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Inflation Accounting and Nonfinancial Corporate Profits: Physical Assets

THIS ARTICLE is the first of two complementary papers concerning inflation accounting and nonfinancial corporate profits. This installment discusses the general conceptual and practical issues in defining an inflation-adjusted measure of profits and examines the treatment of depreciable assets and inventories in detail. The companion article, to appear subsequently in *BPEA*, will analyze accounting practices for financial assets and liabilities, and also aggregate and summarize the results of both papers.

The Definition of Real Corporate Profits

It is widely recognized that inflation of the general price level and relative price adjustments distort and cloud the meaning of corporate accounts and, therefore, also corporate taxation and the portion of the national income accounts (NIA) that is based on corporate financial statistics. The distor-

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tion arises primarily because under current accounting practice firms carry many physical and financial assets and liabilities at original cost or book value, figures that are expressed in dissimilar units and that may deviate widely from current market value or replacement cost. Accounting practices also differ greatly across firms and between tax and book financial reports for the same company. These practices may create unnecessary inefficiencies in taxation and investment, and increase difficulty in predicting or assessing the cyclical position of the economy. Indeed, there has been some speculation that the recognition of the 1974–75 recession was delayed by the distorting effects of inflation on reported business statistics.[1]

The importance of such effects has increased greatly in the past ten years, as has the rate of change of general price levels. Among a number of studies analyzing these issues, several recent papers have concentrated on the impact of inflation on corporate and personal income taxation.[2] The Davidson-Weil and the Tideman-Tucker papers evaluate the potential impact of adoption of inflation-accounting principles recently proposed by the Financial Accounting Standards Board (FASB).[3] In contrast, this paper and its sequel aim to begin from scratch and develop a consistent economic definition of real corporate profits and associated accounting procedures. The individual sources of the inflationary distortions implied by current accounting practices will be analyzed. Estimates of the micro and macro magnitudes involved in moving to inflation-adjusted accounting procedures will be presented.

The first issue to be addressed in such a study is the definition of corporate net income or profits. Corporate income figures are used for a wide variety of purposes. They serve as a base for corporate taxation, as a guide to investment allocation and management performance, as an ingredient

1. See, for example, James P. Gannon, "Analysts Now Agree Recession's Key Cause Was Rampant Inflation," *Wall Street Journal*, April 25, 1975.

2. See, for example, William Fellner, Kenneth W. Clarkson, and John H. Moore, *Correcting Taxes for Inflation* (American Enterprise Institute, 1975), and three papers prepared for the Brookings Conference on Inflation and the Income Tax System, Washington, D.C., October 30–31, 1975 (scheduled for appearance in a Brookings conference volume): Sidney Davidson and Roman L. Weil, "Inflation Accounting: Some Income Tax Implications of the FASB Proposal"; Edward M. Gramlich, "The Economic and Budgetary Effects of Indexing the Tax System"; and T. Nicolaus Tideman and Donald P. Tucker, "The Tax Treatment of Business Profits under Inflationary Conditions."

3. FASB, Proposed Statement of Financial Accounting Standards (Exposure Draft), "Financial Reporting in Units of General Purchasing Power" (December 31, 1974; processed).

in the construction of national income accounts, and as data for determining the functional and personal distribution of income. No single concept or measure of income will always be optimal for all of these uses. While we will focus on a definition that we find most appropriate for income or welfare comparisons, other constructions will be described and the available data necessary for their evaluation will be presented here and in the sequel.

In discussing income definitions, the initial question is whose income is being estimated. There are several classes of claimants on the assets and income flows of a firm, including bondholders, banks and other short-term lenders, and preferred and common stockholders. In our work, profits are taken to be a measure of the increase in real economic power of the equity holders due to their investments. This definition is consistent with current accounting practice and with the tax base of the present corporation income tax.

A fundamental choice faced in defining corporate profits is between using a realization or an accrual basis. An identical issue exists in assessing personal income. The fundamental question is whether assets and liabilities should be carried on balance sheets at historical cost or at current market value. When is economic power enhanced—at the time the market value of an asset increases (or a liability decreases), or when these changes in value are converted into cash? Present corporate accounting practices adopt a combination of the accrual and realization criteria. While accounts receivable and payable are accrued (that is, treated as equivalent to cash), other financial assets and liabilities of nonfinancial corporations are carried at their issue or purchase prices until redeemed or sold, a convention consistent with a realization principle. Land and other real capital assets that are deemed nondepreciable and nondepletable are also carried at purchase price. Real depreciable assets are written down from original cost according to a presumptive schedule of the effects of wear, tear, and obsolescence. The depreciation aspect of this policy can be interpreted as an attempt to approximate accrual accounting for these items, while the original-cost basis is more consistent with the realization principle. As will be described below, current accounting practice with respect to inventoried assets in effect gives firms a once-and-for-all choice between accounting methods that approximate the accrual or realization definitions of income. The present accounting system rests on an intended logic with respect to the accrual-realization choice, although it has not been implemented as pre-

cisely as it might. One of the major tenets of financial accounting is the *going-concern* assumption, according to which the firm will continue in its particular productive activity indefinitely.[4] It is in the business of selling some things and using (not selling) others (like physical plant and equipment). Since these latter items are not going to be sold, their current market value is not relevant for the firm. This classification of goods implies accrual accounting on items that the firm sells and a realization method on those that it does not.

In evaluating the accrual and realization bases, and combinations thereof, a hypothetical "ideal" economy with universal competitive markets and no transactions costs may be a useful tool. In such a world (one in which many economists spend much of their research time), a realization-based definition of income would have little justification. Firms or individuals are implicitly reinvesting in unsold assets and reissuing unredeemed liabilities at each point in time. Their incomes should be independent of their choices about whether to reinvest in the same assets (and liabilities), to exchange assets, or to consume. This sort of logic leads to the Haig-Simons concept of personal income defined as consumption plus the change in accrued net worth,[5] and suggests that distributions to equity holders plus the change in accrued net worth be taken as the corresponding definition of corporate net income (that is, profits). In this world and with this definition of profits, neither depreciation schedules nor alternative inventory-valuation policies are needed. All assets and liabilities would be carried on balance sheets at market value and the net worth of the equity holders would be equal to the value of the firm's assets less the value of its liabilities (the value of the claims of the prior claimants on the assets of the firm). The component of profits reflecting change in net worth would be determined simply by comparing the end-of-period and beginning-of-period balance sheets. This definition of profits includes accrued capital gains. While we

4. See, for instance, Arthur L. Thomas and S. Basu, *Basic Financial Accounting* (Wadsworth, 1972), pp. 59–60.

5. Simons suggests that personal income can be estimated as "(a) the amount by which the value of a person's store of property rights would have increased, as between the beginning and end of the period, if he had consumed (destroyed) nothing, or (b) the value of rights which he might have exercised in consumption without altering the value of his store of rights. In other words, it implies estimate [sic] of consumption and accumulation." Henry C. Simons, *Personal Income Taxation* (University of Chicago Press, 1938), p. 49. See also Robert Murray Haig, "The Concept of Income—Economic and Legal Aspects," in Haig, ed., *The Federal Income Tax* (Columbia University Press, 1921).

view this as appropriate for an income measure, its use for national income accounting, whose primary purpose is measuring current productive activity, may be undesirable.

The computation of the real rather than the nominal change in net worth is best accomplished by stating all entries in the two balance sheets in units of common purchasing power. We follow the convention of using end-of-period (year) dollars to express profits, and for consistency state dividends paid throughout the year in these units. This approach introduces the choice of the appropriate measure of changes in purchasing power of the monetary unit. Arguments can be made for both the consumer price index and the index of domestic spending, which is the deflator for the gross national product less exports plus imports. The important differences between consumer spending and domestic spending are the inclusion of domestic investment and of public goods in the latter. We have chosen the domestic spending deflator as the indicator of general purchasing power both because changes in the prices of public and investment goods affect welfare and because it is defined more precisely than the consumer price index. As is well known, the boundary between consumption and investment goods can be set only arbitrarily because many commodities have aspects of both categories. The conceptually cleanest way out of this dilemma is to include all domestic purchases in the deflator.[6]

These arguments for a real-accrual basis for income in an ideal, complete-market world leave no room for distinctions between expected and unexpected gains, between extraordinary income and sustainable flow, or between operating results and capital gains or losses. Reported net income would include all increases in real net worth, although attempts at categorizing its sources could be considered. In fact, one of the advantages of the accrual approach is that total profits so defined are a state variable of the firm, rather than a figure over which managers have the discretion that they have under the realization principle.

It may be useful to contrast the Haig-Simons definition of profit adopted here, which can be described as *purchasing-power accrual*, with an alternative view of income as that amount of money (or purchasing power) over and above what is necessary to keep capital intact. The latter definition was

6. For a more detailed examination of these issues, see Edward F. Denison, "Price Series for Indexation of the Income Tax System" (paper presented at the Brookings Conference on Inflation and the Income Tax System).

formulated by Pigou, who further credits Marshall.[7] This alternative is certainly more consistent with current accounting practice than is the concept of purchasing-power accrual, but even its implementation would involve substantial accounting reform. The accountant's principle that the firm is in the business of selling some things and not in the business of selling others aligns with Pigou's capital-maintenance concept. It leads to distinguishing between operating profits (gains on items that the firm sells) and holding gains (which reflect the appreciation of items that the firm does not sell). While the purchasing-power-accrual definition calls for inclusion of real appreciation of capital assets in income, current accounting procedures and the capital-maintenance income definition do not.

The two definitions actually represent extremes on a continuum of possibilities. The essential difference between them can be viewed as the assumed spectrum of the "purchasing opportunity set" of the firm. If the corporation is going to maintain indefinitely the same portfolio of physical assets, regardless of events, then one can argue that changes in the value of, say, depreciable assets do not constitute income.[8] On the other hand, if the relevant purchasing opportunity set of the firm is represented by the total domestic sales of new products reflected in the domestic spending deflator, then real capital appreciation should be included in income. The accounting consequences of a definition of income based on capital maintenance, as well as those of the purchasing-power-accrual definition, will be described in the succeeding sections.

Even if the purchasing-power-accrual definition of income is accepted as appropriate in the ideal world sketched above, the difficulties and desirabilities of implementing it in the real world must be considered. The first difficulty involves determining market values. While adequate markets exist to value most inventoried items and financial assets and liabilities, most used physical plants and equipment have no organized market to provide a guide to either their liquidation value or the present value of their future product. This lack presents a real problem and forces a choice among imperfect procedures. The purpose of accounting is to paint as accurate and reliable a picture as possible of the position of the firm (its balance sheet) and the income and expenditure flows it has experienced during a par-

7. A. C. Pigou, "Maintaining Capital Intact," *Economica*, n.s., vol. 8 (August 1941), pp. 271–75.

8. The frequency of conglomerate mergers raises some doubt about the validity of this assumption.

ticular time interval (the income statement). The practical question is whether the valuation of physical plant and equipment without sale is sufficiently arbitrary to make original cost preferable to approximations of current market value. The answer probably depends on the lifetime of the asset and on both the rate of inflation and the size of adjustments in relative asset prices. With average asset lifetimes ranging up to twenty years, even a very low rate of inflation or slow rate of relative price adjustments would make original cost, on average, a poor approximation indeed.

In the absence of reasonable markets in most used physical plant and equipment, there are two alternatives to carrying these items at adjusted (that is, depreciated) original cost: (1) restate the original cost (the depreciation base) by the change in the purchasing power of the dollar since acquisition; and (2) base depreciation on current replacement cost using price indexes of specific capital goods. While neither procedure is ideal, either would probably give a far more accurate picture of the financial position of a firm in an inflationary environment than would uncorrected original cost. Conceptually, the second procedure is superior since it would closely approximate the ideal world if price indexes were perfect and depreciation schedules reflected true economic deterioration relative to new replacement units. This method would involve two separate uses of price indexes. First, price indexes of specific types of equipment and structures would be used to approximate and aggregate the current value of particular depreciable assets. Second, a broad purchasing-power index would be used, as discussed above, to compare these figures on two balance sheets for different years. The accuracy of this two-step procedure depends on the adequacy of indexes of capital-goods prices.[9] The first method is simpler in that it does not require accurate individual price series or information on the composition of the firm's capital stock other than its age structure. We have used it in our numerical estimations of the next section primarily because we lack adequate information to use the conceptually more desirable alternative and because we do not have much faith in existing indexes of capital-goods prices. The shortcoming of the first method is in its failure to account for realignments of relative asset prices, and it should be recognized that this will lead to some inaccuracy in the estimates of real capital gains and losses.

