capitalization of interest may result in a gain in earnings over an extended period of time because the amount of interest amortized will not catch up with the amount of interest capitalized in the current period. Net income will be overstated.

Professor's Note: Although the LOS for this topic does not explicitly state that you should understand potential analyst adjustments for capitalized interest, many analysts "undo" the effects of capitalized interest when analyzing and comparing firms.

An analyst should adjust income statements and balance sheets to reverse the impact of capitalized interest. Specifically, an analyst should make the following adjustments:

- Interest that was capitalized during the year should be added to interest expense. The amount of interest capitalized is disclosed in the financial statement footnotes.
- The amortization of interest capitalized in previous years should be deducted from depreciation expense. However, capitalized interest from previous years might not be disclosed in the financial statements. If this amount is small, the analyst can ignore it. If it is large, the analyst must estimate the adjustment by using the historical ratio of capitalized interest to total capital expenditures.
- The interest that was capitalized during the year should be added back to cash flow from investment and subtracted from cash flow from operations.
- Ratios such as interest coverage and profitability ratios should be recalculated with the restated figures. Interest coverage ratios and net profit margins are likely lower without capitalization.

Capitalization of Interest and Interest Coverage Ratios

The interest coverage ratio, often called times interest earned, is EBIT (operating earnings) divided by interest expense. This ratio gives an indication of the margin of safety the company has in regard to making interest payments on debt. When interest is capitalized, current period interest costs are decreased and the interest coverage ratio is increased. There is an effect of capitalizing interest on EBIT since capitalizing interest incurred during construction increases the asset value, and thereby increases depreciation expense. In the period of capitalization, the decrease in interest expense will be larger than any decrease in EBIT from increased

depreciation, so that the interest coverage ratio is unambiguously increased by capitalization. Since capitalization of interest in a prior period has no effect on interest expense in subsequent periods, any decrease in subsequent period EBIT from greater depreciation will decrease the interest coverage ratio for that period. If interest is capitalized over a number of accounting periods, interest coverage ratios may be higher than without capitalization in each period.

LOS 42.b: Explain the circumstances in which intangible assets, including software development costs and research and development costs are capitalized.

An **intangible asset** is an asset that has no physical existence and there is a high degree of uncertainty regarding future benefits.

When acquired in an arm's-length transaction, identifiable intangible assets (e.g., patents, trademarks, franchises) are recorded at acquisition cost. The expense of their use is recognized by amortization of cost over the shorter of estimated useful or legal lives.

The capitalize-versus-expense issue is relevant to intangible assets and resources such as patents, copyrights, licenses, brand names, goodwill, etc. The particular troubles with accounting for internally generated intangible assets are that the costs may not be easily separable, potential benefits may be difficult to measure (e.g., advertising), and economic life may be nearly impossible to establish (e.g., brand names).

Types of intangible assets include:

- *Research and development (R&D):* Although risky, R&D expenditures are clearly economic assets. (Empirical research suggests the average life is seven to ten years, depending on the assets and the industry). However, under Generally Accepted Accounting Principles (GAAP), specifically SFAS 2, it is required that *research and development expenditures be expensed* when incurred. Outside the U.S., R&D expenditures may be capitalized if various conditions are met (e.g., International Accounting Standard 9 requires expensing research costs but capitalizing development costs).
- *Patents and copyrights* costs (except legal fees of registering, which are capitalized) incurred in developing patents and copyrights are expensed. However, if the patent or copyright is purchased, then the cost is capitalized.
- *Franchise and license* costs are typically capitalized by the purchasing firm.
- *Brands and trademarks:* If *acquired* in arm's-length transactions, the cost is capitalized.
- *Advertising costs*, like R&D expenditures, are expensed when incurred. However, direct-response [direct relation between marketing and sales (e.g., orders taken in response to a call)] advertising costs are capitalized.
- *Goodwill* is an intangible asset representing the difference between the amount paid for an acquired firm and the fair market value of its net assets. Goodwill may be recognized and capitalized only in purchase transactions. Please note that under U.S. GAAP, capitalized goodwill is not expensed (amortized) on a regularly scheduled basis. Instead, an impairment exercise is performed each year to determine if purchased goodwill has been impaired relative to its balance sheet value. If an impairment has occurred, this impairment write off hits the income statement as an expense.
- *Computer software development costs:* SFAS 86 requires that all costs incurred to *establish* the technological or economic feasibility of software intended to be sold to others be expensed (e.g., R&D). Subsequent costs may be capitalized as part of inventory. Disparate accounting for software development costs (e.g., Microsoft expenses all software costs) requires the analyst to *evaluate and eliminate the impact of capitalization* to facilitate company comparisons. SOP 98-1 *requires* expensing of development costs prior to establishing feasibility for software intended for internal use, and requires capitalization of development costs for internal-use software after technological feasibility has been established. Net income computed after "undoing" the effects of capitalizing software development cost will typically be lower. Reclassifying these costs as operating rather than investing cash flows can have a significant impact on cash flow classification, reducing CFO and increasing CFI.

The financial statement effects of intangibles. Consistent with the effects of expensing versus capitalizing, capitalizing development costs will increase current net income. If expenditures are increasing, future net incomes will be greater for the capitalizing firm. Thus, return on assets will be greater and debt-to-equity ratio lower (more income, more equity) for the capitalizing firm. If development expenditures are decreasing, then the amortization of the capitalized expenditures will result in lower future net incomes (and lower ROA) for the capitalizing firm.

Although total cash flows are unaffected, capitalizing development costs will result in lower cash flow from investing and greater cash flow from operations. This is summarized in Figure 4:

Figure 4: Impact of Capitalizing vs. Expensing Development Cost

<i>Effect on ...</i>	<i>If capitalized ...</i>	<i>If expensed ...</i>
Current net income	Greater	Smaller
Future income (increasing capitalized expenditures)	Greater	Smaller
Future income (decreasing capitalized expenditures)	Smaller	Greater
Debt-equity ratio	Smaller	Greater
Return on assets (initial)	Greater	Smaller
Return on assets (future)	Smaller	Greater
Total cash flow	Same	Same
Cash flow from operations	Greater	Smaller
Cash flow from investing	Smaller	Greater

The effect of capitalizing expenditures of various types on ROE and ROA is sometimes confusing to students because the numerator (net income) as well as the denominators (equity and assets) both go up with capitalization. The key to the overall effect on the ratios is that we can safely assume in almost all cases that both equity and assets are significantly larger than net income. For a simple example, consider a non-capitalizing company with NI of 10, equity of 100, and assets of 200. $ROE = 10\%$ and $ROA = 5\%$. If expenditures of 2 are capitalized rather than expensed, $ROE = \frac{12}{102} = 11.8\%$ and $ROA = \frac{12}{202} = 5.9\%$ in the year of capitalization.

LOS 42.c: Calculate and describe both the initial and long-term effects of asset revaluations on financial ratios.

