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Last-in, First-out

BY WILLIAM A. PATON

IN DETERMINING cost of sales and inventory balance it is often not feasible to trace the flow of costs in terms of specific components. It is often necessary, in other words, to adopt some reasonable assumption as to the manner in which the cost stream moves through the enterprise and attaches to periodic revenues. Ignoring arbitrary, unsystematic procedures there are three main possibilities, all of which have some standing in practice. First is the assumption that each drawing of cost factors from the pool of costs incurred is composed of proportionate parts of all the various increments taken into the pool, including the opening inventory as the first increment. The procedure based on this interpretation is generally known as the weighted-average method. Second is the assumption that cost components are utilized in the order of acquisition, beginning with the earliest increment. This is the procession conception of the cost stream, the basis of first-in, first-out procedure. The third possible approach assumes that costs pass on or expire in the reverse of acquisition order, that the latest increments in the pool are always drawn first. This is the last-in, first-out method, a procedure which has been widely discussed in recent years and has received strong support from certain quarters. It is this third procedure or policy which it is proposed to examine critically in this paper.

TECHNICAL CHARACTER OF METHOD

As a means of considering the technical character of last-in, first-out procedure let us assume that during the first month of operation the X company

NOTE.—Material used in this article has been adapted by the author from his forthcoming book, *Advanced Accounting*.

buys a particular class of materials in five lots as follows:

Date	Quantity	Price	Amount
Jan. 5.....	1,000	\$3.0000	\$ 3,000.00
12.....	4,000	2.9000	11,600.00
20.....	2,000	2.9000	5,800.00
25.....	1,500	3.0000	4,500.00
30.....	3,000	3.1425	9,427.50
	11,500		\$34,327.50

During the month 6,500 units are drawn from stock and placed in operation and the inventory on January 31st is 5,000 units. With these conditions the cost of materials used in January, determined by last-in, first-out procedure, is found as follows:

Date	Quantity	Price	Amount
Jan. 30.....	3,000	\$3.1425	\$ 9,427.50
25.....	1,500	3.0000	4,500.00
20.....	2,000	2.9000	5,800.00
	6,500		\$19,727.50

The cost of goods remaining in stock consists of the remaining lots, in this case the first two acquired, as shown by the following:

Date	Quantity	Price	Amount
Jan. 12.....	4,000	\$2.9000	\$11,600.00
5.....	1,000	3.0000	3,000.00
	5,000		\$14,600.00

In the following period the opening inventory would represent the oldest stock and hence be the first component of the next inventory taken. Assuming no change in the physical amount of stock on hand at succeeding inventory dates it is noticeable that the effect of the method is to peg the inventory permanently at precisely the amount of the cost of the original accumulation.

An interesting technical feature of last-in, first-out procedure lies in the fact that a change in the period of

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reckoning may change the results obtained—a condition which does not attach to the first-in, first-out method. If inventory is taken and cost of goods utilized or sold is computed at the end of the period, for example, the cost of goods withdrawn is found—as shown above—by totaling quantities and corresponding charges incurred throughout the period, beginning with the most recent increments, until all quantities and charges have been absorbed except for the amounts applicable to the new inventory. If, on the other hand, withdrawals are computed from day to day the total amount absorbed for the period is found by combining a series of computations made before the data as to last-in increments for the period viewed as a whole are available.

Assume, for example, that the receipts section of a particular stores account for January shows the following:

Date	Quantity	Unit cost	Amount
Jan. 1 (bal.)	1,000	\$1.00	\$1,000.00
10.....	500	1.10	550.00
25.....	900	1.15	1,035.00

Six requisitions are filled during January showing in the order of issue the following quantities—100, 400, 50, 600, 200, and 200—a total of 1,550 units. The assumed dates are indicated below. If the total issues for the month are priced by last-in, first-out with the data for the entire period available the amount drawn is computed as follows:

Issue date	Quantity	Issue price	Amount
Jan. 4.....	100	\$1.15	\$ 115.00
8.....	400	1.15	460.00
13.....	50	1.15	57.50
15.....	{ 350	{ 1.15	{ 402.50
	{ 250	{ 1.10	{ 275.00
20.....	200	1.10	220.00
27.....	{ 50	{ 1.10	{ 55.00
	{ 150	{ 1.00	{ 150.00
	<u>1,550</u>		<u>\$1,735.00</u>

Determining issues in this manner leaves an inventory of 850 units as-

sumed to be from the opening inventory, priced at one dollar each. If, however, the issues were priced when issued, quite a different division of costs would be obtained. On January 4th and 8th, for example, the most recently acquired stock is the opening inventory, and the issues of these dates would be priced in terms of the unit cost attaching to the opening inventory. Similarly each batch issued would be priced in terms of the unit cost of the latest acquisitions as of the date of issue. The results for the month would be as follows:

Issue date	Quantity	Issue price	Amount
Jan. 4.....	100	\$1.00	100.00
8.....	400	1.00	400.00
13.....	50	1.10	55.00
15.....	{ 450	{ 1.10	{ 495.00
	{ 150	{ 1.00	{ 150.00
20.....	200	1.00	200.00
27.....	200	1.15	230.00
	<u>1,550</u>		<u>\$1,630.00</u>

The cost of the inventory of 850 units on hand on January 31st is now \$955. This is made up as follows:

150 units from opening inventory at \$1.00.....	\$150.00
700 units from receipts of January 25 at \$1.15.....	805.00
	<u>\$955.00</u>

This inventory, a mixture, is not far removed from that which would be computed under the first-in, first-out issuing procedure, although the last-in, first-out conception has been strictly adhered to in pricing issues from day to day.

EFFECT ON PERIODIC INCOME

The adoption of last-in, first-out is sometimes defended by reference to the view that in determining true profit the revenues of the period should be charged with costs measured by the level of prices obtaining at the end of the period. Is there any substantial merit in this line of argument? Answer in the nega-

tive seems to be called for. In the first place not very much of a case can be made for measuring profit in the manner indicated. In the revenues of the period are represented the prices of product in effect from day to day, and the costs to be charged to such revenues are the actual costs which have been incurred throughout the period and earlier which are reasonably assignable to the various batches of product sold. It is not always easy to identify and price the applicable cost elements, but there seems to be no good reason for assuming that the problem can be solved by considering only the conditions obtaining at the close of the period. Current replacement costs may have a special bearing on future selling prices, but it does not follow that the costs of the past can be ignored in measuring the realized profit or loss of the past. In the second place the use of last-in, first-out does not result in charging revenues with costs based on year-end prices. Assume, for example, an opening inventory of 1,000,000 barrels of crude oil, acquisitions during the period of 50,000,000 barrels, and sales of 50,000,000 barrels. With these conditions the materials cost of sales by the last-in, first-out method, applied to the data of the period as a whole, is identical with the total cost of acquisitions, received at varying prices, and this figure will not even approximate the cost of 50,000,000 barrels at the latest quotation where there has been a sharp movement in prices toward the end of the year. There is the further point, as explained in the preceding section, that where there is a continuous pricing of goods issued under last-in, first-out procedure the total cost of issues for the period may not coincide with the cost of the most recent acquisitions in corresponding quantity. In the third place it may be urged that for managerial purposes it is more useful to apply the relatively recent costs to the goods on hand than to goods sold. Completed sales and the

related costs are "water under the bridge," closed transactions. Utilization of the inventory, on the other hand, lies in the future and in planning such utilization the current level of costs is especially significant.

The use of last-in, first-out as compared with first-in, first-out procedure undoubtedly tends to reduce the fluctuations from period to period in reported net income, and the advocates of the former method make much of this fact. Assume, for example, that in the first period of operation the X company buys 10,000,000 barrels of oil in ten equal lots at prices ranging from 91 cents per barrel for the first lot, 92 cents for the second lot, and so on to one dollar for the last lot, and that the inventory at the end of the period is 1,000,000 barrels. With these conditions the application of first-in, first-out yields a figure for the cost of goods sold or utilized (assuming no loss through shrinkage or otherwise) amounting to the cost of the first nine lots, or \$8,550,000, while the use of last-in, first-out method gives a figure of \$8,640,000, the cost of the last nine lots. And the cost of the inventory computed by the first method is \$1,000,000, and by the second method, \$910,000, a difference of \$90,000. This means that the net income reported under first-in, first-out will be \$90,000 more (or the net loss \$90,000 less) than will be reported under last-in, first-out. Similarly, if the purchases of the X company during the first period were acquired in ten lots at declining prices ranging from one dollar for the first lot, 99 cents for the second, and so on to 91 cents for the last, with other conditions as before, the use of first-in, first-out would yield a cost of goods sold or utilized of \$8,640,000 and the use of the other method would give a figure of \$8,550,000. The inventory figures, likewise, would be reversed. With respect to net income, in turn, the effect of last-in, first-out under these circumstances as compared with the

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alternative procedure would be an addition of \$90,000.

As suggested by the example, the extent to which the peaks of good years are cut off and the valleys of bad years are filled in any case by the use of the last-in, first-out method depends on the relative importance of the inventory figure in the computation and the severity of the advance or decline in prices, but there is no denying the fact that the method exerts a stabilizing influence on reported earnings. The question then arises, Is such stabilizing desirable? In answering this query a clear distinction must be drawn between the stabilization of the actual volume of business and of the actual income, and a policy of statistical smoothing or averaging.