9. Also, assets, such as office buildings, that can be relatively accurately assessed should be carried at recent assessed market valuations with both of the alternative approaches.

Neither of the two inflation-adjustment methods for physical plant and equipment precisely records future "use values" or liquidation prices. Yet either of these alternatives is a more satisfactory measure than is depreciated original cost. Several attempted corporate acquisitions (for example, Otis Elevator) have involved prices in excess of book value. On the other hand, Penn Central was carrying its assets at values far above their liquidation potential. The appropriate price for physical assets clearly depends a great deal on whether they are being actively bought or liquidated. The current market price may indicate a kind of average of the "buyer's price" and the "seller's price" and provides a useful measure of the economic position of the firm even in this world of imperfect competition and high transactions costs on used physical assets.

Adopting accounting procedures consistent with an inflation-adjusted definition of profit involves adjustments to every balance-sheet entry. However, none of the current proposals for inflation accounting (or "current value" or "general value" accounting) is that far-reaching. The proposal of the Cost Accounting Standards Board (CASB), which is the accounting authority for U.S. government contracts, deals only with depreciation and, in a manner similar to our arguments above, suggests the adoption of a technique that restates original cost in terms of general purchasing power. The board finds that specific replacement-cost depreciation may be the more desirable approach, but notes that it is complicated and that its prompt application is not feasible. The SEC proposal goes slightly further, requiring footnote disclosure of specific replacement-cost data for both fixed depreciable assets and inventories. The FASB draft contains the most comprehensive plan, proposing, in addition to depreciation and inventory corrections, the inclusion in net income of the decline in the real burden of net financial liabilities.[10] That has proven to be the most controversial aspect of the draft.[11] Even the FASB, however, omits one major correction in not calling for restatement of all nominal assets and obligations to their market values—an issue that will be discussed in detail in our sequel paper.

10. CASB, "Proposed Rules: Historical Depreciation Costs—Adjustment for Inflation," *Federal Register*, vol. 40, no. 197 (October 9, 1975), pp. 47517–19; 4 CFR, pt. 413; FASB, "Financial Reporting in Units of General Purchasing Power"; Securities and Exchange Commission, Notice of Proposed Amendments to Regulation S-X to Require Disclosure of Certain Replacement Cost Data in Notes to Financial Statements (S7-579).

11. See, for example, "The Numbers Game," *Forbes*, vol. 116 (August 15, 1975), p. 40.

Partial adjustments, such as those in these proposals, may not offer a result that is closer to an economic definition of income. These proposals would lower reported corporate profits and taxes in the presence of inflation, and may be viewed positively by some for that reason. A more desirable approach is to separate the issues and first develop accounting procedures that reflect the impact of inflation on incomes and costs in an economically meaningful manner. That is the primary purpose of our two articles. Once such a framework is developed (even if not unanimously accepted), the debate about how to tax the resulting income can open.

The need to revise the accounting definition of profits for inflation has become increasingly apparent in light of the performance of prices in the first half of the 1970s. The transformation from nominal to real accounts can no longer be accomplished by deflation with a simply constructed indicator of movements in the general price level. Moreover, a picture of the real position of both the micro and macro aspects of the economy is as essential as ever for policy analysis.

Accounting for Depreciable Physical Assets

Current accounting procedures for depreciation are accurate only in an environment of no price changes, relative or absolute, and only to the extent that real depreciation matches the presumptive time schedule of write-offs used by firms. None of these conditions is met, and the condition of absolute price-level stability has not recently been approximated in the U.S. economy. This section discusses the current accounting treatment of depreciable assets and alternatives that take account of inflation.

The current practice of basing depreciation on historical cost presents several related problems. First and most important, the original cost of an item is irrelevant as a balance-sheet entry. This cost is sunk; taking the extreme case of a hyperinflation highlights the inappropriateness of such figures for assessing a firm's financial position. Second, historical-cost depreciation adds uncertainty to some investment decisions since the fraction of forgone purchasing power that is deductible depends upon future rates of inflation. Finally, most accounting statistics, both in national income accounts and corporate reports, are stated in common units such as current dollars or constant 1958 dollars. Historical-cost depreciation statistics,

however, represent a summation of individual components that are expressed in dissimilar units due to the dispersion of ages of depreciable property and the fluctuations in the purchasing power of the dollar.

As argued in the previous section, the purchasing-power-accrual definition of profits, in principle, calls for depreciation accounting based on specific price indexes for capital goods. Assets would be depreciated on a basis approximating replacement cost determined by adjusting original cost by the percentage change since acquisition in the appropriate capital-price index. In addition, any appreciation of a firm's capital goods relative to an indicator of general purchasing power (such as our choice, the domestic spending deflator) would be entered as income. The use of specific capital-price indexes and replacement-cost depreciation is also consistent with the capital-maintenance definition of income. The one difference is that under this concept, real appreciation would not be counted as income. While such replacement-cost procedures seem feasible, given sufficient resources, we believe their introduction should be postponed until the price indexes for capital assets are substantially improved. Furthermore, the alternative of adjusting depreciable assets and the corresponding depreciation bases by the movement of a single broad capital-price index relative to the general deflator seems to us an unsatisfactory halfway house. First, price indexes for aggregate capital assets, as well as for specific ones, are poor; second, it may be better to ignore all *real* gains from fixed assets than incorrectly to assign all holders the average gain experienced.

A remaining alternative, then, is simply to inflate the original cost of all depreciable assets by the general purchasing-power indicator. This technique, which has been proposed by both the FASB and the CASB, is simple, and the impact of its adoption is relatively easy to gauge as very little information regarding capital portfolios is required. While this approach, which we will term "general-value depreciation," cannot capture the effects of changes in relative asset prices, it does adjust income and balance-sheet statements for general inflation. In face of the inadequate data, it is a compromise consistent with the definitions of income based on purchasing-power accrual and on capital maintenance. Following a brief historical survey of actual depreciation policies and an analysis of their adequacy for varying inflation rates and for firms with differing growth rates, this section contains estimates of the impact of adopting a policy of straight-line general-value depreciation on the thirty firms in the Dow Jones industrial index and on nonfinancial corporations in the aggregate.

STRAIGHT-LINE DEPRECIATION

The dominant technique of calculating depreciation for "book" purposes—public reports to stockholders and presumably internal management guidance—applies straight-line writeoffs, s, to historical cost. Thus, for an asset costing C dollars which is expected to last l years, equal annual amounts of C/l are charged to depreciation throughout its service life. When the future stream of depreciation allowances is discounted at a constant interest rate, r, its present value, PV, is given (in continuous time) as

$$PV_s = \frac{C}{l}\int_0^l e^{-rt}dt. \tag{1}$$

If the nominal interest rate can be separated into an inflation component, $\dot{p}$, and a "real rate," i, such that $r = i + \dot{p}$, then

$$PV_s = \frac{C}{l}\int_0^l e^{-(\dot{p}+i)t}dt. \tag{2}$$

For a given i, a higher inflation rate reduces the present value of the depreciation stream.

The extent to which straight-line original-cost depreciation falls short of straight-line replacement-cost (or general-value) depreciation for any firm in an inflationary environment depends on the growth rate of the firm's capital stock and the longevity of its assets as well as on the inflation rate. We shall show that the understatement is smallest for rapidly growing firms with short-lived assets. Consider a firm with only one type of capital which has a service life of l years. The age structure of the firm's assets is given by the function $I(t)$, which is the number of units of capital acquired at time t. Assume smooth exponential growth (g) in asset acquisition, that is,

$$I(t) = I_0 e^{gt}, \tag{3}$$

and consider the present to be identified with $t = l$. This implies that the firm has depreciable assets that were purchased from the time $t = 0$ (when I_0 were purchased) to the present (when $I_0 e^{gl}$ is acquired). We also assume that all prices have been rising uniformly and smoothly at a rate $\dot{p}$, and thus the price of capital goods, π, is given by

$$\pi(t) = \pi_0 e^{\dot{p}t}. \tag{4}$$

With this simplified model, the original cost of the firm's depreciable assets is given by

$$I_0\pi_0\int_0^l e^{(g+\dot{p})t}dt, \tag{5}$$

whereas their replacement-cost (or general-value depreciation basis) would be

$$I_0\pi_0 e^{\dot{p}l}\int_0^l e^{gt}dt. \tag{6}$$

Using original-cost straight-line depreciation, the firm deducts the fraction $1/l$ of expression 5. Under a policy of straight-line general-value depreciation,[12] the firm could deduct the fraction $1/l$ of expression 6. The adequacy of straight-line original-cost depreciation can be judged by computing the ratio of 5 to 6, or

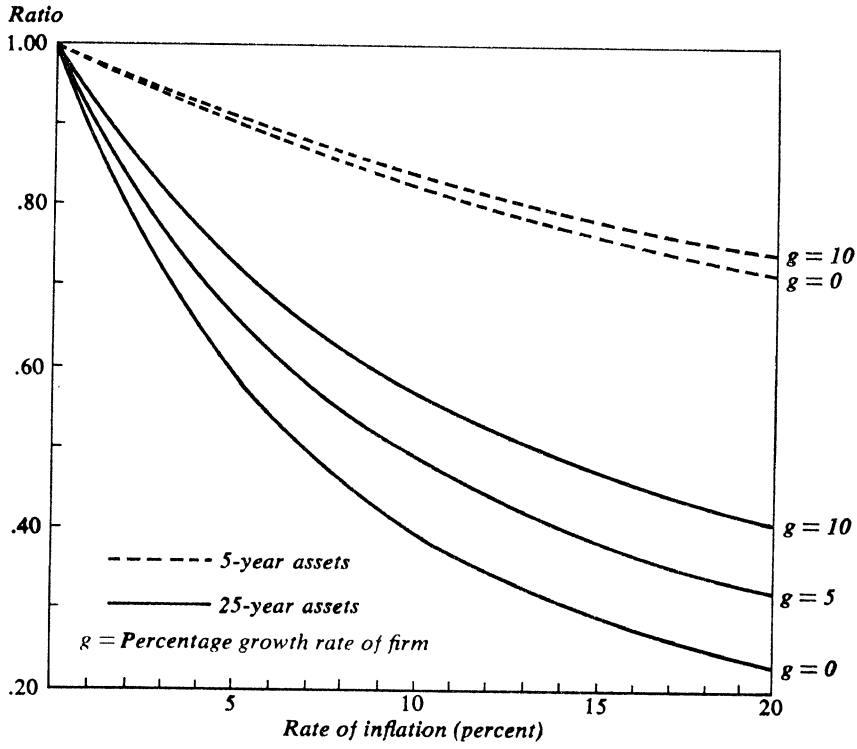
$$\frac{\int_0^l e^{(g+\dot{p})t}dt}{e^{\dot{p}l}\int_0^l e^{gt}dt}. \tag{7}$$

Figure 1 illustrates the behavior of the ratio of straight-line depreciation under the two bases for different growth rates, g, asset lives, l, and rates of inflation, $\dot{p}$. The figure indicates that original-cost depreciation is much more nearly adequate for firms with short-lived assets and rapid growth. Moreover, growth makes a substantially bigger difference for the adequacy of original-cost depreciation for assets with longer service lives.

Quite apart from inflation, there is little evidence on how well straight-line conforms to actual economic depreciation. In the extreme example of an asset such as a light bulb, which has a constant productivity until it suddenly fails, economic depreciation would be less than straight-line in the early part of its life. The other extreme—where straight-line is initially inadequate—is less easily exemplified, but would be characterized by a capital good whose product rapidly declines during its lifetime. Even in a world of no inflation and perfect markets, an asset would require a particular pat-

12. With all prices rising at a uniform rate in this example, straight-line replacement-cost and straight-line general-value depreciation are the same.

Figure 1. Ratio of Straight-Line Original-Cost Depreciation to Straight-Line Replacement-Cost Depreciation, Selected Growth and Inflation Rates



Source: Text equation 7.

tern of productivity for its present value to decline linearly with age. Straight-line depreciation is economically accurate for an asset whose product declines linearly (with a slope proportional to the real interest rate) until it drops suddenly to zero at the end of its lifetime. For an asset that lasts l years and cost C dollars, and with a real interest rate, r, the product, P, as a function of age, a, must be

$$P(a) = \frac{C}{l} + r\frac{C}{l}(l - a) \tag{8}$$

if the present value, PV, is to be of the form

$$PV(a) = C\frac{(l - a)}{l}; \tag{9}$$

Equations 8 and 9 indicate that straight-line depreciation is an intermediate case that does not correspond to the light-bulb example when the real interest rate is positive. Nonetheless, since it is viewed as generally appropriate by management and since no evidence points strongly toward other patterns, we shall use straight-line as our reference method when we estimate general-value depreciation.