Revaluation of assets with values that have decreased below their balance sheet values is permitted under both U.S. GAAP and IAS GAAP and reduction in asset carrying values (impairments) are covered separately. Revaluations to recognize increases in fixed asset values are not permitted under U.S. GAAP, but are permitted under IAS GAAP under IAS 16. Non-depreciable assets such as land typically appreciate over time to levels significantly above the book (historical) values recorded on the balance sheet and are therefore subject to upward revaluations.

A positive asset revaluation will result in an increase in the values of both equity and assets. In general, this will decrease debt ratios (D/E and D/A), decrease profitability ratios (ROE and ROA), and decrease asset turnover (sales/assets). For an upward revaluation of *depreciable* assets, EBIT and net income will be reduced, due to the increase in periodic depreciation, as will interest coverage ratios. The decrease in net income will further decrease profitability ratios and will, over time, decrease book value per share as well.

Example: Effects of Revaluation

Coser Inc. has assets with a book value of \$8 million, debt with a book value of \$5 million, and equity with a book value of \$3 million. It has land (a non-depreciable asset) with a book value of \$2 million and under IAS 16, Coser will revalue the land to its current market value of \$4 million. Before the revaluation, net income for the year is expected to be \$0.5 million. Calculate the effects on ROE, ROA, and the D/E ratio.

Answer:

The revaluation will increase the value of the land by \$2 million from \$2 million to \$4 million, resulting in an increase in the value of assets from \$8 million to \$10 million and an increase in the book value of equity from \$3 million to \$5 million. There will be no effect on the income statement since it is a positive revaluation and the land is not depreciated.

The return on equity (ROE) will decrease from $\$0.5 \text{ million} / \$3 \text{ million} = 16.67\%$ to $\$0.5 \text{ million} / \$5 \text{ million} = 10\%$.

The return on assets (ROA) will decrease from $\$0.5 \text{ million} / \$8 \text{ million} = 6.25\%$ to $\$0.5 \text{ million} / \$10 \text{ million} = 5\%$.

The debt to equity ratio will decrease from $\$5 \text{ million} / \$3 \text{ million} = 1.67$ to $\$5 \text{ million} / \$5 \text{ million} = 1.00$.

KEY CONCEPTS

1. Capitalization of outlays, compared to expensing, causes lower variability of net income, higher net income, higher operating cash flow, and lower leverage ratios. Capitalization causes return on assets (ROA) and return on equity (ROE) to be higher in the year of capitalization and lower in later years unless capitalized expenditures are increasing.
2. Capitalization of interest causes interest expense to be lower, depreciation to be slightly higher, cash flow from operations to be higher, and the interest coverage ratio to be higher. Analysts often adjust financial statements to remove the effects of capitalized interest.
3. In general, intangible asset costs are capitalized when the assets are acquired from an outside entity. In most countries, R&D costs cannot be capitalized; only the legal fees to obtain a patent or trademark internally can be capitalized, and development costs for software for external sale may be capitalized after technical and economic feasibility have been established.
4. Upward asset revaluations (allowed under IASB GAAP) will increase asset and equity values, decreasing ROA, ROE, D/E, D/A, and asset turnover; and will decrease EBIT and NI when depreciable asset values are increased.

CONCEPT CHECKERS: ANALYSIS OF LONG-LIVED ASSETS, PART I: THE CAPITALIZATION DECISION

1. Which of the following statements is TRUE?
 - A. The choice between capitalization and expensing makes no operational difference.
 - B. Firms that capitalize costs will show more variability in reported income.
 - C. Firms that capitalize costs will have lower assets and equity.
 - D. Cash flow from operations is not affected by the capitalization or expensing choice.
2. For purposes of analysis, capitalized interest should be:
 - A. added to fixed assets.
 - B. added back to the cash flows for investment.
 - C. added to interest expense and results in higher net income.
 - D. subtracted from interest expense and results in higher net income.
3. With the exception of legal costs, generally accepted accounting principles (GAAP) require that costs incurred in:

<u>Developing Patents Are:</u>	<u>Purchased Patents Are:</u>
A. expensed	expensed
B. expensed	capitalized
C. capitalized	expensed
D. capitalized	capitalized
4. Which of the following statements is FALSE? All other things being equal, firms that capitalize costs will:
 - A. show smoother reported income than expensing firms.
 - B. have higher operating cash flow and lower investment cash flow than expensing firms.
 - C. have lower leverage ratios than expensing firms.
 - D. have lower profitability ratios in the early years than expensing firms.
5. With the exception of legal costs, generally accepted accounting principles (GAAP) require that costs incurred in establishing the technological feasibility of software be:
 - A. expensed, and interest expenses relative to the construction of a building must be expensed.
 - B. expensed, and interest expenses relative to the construction of a building must be capitalized.
 - C. capitalized, and interest expenses relative to the construction of a building must be expensed.
 - D. capitalized, and interest expenses relative to the construction of a building must be capitalized.
6. Which of the following statements is *most* correct? Accounting choices:
 - A. never affect cash flows.
 - B. always affect cash flows.
 - C. may affect the classification of cash flow components without affecting total cash flow.
 - D. never affect the classification of cash flow components without affecting total cash flow.
7. Firm A expenses costs while Firm B capitalizes them. All other things being equal, which of the following choices *best* describes the relationship between the debt ratios of Firm A and Firm B?
 - A. They will be equal.
 - B. Firm A's will be lower.
 - C. Firm A's will be higher.
 - D. Cannot be determined without more information.

8. Capitalizing construction interest costs leads to:
- a lower debt ratio.
 - higher future depreciation expense.
 - lower reported income after the first year.
 - all of the above.

Use the following data to answer Questions 9 and 10.

Smokee Enterprises capitalizes most costs and Eb One Manufacturing expenses most costs.

9. Which of the following choices **CORRECTLY** describes Smokee's financial results for current income, debt-to-equity ratio, and cash flow from operations as compared to Eb One's results?

	<u>Current Net Income</u>	<u>Debt-to-Equity Ratio</u>	<u>Cash Flows From Operations</u>
A.	Greater	Smaller	Smaller
B.	Greater	Smaller	Greater
C.	Smaller	Greater	Smaller
D.	Smaller	Smaller	Greater

10. Which of the following choices **CORRECTLY** describes Eb One's financial results for initial return on assets, total cash flow, and cash flow from investing as compared to Smokee's results?

