

INVENTORY

Definition: inventory is a stock of goods or other items owned by a firm and held for sale or for processing before being sold, as part of a firm's ordinary operations.

Merchandise inventory - inventory of retailers or wholesalers. -

Finished goods - manufacturing firms. (Also hold work in process and raw materials or supplies).

For most firms, inventories are the firm's major revenue producer. Exceptions would be service-oriented companies, which carry little or no inventories.

The percentage of inventories to total assets range from as low as 20% for manufacturers to over 65% for retail firms.

Manufacturing	
Drugs and Medicine	23.6
Household Electric Appliances	29.8
Sporting and Athletic Goods	39.4
Wholesale	
Drugs	40.2
Electrical Appliances	43.5
Sporting and Recreational Goods	49.4
Retail	
Drugs .	- 47.1
Household Appliances	50.7
Sporting Goods and Bicycles	63.6

Source: Robert Morris Associates. *Annual Statement Studies*, Philadelphia, PA. 1992.

Given the relative magnitude of inventory, one important factor in measuring income is the value of ending inventory. The higher the value of ending inventory (reported in the **balance sheet**), the lower the value of COGS and, therefore, the higher the net income (**income statement**). The significance of inventory accounting is underlined by the presence of inflation and by the implications of tax payments and cash flows.

Before one gets into the valuation problem, recall the inventory equation:

$$EI = BI + P - COGS$$

or

$$BI + P = COGS + EI$$

Left Side known — issue is to allocate sum on left side to right side

Cost-Flow Assumption and Valuation

Inventory valuation is based on an assumption regarding the flow of costs and has nothing to do with the **actual** order in which products are sold. The cost-flow assumption is made in order to match the cost of products sold during an accounting period to the revenue generated from the sales and to assign a dollar value to the inventory remaining for sale at the end of the period.

Because purchase prices fluctuate during the year, COGS and the value of ending inventory both require an assumption about the physical flow of inventory.

1. **FIFO: First In First Out**, assigns cost of the earliest units acquired to the COGS and the cost of the most recent acquisitions to ending inventory.
2. **LIFO: Last In First Out**, assigns the cost of the latest units acquired to the COGS and the cost of the oldest acquisitions to ending inventory.
3. **Weighted average**: Assigns an average cost to COGS.

- Impact of LIFO and FIFO in periods of rising prices

	LIFO	FIFO
Cost of goods sold	Higher	Lower
Income before taxes	Lower	Higher
Income taxes	Lower	Higher
Net income	Lower	Higher
Cash flows	Higher	Lower
Inventory balance	Lower	Higher
Working capital	Lower	Higher

Inventory example

Opening inventory	10	Balance Sheet	
1st unit purchased	11	Cash	50
2nd unit purchased	12	Inventory	<u>10</u>
			60
		Equity	60

Sell 1 unit for 24

	<u>FIFO</u>	<u>Wtd Avg</u>	<u>LIFO</u>
Revenues			
COGS			
Gross Profit			
GP Margin			
Balance Sheet			
Cash			
Inventory			
Equity			
CFO			

Introduce taxes @ 20%

	<u>FIFO</u>	<u>Wtd Avg</u>	<u>LIFO</u>
Revenues			
COGS			
Gross Profit			
Taxes			
Net Income			
Balance Sheet			
Cash			
Inventory			
Equity			
CFO			

Informational implications

**LIFO -- closest to current cost on I/S
-- furthest from current cost on B/S**

**FIFO -- furthest from current cost on I/S
-- closest to current cost on B/S**

**Weighted average -- best or worst of both world??
-- actually closest to FIFO**

RISING PRICES -- PRAGMATIC CONSIDERATIONS

When LIFO is a permitted method for income taxes, lower income translates into lower taxes and thus higher cash flows. *In the U.S., IRS regulation require that the same method of inventory accounting used for tax purposes also be used for financial reporting.*

From an economic perspective, given rising prices, LIFO is a good choice, as taxes will be lower and cash flows will be higher despite the lower reported income.

In the US, under conditions of rising prices, the tax savings from LIFO usually dictate the choice of that method. In an annual survey of accounting practices followed by 600 industrial and merchandising corporations in the U.S. in the early 1970s, 146 companies surveyed reported using LIFO. By the early 1990s, this number has increased to 361.

Impact of LIFO on Turnover Ratio:

Illustration of Turnover Ratio Under LIFO and FIFO

Year	Quarter	Purchases = Sales	Cost per Unit	Total	For Entire Year		
Opening inventory		100	\$10.00	\$1,000			
1	1	100	\$11.00	\$1,100	FIFO	COGS	\$ 4,641
1	2	100	\$12.10	\$1,210		Avg. inv.	\$ 1,232
1	3	100	\$13.31	\$1,331	LIFO	COGS	\$ 5,105
1	4	100	\$14.64	\$1,464		Avg. inv.	\$ 1,000
2	1	100	\$16.11	\$1,611	FIFO	COGS	\$ 6,795
2	2	100	\$17.72	\$1,772		Avg. inv.	\$ 1,804
2	3	100	\$19.49	\$1,949	LIFO	COGS	\$ 7,474
2	4	100	\$21.44	\$2,144		Avg. inv.	\$ 1,000
3	1	100	\$23.58	\$2,358	FIFO	COGS	\$ 9,948
3	2	100	\$25.94	\$2,594		Avg. inv.	\$ 2,641
3	3	100	\$28.53	\$2,853	LIFO	COGS	\$10,943
3	4	100	\$31.38	\$3,138		Avg. inv.	\$ 1,000

Turnover Ratios

	Year 1	Year 2	Year 3
FIFO	3.77	3.77	3.77
LIFO	5.11	7.47	10.94
Current cost	4.14	4.14	4.14

ADJUSTMENTS

Adjustment from LIFO to FIFO *Balance Sheet Adjustment*

$$\text{Inventory}_F = \text{Inventory}_L + \text{LIFO Reserve}$$

Income Statement Adjustment

Adjustment of COGS from LIFO to FIFO

Purchases need not be adjusted (are not a function of the accounting method) can be derived from the financial statements.