ACCELERATED DEPRECIATION

Depreciation statistics reported on tax returns, which are the basis for estimates in the national income accounts of corporate profits, are quite different from "book" estimates. In the past generation several changes in Internal Revenue Service rules have allowed more rapid recovery of corporate investment costs, although the rules are still based on original cost. First, the average service life used for depreciation purposes was gradually shortened during the 1940s and 1950s from 100 percent of the service lives in the Treasury Department's 1942 edition of *Bulletin "F"* to an average of approximately 64 percent for manufacturing equipment and 75 percent for structures by the mid-sixties.[13] This shortening was completed and made official policy by the issuance of the 1962 *Depreciation Guidelines and Rules* for broad classes of assets.[14]

Further liberalization was achieved by the IRS code of 1954, which permitted businessmen to depart from straight-line depreciation for new investments, and to use two new accelerated methods. One of these was double-declining-balance (*ddb*), under which the firm is allowed to deduct the fraction $2/l$ of the undepreciated balance of an asset (rather than $1/l$ of the entire original cost, with straight-line, *s*). A firm was permitted to switch to the straight-line method based on the undepreciated balance and remain-

13. Allan H. Young "Alternative Estimates of Corporate Depreciation and Profits: Part I," *Survey of Current Business*, vol. 48 (April 1968), p. 20. See ibid., pp. 19–21, for a discussion of service lives from the first edition of the U.S. Treasury Department's *Bulletin "F"* in 1920 through the third edition, *Bulletin "F" (Revised January 1942): Income Tax Depreciation and Obsolescence, Estimated Useful Lives and Depreciation Rates.*

14. This was followed by the issuance of *Depreciation Guidelines and Rules, Revised August 1964.*

ing lifetime at any time it desired; to maximize the present value of its deductions, a firm should always switch when the remaining life is $l/2$. With such a policy, the present value of the depreciation allowances for an asset costing C is

$$PV_{ddb/s} = \frac{2C}{l}\int_0^{l/2} e^{-(2/l+r)t}\,dt + \frac{2C}{l}\int_{l/2}^{l} e^{-(1+rt)}\,dt. \tag{10}$$

The other alternative permitted by the 1954 IRS code was the sum-of-years-digits (*syd*) method of depreciation. Under it, the fraction of the original cost deducted each year declines linearly over the l-year service lifetime, with the fractions summing to unity.[15] The present value of the future depreciation allowances with this technique is given by

$$PV_{syd} = \frac{2C}{l}\int_0^{l} (l - t)e^{-rt}dt. \tag{11}$$

Both the double-declining-balance and the sum-of-years-digits methods accelerate depreciation in the sense that, relative to straight-line, they result in more depreciation in the early years and less in the later years of an asset's service life. These two accelerated methods were immediately adopted for tax purposes for approximately 31 percent of new investment in manufacturing in 1954; by 1960, the percentage was up to 75,[16] and for 1975, it could be approximately 90.

The most recent change in depreciation rules for federal taxation occurred in 1971 with the inauguration of the class-life asset-depreciation-range system. This policy allows firms to group assets into "vintage accounts" and provides a range (plus or minus 20 percent of the guideline life) from which a lifetime may be selected for depreciation purposes. The vintage accounts may be established for both pre-1970 and post-1970 assets, but the lifetime-range choice is available only for assets acquired new

15. Although the formulas here are expressed in continuous time for simplicity, actual deductions are taken on an annual basis. This fact can shift the choice of method away from the one the formulas would indicate, especially for short-lived assets. With continuous deductions, the sum-of-years-digits technique always leads to the largest present value, while on an annual basis double-declining-balance is superior for short-lived assets. With sum-of-years-digits depreciation on an annual basis, the proportion of original cost deductible in any year is given by a fraction whose numerator is the remaining useful life and whose denominator is the sum of all of the years' digits in the service life.

16. Young, "Alternative Estimates," p. 19.

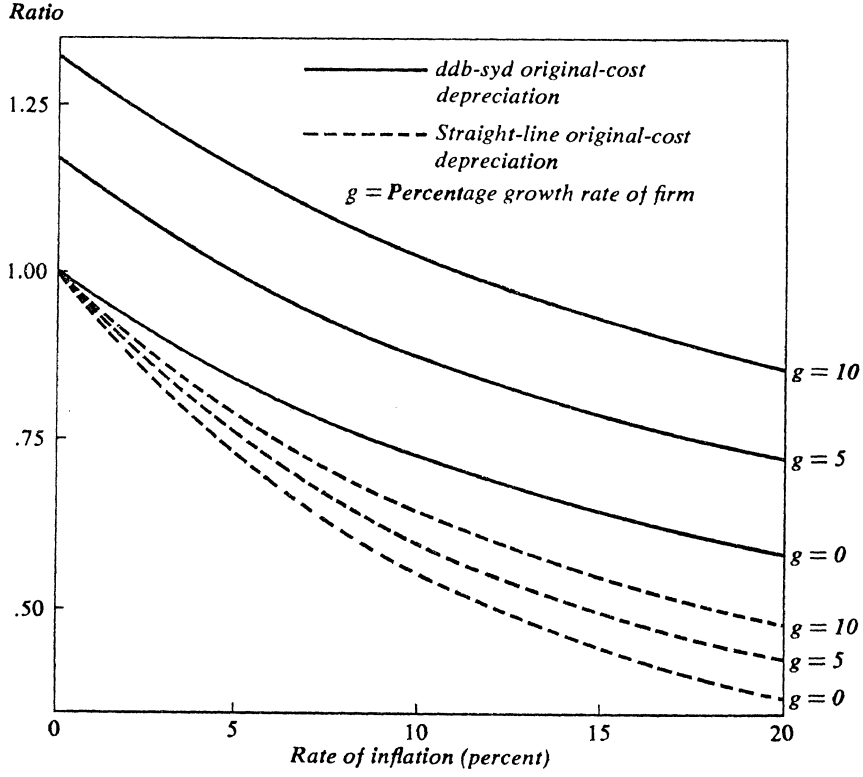
since 1970.[17] Under these vintage accounts, switching from the double-declining-balance to the sum-of-years-digits technique offers a higher present value of depreciation than any other available method. Consider an asset with an integer lifetime of N years. The fraction of original cost deductible during the first year with double-declining-balance is $2/N$, which always exceeds the first-year fraction with sum-of-years-digits, which is $2/(N + 1)$. The two techniques result in the same depreciation for the second year, while the sum-of-years-digits method always results in the higher depreciation figures in the third and subsequent years. This combination of techniques offers the optimal policy for all eligible investments, with the switch taking place in the second or third year.

With the accelerated methods permitted by IRS, depreciation charges reported on corporate tax returns are generally far higher than those reported to stockholders, which are calculated predominantly under the straight-line original-cost method. Indeed, accelerated original-cost depreciation may exceed our standard of straight-line general-value (or replacement-cost) depreciation for many firms even when inflation rates are quite high. But by no standard are accelerated writeoffs a satisfactory substitute for inflation accounting. In the aggregate, any accelerated method will make an adequate "correction" for inflation only at some particular rate of price increase. And, among firms, it will always discriminate, generating particularly large depreciation charges (and hence lower tax liabilities) for rapidly growing firms. These firms have an especially large fraction of their assets in young capital goods, and it is for such goods that accelerated depreciation most exceeds straight-line, and original cost least understates replacement cost. Indeed, the differential effect of the firm's growth rate on depreciation is much greater under accelerated methods than under the straight-line method.

Figure 2 illustrates, for an asset with a fifteen-year service life, the effects of the growth rate, g, and the inflation rate, $\dot{p}$, on the ratio of the firm's deductions under accelerated original cost, compared with those with straight-line replacement-cost depreciation. The accelerated method used to generate this figure is the double-declining-balance method with the switch at the optimal time to sum-of-years-digits (*ddb-syd*). For comparison, the original-cost, straight-line case for fifteen-year assets is also shown. As is evident in the figure, the depreciation deductions of a firm that uses

17. See Commerce Clearing House, *Standard Federal Tax Reports: 1973 Depreciation Guide*, vol. 60 (September 11, 1973).

Figure 2. Ratio of *ddb-syd* Original-Cost Depreciation to Straight-Line Replacement-Cost Depreciation, 15-Year Asset Life and Selected Growth and Inflation Rates[a]

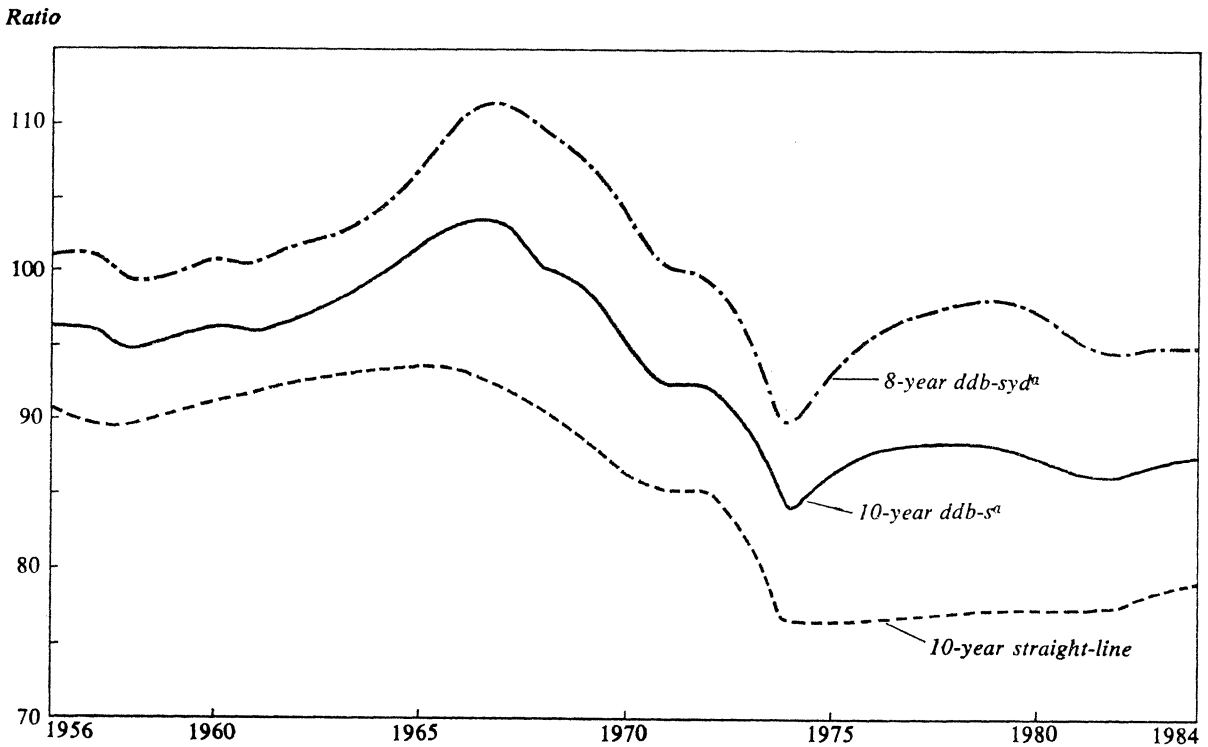


Source: Developed by authors.
a. *ddb* is double-declining-balance method; *syd* is sum-of-years-digits method; the method used is *ddb* with the switch to *syd* at the optimal point.

the optimal accelerated technique and whose (real) acquisitions have been growing at a rate of 5 percent exceed those under straight-line replacement-cost at rates of inflation of less than 5 percent. In general, the higher the firm's growth rate, the more adequate is *ddb-syd* original-cost depreciation and the higher is the "break-even" inflation rate.

Figure 3 indicates the historical (and future) importance of growth and inflation on depreciation deductions. It illustrates the ratio of depreciation deductions with several original-cost methods to straight-line general-value deductions for a hypothetical firm whose capital assets have a ten-year

Figure 3. Ratio of Original-Cost Depreciation to Straight-Line General-Value Depreciation, for Selected Original-Cost Methods, 1956–84



Source: Estimates for a single firm whose real investments are proportional to the economy's real gross domestic investment. The real investment growth rate is taken as 3 percent for 1975–84; the rate of inflation is projected at 6 percent.

a. *ddb* is double-declining-balance method; *syd* is sum-of-years-digits method; *s* is straight-line method

guideline life. Under the class-life asset-depreciation-range system, the firm is permitted to depreciate such assets over periods as short as eight years. It is assumed that the firm's real investments have been proportional to the nation's real gross domestic investment in the past and that their prices have followed the actual domestic spending deflator. The growth rate of real investment is taken as 3 percent from 1975 to 1984, while the rate of inflation is projected at 6 percent. Plainly, with any of the depreciation techniques, varying growth and inflation rates would have caused highly erratic deviations between deductions based on original cost and those made on a straight-line general-value basis. In fact, depreciation reported for tax purposes has not moved along any one of the depicted curves, but rather has shifted toward the more accelerated methods, nonetheless deviating widely from any consistent inflation-adjusted policy.