	<u>Initial Return on Assets</u>	<u>Total Cash Flow</u>	<u>Cash Flows From Investing</u>
A.	Smaller	Larger	Equivalent
B.	Larger	Equivalent	Smaller
C.	Smaller	Equivalent	Larger
D.	Equivalent	Larger	Smaller

11. Which of the following statements about the treatment of intangible assets is **FALSE**?
- Advertising costs are expensed when incurred.
 - All software development costs may be capitalized.
 - Internally developed patent and copyright costs are expensed when incurred.
 - In the U.S., research and development costs are expensed when incurred.
12. The interest costs during construction are:
- expensed as incurred.
 - expensed at the completion of the construction project.
 - capitalized and then, once construction is completed, amortized over the life of the loan.
 - capitalized and then, once construction is completed, amortized over the life of the constructed asset.
13. Which of the following statements is **TRUE**?
- Research and development is capitalized according to U.S. GAAP.
 - The costs associated with the creation of a brand name within a company are capitalized.
 - In the case of a patent, the costs of developing the patent are expensed but legal costs can be capitalized.
 - The difference between the purchase price and the fair value of identifiable net assets acquired in a purchase transaction is expensed in the period in which the acquisition is made.

14. Wildwood Builders has assets of €315 million and liabilities of €112 million. The book value of its land holdings (a non-depreciable asset) is currently €30 million but its market value has increased since purchase to €45 million. If Wildwood revalues its land on the balance sheet to reflect this increase in value, the effect on ROE and net income in the period of the revaluation will be:

	<u>ROE</u>	<u>Net Income</u>
A.	decrease	decrease
B.	unchanged	increase
C.	decrease	unchanged
D.	increase	unchanged

ANSWERS – CONCEPT CHECKERS: ANALYSIS OF LONG-LIVED ASSETS, PART I: THE CAPITALIZATION DECISION

1. A There is no operational difference.
2. B For analysis purposes, interest expense should be added to cash flows for investment.
3. B If a firm develops the patent as part of its own operations, the cost is expensed. Only costs for purchasing a patent are capitalized.
4. D Firms that capitalize costs will show higher profitability ratios in early years due to the costs being spread out.
5. B Establishing technological feasibility of software is an operational activity and costs must be expensed. Interest related to construction must be capitalized.
6. C Overall cash flow may be the same even when accounting choices affect the classification of cash flow components. Accounting choices will affect cash flows if they affect taxes.
7. C Firm A will have a lower level of assets, making the expensing firm's debt ratio appear higher.
8. D All statements are true. The company will have a lower debt ratio because total equity (the denominator) will increase while the numerator is unchanged. The higher future depreciation expense results from the amortization of the capitalized interest, which an expensing firm would not have. This also results in lower reported income.
9. B Capitalizing firms will have greater net incomes, smaller debt-to-equity ratios due to the larger amount of equity, and greater cash flow from operations due to the classification of expenditures as investment cash flows.
10. C Firms that expense costs will have a smaller initial return on assets due to the effect of lower net income, the same total cash flows (only classification is different), and larger CFI due to expenses being considered CFO.
11. B Software development costs are operational in nature and must be expensed.
12. D Interest costs from construction are capitalized and amortized over the life of the asset.
13. C R&D costs are expensed, only acquired brand names are capitalized, and goodwill is capitalized. Legal costs of securing a patent can be capitalized.
14. C Equity value will be increased with no effect on net income.

ANALYSIS OF LONG-LIVED ASSETS: PART II – ANALYSIS OF DEPRECIATION AND IMPAIRMENT

Study Session 9

EXAM FOCUS

Depreciation is allocating the cost of an asset to expense over time. In reality, depreciation is an allocation of past cash flows; depreciation expense appears on the income statement but has no impact on the statement of cash flows. There are multiple acceptable methods of calculating depreciation, and the method the firm chooses is its own decision. A firm using a slower method of depreciation will show higher net income. A firm may choose to use an

accelerated method on its tax return to show lower taxable income and thus pay less in taxes. On the Level 1 exam, be prepared to calculate depreciation using all of the methods discussed in this topic review. Also know the effects of accelerated versus straight-line depreciation, as well as the effects on financial statements and ratios of taking a write-down on an impaired asset.

LOS 43.a: Identify the different depreciation methods and discuss how the choice of depreciation method affects a company's financial statements, ratios, and taxes.

The underlying *principle of depreciation* is that cash flows generated by an asset over its life cannot be considered income until provision is made for the asset's replacement. This means that the *definition of income* requires a subtraction for asset replacement.

The accounting problem is how to allocate the cost of the asset over time. Depreciation is the systematic allocation of the asset's cost over time.

Two important terms are:

- *Book value*. The net value of an asset or liability as it is listed on the balance sheet. For property, plant, and equipment, book value equals historical cost minus accumulated depreciation.
- *Historical cost*. The original purchase price of the asset including installation and transportation costs. The gross investment in the asset is the same as its historical cost.

Depreciation is a real and significant operating expense. Even though depreciation doesn't require current cash expenditures (the cash outflow was made in the past when the company invested in the depreciable assets), it is an expense that is just as important as labor or material expense. Therefore, analysis should *not* exclude depreciation expense. For financial statements, the analyst must decide whether the depreciation expense the firm reports is significantly more or less than the true decline in the value of the asset over the period, its *economic depreciation*. One chain of video rental stores was found to be overstating income by depreciating its stock of movies by equal amounts each year. In fact, a greater portion of the decrease in the value of newly released movies was realized in the first year. Depreciating this asset by a greater amount during the first year would have better approximated economic depreciation than depreciating it by equal amounts over three years.

Four methods of calculating depreciation are described here.

Straight-line (SL) depreciation is the dominant method of computing depreciation. It applies an equal amount of depreciation to each year over the asset's estimated depreciable life:

$$\text{depreciation expense} = \frac{\text{original cost} - \text{salvage value}}{\text{depreciable life}}$$

Example: Calculating straight-line depreciation expense

Melfi Co. has purchased a machine with a 4-year useful life. The machine cost \$4,000 and has an estimated salvage value of \$1,000. Using the SL method, calculate depreciation expense in year 1 and year 4. Note: This same example will be used throughout this discussion.

Answer:

The constant depreciation expense over all years will be:

$$\frac{\text{original cost} - \text{salvage value}}{\text{depreciable life}} = \frac{(\$4,000 - \$1,000)}{4} = \$750$$

There are some flaws with using straight-line depreciation.

- Straight-line depreciation is constant through time, while repair and maintenance expense will typically increase over the life of the asset. This will cause a decrease in reported income over time.
- This method yields an increasing rate of return over the life of the asset.

For example, assume the asset discussed above generates an annual income of \$1,200 before the \$750 depreciation charge. Net income will be \$450 a year for each of the asset's four years of useful life. The book value (cost less accumulated depreciation) of the asset begins at cost, then decreases with the added depreciation expense each year. This decreasing book value and constant income results in an increasing rate of return on the asset, as shown in Figure 1.

Figure 1: ROA Calculation

Year	Beginning Carrying Value	Straight-Line Depreciation	Net Income	Rate of Return on Assets
1	\$4,000	\$750	\$450	11.25%
2	\$3,250	\$750	\$450	13.85%
3	\$2,500	\$750	\$450	18.00%
4	\$1,750	\$750	\$450	25.71%

The increase in maintenance generally does not negate the increase in return on assets (ROA) caused by the constant depreciation expense.