No doubt there is much to be said for any promising program which aims to minimize business fluctuations. It should be equally evident that any plan designed to alter the appearance of business affairs without effecting any change in the objective circumstances is open to serious question. The extractive enterprises, it is generally agreed, are subject to sharp fluctuations from year to year. If this is the case it is certainly not desirable to introduce accounting methods in this field which bring about a purely specious, artificial stability. In other words, if there are good years and bad years this condition should be disclosed, not obscured, by the accounts and reports.

It is true that yearly statements at the best are subject to serious limitations as a basis for judging the progress of the continuing enterprise. This fact, however, does not justify arbitrary tinkering with such statements. The proper remedy lies in the extension of the use of average and cumulative statements to supplement the annual report. Entire elimination of the short-term reckoning is preferable to artificial modification of such reckoning. The statement for the particular year, if issued at all, should

reflect the conditions of that year, good or bad.

FIRST-IN, FIRST-OUT AND PROFIT REALIZATION

The proponents of last-in, first-out sometimes argue that the use of first-in, first-out may result in the recognition of unrealized profit in the form of "mere inventory markup." This argument is almost entirely lacking in force. In a period of rising prices, it is true, the inventory absorbs an increasing number of dollars, an increasing amount of capital. It is also true that profits may be "tied up" in the inventory, even where there is no increase in the physical quantity of goods on hand. But this is a far cry from recognition of unrealized profits. Assume, for example, that a tire dealer at the beginning of a particular year has on hand 2,000 tires which cost \$15 each, a total inventory of \$30,000. During the year, to continue the illustration, purchases consist of ten lots of 2,000 tires each, all of one make and size. The first lot cost \$15.50 per tire, and in the case of each succeeding purchase the cost increased by 50 cents per tire, the unit price of the last batch being \$20. The dealer marks and racks the tires in such a manner that the oldest stock is always utilized first. Total sales during the year amount to 20,000 tires and the inventory again consists of 2,000 units. Following first-in, first-out procedure, which conforms precisely to the flow of goods in this situation, the cost of goods sold for the year is \$345,000 and the cost of goods on hand at the end of the period is \$40,000. The investment in inventory is now \$40,000 as compared with \$30,000 at the beginning of the year although the physical quantity is unchanged. But there is no lack of realization here. The literal fact is that specific goods which cost \$345,000 have been sold and that goods which cost \$40,000 are on hand awaiting sale. There is no more question about the investment of \$40,000 now

than there was with regard to the investment of \$30,000 at the beginning of the year. If the increase has been financed from profits it is of course true that this section of profits is not immediately available for cash dividends, but the same can be said of any absorption of profits in current assets other than cash or similar resources, or in fixed assets. Moreover, the increase in the inventory of \$10,000 with no increase in quantity is just as real and valid an asset as would have been present if, with no change in tire prices, the dealer had increased his physical stock at a cost of \$10,000. No one would question the validity of the cost of a building which was erected at an expenditure of \$40,000 because a preceding building, of the same character, cost only \$30,000, and there is no excuse for questioning the validity of the inventory of \$40,000 because an earlier inventory of the same character, but consisting of other units, cost only \$30,000.

ACTUAL PHYSICAL MOVEMENT AND ASSUMED ORDER OF USE

For most situations a flow of items in procession fashion reflects efficient utilization of resources. In many cases, of course, the actual movement does not conform closely to the procession assumption, and often there would be little point to attempting to bring about a more complete agreement of objective circumstances and first-in, first-out accounting procedure. Nevertheless it may be insisted that wherever convenient it is well to secure a physical use in roughly a first-in, first-out order, and that in the handling of perishables such method of use is imperative.

Last-in, first-out in the physical sense, on the other hand, would seldom if ever be desirable as a settled policy, and seldom if ever in practice is such an order of use actually followed for any considerable period. Indeed, if this method of handling goods were generally employed the loss due to deterioration

would be enormous. Here seems to be a serious objection to the general use of last-in, first-out as an accounting procedure. Other things being at all equal it is presumably better to adopt conceptions and methods in accounting which are in harmony with external conditions, with objective administration of resources. At least the burden of proof should be very definitely on those who propose methods of reckoning costs which run directly counter to good physical practice. Accounts show dollars rather than goods, but the recorded dollars should faithfully reflect the existing array of productive factors.