The role of growth in our analysis may raise questions. For example, since the present value of future depreciation deductions for a particular asset is independent of the rate of growth of the firm's capital acquisitions, how can accelerated methods for tax purposes discriminate in favor of growing firms? The answer turns on interest-free loans. A firm that uses accelerated depreciation can be thought of as receiving loans from the Treasury in the early years of an asset's life equal to the tax rate times the amount by which its deductions exceed those under straight-line. These loans are repaid, without interest, in the later years of the asset's life when the deductions under accelerated methods are smaller than those with straight-line. The advantage of growth is simply that the firm continuously receives a larger volume of loans than it is repaying (somewhat analogously to the gains available to a growing economy through the use of a Samuelson consumption-loan plan). Even after the firm's growth ceases and it reaches an investment plateau, it will continue for a period (l years) to receive larger deductions than the permanently stable enterprise. Only when new investment just matches capital retirements will the advantage disappear. Even then, the only consequence is that the firm no longer receives interest-free loans. None of the firm's previous gains are eroded unless its investment is reduced toward its pregrowth level.

EMPIRICAL ESTIMATES

We will now attempt to evaluate empirically the microeconomic and macroeconomic impacts of switching from the actual book and tax practices of

depreciation accounting to a straight-line general-value basis. We assume throughout that profits plus depreciation figures are invariant to changes in accounting procedures.

Microeconomic estimates. To gain some feel for the effect on individual firms of a switch to general-value basis, we have calculated the 1974 figures for the thirty firms in the Dow Jones industrial average. The results shown in table 1 are necessarily approximations. Most firms use straight-line for book purposes and accelerated methods for their IRS tax returns. For the five firms not using straight-line depreciation for book purposes, we have estimated what their depreciation would have been with that method. Column 1 shows estimates of the depreciation the thirty firms would have claimed with a general-value system and column 2 contains book depreciation figures for these companies. The estimates of column 1 cannot be precise, however, because detailed information on the age structure of capital assets of companies is unavailable. We have taken the ratio of the firm's capital stock to its straight-line depreciation deductions as the average lifetime, l, of its capital stock. Then, from the Compustat file, we have data on each firm's capital acquisitions for the past l years. We have taken the term

$$\frac{\pi(l)\sum_{t=0}^{l} I(t)}{\sum_{t=0}^{l} \pi(t)I(t)} \tag{12}$$

as our ratio of general-value to original-cost depreciation, where $\pi(t)$ is the domestic spending deflator at time t. Of course, a firm's assets have a spectrum of lifetimes rather than a uniform service life of l years. Our assumptions have been made for simplicity and with data availability in mind. We have tested our method of computing the ratio of general-value to original-cost (expression 12) against the correct number for several realistic but hypothetical companies and for historical rates of inflation. The results were such that we subjectively place a confidence interval of 2 percentage points around the figures shown in column 4 of table 1.

The table is generally self-explanatory. It shows that, with our proposed inflation adjustment, the thirty Dow Jones industrial companies would have reported book depreciation of some $3.9 billion, or 35.4 percent, above current book depreciation. If straight-line depreciation were used for book purposes by all thirty firms, the general-value figures would exceed straight-line original-cost figures by $4.2 billion, or 38.2 percent. General-value de-

preciation would have exceeded 1974 tax depreciation by a total of $1,319 million, or 10.2 percent, for the twenty-seven companies on which we have complete data. If these twenty-seven firms are all in a 48 percent marginal tax bracket, the effect of their adopting general-value straight-line depreciation for both book and tax purposes would be to reduce their aggregate tax bill by $633 million and their reported after-tax book profits by $3,088 million. This latter number is 20.6 percent of the total reported after-tax profits of these twenty-seven companies of $14,982 million. The difference between the general-value and the IRS depreciation figures varies greatly among firms, as is shown in column 6, reflecting differences among firms in growth rates, age structures of capital assets, and present depreciation-accounting procedures.

Macroeconomic estimates. The macro estimates we have are from an unpublished updating by the U.S. Bureau of Economic Analysis of Allan Young's 1968 study of corporate depreciation and profits cited in note 13. Column 1 of table 2 shows the annual nonfinancial corporate depreciation in the national income accounts, which are those reported to IRS, from 1929 to 1974. That time series is obviously not consistent during the interval because of the important tax-accounting changes described above. Columns 2 through 5 indicate what NIA-IRS depreciation would have been under alternative consistent policies. Columns 2–4 show that actual practice for tax reporting has become significantly more generous over time relative to any constant method based on original cost. In fact, the cumulative difference between NIA depreciation (column 1) and straight-line original-cost depreciation with Bulletin F service lives (column 2) for the twenty-five years 1950–74 is $170 billion, a figure that amounts to 12 percent of the $1,431 billion of cumulative before-tax profits. On the other hand, the cumulative straight-line replacement-cost depreciation (column 5) for the twenty-five years (0.85 Bulletin F service lives) amounts to $53 billion more than the corresponding NIA figure in column 1. Most of that discrepancy is attributable to the years 1950–54 and 1970–74. It reached a record high of $10.3 billion in 1974, as inflation's impact on the gap between replacement and original cost far outweighed the offset due to accelerated methods.[18]

18. The numbers of column 5 are for replacement-cost and not general-value depreciation. In the aggregate this makes very little difference, however, because prices of investment goods have moved very similarly to overall prices. In 1975:2, the figures were: GNP deflator, 183.9; domestic spending deflator, 185.1; nonresidential fixed investment deflator, 177.7, all based on 1958 = 100.

Table 1. Amount of Depreciation under Alternative Accounting Methods, Thirty Dow Jones Industrials, 1974

Dollar amounts in millions

Company[a]	*Straight-line general-value depreciation* (*1*)	*Book depreciation* (*2*)	*Underdepreciation for book purposes*		*Tax depreciation* (*5*)	*Under-depreciation for tax purposes* (*6*)
			Amount (*3*)	*Percent* (*4*)		
Allied Chemical	164.1	115.5	48.6	42.2	143.3	20.8
Aluminum Company of America	234.7	164.7	70.0	42.5	190.4	44.3
American Brands	61.5	48.3	13.2	27.3	43.6	17.9
American Can	108.6	75.8	32.8	43.3	85.8	22.8
American Telephone and Telegraph	5,091.6	3,690.4	1,401.2	38.0	4,515.1	576.5
Anaconda[b]	84.6	50.7[a]	33.9	66.9	50.7	33.9
Bethlehem Steel	310.2	210.9	99.3	47.1	259.3	50.9
Chrysler	208.3	184.5[a]	23.8	12.9	184.5	23.8
E. I. du Pont de Nemours	542.3	506.4[a]	35.9	7.1	545.8	−3.5
Eastman Kodak	223.0	211.2[a]	11.8	5.6	211.2	11.8
Esmark	60.3	44.9	15.4	34.3	n.a.	n.a.
Exxon	2,161.5	1,624.6	536.9	33.0	2,308.8	−147.3
General Electric	491.3	376.2	115.1	30.6	411.0	80.3
General Foods	71.3	55.1	16.2	29.4	78.0	−6.7
General Motors	1,202.2	846.6	355.6	42.0	1,057.1	145.1

Goodyear Tire and Rubber	233.1	172.0	61.1	35.5	233.7	−0.6
International Harvester	105.9	75.5	30.4	40.2	88.4	17.5
International Nickel	133.4	97.4	36.0	37.1	169.5	−36.1
International Paper	189.5	135.1	54.4	40.3	158.2	31.3
Johns-Manville	40.4	28.3	12.1	42.6	48.4	−8.0
Owens-Illinois	102.2	74.2	28.0	37.8	82.2	20.0
Procter & Gamble	120.2	87.4	32.8	37.5	151.0	−30.8
Sears, Roebuck	199.9	149.0	50.9	34.2	215.6	−15.7
Standard Oil of California	702.0	510.4	191.6	37.6	n.a.	n.a.
Texaco	962.7	702.4	260.3	37.1	726.4	236.3
Union Carbide	353.4	248.2	105.2	42.4	281.5	71.9
U.S. Steel	587.6	385.7	201.9	52.3	420.7	166.9
United Technologies	88.6	78.5[a]	10.1	12.9	81.1	7.5
Westinghouse Electric	167.0	123.5	43.5	35.2	178.8	−11.8
F. W. Woolworth	82.6	63.0	19.6	31.2	n.a.	n.a.
All companies	15,084.0	11,136.4	3,947.6	35.4	...	...

Sources: Column 1, derived from expression 12 and from Standard and Poor's Compustat data file; columns 2 and 5, from 10-K reports filed annually by the companies with the Securities and Exchange Commission; column 3 is column 1 minus column 2; column 4 is column 3 divided by column 2, converted to percent; column 6 is column 1 minus column 5. Figures are rounded.

a. Five firms reported book depreciation on a basis different from straight-line original-cost. Our estimate of what their depreciation would have been with the latter are: Anaconda, 39.9; Chrysler, 145.2; du Pont, 398.5; Eastman Kodak, 166.2; United Technologies, 61.8.

b The meaning of the value for Anaconda may be distorted because of Chilean appropriation of properties.

n.a. Not available.

Table 2. Depreciation of Nonfinancial Corporations in National Income Accounts and with Alternative Methods, 1929–74

Billions of dollars

Year	*National income accounts*[a] (*1*)	*Straight-line original-cost with Bulletin F service lives* (*2*)	*Straight-line original-cost with .85 Bulletin F service lives* (*3*)	*Double-declining-balance original-cost with .85 Bulletin F service lives* (*4*)	*Straight-line replacement-cost with .85 Bulletin F service lives* (*5*)
1929	4.1	4.4	4.7	5.2	5.6
1930	4.2	4.6	4.9	5.3	5.5
1931	4.2	4.5	4.8	5.1	5.1
1932	3.9	4.5	4.7	4.7	4.5
1933	3.7	4.3	4.5	4.4	4.2
1934	3.6	4.2	4.4	4.2	4.3
1935	3.5	4.1	4.3	4.0	4.3
1936	3.5	4.1	4.3	4.1	4.4
1937	3.6	4.3	4.5	4.3	4.9
1938	3.6	4.4	4.5	4.4	5.0
1939	3.7	4.4	4.5	4.4	4.9
1940	3.7	4.4	4.5	4.4	4.9
1941	4.1	4.6	4.7	4.7	5.4
1942	5.0	4.7	4.8	4.8	6.1
1943	5.3	4.6	4.7	4.6	6.1
1944	6.0	4.5	4.6	4.5	6.0
1945	6.3	4.6	4.6	4.7	6.0
1946	4.6	4.9	5.0	5.3	6.8
1947	5.7	5.5	5.7	6.6	8.3
1948	6.8	6.4	6.7	8.1	10.0
1949	7.8	7.4	7.9	9.5	11.1
1950	8.6	8.5	9.0	10.8	12.4
1951	10.0	9.5	10.2	12.0	14.3
1952	11.2	10.5	11.2	13.0	15.4

Sources: 1929–63, Allan H. Young, "Alternative Estimates of Corporate Depreciation and Profits: Part II," *Survey of Current Business*, vol. 48 (May 1968), table 4; 1964–74, unpublished data provided by the U.S. Bureau of Economic Analysis.

a. This is also the Internal Revenue Service depreciation for nonfinancial corporations.