There are two **accelerated depreciation methods**, sum-of-year's digits (SYD) and double-declining balance (DDB), which recognize greater depreciation expense in the early part of an asset's life and less expense in the latter portion of its life.

The economic justifications of accelerated depreciation methods include increasing repair and maintenance costs, decreasing revenues and operating efficiency, and greater uncertainty about revenues due to obsolescence in the later years of the asset's life.

Accelerated depreciation methods are usually used on tax returns (when allowed) because greater depreciation expense in the early portion of the asset's life results in less taxable income and a smaller tax payment. A firm may

use straight-line depreciation for its financial statements and an accelerated method on its tax returns. This initial saving on taxes is a deferral because a greater tax payment will be required in the latter part of the asset's life. Note that total depreciation is initial cost minus salvage value over the asset's life in either case; an accelerated method just moves some depreciation to earlier periods.

The **sum of the years' digits (SYD)** method applies more depreciation in the early years of an asset's life than the later years. The formula to calculate SYD depreciation is:

$$\text{depreciation in year } x = \frac{(\text{original cost} - \text{salvage value}) \times (n - x + 1)}{\text{SYD}}$$

where:

n = depreciable life

$\text{SYD} = (1 + 2 + \dots + (n - 1) + n)$

A quick way to calculate the sum is to use the following formula: $\text{sum} = [n(n+1)]/2$. Therefore, the sum for a 5-year useful life is $[(5)(6)]/2 = 15$ and for a 10-year useful life is $[(10)(11)]/2 = 55$.

Example: Calculating sum of the year's digits depreciation expense

Melfi Co. has purchased a machine with a 4-year useful life that cost \$4,000 and has an estimated salvage value of \$1,000. Using the sum of the years' digits method, calculate depreciation expense in year 1 and year 4.

Answer:

$$\text{SYD} = 1 + 2 + 3 + 4 = 10, \text{ or } \text{SYD} = [(4)(5)]/2 = 20/2 = 10$$

$$\text{depreciation in year } x = \frac{(\text{original cost} - \text{salvage value}) \times (n - x + 1)}{\text{SYD}}$$

$$\text{depreciation in year 1} = \frac{(\$4,000 - \$1,000) \times (4 - 1 + 1)}{10} = \$1,200$$

$$\text{depreciation in year 4} = \frac{(\$4,000 - \$1,000) \times (4 - 4 + 1)}{10} = \$300$$

Note that the factors are simply 4/10, 3/10, 2/10, and 1/10 for the four years. Observe that the *total* depreciation expense calculated with the sum-of-years'-digits (SYD) method over the useful life of the asset is the same as that given by the straight-line method. That is, cost less salvage, which is \$3,000.

The **double-declining balance (DDB)** method is a second accelerated method. The formula to calculate DDB depreciation is:

$$\text{depreciation in year } x = \frac{2}{\text{depreciable life}} \times \text{book value at beginning of year } x$$

The salvage value is not used in the formula. The remaining book value is not allowed to go below the salvage value. If the amount of depreciation in year x would take the book value below the salvage value, the depreciation in year x is equal to the difference between book value at the beginning of the year and the salvage value.

- The use of the *declining balance method* results in a constant percentage of an asset's carrying value (book value) being depreciated each period.

- The constant percentage can be any rate, but the most common are 200 DB (a.k.a. double declining balance or DDB) and 150 DB. The rate is stated as a percentage of the straight-line rate. If the asset has a 10-year life, the straight-line rate is 10% per year and the 200DB rate is 20%; if the asset has a 20-year life, the straight-line rate is 5% and the 150DB rate is 150% of 5% or 7.5%.

Example: Calculating double declining balance depreciation expense

Melfi Co. has purchased a machine with a 4-year useful life that cost \$4,000 and has an estimated salvage value of \$1,000. Using the double-declining balance method, calculate depreciation expense in year 1 and year 4.

Answer:

$$\text{depreciation in year } x = \frac{2}{\text{depreciable life}} \times \text{book value at beginning of year } x$$

$$\text{depreciation in year 1} = \frac{2}{4} \times \$4,000 = \$2,000$$

$$\text{book value at the beginning of year 2} = \$4,000 - \$2,000 = \$2,000$$

$$\text{depreciation in year 2} = \frac{2}{4} \times \$2,000 = \$1,000$$

Book value at the end of year 2 is \$2,000 – \$1,000 = \$1,000. Because book value at the end of year 2 is equal to salvage value, depreciation in years 3 and 4 will be zero.

The **units-of-production** and **service hours** methods apply depreciation at the rate at which an asset is being used. Either the production capacity or the service life of the asset is estimated when the asset is put into service. The cost of the asset minus the salvage value is divided by either the production capacity or service life to achieve either a rate per unit or a rate per hour. Depreciation is then charged based on the year's production or usage. Depreciation is never charged once the asset's book value reaches its estimated salvage value.

Example: Calculating units-of-production and service hours depreciation expense

Melfi Co. has purchased a machine with a 4-year useful life. The machine cost \$4,000 and has an estimated salvage value of \$1,000. The depreciable life is four years, and the machine is estimated to last 6,000 hours and produce 30,000 units. The machine is operated 1,200; 2,000; 2,000; and 1,500 hours in years 1 through 4; and the machine produces 12,000; 11,000; 10,000; and 9,000 units in years 1 through 4. Calculate depreciation expense in year 1 and year 4 using the units-of-production and service hours methods.

Answer:

Units of production:

$$\text{rate per unit} = \frac{\$4,000 - \$1,000}{30,000 \text{ units}} = \$0.10$$

$$\text{depreciation in year 1} = \$0.10 \times 12,000 = \$1,200$$

$$\text{depreciation in year 2} = \$0.10 \times 11,000 = \$1,100$$

$$\text{depreciation in year 3} = \$0.10 \times 10,000 = \$1,000$$

However, book value at the beginning of year 3 was \$1,700 (= \$4,000 – \$1,200 – \$1,100), so only \$700 would be charged to depreciation in year 3 to make the book value equal to the salvage value of \$1,000, and no depreciation would be charged in year 4.

Service hours:

$$\text{rate per hour} = \frac{\$4,000 - \$1,000}{6,000 \text{ hours}} = \$0.50$$

$$\text{depreciation in year 1} = \$0.50 \times 1,200 = \$600$$

$$\text{depreciation in year 2} = \$0.50 \times 2,000 = \$1,000$$

$$\text{depreciation in year 3} = \$0.50 \times 2,000 = \$1,000$$

$$\text{depreciation in year 4} = \$0.50 \times 1,500 = \$750$$

However, book value at the beginning of year 4 was \$1,400 (\$4,000 – \$600 – \$1,000 – \$1,000), so only \$400 would be charged to depreciation in year 4 to make book value equal to the salvage value of \$1,000.

Sinking fund depreciation, sometimes called the annuity method, is seldom used and is prohibited in the U.S. and other countries. Depreciation expense actually *increases* each year so that the asset earns the same rate of return each year.