RELATION TO ASSET VALUATION

Enthusiasts for last-in, first-out often urge that the inventory is essentially a fixed asset, at least to the amount of a normal stock, and should be priced accordingly. Assuming for the sake of argument that the inventory is an asset similar to plant, and ignoring entirely the question of accrued depreciation, it is worth-while to see if the last-in, first-out procedure applied to inventory conforms to standard practice with respect to the handling of acquisitions and retirements of buildings and equipment.

Under last-in, first-out procedure the goods on hand are always assumed to be composed of the oldest stock. This means that the original cost of building up the minimum quantity of inventory carried is permanently retained in the accounts. For example, if the X company in its first period of operation acquires an inventory of 1,000,000 barrels of oil at a cost of 50 cents a barrel and if in subsequent periods the quantity never falls below this amount there will be included in each succeeding inventory 1,000,000 units priced at the original cost of 50 cents each, without regard to the actual cost of the materials on hand. Any excess of inventory over 1,000,000 barrels will be priced in terms of the oldest possible increment in view of the record of purchases and with-

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drawals. What are the results if this procedure is applied to plant? Assume, for example, that at the beginning of operations the X company acquires 100 similar trucks at a cost of \$1,500 each, and that three years later these trucks are replaced with 100 new units, of the same type as the old, at a cost of \$1,200 each. Following the last-in, first-out method the "inventory" of trucks at the end of three years remains pegged at \$150,000, notwithstanding the obvious fact that the existing fleet cost only \$120,000. Moreover, this condition will remain unchanged no matter how many times the "stock" of trucks is renewed, and no matter how far the cost of succeeding fleets varies from that of the first installation.

Such a treatment of plant account would be the very antithesis of good practice and would presumably not be tolerated by any public accountant. The requirement that the records shall show the cost of the existing layout of facilities, rather than the cost of an earlier generation of assets, is almost axiomatic. Even under the retirement policy of dealing with plant cost, which has a strong foothold in the public-utility field, the preferred treatment is to close out the cost of old units as retired and capitalize the cost of new units placed in service. For the larger elements of plant it is generally possible to identify specific units eliminated in terms of specific costs of acquisition. Where such identification is not feasible the assumption that assets pass through the enterprise on a first-in, first-out basis is usually relied upon in estimating the cost of units retired. There is no place in the procedure at any point for last-in, first-out.

Upon examination, then, the view that last-in, first-out procedure may appropriately be applied to inventory costs because of an assumed relation of inventories to fixed assets is found to be without merit. There is nothing in the standard practices associated with plant

accounting to encourage use of last-in, first-out.

Implied in the foregoing is a serious objection to last-in, first-out from the balance-sheet standpoint. Over a period of years the cost of the inventory derived by the use of this method may be greatly in excess of, or far below, the prevailing cost of the goods. Suppose, for example, a concern acquired an original inventory of raw sugar at a cost of 20 cents a pound and that some years later the cost of such material has fallen to 4 cents. Is it good reporting to continue to show an inventory, up to the amount of the original quantity, priced at 20 cents? Similarly if an initial inventory of copper is acquired at 5 cents a pound is it proper to continue to report the inventory at this price during years in which all copper acquired was purchased at not less than 10 cents per pound? Evidently a balance-sheet in which important assets are priced by the last-in, first-out procedure cannot be relied upon to furnish a showing of current position which is even roughly reliable.

RELATION TO TAXABLE INCOME

Under an income-tax program which emphasizes the annual reckoning it is not surprising that last-in, first-out has gained many adherents, particularly in fields in which the annual fluctuations in the volume of sales and amount of net income are often very sharp. For example, if an oil refining company makes a profit of \$5,000,000 in its first year of operation and loses \$2,000,000 the next year the income tax is not based on the profit of the two-year period, \$3,000,000. Instead the company is subject to a tax based on \$5,000,000 the first year and is not entitled to any refund on account of the bad showing of the second period. As explained earlier, the use of the last-in, first-out procedure as compared to first-in, first-out tends to reduce—in the reports—the extent of the periodic swings. As-

suming that the figures just given are based on first-in, first-out procedure it would be quite possible that a shift to the other method of computing cost of sales would cut off a considerable fraction of the profit shown in the first year and cancel a substantial portion of the loss suffered in the second year, and if the revised treatment were accepted for tax purposes a reduction in the total taxable income of the two years would result.

It should be understood that restricting reported profits in years of

good business and advancing prices and improving the showing in years of shrinking volume and falling prices through the aid of the last-in, first-out procedure will not affect the total amount of tax substantially over a period of years where there are no net losses in particular periods. Moreover, to the extent that net losses may be forwarded and treated as allowable deductions in succeeding years the importance of the procedure as a means of modifying tax liability is minimized.