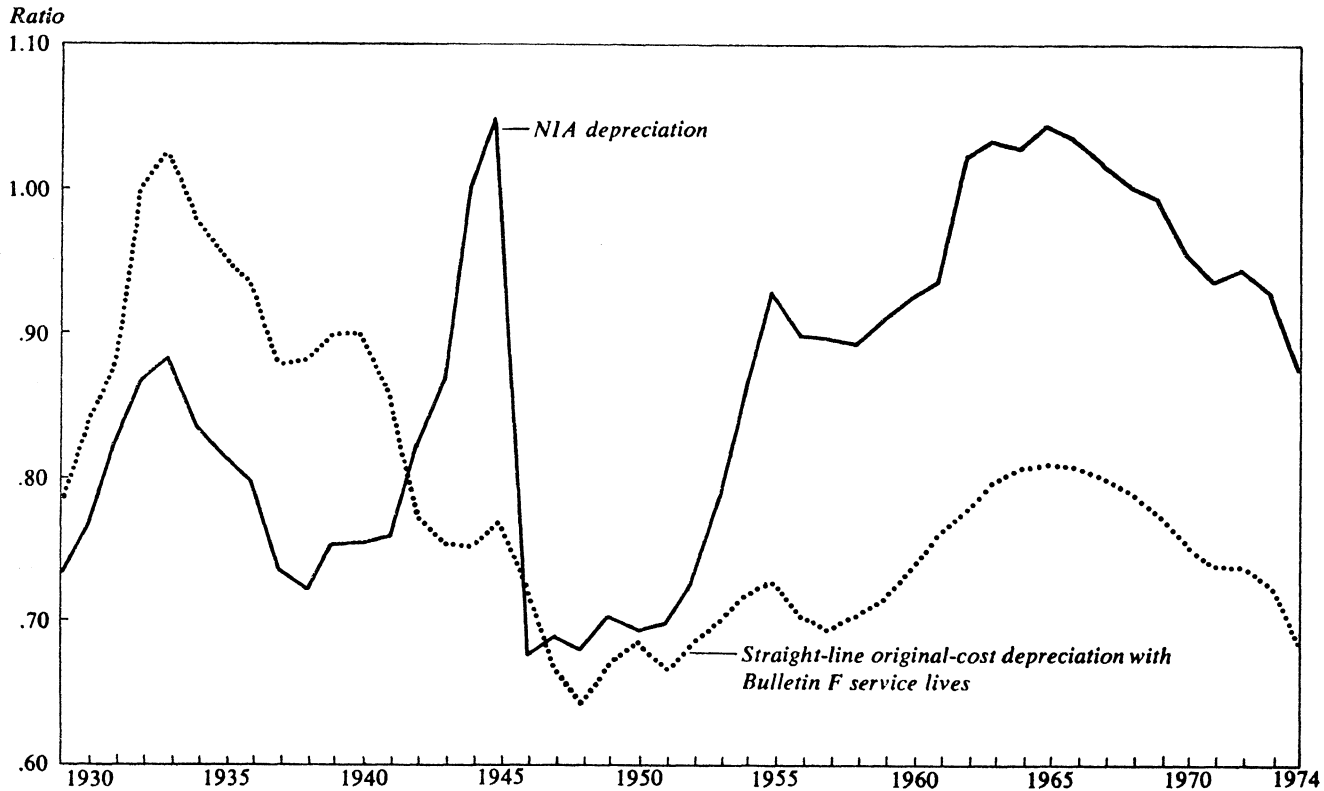
Figure 4 illustrates the time series of the ratio of NIA-IRS depreciation to straight-line replacement-cost using 0.85 of Bulletin F lives, and of straight-line original-cost (Bulletin F lives) to straight-line replacement-cost (0.85 F lives). The changes in policy are plainly revealed. Before the Second World War, actual depreciation was substantially less than re-

Table 2. (*Continued*)

Year	*National income accounts*[a] (*1*)	*Straight-line original-cost with Bulletin F service lives* (*2*)	*Straight-line original-cost with .85 Bulletin F service lives* (*3*)	*Double-declining-balance original-cost with .85 Bulletin F service lives* (*4*)	*Straight-line replacement-cost with .85 Bulletin F service lives* (*5*)
1953	12.8	11.4	12.2	14.1	16.3
1954	14.5	12.1	13.0	15.0	16.9
1955	16.8	13.1	14.1	16.2	18.1
1956	18.3	14.3	15.4	17.8	20.4
1957	20.2	15.6	16.9	19.5	22.6
1958	21.2	16.7	18.0	20.6	23.8
1959	22.6	17.7	19.1	21.7	24.9
1960	24.0	19.1	20.6	23.4	26.0
1961	25.1	20.4	22.0	24.7	26.9
1962	28.8	21.8	23.5	26.2	28.1
1963	30.4	23.4	25.2	28.0	29.4
1964	32.2	25.1	27.0	30.1	31.2
1965	34.5	26.6	28.8	33.0	33.0
1966	37.5	29.1	31.6	36.5	36.2
1967	40.7	31.9	34.7	40.3	40.0
1968	44.3	34.9	37.9	44.1	44.3
1969	48.8	38.1	41.4	48.1	49.3
1970	52.7	41.4	45.0	52.0	55.2
1971	56.8	44.7	48.5	55.6	60.9
1972	62.1	48.3	52.3	59.8	65.9
1973	66.4	51.8	56.1	64.2	71.9
1974	71.4	55.7	60.4	69.1	81.7
Total, 1950–74	811.9	641.7	694.1	795.8	865.1

placement-cost depreciation and even less than straight-line original-cost depreciation based on Bulletin F lives. One must assume that firms were depreciating over lifetimes exceeding those of the 1942 issue of Bulletin F. Actual depreciation spurted during the war due to the sixty-month amortization permitted for defense-related facilities. With the conclusion of the

Figure 4. Ratios of Depreciation under Selected Methods to Straight-Line Replacement-Cost Depreciation, with 85 Percent Bulletin F Service Lines, 1929–74



Source: Table 2, ratios of column 1 to column 5, and column 2 to column 5

war, depreciation fell sharply to 70 percent of our replacement-cost denominator and just about to the level of Bulletin F original-cost straight-line. Rapid amortization was reinstituted during the Korean War and, together with the new accelerated methods introduced in 1954, raised depreciation to 90–93 percent of replacement cost during the 1955–61 period. With the issuance of the 1962 *Guidelines and Rules*, depreciation rose to over 100 percent of replacement cost. A steady erosion of depreciation relative to replacement cost has occurred since 1965, however, reversed only by the introduction of the asset-depreciation-range system in 1971.

The fact that depreciation has remained between 85 and 105 percent of replacement cost for the past twenty years is not particularly comforting. The point is that business has been offered depreciation deductions whose adequacy in terms of general value or replacement cost has fluctuated rapidly and widely. The slide from 104.5 percent in 1965 to 87.4 percent in 1974 may have had as serious consequences as, say, a fall from 80 to 65 percent. The fluctuation in the environment may be as important a phenomenon as the correctness of the average level.

With our policy recommendation—general-value straight-line depreciation for both book and tax purposes and the use of the domestic spending deflator as the indicator of price levels—tax-reported depreciation in 1974 would have been increased by approximately $10.3 billion, or 14 percent for the aggregate of nonfinancial corporations, with the impact varying widely among individual companies.

Inventory Accounting

Inventory accounting, like depreciation accounting, is necessary to fill the need for annual and periodic financial reports by firms whose production and sales are an ongoing operation. Neither type of accounting would be necessary if firms acquired all assets and materials, sold their products, and completely liquidated within one reporting period. In such a simple case, often modeled within economic theory, income would be total revenue minus all costs. In the more realistic situation of a continuing operation, an accurate depiction of financial flows and position is more difficult. The accounting problems are clearest and most severe with regard to assets (such as inventories and depreciable property) and liabilities (such as long-term debt) that are carried over from one reporting period to the next. Just

as they are in depreciation accounting, these difficulties are exacerbated by inflation, by the multitude of accounting procedures available, and by differences in growth rates and production processes among firms. In this section we will examine some of the current techniques available to the firm for valuing inventories and "costing" goods sold. A method of partially alleviating the distortions caused by inflation will be proposed, and some estimates of the micro and macro impacts of inflation on inventory valuation will be presented.

CONCEPTS: LIFO AND FIFO

Conceptually, the simplest of all inventory policies is the specific-invoice method, which requires that the cost of each item sold or inventoried be known. With this technique, the gain on items sold is simply the difference between their selling prices and their costs, and the value of inventory is the sum of the costs of items in stock. There is a complete correspondence between the flow of goods and the reported flow of costs.

The accounting profession and the IRS have long recognized that even small businesses would find it difficult to keep track of the cost of each specific item in inventory. Therefore, several inventory accounting procedures have been developed that break the direct link between flow of goods and flow of costs. We will concentrate on two such methods—first-in-first-out, or FIFO, and last-in-first-out, or LIFO—because of their importance and because they generally represent the extremes in the range of choice faced by a firm.[19]

Under the FIFO inventory method, the cost of goods sold is computed as if these items were the oldest available in inventory. As this is probably not an unreasonable flow-of-goods assumption, the resulting costs (and, therefore, profits) that are reported in the firm's income statement are probably not dissimilar from those that would result from using the specific-invoice method. The remaining inventory, which is entered in the balance sheet, is valued at the cost of the most recently acquired or produced items and therefore approximates market value or replacement cost of the inventoried stock.

19. Of several other inventory-accounting methods, two relatively important ones are the average-cost method and the retail-cost method. A complete discussion of the mechanics of the various techniques can be found in William W. Pyle and John Arch White, *Fundamental Accounting Principles* (5th ed., Irwin, 1969).

The logic of the LIFO method is quite the opposite. With this technique the cost of goods sold is taken as the cost of the items most recently produced or added to inventory. This cost approximates the expense of replacing the item in inventory, whereas FIFO values the sold good at close to its original cost. With LIFO, no attempt is made to link the actual flow of goods and flow of costs: nobody would seriously recommend a policy of shipping the most recently produced goods and holding the oldest output in stock. Since LIFO charges the most recently produced or inventoried items against goods sold, the stocks carried forward and reflected on the balance sheet are treated as if they were the earliest acquired or produced. With inflation, this practice implies that the value of inventory can be seriously understated relative to current or replacement value on the balance sheet of firms that have produced or acquired at least as many items as they have sold for several years. This drawback is partially overcome since most LIFO firms report the cumulative balance-sheet difference between LIFO and FIFO.

In an environment of permanently stable prices, LIFO and FIFO policies yield absolutely identical income statements and balance sheets. However, in a world with relative and absolute price changes, the two methods yield significantly different results. To illustrate these differences, consider a firm—say, a new-car lot—whose sales and acquisitions just match in physical units so that the stock on hand, S, is a constant. If the price of the item is increasing by an amount, ΔP, each reporting period, the firm will report inventory profits of $S\Delta P$ with the FIFO system, but zero with LIFO. There is some logic behind both numbers. The firm has generated no cash flow since each item is replaced as it is sold, and this fact is reported under LIFO, but the stock on hand has appreciated in nominal value, as reflected by the FIFO earnings. In the absence of the corporation income tax, the number reported would have no consequences for cash flow. However, in the presence of the tax, LIFO results in lower liability (zero in this example) and therefore a larger cash flow. In contrast to depreciation accounting, the IRS and SEC require that firms use consistent inventory policies for book and tax purposes, so LIFO results in lower reported earnings as well as tax savings in cases such as our example.

LIFO and FIFO represent examples of the two different concepts of income discussed in the first section. LIFO is consistent with an income definition that includes only realized gains, whereas FIFO reflects profits and losses as they accrue. When the two systems are viewed in this manner,

the surprising fact is that the government gives firms a choice between them. Recognizing the difference as that between realization and accrual also should make clear that the tax savings arising from choosing LIFO in an inflationary period may actually amount to a deferral of taxes. Should prices drop to their original level or should the firm liquidate its inventory, LIFO inventory profits and taxes would exceed those under FIFO. The gains would be completely eliminated or "repaid," although no interest would have been charged on the "loan."