You can think about the rate of return on an asset or its return on investment as the net income generated from using the assets divided by its book value. If net income is changing over an asset's life only because depreciation is changing, both SL and accelerated depreciation methods lead to an increasing return on investment over time. With straight-line depreciation, the net income is the same each year, but the book value is decreasing, which produces an increasing return on investment. With accelerated methods, net income (net of depreciation) is increasing each year as well, and the return on investment increases even more in later years. With sinking fund depreciation, depreciation increases each year so that net income decreases in proportion to the decrease in book value and keeps return on investment constant over the asset's life.

Effects of the Choice of Depreciation Method on Financial Statements, Ratios, and Taxes

Depreciation is an allocation of past investment cash flows, and the choice of depreciation method on the firm's financial statements has no impact on the statement of cash flows. It is important for the analyst to consider the capital expenditures to better understand the impact of the choice of depreciation methods.

In the early years of an asset's life, accelerated methods tend to depress net income and retained earnings and result in lower return measures [return on equity (ROE) and return on assets (ROA)]. At the end of the asset's life, the effect reverses. For firms with stable or rising capital expenditures, the early year effect will dominate, and depreciation expense on the total firm basis will be higher using accelerated methods.

A firm that chooses an accelerated depreciation method (e.g., DDB) instead of using straight-line, will tend to have greater depreciation expense and lower net income. This will persist if the firm is investing in new assets such that the lower depreciation on old assets is more than compensated for by the higher depreciation on new assets. (If the firm is not investing in new assets, then the higher depreciation expense and lower net income are reversed in the later part of the asset's life.)

Although accelerated depreciation methods produce lower net assets and equity than straight-line, the lower net income causes a lower return on equity and return on assets. Regarding turnover ratios (e.g., sales over total assets), the lower asset levels for accelerated methods imply a higher ratio. There is no effect on cash directly caused by choice of depreciation methods, although the use of accelerated depreciation on tax returns reduces the cash paid for income taxes early in the asset's life and increases taxes paid in the later years of the asset's life. These relationships are summarized in Figure 2, assuming the firm is investing in a new asset.

Figure 2: Financial Statement Impact of Depreciation Methods*

	<i>Straight Line</i>	<i>Accelerated (DDB & SYD)</i>
Depreciation expense	Lower	Higher
Net income	Higher	Lower
Assets	Higher	Lower
Equity	Higher	Lower
Return on assets	Higher	Lower
Return on equity	Higher	Lower
Turnover ratios	Lower	Higher
Cash flow**	Same	Same

* The relationships indicated in the table are for the early years of an asset's life and are reversed in the latter years of the asset's life if the firm's capital expenditures decline.

** Assuming the depreciation method used for tax purposes is unchanged.

LOS 43.b: Explain the role of depreciable lives and salvage values in the computation of depreciation expenses, and compute and describe how changing depreciation methods or changing the estimated useful life or salvage value of an asset affects financial statements and ratios.

Depreciable Lives and Salvage Values

In general, a longer useful life estimate decreases annual depreciation and increases reported net income, while a shorter estimate of the asset's useful life will have the opposite effect. A higher estimate of the residual (salvage) value will also decrease depreciation and increase net income, while a lower estimate of the salvage value will increase depreciation and decrease net income.

The choice of estimated lives and residual values gives companies some ability to manage earnings, and an analyst should be alert to instances of excessively long depreciable life assumptions or excessively high residual (salvage) values, both of which will lead to an overstatement of net income. Although companies are required to disclose information on depreciable lives, such disclosures are often given as ranges and cover groups of assets rather than specific assets.

- Management could estimate a useful life longer than that warranted (thus reducing depreciation expense and increasing income) and then write down the overstated assets in a restructuring process.
- Management might also write down assets, taking an immediate charge against income, and then record less future depreciation expense based on the written-down assets. This results in higher future net income in exchange for a one-time charge to current income.
- Although not as significant as misspecifying the life of a depreciable asset, the residual value could be significantly overstated, thus understating depreciation expense during the life of the asset and overstating the loss when the asset is retired.

Changing Depreciation Methods or Changing the Estimated Useful Life or Salvage Value of an Asset

There are three ways that a company can change the way depreciation is applied.

Change in method for new assets. A company can change its method of depreciation for new assets but keep depreciating existing assets the same way it has done in the past. This will cause estimates of future income to be revised. The effect of this type of change on income will be gradual.

Change in method for existing assets. If the company changes its method of depreciation for all assets, several changes will occur:

- The firm must show the effect the change would have had on prior-period results.
- Existing depreciation expense will change.
- Because this change represents a change in an accounting principle, the cumulative effect of the change on past income will be shown net of tax on the income statement.
- Estimates of future income will be revised. These changes may be significant.

Changes in depreciable lives or salvage values. Changes in depreciable lives or salvage values are considered changes in accounting estimates and not a change in an accounting principle. Past income does not need to be restated. However, current income will change and estimates of future income will be revised, so the analyst should be alert to the possibility of earnings manipulation from such a change. Although no cumulative effect exists when estimated life is increased (change in estimate), a more liberal estimate of an asset's economic life will decrease depreciation and increase net income, ROA, and ROE. The opposite will occur if the firm reduces estimated asset life or changes to an accelerated depreciation method.

Effect of changes on financial statements. Switching from accelerated methods to straight-line will cause expenses to be lower and income to be higher. If a firm changes from an accelerated to straight-line depreciation method, the effect on financial statements is summarized in Figure 3.

Figure 3: Effect of Changing Depreciation Methods

Cumulative effect if applied to all assets	Increases net income—no change in income from continuing operations
Cumulative effect if applied only to newly acquired assets	No cumulative effect exists
Depreciation expense	Decreases
Net income from continuing operations	Increases
ROA and ROE	Although assets and equity increase, the larger net income will increase these ratios

LOS 43.c: Discuss the use of fixed asset disclosures to compare companies' average age of depreciable assets, and calculate, using such disclosures, the average age and average depreciable life of fixed assets.

The footnotes to the financial statements typically provide the analyst with a wealth of information regarding the structure of the company's fixed asset base. An analyst can use this data and other financial statement data to compute average age estimates. Average age data is useful for two reasons:

- It helps identify portfolios of older, less-efficient assets, which may make the firm less competitive.
- An analyst can estimate when major capital expenditures will be required, which will help the analyst forecast when the firm will face significant financing requirements.

In addition:

- If a firm's average depreciable life is significantly greater than that of a similar firm, then one would expect it to have a lower depreciation expense and higher net income because it has used the longer useful life expectation.
- If the average age of assets is large and the cost of new PP&E has risen over time, then the firm's profit margins will be higher because depreciation expense is based on less costly, but potentially less efficient, PP&E.

There are three calculations that are useful concerning the quality of fixed assets on the balance sheet.