We use the following relationships:

$$\text{COGS}_F = \text{BI}_F + P - \text{EI}_F$$

$$\text{COGS}_L = \text{BI}_L + P - \text{EI}_L$$

$$\text{COGS}_F = \text{COGS}_L - [(\text{EI}_F - \text{EI}_L) - (\text{BI}_F - \text{BI}_L)]$$

$$\text{COGS}_F = \text{COGS}_L - [\text{LIFO reserve}_E - \text{LIFO reserve}_B]$$

Adjustment from FIFO to LIFO (Current Cost)

Only I/S adjustment relevant

$$\text{COGS}_L = \text{COGS}_F + [\text{BI}_F \times \text{specific inflation rate}]$$

RATIO ADJUSTMENTS

Income Numbers --- USE LIFO

- Gross Margin
- Turnover
- Debt/Equity
- ROA
- Current Ratio -- Working Capital

B/S Numbers -- USE FIFO

(JIT implications)

Other Considerations

- LIFO LIQUIDATIONS
- DECLINING PRICES

SUN COMPANY: Inventory Disclosures

Inventories of crude oil and refined products are valued at the lower of cost or market. The cost of such inventories is determined principally using LIFO. Materials, supplies, and other inventories are valued principally at the lower of average cost or market.

Inventories at December 31

<i>(\$ in millions)</i>	1991	1992	1993	1994
Crude oil	\$147	\$109	\$140	\$193
Refined products	229	261	244	335
Materials, supplies, and other	<u>106</u>	<u>81</u>	<u>80</u>	<u>85</u>
Total	\$482	\$451	\$464	\$613

The current replacement cost of all inventories valued at LIFO exceeded their carrying cost by \$536, \$530, \$390, and \$459 million at December 31, 1991 through 1994, respectively.

<i>(\$ in millions)</i>	1991	1992	1993	1994
Cost of Goods Sold	8,460	7,192	5,821	6,276

Adjustment from LIFO to FIFO, 1991-1 994

A. Adjusting LIFO Inventory to FIFO (Current) Cost

All Inventories	1991	1992	1993	1994
Total reported inventories*	\$482	\$451	\$464	\$ 613
LIFO reserve	<u>536</u>	<u>530</u>	<u>390</u>	<u>459</u>
Inventories at FIFO	\$1,018	\$ 981	\$854	\$1,072

Inventories Carried at LIFO

Crude oil / refined products at LIFO	\$ 376	\$ 370	\$ 384	\$ 528
LIFO reserve	<u>536</u>	<u>530</u>	<u>390</u>	<u>459</u>
Crude oil / refined products at FIFO	\$ 912	\$ 900	\$ 774	\$ 987

B. Adjusting LIFO COGS to FIFO COGS

Cost of goods sold at LIFO		\$7,192	\$5,821	\$ 6,276
Less: LIFO Effect**		<u>(6)</u>	<u>(140)</u>	<u>69</u>
Equals: Cost of goods sold at FIFO		\$7,198	\$5,961	\$6,207

**Change in LIFO reserve

Going from LIFO to FIFO

$$COGS_F = COGS_L - \Delta \text{ LIFO reserve}$$

Going from FIFO to LIFO

$$COGS_L = COGS_F + (r \times BI_F)$$

$$\text{Therefore } (r \times BI_F) = \Delta \text{ LIFO reserve}$$

$$(r \times 774) = 69$$

$$r = 69/774 = 8.9\%$$

Amerada Hess: Inventories, December 31, 1993 - 1994

Years Ended December 31, data in \$ millions	1993	1994
Inventories at year end:		
Crude oil	\$299	\$250
Refined and other finished products	<u>436</u>	<u>583</u>
Subtotal	\$735	\$833
Materials and supplies	<u>118</u>	<u>113</u>
Total inventory	\$853	\$946
Cost of products sold & operating expenses	\$ 4,287	\$ 4,450

Inventories: Crude oil and refined product inventories are valued at the lower of cost or market value. Cost is determined on the first-in, first-out method for approximately 60% of the inventories and the average cost method for the remainder. Inventories of materials and supplies are valued at or below cost.

Source: Amerada Hess Annual Reports, 1993-1994

$ \begin{aligned} \text{COGS}_L &= \text{COGS}_F + (r \times \text{BI}_F) \\ &= 4,450 + (8.9\% \times 735) \\ &= 4,450 + 65 \\ &= 4,515 \end{aligned} $
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THE LIFO VERSUS FIFO CHOICE

Which is the preferred choice? Answer involves complicated calculations since a number of factors must be considered:

- (1) **Estimated tax savings** from use of LIFO.
- (2) **Inventory materiality:** The larger the firm's inventory balance, the greater the incentive to use LIFO as the potential tax saving is larger.
- (3) **Tax loss carryforward:** The larger a firm's tax loss carryforward, the less incentive to use LIFO.
- (4) **Inventory variability:** The higher the variability the more likely the company to face inventory liquidation. Favors FIFO over LIFO.
- (5) **Bookkeeping cost** (higher for LIFO): Larger firms will be able to absorb these costs more readily.
- (6) **Leverage:** Leverage and current ratios appear better under FIFO (the debt agreement hypothesis)

Why do some firms stay on FIFO?

- It may indicate above factors skewed towards FIFO choice e.g. declining prices
- Management compensation, debt covenants
- Management inefficiency
- Low quality of earnings