The differences between LIFO and FIFO can be illuminated further by examining the income statement and inventory balance sheets of a very simple hypothetical firm. This company may be viewed as a warehouse that acquires and sells the same item. At any point in time the acquisition and selling prices are the same, so the only type of profit possible for this firm is that due to the appreciation of inventoried goods. Table 3 describes the activities, income, and inventory valuation for this firm for fourteen periods (years). In period 0 the firm simply acquires a stock of ten items. Periods 1 through 4 are characterized by a steady increase in price and by sales that just match acquisitions. With FIFO accounting, the firm reports profits equal to $S\Delta P = 20$ in periods 3 and 4; with LIFO, profits are zero. The value of inventory under FIFO approximates market value, whereas LIFO greatly understates it by period 4. Both sales and inventories grow in periods 5 through 7. This changes the situation very little with FIFO, since profits are still reported as the increase in value of each period's initial stock of inventories. There are no LIFO profits as long as acquisitions at least match sales.[20] Prices stabilize in period 8 and decline in 9 and 10. Sales just match acquisitions, so that inventories remain stable at 13 units. While LIFO profits remain zero, FIFO accounting results in a loss (and, hence, tax savings or credit) for these periods. Prices are stable in periods 11–13, but the firm gradually liquidates inventories. The FIFO method now reports zero profits, while the LIFO method reports large profits as inventoried items (some still valued at the acquisition cost in period 0) are sold. As the last row of the table shows, the firm has a cumulative profit of $74 under either system, but the time patterns of income differ. Under the FIFO system, income is reported as the value of inventory increases, but under LIFO it is recorded only when the inventory is liquidated. The source of the $74 profit is clear when one tabulates net acquisitions as ten units at $8 (period 0), and one unit at $16, one unit at $18, and

20. This is due to the assumption that prices are perfectly stable within each period.

Table 3. Financial Accounts of Hypothetical Firm Using FIFO or LIFO Inventory Accounting, Fourteen Periods

Period	Acquisitions (units)	Price (dollars)	Sales (units)	Revenue (dollars)	Stock (units)		Cost of sales (dollars)		Value of final inventory (dollars)		Profits (dollars)	
					Initial	Final	FIFO	LIFO	FIFO	LIFO	FIFO	LIFO
0	10	8	0	0	0	10	0	0	80	80	0	0
1	7	8	7	56	10	10	56	56	80	80	0	0
2	7	10	7	70	10	10	56	70	94	80	14	0
3	7	12	7	84	10	10	64	84	114	80	20	0
4	7	14	7	98	10	10	78	98	134	80	20	0
5	8	16	7	112	10	11	92	112	170	96	20	0
6	9	18	8	144	11	12	122	144	210	114	22	0
7	10	20	9	180	12	13	156	180	254	134	24	0
8	10	20	10	200	13	13	194	200	260	134	6	0
9	10	18	10	180	13	13	200	180	240	134	−20	0
10	10	16	10	160	13	13	186	160	214	134	−26	0
11	8	16	10	160	13	11	166	166	176	96	−6	−6
12	6	16	10	160	11	7	160	136	112	56	0	24
13	0	16	7	112	7	0	112	56	0	0	0	56
All periods	109	...	109	1,716	...	...	1,642	1,642	...	...	74	74

Source: Developed by authors.

one unit at $20 (periods 5 through 7) for a total cost of $134. These thirteen units were sold in periods 11 through 13 at $16 apiece for a total revenue of $208.

Given the liberal dollar-value pooling of items that is permitted for inventory accounting, a valid question is whether most firms in the real world need to anticipate major inventory liquidations (that is, inventory-profit realizations). Certainly, some fluctuations are unavoidable, but most well-managed LIFO companies can control end-of-year inventories to avoid substantial realizations and taxes. To reap the maximum tax benefits, the optimal time to adopt LIFO may be when inventories are relatively low. With proper management, the difference between tax savings and tax deferral may be virtually eliminated; the postponement may be made sufficiently long to permit virtual escape of taxes under the realization (LIFO) system.

Despite the clear tax advantages of the LIFO technique in inflationary environments, FIFO remains the most commonly used inventory accounting method. Of the 2,600 firms listed on the New York and American Stock Exchanges, only 262 were using LIFO at the end of 1973, and nearly 20 percent of those had adopted the policy during that year.[21] In 1974 there was a large movement toward LIFO, with approximately 250 firms making a full or partial switch.[22] This movement reduced aggregate FIFO inventory profits by 15 percent, or $5.2 billion, as measured by the Department of Commerce's inventory valuation adjustment. At first glance, the puzzle is why so many corporations continue to use methods other than LIFO, which result in higher reported earnings and thus larger tax bills during inflationary periods. In 1974, even after the many inventory-accounting changes, nonfinancial corporations reported FIFO-type inventory profits amounting to $35.1 billion on which they paid taxes of approximately $17 billion. Obviously, despite the major move to LIFO in the past two years, there still appears to be a large incentive for further shifts.

Several possible explanations might underlie the continued predominance of the FIFO method. Most revolve around the fact that LIFO results in lower reported earnings with inflation. While economists who believe in perfect markets (and investors who "see through" accounting changes)

21. Study by Gary S. Schieneman of Arthur Young and Co., reported in "New Sets of Books: More Companies Alter Accounting Methods to Neutralize Inflation," *Wall Street Journal*, October 7, 1974.

22. *Survey of Current Business*, vol. 54 (November 1974), p. 2.

would not expect this fact to have any negative impact on the market value of the firm, managers may not share this viewpoint. Preliminary evidence compiled by the authors indicates that the price of the common stock of companies that switched from FIFO to LIFO in 1974 fell relative to historical relationships with the market averages during the first three months following the announcement of the switch. If this evidence is confirmed by detailed studies, it might indicate that investors had not realized how much of previously reported profits represented inventory appreciation. Lowering reported earnings may impose other difficulties on the corporation and its management. Quite commonly, a firm is constrained in its dividend and borrowing policies by the terms of its existing bonds and bank credit. These constraints often depend on such figures as reported net income and the firm's ratio of assets to liabilities, both of which will be lower under LIFO in an inflationary economy. Furthermore, most profit-sharing and executive-bonus plans are tied directly to reported earnings. Altering these programs to compensate for the switch from FIFO to LIFO may be difficult. The lower reported earnings might well be attractive, however, to regulated firms or to firms that face negotiations with powerful labor unions.

An often-cited reason for not adopting LIFO is its relative computational difficulty. While it may involve a somewhat more complicated mechanical and statistical procedure, the additional costs are unlikely to be of the same order of magnitude as the tax benefits for large firms. Two final reasons for not switching to LIFO can be recalled from our hypothetical example. The first is the expectation of falling prices, which may be important in a few industries (for example, agricultural products and semiconductors). The second is that companies whose inventories are frequently liquidated—perhaps involuntarily—due to strikes, bad weather, or particularly volatile demand or supply conditions, experience little benefit from LIFO because of the resulting frequent realization of the gains on the value of their inventories. These advantages of FIFO relative to LIFO must have been sufficient in total to outweigh the LIFO tax benefits for most companies until the rapid inflation of 1973–75 induced many firms to switch. Others may join them as managements reweigh the tradeoff in light of the present economic environment.

For financial-reporting purposes, we see no clear reason to offer firms a choice of inventory-accounting method. The use of varying techniques can only cloud financial comparisons and, one would expect, lead to investment

inefficiencies. The FIFO system is clearly the more consistent with the purchasing-power-accrual definition of profits and we favor its uniform adoption for book-reporting purposes. However, the change in the FIFO value of inventories would be adjusted for changes in the purchasing power of the monetary unit. We propose to enter into income the real (or relative) appreciation of inventoried items. To do so, one must deduct from a firm's FIFO income an amount equal to the FIFO value of initial inventories multiplied by the change in the domestic spending deflator. The advantage of this method, which we term "constant-dollar FIFO," is that inventories are carried on balance sheets using FIFO values, which approximate market or replacement value, but are adjusted in income statements for changes in the price level. Firms whose inventories have appreciated in relative terms would report this fact in their financial statements.[23]

In contrast, LIFO inventory accounting is more consistent with the capital-maintenance definition of income. Those supporting this measure of profits appeal to the going-concern assumption, just as they do in the case of depreciable assets, and argue that inventory stocks are a permanent component of the capital assets necessary to conduct the firm's activities. They further argue that the fact that particular items pass through inventory is not relevant. No gain or loss is experienced on such items as long as they are replaced by equivalent units. As we pointed out in the first section of this paper, the critical distinction between the two concepts of income lies in the assumption made regarding the purchasing opportunity set of the firm.

EMPIRICAL ESTIMATES

We have calculated the impact of adopting constant-dollar FIFO on the reported income of each of the Dow Jones industrials.[24] The results are

23. The difference between LIFO and constant-dollar FIFO is that the former ignores all gains or losses on inventories as long as inventories are not liquidated, while the latter records all capital gains or losses relative to the domestic spending deflator. The government could, and perhaps should, offer firms a once-and-for-all choice of LIFO instead of constant-dollar FIFO for tax purposes at no expected revenue cost. In fact, to the extent that one might expect goods prices to fall relative to the cost of services in the long run, firms choosing LIFO would end up paying more taxes on average.

24. Unfortunately, it is not feasible to estimate the micro impact of requiring all firms to use a LIFO policy because the necessary data are not publicly available.

shown in table 4, which provides an illustration of the importance of inventory policies and serves further to clarify the proposed system. The value of each firm's inventory as reported on the balance sheet is shown in the double column 1. Column 2 reports the adjustment necessary to achieve a FIFO basis. The data of this column are contained in the notes to the financial statements of the non-FIFO Dow companies. The adjustment is zero for FIFO companies such as American Brands, but can be quite large for firms that have used LIFO for a reasonably long period (U.S. Steel is one example). Among the Dow thirty, Allied Chemical, Goodyear, Owens-Illinois, and Texaco switched from an all-FIFO to a LIFO policy during 1974. Others, such as du Pont and Eastman Kodak, increased the proportion of their inventories using LIFO. The double column 3 gives the FIFO value of inventories for each of the corporations. The 1974 statistics in this column are those that would be reported on balance sheets under our proposed policy. Column 4 reveals the additional income that each firm would report using FIFO, the number being the difference between the 1974 and 1973 figures in column 2. For example, du Pont would have reported $368.6 million additional pretax earnings if it had used FIFO accounting exclusively. Column 5 gives the inflation adjustment, which simply corrects for the fact that the 1973 and 1974 entries in column 3 are not measured in units of the same purchasing power. The adjustment is the amount that must be added to the 1973 figure to express it in 1974 dollars. The final column displays the change in income that each firm would experience in switching from its current practice to the proposed policy.

The results of table 4 suggest that a constant-dollar FIFO policy would have a very uneven impact on the earnings of the Dow Jones industrial companies. Those firms that currently use FIFO would report lower incomes and pay less taxes due to the constant-dollar correction. Those now using the LIFO technique generally would report higher profits. As one might expect, their inventories appreciated more rapidly than the domestic spending deflator, and thus the effect on income of the change to FIFO reflected in column 4 generally outweighs the purchasing-power correction of column 5. Predominant among these companies are the three international oil companies, whose inventories clearly appreciated in real terms. The last row of the table indicates that taken together the thirty companies would have reported $360 million additional income in 1974 with constant-dollar FIFO accounting. The company-by-company changes, however, are larger than this aggregate would indicate.

Table 4. Impact on Thirty Dow Jones Industrials of Adopting Constant-Dollar FIFO Inventory Accounting, 1974

Millions of dollars

Company[a]	*Book value of inventories (1)*		*FIFO minus book value (2)*		*FIFO value of inventories[b] (3)*		*Additional profits had FIFO been used[c] (4)*	*Inflation adjustment[d] (5)*	*Change in reported profits[e] (6)*
	1973	*1974*	*1973*	*1974*	*1973*	*1974*			
Allied Chemical	226.9	287.9	0.0	70.1	226.9	358.0	70.1	27.4	42.7
Aluminum Company of America	452.2	566.4	169.8	342.7	622.0	909.1	172.9	75.2	97.7
American Brands	477.9	557.6	0.0	0.0	477.9	557.6	0.0	57.8	−57.8
American Can	324.1	444.1	51.0	183.0	375.0	627.1	132.0	45.3	86.7
American Telephone and Telegraph	369.1	449.8	0.0	0.0	369.1	449.8	0.0	44.6	−44.6
Anaconda	177.1	233.9	146.0	212.1	323.1	446.0	66.1	39.0	27.1
Bethlehem Steel	442.7	510.5	303.0	607.0	745.7	1,117.5	304.0	90.1	213.9
Chrysler	1,803.4	2,452.9	0.0	0.0	1,803.4	2,452.9	0.0	218.0	−218.0
E. I. du Pont de Nemours	924.9	1,420.3	14.1	382.7	939.0	1,803.0	368.6	113.5	255.1
Eastman Kodak	737.5	937.8	44.8	210.7	782.3	1,148.5	165.9	94.6	71.3
Esmark (10/26/74)	343.9	387.3	0.0	0.0	343.9	387.3	0.0	41.8	−41.8
Exxon	385.5	528.1	275.0	680.0	660.5	1,208.1	405.0	79.8	325.2
General Electric	1,986.2	2,257.0	429.7	783.7	2,415.9	3,040.7	354.0	292.0	62.0
General Foods (3/30/75)	467.6	579.2	0.0	0.0	467.6	579.2	0.0	48.8	−48.8
General Motors	5,176.9	6,404.7	0.0	0.0	5,176.9	6,404.7	0.0	625.7	−625.7
Goodyear Tire and Rubber	519.7	565.2	0.0	112.9	519.7	678.1	112.9	62.8	50.1
International Harvester (10/31/74)	1,280.0	1,505.2	0.0	0.0	1,280.0	1,505.2	0.0	155.8	−155.8
International Nickel	372.8	533.4	0.0	0.0	372.8	533.4	0.0	45.0	−45.0