- **Average age** (in years) is approximated by:

$$\frac{\text{accumulated depreciation}}{\text{depreciation expense}}$$

This is only a rough estimate and can be significantly affected by changes in the asset mix.

- **Relative age**, or average age as a percentage of depreciable life, is:

$$\frac{\text{accumulated depreciation}}{\text{ending gross investment}}$$

This calculation is more accurate when straight-line depreciation is being used and provides a better indication of whether the firm's assets are old or new.

- **Average depreciable life** is approximated by:

$$\frac{\text{ending gross investment}}{\text{depreciation expense}}$$

As is true for average age (in years), this is only an approximation and is affected by changes in the asset mix.

Example: Calculating average age and depreciable life

At the end of 2003, a company has gross fixed assets of \$3 million and accumulated depreciation of \$1 million. During the year, depreciation expense was \$500,000.

What is the average age in years and in percentage of the fixed assets, and what is the average depreciable life?

Answer:

$$\text{average age in years} = \frac{\text{accumulated depreciation}}{\text{depreciation expense}} = \frac{\$1,000,000}{\$500,000} = 2 \text{ years}$$

$$\text{average age as a percentage} = \frac{\text{accumulated depreciation}}{\text{ending gross investment}} = \frac{\$1,000,000}{\$3,000,000} = 33\%$$

$$\text{average depreciable life} = \frac{\text{ending gross investment}}{\text{depreciation expense}} = \frac{\$3,000,000}{\$500,000} = 6 \text{ years}$$

If a firm's relative age of plant and equipment is high, then the firm has not been adding to its capital stock. The firm is probably a less efficient and less competitive producer and will have to invest in PP&E in the future. However, the measure is sensitive to the estimated life and salvage value used—the shorter the estimated life, the greater the depreciation and the higher the average age percentage.

LOS 43.d: Define impairment of long-lived assets and explain what effect such impairment has on a company's financial statements and ratios.

Financial reporting of impaired assets. Generally accepted accounting principles (GAAP) *require* that assets be carried at acquisition cost less accumulated depreciation. There is also a requirement that carrying amounts be reduced to market value when there is no longer an expectation that net balance sheet values can be recovered from future operations.

Assets carried at more than the recoverable amounts are considered *impaired*. For impaired assets retained by the firm, the issue is how to report the firm's inability to fully recover its carrying amount. Since management largely controls the timing and amount of impairment recognition, it is a potential tool for income manipulation. It is difficult to compare the impact of impairment and the resulting ratios over time and across companies.

Professor's Note: Impairments are reported on the income statement pretax (above the line) as a component of income from continuing operations.

Impairment losses are sometimes reported as a component of restructuring, which also includes elements that affect cash flows (e.g., severance pay). It is, therefore, important to separate writedowns of assets that do not affect cash flow from those components of restructuring that do affect cash flow.

Loss from the impairment of assets must be recognized when there is evidence of a lack of recoverability of the carrying amount. Lack of recoverability may be signaled by:

- Changes in business environment or laws and regulations.
- A decline in the usage rate or market value of an asset.
- A forecast for a significant decline in profitability related to the asset.
- Significantly higher costs than expected.

The impairment of an asset cannot be restored under U.S. GAAP. However, some foreign countries and the IASB allow firms to recognize increases in value.

If an asset is held for disposition, it is carried on the balance sheet at the lower of cost or net realizable value.

Recoverability test. An asset is considered impaired if the carrying value (asset cost less accumulated depreciation) is more than the undiscounted cash flow from the asset's use and disposal.

$$\text{Impaired if: } \begin{array}{l} \text{carrying value} \\ \text{of assets} \end{array} > \begin{array}{l} \text{undiscounted expected} \\ \text{future cash flows} \end{array}$$

Loss measurement. If a long-lived asset becomes permanently impaired, the relevant portion of its book value should be immediately recognized as a loss on the income statement. The loss is the excess of carrying value over the asset's fair market value (if known) or an estimate of present value of future cash flows if market value is unknown.

Professor's Note: The difference between the way cash flows are treated in testing for and measuring impairment can be confusing. In testing for impairment, undiscounted future cash flows are used. Once impairment has been detected, it should be estimated using discounted future cash flows.

Impact of Impairment on Financial Statements

- A writedown of assets affects the balance sheet categories of assets (PP&E), deferred tax liabilities, and stockholders' equity (retained earnings). Deferred tax liabilities result because financial statement depreciation is less than tax return depreciation. An impairment charge on the financial statements moves depreciation closer to tax return depreciation and reduces the future tax liability expected as these amounts come together. Deferred tax liabilities are fully described in the next study session.
- During the year of writedown, the loss from impairment decreases income from continuing operations. This decreases retained earnings. The assets and associated deferred taxes are reduced.
- Fixed asset turnover and total asset turnover both increase because asset values are lower.
- Writedowns increase a firm's debt-to-equity ratio as a result of the decrease in retained earnings and equity.
- Cash flow is not affected. Recognition of the impairment leads to a reduction in a deferred tax liability, not a current refund.
- In future years, less depreciation expense is recognized on the written-down asset, resulting in higher net income. Figure 4 relates the effects of impairments.

Figure 4: Impairment—Effects on Financial Statements

Impairment Effects	
Cash flow	No effect
Assets (PP&E)	Decrease
Deferred tax liabilities	Decrease
Stockholders' equity	Decrease
Current net income, ROA, ROE	Decrease
Future net income, ROA, ROE	Increase
Future depreciation expense	Decrease
Asset turnover ratio	Increase
Debt-to-equity ratio*	Increase

*Current D/E increases as equity goes down with the impairment charge and then decreases over time because lower depreciation going forward increases net income, retained earnings, and equity.

Analysis of Impairments

- Impairments may compensate for past underdepreciation or changes in market conditions and are quite difficult to forecast.
- Cash flow resulting from tax effects is difficult to determine, although generally there is none because impairments are not deductible for taxes.
- Impairments have resulted in diverse accounting practices, undermining comparability across firms and through time.

LOS 43.e: Discuss the liability for closure, removal, and environmental effects of long-lived operating assets, and discuss the financial statement impact and ratio effects of that liability.

Companies often own and operate assets that cause environmental damage, including strip mines, nuclear power plants, offshore oil platforms, and production plants that produce toxic waste as a by-product. Governments often require the company to clean up the site after the company ceases using the asset, and restore the asset or land to its original condition. Prior to the issuance of SFAS 143, companies took different approaches to the accounting for this **asset retirement obligation (ARO)**.

SFAS 143 requires a consistent treatment of the ARO resulting from obligations related to remedying environmental damage caused by a company. The following rules apply:

- SFAS 143 applies to all companies and all legal and contractual obligations, including leased assets and legally enforceable contracts.
- The fair value of the ARO (liability) must be recognized. Fair value is either the liability's market value or, if market value is not available, the present value of the expected cash flows necessary to retire the liability (return the asset to the condition required). An equal amount must be added to the carrying value of the asset.
- The company must recognize accretion of the liability on the income statement as part of interest expense. The liability on the balance sheet increases each year.
- Prior-period amounts are not adjusted for changes in the estimated amount of the liability.