International Paper	227.9	324.4	46.0	65.0	273.9	389.4	19.0	33.1	−14.1
Johns-Manville	117.1	160.7	0.0	0.0	117.1	160.7	0.0	14.2	−14.2
Owens-Illinois	287.3	356.8	0.0	36.0	287.3	392.8	36.0	34.7	1.3
Procter & Gamble	535.5	754.2	87.0	163.0	622.5	917.2	76.0	75.2	0.8
Sears, Roebuck (1/31/75)	1,879.1	1,979.3	0.0	0.0	1,879.1	1,979.3	0.0	216.6	−216.6
Standard Oil of California	658.4	1,098.9	120.4	672.4	778.7	1,771.3	552.0	94.1	457.9
Texaco	1,359.3	2,542.1	0.0	380.0	1,359.3	2,922.1	380.0	164.3	215.7
Union Carbide	752.9	1,092.2	66.0	233.0	818.9	1,325.2	167.0	99.0	68.0
U.S. Steel	629.1	695.1	650.0	930.0	1,279.1	1,625.1	280.0	154.6	125.4
United Technologies	767.1	872.0	27.2	73.5	794.3	945.5	46.3	96.0	−49.7
Westinghouse Electric	1,106.8	1,158.9	163.0	202.0[f]	1,269.8	1,360.9	39.0	153.5	−114.5
F. W. Woolworth (1/31/75)	816.4	864.7	0.0	0.0	816.4	864.7	0.0	94.1	−94.1
All companies	25,605.0	32,521.0	2,593.0	6,340.0	28,198.0	38,861.0	3,747.0	3,387.0	360.0

Sources: Columns 1 and 2, form 10-K, reports filed annually by the companies with the Securities and Exchange Commission; other columns, see notes below. Figures are rounded.

a. The date beside the company name indicates the end of the fiscal year if it is other than December 31, 1974.

b. Column 1 plus column 2.

c. Difference between the 1974 and 1973 numbers in column 2.

d. This is the adjustment necessary to express the 1973 number in column 3 in end-of-fiscal-1974 dollars, using the domestic spending deflator. For those companies whose fiscal year is the same as the calendar year, the column 5 entry is 12.088 percent of the 1973 number in column 3.

e. Column 4 minus column 5.

f. Includes only inventories of continuing operations.

Table 5. Book and Market Value of Inventories and the Effects of Constant-Dollar FIFO Inventory Accounting on Earnings of Nonfinancial Corporations, 1945–74

Billions of dollars

Year	*Book value of inventories* (*1*)	*Market value of inventories* (*2*)	*Change in book value* (*3*)	*Change in market value* (*4*)	*Adjustment to FIFO* (*5*)	*Constant-dollar adjustment* (*6*)	*Net effect of constant-dollar FIFO* (*7*)	*Inventory valuation adjustment* (*8*)
1945	28.9	30.3	−0.5	−0.6	−0.1	−2.2	−2.3	−0.6
1946	40.1	42.6	11.2	12.3	1.1	−2.7	−1.6	−5.3
1947	47.3	50.3	7.2	7.7	0.5	−4.2	−3.7	−5.9
1948	51.5	54.9	4.2	4.6	0.4	−1.6	−1.2	−2.2
1949	47.9	50.2	−3.6	−4.7	−1.1	1.0	−0.1	1.9
1950	57.7	61.0	9.8	10.8	1.0	−3.2	−2.2	−5.0
1951	67.4	71.1	9.7	10.1	0.4	−2.3	−1.9	−1.2
1952	68.7	72.1	1.3	1.0	−0.3	−1.3	−1.6	1.0
1953	70.5	73.9	1.8	1.8	0.0	−0.5	−0.5	−1.0
1954	68.9	72.2	−1.6	−1.7	−0.1	−0.8	−0.9	−0.3
1955	75.5	79.2	6.6	7.0	0.4	−1.7	−1.3	−1.7
1956	83.0	87.4	7.5	8.2	0.7	−3.3	−2.6	−2.7
1957	85.2	89.2	2.2	1.8	−0.4	−2.7	−3.1	−1.5
1958	82.9	86.9	−2.3	−2.3	0.0	−1.8	−1.8	−0.3
1959	87.5	91.7	4.6	4.8	0.2	−1.3	−1.1	−0.5

1960	90.2	94.6	2.7	2.9	0.2	−1.6	−1.4	0.2
1961	91.8	96.3	1.6	1.7	0.1	−1.0	−0.9	−0.1
1962	96.2	100.8	4.4	4.5	0.1	−1.1	−1.0	0.3
1963	101.0	106.2	4.8	5.4	0.6	−1.4	−0.8	−0.5
1964	107.3	112.7	6.3	6.5	0.2	−1.8	−1.6	−0.5
1965	116.8	123.2	9.5	10.5	1.0	−2.1	−1.1	−1.7
1966	133.1	140.4	16.3	17.2	0.9	−4.1	−3.2	−1.8
1967	141.4	149.2	8.3	8.8	0.5	−5.0	−4.5	−1.1
1968	151.1	160.0	9.7	10.8	1.1	−6.3	−5.2	−3.3
1969	162.9	174.1	11.8	14.1	2.3	−9.0	−6.7	−5.1
1970	171.8	184.2	8.9	10.1	1.2	−9.2	−8.0	−4.8
1971	177.4	190.6	5.6	6.4	0.8	−6.5	−5.7	−4.9
1972	190.9	206.9	13.5	16.3	2.8	−7.3	−4.5	−7.0
1973	217.6	245.9	26.7	39.0	12.3	−17.5	−5.2	−17.6
1974	265.6	307.4	48.0	61.5	13.5	−29.7	−16.2	−35.1

Sources: Columns 1 and 2, data provided by John C. Hinrichs, U.S. Bureau of Economic Analysis; column 8, 1945–63—U.S. Department of Commerce, *The National Income and Product Accounts of the United States, 1929–1965: Statistical Tables* (1966), table 6.10; for later years, various July issues of *Survey of Current Business;* column 5 is column 4 minus column 3; column 6 is column 2 in year $(t-1)$ multiplied by the ratio of the domestic spending deflator at the end of year t to the domestic spending deflator at the end of year $(t-1)$. This correction is necessary to state the market values of inventories at the end of year $(t-1)$ in dollars of the value of end of year t; column 7 is column 5 plus column 6.

The Dow Jones industrials are not representative with respect to inventory policy. They are all extremely large corporations and have adopted LIFO to a much broader extent than have companies in general. Estimates of the aggregate impact of constant-dollar FIFO on nonfinancial corporations are shown in table 5. The procedure to determine the effect of requiring all firms to use FIFO is to add to profits the difference between the increases in the market value and in the book value of inventories. Such a technique clearly makes heavy demands on the underlying data. The results are shown in column 5. The net effect of every firm switching to constant-dollar FIFO is shown in column 7; in 1974 such a policy would have meant a decrease in before-tax profits of $16.2 billion. This reduction is sharply larger than the $6.0 billion average figure for the previous five years. Aggregate earnings also would have been lower for every postwar year under this accounting system.

It is of interest to compare the estimated impact of constant-dollar FIFO with the "inventory profits" as reflected by the inventory valuation adjustment (IVA). The IVA reflects the total inventory profits of firms on methods other than LIFO (with sign reversed), plus the inventory profits of those firms on LIFO that are liquidating; except in periods of significant inventory liquidation, adding IVA to reported aggregated income in effect places virtually all firms on a LIFO basis.[25] If the average price of inventoried goods increases by the same percentage as the domestic spending deflator, the IVA should correspond exactly to the impact of constant-dollar FIFO. If, on the other hand, inventoried goods have fallen in relative terms, the constant-dollar FIFO correction will be larger in absolute value. A comparison of the data in column 8 with the net effects of constant-dollar FIFO reported in column 7 indicates that for long periods (for example, 1956–64 and 1966–71) the prices of inventoried items went up more slowly than the domestic spending deflator and thus constant-dollar FIFO would have resulted in lower earnings and taxes than LIFO. However, in the 1972–74 period the prices of inventoried goods rose sharply even in relative terms, and thus the IVA far exceeded the profit correction associated with a shift to constant-dollar FIFO. The 1974 data of the two adjustments are consistent with the findings of Fellner and his associates that inventory prices

25. A detailed exposition of the way in which IVA is calculated for a hypothetical firm that is liquidating inventories can be found in U.S. Department of Commerce, *National Income, 1954 Edition*, A Supplement to the *Survey of Current Business* (1954), p. 45.

went up 1.8 times as fast as the GNP deflator.[26] In fact, the IVA correction of $35.1 billion for 1974 is unprecedented in magnitude; it was 32 percent of the total before-tax profits of nonfinancial corporations and exceeded in absolute value their total after-tax *retained* earnings for the first time since 1938. These IVA inventory profits, even though they were partially real, generated no cash flow as they were not realized. In a sense, the retained net cash flow was negative, which partially explains the heavy demand for external financing in 1974 even in the face of a weakening economy. Moreover, the difference of $18.9 billion between the IVA—which is essentially the effect of uniform LIFO—and constant-dollar FIFO reveals that, in a period of marked changes in relative prices, the purchasing-power-accrual and capital-maintenance concepts of income can diverge widely.

Both the constant-dollar FIFO impacts shown in column 7 of table 5, taken subject to an awareness of the accuracy that our manipulations demand of the underlying data, and the IVA indicate that reported inventory profits seriously distort corporate profit accounts and taxation in periods of inflation as rapid as that of 1973–74. Few signs point to a future of stable purchasing power, and thus it is important that inventory accounting be reformed so that corporate reports are more accurate, comparable, and revealing. Constant-dollar FIFO has many advantages over any of the existing techniques. It would give meaningful balance sheets *and* income statements and is consistent with the purchasing-power-accrual definition of profit advanced above. We advocate it as an eminently feasible inventory-accounting technique.

Interim Conclusions

As was stressed earlier, a set of accounts adjusted for inflation requires corrections of each of the nominal entries in balance sheets. Partial adjustments such as those proposed by the SEC, CASB, and FASB may be counterproductive. This paper has analyzed in detail the accounting of *physical* assets consistent with both the purchasing-power-accrual and capital-maintenance definitions of income. At this point, we can reach conclusions about some of the individual factors affecting the conversion from a nominal to a real measure of corporate profits, but we cannot draw a global

26. *Correcting Taxes for Inflation*, p. 28.

picture until the treatment of financial assets and liabilities is examined in our second paper.

We have recommended a mandatory policy of straight-line general-value depreciation and of constant-dollar FIFO. Our empirical analysis demonstrates that both adjustments would have impacts on book and tax profits that would vary widely among corporations. This is true for depreciation because of the differing original-cost techniques now used by the firms and because the present methods discriminate among firms with different growth rates and age structures of capital stock. With respect to inventory accounting, the current use by firms of very different accounting methods—LIFO and FIFO—would be responsible for much of the variation.

In 1974, in the aggregate for nonfinancial corporations, adopting straight-line general-value depreciation would have increased tax-reported depreciation and reduced taxable profits by $10.3 billion; uniform constant-dollar FIFO inventory accounting would have lowered profits further by $16.2 billion. The magnitude of both of these numbers was far greater for 1974 than for any previous year due to the accelerated pace of inflation, and that experience has greatly stimulated the attention to inflation accounting. But these adjustments are only part of the story.

There are other important adjustments, most involving the liability side of the balance sheet for nonfinancial corporations. Corrections for the diminishing real value of a given nominal debt tend to *raise* profit estimates, and these corrections may be larger than, or of comparable size to, those for physical assets. An attempt at estimating the impact of a complete set of accounting procedures that adjust for inflation will be made in the sequel to this paper.

Comments and Discussion

William J. Fellner: Shoven's and Bulow's interesting paper provides a good point of departure for discussion. My views differ from theirs in various respects, and I believe that readers should be made aware of alternative ways of looking at these matters. This is so particularly because problems that the authors believe belong together shape up as separate problems to some of us.

Perhaps this observation does not apply *literally* to the problem of tax accounting on the one hand and of the national income and product accounts (NIPA) on the other, because the authors' intention may not have been to *merge* these two problems but to *disregard* the NIPA in their study. But even in that event, readers should be reminded that the NIPA call for formulating principles different from those applicable to tax accounting, and different from those advocated by Shoven and Bulow, who, I think, are concerned mainly with tax accounting even if they do not say so explicitly.