The company is required to disclose the following information:

- A description of the ARO and the asset.
- A reconciliation of the ARO liability, including specific information on new liabilities incurred, old liabilities extinguished, accretion expense, and revisions to the ARO estimate.
- The fair value of funds set aside to retire the ARO obligation.

Most companies will experience the following financial statement effects from the implementation of SFAS 143:

- Fixed assets and liabilities reported on the balance sheet will increase.
- Net income will be lower because of the additional depreciation of the asset and the accretion of the liability. The accretion will increase each year.

In general, the implementation of SFAS 143 will make the financial statements of a firm with an ARO look worse. Figure 5 shows the ratio effects of implementation of SFAS 143.

Figure 5: Ratio Effects of SFAS 143

<i>Ratio</i>	<i>Numerator</i>	<i>Denominator</i>	<i>Effect on Ratio</i>
Asset turnover	Sales will not change.	Assets will increase because of higher fixed assets.	Decrease
Liabilities-to-equity	Liabilities will increase because of ARO liability.	Equity will decrease because of lower net income.	Increase
Return on assets	Net income will decrease.	Assets will increase.	Decrease
Interest coverage	EBIT will decrease because of higher depreciation.	Interest expense will increase because of accretion of ARO liability.	Decrease

KEY CONCEPTS

1. Depreciation methods include straight-line and accelerated methods, units of production and service hours methods, and the sinking fund method.
2. Compared to straight-line methods, accelerated methods decrease operating earnings and net income in the early years of an asset's life and increase them in the later years.
3. The choice of depreciation method on the firm's financial statements does not affect the firm's cash flow, but the use of accelerated depreciation methods for tax reporting lowers taxable income and taxes due, increasing the firm's cash flow by the reduction in taxes.
4. A change in accounting method requires a restatement of prior income and an adjustment on the income statement for the cumulative after-tax effect of the change.
5. Longer estimates of useful lives and higher estimates of residual asset values both reduce depreciation expense and increase reported earnings.
6. Using balance sheet items, an analyst can estimate average age and average depreciable asset lives (both are approximate and affected by asset mix) and can estimate the relative age of the assets when straight-line depreciation is used.
7. Impairment must be recognized when the carrying value of an asset is higher than the sum of the future cash flows (undiscounted) from their use and disposal. Impairments will cause income, asset value, deferred taxes, equity, and future depreciation to decline, resulting in an increase in future net income.
8. SFAS 143 requires capitalization of environmental remediation expenses and for most firms will lead to higher assets, liabilities, depreciation expense, and interest expense, which will tend to decrease net income. ROA, asset turnover, and interest coverage ratios will all decrease, and liabilities-to-equity will increase.

CONCEPT CHECKERS: ANALYSIS OF LONG-LIVED ASSETS, PART II—ANALYSIS OF
DEPRECIATION AND IMPAIRMENT

1. Which of the following accounts is *least likely* to be affected by an asset impairment?
 - A. Inventory.
 - B. Fixed assets.
 - C. Deferred taxes.
 - D. Stockholders' equity.
2. Which of the following will NOT enable a firm to report higher income in the future?
 - A. Changing from sum of the years' digits to straight-line while capital expenditures are increasing.
 - B. Declaring an asset impairment.
 - C. Resetting the salvage values of all of its assets to zero.
 - D. Increasing the depreciable life of all of its assets.

Use the following data to answer Questions 3 through 6.

Acquisition cost of asset	\$25,000
Salvage value	\$3,000
Useful life	4 years
Cash flow per year	\$8,000
Expected output of machine	25,000 units

3. Based on the straight-line (SL) method, the first year's depreciation will be:
 - A. \$4,460.
 - B. \$5,500.
 - C. \$6,250.
 - D. \$8,800.
4. Based on the sum of the years' digits (SYD) method, the first year's depreciation will be:
 - A. \$4,460.
 - B. \$5,500.
 - C. \$6,250.
 - D. \$8,800.
5. Based on the double-declining balance (DDB) method, the first year's depreciation will be:
 - A. \$4,400.
 - B. \$5,500.
 - C. \$8,800.
 - D. \$12,500.
6. If the actual usage of the asset in the first year is 7,200 units, then depreciation under the units-of-production method will be:
 - A. \$4,400.
 - B. \$5,500.
 - C. \$6,336.
 - D. \$7,200.

7. Compared to firms using the sum of the years' digits (SYD) method, a firm using straight-line (SL) depreciation will initially report earnings that are:
- lower.
 - equal.
 - greater.
 - dependent on usage.

Use the following data to answer Questions 8 through 10.

Tofu Products, Inc., has purchased a new soybean processor for \$300,000 (shipping and installation included).

- The processor has a useful life of 15 years.
 - The expected salvage value is \$10,000.
 - Their corporate tax rate is 39%.
 - They expect to earn \$500,000 before depreciation and taxes.
8. What is the depreciation expense for year 3 if the sum of the years' digits (SYD) depreciation method is used?
- \$19,333.
 - \$29,604.
 - \$31,417.
 - \$36,250.
9. What is the depreciation expense for year 2 if the double-declining balance (DDB) method is used?
- \$19,333.
 - \$24,242.
 - \$34,667.
 - \$40,000.
10. Which of the three methods—SL, SYD, or DDB—will produce the *most* year-1 net income?
- Straight-line.
 - Sum of the years' digits.
 - Double-declining balance.
 - They all will produce the same level of net income.

Use the following data to answer Questions 11 through 13.

Gross plant and equipment	\$1,500,000
Depreciation expense	\$225,000
Accumulated depreciation	\$675,000

The firm uses SL depreciation.

11. The average depreciable life of plant and equipment is:
- 3.00 years.
 - 3.67 years.
 - 6.67 years.
 - 10.33 years.
12. The average age, given as percent, of the plant and equipment is:
- 40%.
 - 45%.
 - 50%.
 - 55%.

13. The average age in years of plant and equipment is:
A. 2.67 years.
B. 3.00 years.
C. 3.67 years.
D. 6.67 years.
14. Which of the following statements about depreciation methods is FALSE?
A. Sinking fund depreciation is a common depreciation method in the U.S.
B. The cost of plant and equipment includes all necessary expenditures made prior to placing the asset into service.
C. When using the DDB method, depreciation is ended when book value is reduced to salvage value.
D. Accelerating deductions by using SYD for tax purposes and SL for financial reporting will result in the creation of a deferred tax liability.
15. Which of the following statements is *most likely* FALSE? Assuming the firm continues to invest in new assets, firms that choose accelerated depreciation over straight-line (SL) depreciation will tend to have lower:
A. equity.
B. net income.
C. return on assets.
D. depreciation expense.
16. Which of the following statements is TRUE? When a company changes the salvage values of an asset:
A. past earnings must be restated.
B. the company must report a change in accounting principles.
C. current and future income will be slightly affected.
D. an impairment is declared.
17. Which of the following statements about how inflation affects the measurement of economic depreciation is FALSE? In an inflationary period:
A. reported ROAs and ROEs will be too low.
B. reported income will be too high.
C. depreciation based on historical costs will not be sufficient to replace the asset.
D. depreciation based on the current cost of the asset (rather than historical costs) will create superior future cash flow estimates.
18. A change in depreciation method is:
A. not allowed under GAAP.
B. considered a change in accounting estimates.
C. considered a change in accounting principles.
D. required when an asset is judged to be impaired.
19. An asset is impaired when:
A. accumulated depreciation exceeds acquisition costs.
B. the firm can no longer fully recover the carrying amount of the asset through operations.
C. accumulated depreciation plus salvage value exceeds acquisition costs.
D. the present value of future cash flows exceeds the carrying amount of the asset.

20. Which of the following statements is FALSE? During the year of a writedown, the loss from impairment will decrease:
 - A. cash flows.
 - B. asset values.
 - C. retained earnings.
 - D. income from continuous operations.
21. Which of the following choices describes a *benefit* of calculating average age of assets?
 - A. Firms with low average age of assets typically are inefficient.
 - B. An analyst can use the data to help forecast future capital expenditures.
 - C. Average age multiplied by asset turnover will be equal to the DuPont ROE.
 - D. Risk arbitrage analysts view companies with low average age as takeover candidates.
22. To determine whether an asset is impaired, an analyst should use:
 - A. discounted cash flows and should use discounted cash flows to calculate the amount of the impairment.
 - B. discounted cash flows and should use undiscounted cash flows to calculate the amount of the impairment.
 - C. undiscounted cash flows and should use discounted cash flows to calculate the amount of the impairment.
 - D. undiscounted cash flows and should use undiscounted cash flows to calculate the amount of the impairment.
23. Which of the following statements about SFAS 143 on environmental remediation is FALSE?
 - A. Implementation of SFAS 143 inflates depreciation expense.
 - B. Ratio impacts include lower asset turnover and higher debt-to-equity ratios.
 - C. The periodic interest accretion increases expenses and decreases cash flow from operations.
 - D. The asset and liability are recorded at the time of asset acquisition and include the costs to return the land to the condition required.
24. Which depreciation method will NOT lead to an increasing return on investment when net asset cash flows are level over the asset's life?
 - A. Sum-of-the-year's-digits.
 - B. Straight line.
 - C. Double declining balance.
 - D. Sinking fund.

ANSWERS – CONCEPT CHECKERS: ANALYSIS OF LONG-LIVED ASSETS, PART II—ANALYSIS OF DEPRECIATION AND IMPAIRMENT

1. A Inventory will not be affected.
2. C Decreasing salvage values to zero would result in higher depreciation expense and, thus, decreased income. To increase income, the company would need to increase salvage values. The other choices would result in less depreciation expense and, thus, higher income.
3. B Straight-line (SL) depreciation is equal for all years.

$$\text{year 1 SL depreciation} = \frac{\text{original cost} - \text{salvage value}}{\text{depreciable life}}$$

$$\frac{\$25,000 - \$3,000}{4} = \$5,500$$
4. D Sum of years' digits (SYD) depreciation for year 1 = $(\text{original cost} - \text{salvage value}) \times \frac{(\text{useful life} - \text{year of interest} + 1)}{\text{sum of the useful life's digits}}$

$$= \frac{(\$25,000 - \$3,000)(4 - 1 + 1)}{(4 + 3 + 2 + 1)} = \$8,800$$
5. D Using the double-declining balance method:

$$\text{year 1 depreciation} = \frac{2}{\text{useful life}} \times \text{original cost} = \frac{2}{4} \times \$25,000 = \$12,500$$
6. C Using the units of production method, the year 1 depreciation = rate per unit \times number of units.
 Rate per unit = $(\text{original cost} - \text{salvage value}) / \text{expected output} = (25,000 - 3,000) / 25,000 = 0.88$
 Thus, year 1 depreciation = $0.88 \times (7,200) = \$6,336$.
7. C The sum of years' digits (SYD) method will report greater depreciation early on, thus reporting lower earnings. A firm using straight-line (SL) depreciation will report greater earnings. Neither method considers usage.
8. C SYD depreciation for year 3 = $(\text{original cost} - \text{salvage value}) \times \frac{\text{useful life} - \text{year of interest} + 1}{\text{sum of the useful life's digits}}$

$$\text{SYD} = 1 + 2 + \dots + 15 = 120$$

$$\text{depreciation} = \frac{(15 - 3 + 1)}{120} \times 290,000 = \$31,417$$
9. C Depreciation in year 1: $\frac{2}{15} \times 300,000 = \$40,000$.
 Book value in the beginning of the second year = $300,000 - 40,000 = \$260,000$.
 Depreciation in year 2: $\frac{2}{15} \times 260,000 = \$34,667$.
10. A Because straight-line (SL) depreciation reports the lowest expense, it will report the highest year-1 income. The other two methods accelerate depreciation expense.
11. C Average depreciable life = $\frac{\text{ending gross investment}}{\text{depreciation expense}} = \frac{1,500,000}{225,000} = 6.67 \text{ years}$.

12. B Average age as a percentage of plant and equipment = $\frac{\text{accumulated depreciation}}{\text{ending gross investment}} = \frac{675,000}{1,500,000} = 45\%$
13. B Average age = $\frac{\text{accumulated depreciation}}{\text{depreciation expense}} = \frac{675,000}{225,000} = 3.00 \text{ years}$
14. A Sinking fund depreciation is prohibited in the U.S.
15. D A firm that continues to invest in new assets will have higher depreciation expense due to the use of accelerated methods.
16. C Changing the salvage value of an asset is considered a change in accounting estimate; past income does not need to be restated.
17. A Inflation causes ROA and ROE to be too high because the true cost of replacing the asset is not reflected by depreciation.
18. C A change in depreciation method is a change in the method of accounting. The cumulative effect on past income should be noted.
19. B This statement correctly describes an impaired asset.
20. A The loss from impairment does not affect cash flow.
21. B Average age calculations can be useful because they allow an analyst to assess the quality of a company's assets and help the analyst forecast when major capital expenditures will be required.
22. C Don't let this confuse you. In testing for impairment, undiscounted cash flows are used. Once impairment has been detected, it should be measured using discounted cash flows.
23. C Cash flow is not decreased by SFAS 143 since the annual accretion is not a cash charge. The other statements are true. The debt-equity ratio is higher because debt will be higher and equity will be lower. Asset turnover ratios are lower because assets are higher. The present value of the liability added to the asset's balance at the time of purchase is depreciated over the asset's useful life, thus increasing depreciation expense.
24. D Sinking fund depreciation is calculated to produce a constant return on investment.