Current net output in the usual sense—the net output with which the NIPA are concerned—excludes all revaluations of physically unchanged capital. To the extent that the revaluation of such capital results from using up old capital and replacing it with identical but newly produced and more costly items, the equivalent of the revaluation does enter into the value of the *gross* output, but should be eliminated from the *net*. This is analogous to saying that, if someone needs to make a greater (or more costly) effort than before to stand still, this necessity should not affect a measure of his achievement as expressed in terms of the result. However, due to a "freak," one must qualify the proposition concerning a legitimate effect on the gross (though not on the net) current output of a revaluation of physically unchanged capital when the revaluation results from more costly replacement.

The "freak" is that, as concerns inventory change, even the "gross" output is net. It follows that in national income accounting of inventory change, but not of the replacement of fixed capital, even the *so-called* gross output should remain unaffected by the revaluations in question. But on a conceptual level, this is indeed a "freak," and it leaves unaltered the conclusion that the revaluation of physically unchanged capital should not show in the NIPA's *net* output.

Hence, in measuring *net* output, the NIPA call for depreciation and inventory valuation methods involving estimates of the cost of using up capital at the prices of the period in which the fixed capital and the specific inventory were in fact consumed. For most years, the results of this procedure would be very similar to those of replacement-cost depreciation combined with LIFO, but not always. As for the time shape of capital consumption implied in alternative methods of depreciating fixed capital, the NIPA call for relying on some estimate (or best guess) of the rates of decline of asset values to their owners. On the other hand, the principles relevant to the NIPA would apply to tax accounting only if its purpose were to exclude all revaluations of physically unchanged capital from the tax base. Since this is not the purpose, the tax-accounting problem is more complex.

Even if Shoven and Bulow are interpreted as focusing on tax accounting, and not on some combination of that subject and NIPA, their paper reveals the conviction that it is useful to merge problems that many observers would like to appraise separately.

For example, if consideration of the changeover from accelerated to straight-line depreciation is merged with adjusting the tax base to inflation, as it *is* in this paper, then the authors should make it easy for the reader to look at the components separately. I will try to do that using preliminary estimates of the Bureau of Economic Analysis. In the course of the operations suggested by the authors, on the assumption of Bulletin F service lives, for the nonfinancial corporations taken together in 1974, first about $16 billion of depreciation allowances is subtracted by the postulated shift from the actual depreciation practices to straight-line, and then, as a correction for inflation, about $21 billion of depreciation allowances is added to the new, reduced, figure. Recognizing that Bulletin F lives are unrealistically long and assuming 85 percent of them, the withdrawal of depreciation allowances due to the shift to straight-line is $11 billion and the addition to the reduced book depreciation arising from adjustment for inflation

is $21 billion; the corresponding figures assuming 75 percent of Bulletin F lives are $7 billion and $24 billion, respectively.

Merging their analysis of the two phenomena leads Shoven and Bulow to express the increase of depreciation due to the inflation adjustment as a proportion of a depreciation figure that has first been diminished by the shift to straight-line. Since in 1974 the actual depreciation charges of all nonfinancial corporations amounted to roughly $70 billion, the numbers I presented suggest that the increase of depreciation *for nonfinancial corporations as a group* resulting from the Shoven-Bulow inflation adjustment ranges (depending on the service-life assumption) between 35 and 40 percent of a book depreciation base that was first reduced by the shift to straight-line. Shoven and Bulow obtained a figure of 38.2 percent for a sample consisting of the thirty Dow Jones companies; they should be complimented for obtaining by their technique this representative result from a small sample, as should those who have constructed the Dow Jones sample. Yet, Shoven's and Bulow's *net* addition to the actual book depreciation allowances of 1974 comes out at between 8 and 23 percent for all nonfinancial corporations if the allowances are not first diminished by a shift to straight-line.

Throughout this discussion, I have followed Shoven's and Bulow's practice of neglecting the numerical difference between the general GNP deflator (which by their standards they should be using for inflation correction) and the deflator applicable to nonresidential fixed business capital (on which the BEA estimates of current-cost depreciation are based). In summary, I believe that the shift to straight-line and the shift to inflation accounting—the two components of Shoven's and Bulow's merged operation—need to be looked at separately.

As to the authors' merger of the problem of inflation accounting with the problem of shifting to a profit concept based on accrual rather than realization, not only do I find the merger unconvincing, but, quite aside from that, I have strong misgivings about reliance on the accrual principle.

My misgivings arise from the fact that a probabilistically expected value with very little dispersion about the mean is not identical in any decision-theoretical sense with the same probabilistically expected value combined with very high dispersion. This distinction between reasonably safe and highly conjectural values plays a large role in the decisionmaking process not only of an asset owner, but also of his creditors. Defense of the realization principle is frequently based on references to the problem of liquidity

and of limited credit availability, but what lies behind this is the problem of uncertainty—the problem of the higher moments of probability distributions; and that problem looms very large in procedures by which unrealized accruals are estimated. It should be noted in the present context that accounting techniques by which the inflation-corrected value of the stock of assets is set against the inflation-corrected stock of liabilities in balance sheets intended as bases for tax computation involve placing exceedingly risky valuations on the same footing as valuations that are subject to very little uncertainty.

If the relevance of the distinction between "realized" and "unrealized" is taken for granted, a number of thorny questions arise. In an analysis that (like Shoven's and Bulow's) does not draw this distinction, these questions get lost though they are of great practical importance; and they will remain important because the distinction is likely always to be relevant to taxation.

Among the difficult questions to be faced are those relating to capital that has remained physically identical but has been *turned over* during the period under consideration. Does capital consumption combined with pari passu replacement of the stock involve realization during the process?

An affirmative answer implies the view that, since the owner could have abstained from using his sales proceeds for replacement, he is in a position no different from that of a producer who has reinvested his net profits to make an addition to his stock, so that both should be viewed as having engaged in realization followed by a deliberate act of purchase. On *this* view, one must conclude that the conventional historical-cost tax-depreciation practices for fixed capital imply the right judgment on "realization due to turning over the investor's capital," except for the failure to make the kind of adjustment for the general inflation rate that Shoven and Bulow describe correctly; and on this view, one must also conclude that FIFO does, but LIFO does not, imply the right tax-policy judgment on "realization due to turning over the investor's capital," though FIFO too should be supplemented with the kind of correction for the general inflation rate that Shoven and Bulow describe. To the extent that investment is financed by debt, supplementing depreciation practices or the FIFO valuations with provisions for inflation adjustment calls for a transfer of such tax allowances to direct or indirect creditors, since to that extent, any nominal gains from revaluation that merely reflect inflation appear in the tax returns of creditors rather than of investors.

But what if one takes the view that there is no such thing as "realization

due to turning over the investor's capital"? In other words, what if merely *replacing* fixed capital and inventories involves no realization? This view essentially means emphasizing the fact that even a gradual liquidation of an investor's operations would create uncertainties of valuation of which investors and creditors are aware, and that justify regarding replacement (avoidance of liquidation) differently from net investment out of realized profits. On *this* view, replacement-cost depreciation of fixed capital—rather than merely a correction of historical cost for the general inflation rate—should be used for computing the tax base except where the investor is liquidating his fixed capital; and, whether or not the investor is liquidating his inventories, the appropriate inventory-valuation method for tax purposes in this case is LIFO, rather than correction of FIFO with reliance on a general inflation index. That is, these practices would be appropriate to tax accounting if, in addition to drawing the usual line between realized and unrealized gains, one were willing to rule quite generally that turning over the investor's capital involves *no* realization.

Yet, the U.S. tax code is not based on any consistently maintained conception of this sort. Instead, it embodies a compromise: on the one hand, our tax code implies that turning over *fixed capital* when it is consumed and replaced does involve realization (which is a FIFO-like conception applied to fixed capital); and, on the other, the investor may opt either for the treatment of the joint act of using up and replacing *inventories* as realization (the FIFO option), or against such treatment (the LIFO option). Considering the complexities of the problem, I find this willingness to compromise understandable. But it greatly complicates tax problems, especially in an inflationary period that would call for correcting FIFO inventory valuation and FIFO-like depreciation practices by a general inflation factor, with the tax allowance going to the investor rather than to creditors only to the extent of internal financing. At the same time, correction by a general inflation index is out of place where LIFO practices are applied, because there the joint act of using up and replacing is not viewed as implying realization and the result is that the exclusion from the tax base is "automatic" and unrelated to the problem of inflation accounting.

I would like to make several points in summary. First, I suggest that, even for an inflationary era, we obtain reasonably simple logical principles for the NIPA. Almost equally straightforward are the principles for tax accounting based on the conception that using up physical capital plus replacing it involves no realization, and hence any gains or losses developing

from this practice should not enter into the tax base. Next, given a tax code that does not take this position but is a compromise, one must work through rather messy complexities. Finally, on what is to me the basically unconvincing conception of accrual taxation combined with inflation correction, the *impression* of logical purity or internal consistency emerges; but this impression is unjustified if there is no consistent way of sharing the inflation correction between investors on the one hand and their direct and indirect creditors on the other.

Edward M. Gramlich: The recent rise in prices has spawned much interest in the question of the proper measurement of incomes or profits in inflationary times. The papers on indexing income measures for inflation that have lately resulted from this concern have probably already convinced economists about one important benefit of stable prices: the indexing question is so complicated that economists, accountants, and tax lawyers would have a much improved standard of living if they never had to read or write another paper on the topic. Working against this constraint, however, Shoven and Bulow have done an admirable job: their paper is clear and informative, though a little heavy on their own recommendations and correspondingly light on discussion of some of the underlying issues. I want to bring out a few of these issues.

Most of the literature focuses on the tax implications of inflation accounting—ways in which tax schedules could be adjusted so that real tax levels (and ultimately the real incomes and relative prices facing firms and households) would be unaffected by inflation. For that purpose, there are two requirements. The first, known as type I indexing, involves setting magnitudes such as personal exemptions, deductions, rate brackets, and so forth in "real" terms, and hence ensuring that the average tax rate and progressivity of the schedule do not change in inflationary times. These issues are not discussed in the Shoven-Bulow paper, which does not concentrate on the tax implications of inflation accounting. The second, type II indexing, deals with the proper measurement of the tax base during inflation. This is the central question of any inflation adjustment, and the one on which Shoven and Bulow spend their efforts.

Within type II indexing, then, one still has to clarify several issues. The first issue is whether general price inflation applies more or less similarly to all goods, or whether prices advance at markedly different rates. Type II indexing becomes much more complicated if the latter is true and, to their

credit, Shoven and Bulow did not shy away from this complexity. I don't agree with all their conclusions, however, and will try to slug it out with them on that issue. The second issue is an economist's favorite: whether inflation is anticipated or unanticipated and whether that makes a difference. Shoven and Bulow have narrowed their focus to the accounting convention and spend little time on its effects, but I want to say something about this aspect of the question. The third question is whether income is to be measured (and taxed) on a realization or accrual basis. Here the authors' treatment looks fine to me and I have no quarrel with them.

The first important point raised by the paper concerns general versus specific inflation. If all prices are rising at the same rate, Shoven and Bulow and others would argue that at least two types of distortion arise in measuring and taxing the income from physical capital. Since depreciation allowances are based on original cost, they are understated and the firm's income and tax liabilities are accordingly overstated. Also, since some inventories are valued under the FIFO convention, there is a similar overstatement of nominal inventory capital gains. In both cases the true economic cost of using up either fixed capital or inventories is understated by original cost or FIFO, and a possible remedy is to use Shoven's and Bulow's "general-value depreciation" in the former case and something I will call "inflated FIFO" in the latter. This means simply allowing the firm to raise its original cost of consuming the good or the inventory by the percentage change in general prices since the time the good was bought. As Shoven and Bulow point out, if all markets were nearly perfect and taxation were on an accrual basis, something close to this practice would happen automatically.

But if prices change at different rates and the accounting and tax systems are on a mixed accrual and realization basis, the situation gets muddier. Assume that firm A bought an inventory that rose 15 percent while prices in general rose 10 percent. Most people would agree that if, of the nominal gain of 15 percent, 10 just keeps pace with inflation, it should not be regarded as income, and it can be kept out of measured and taxable income by inflated FIFO costing of inventories. But what about the other 5 percent? The Shoven-Bulow answer is that that is income (and presumably ought to be taxable), though they don't say exactly why. My own is that it probably should not be taxable, but the matter should in any event depend on the substitution possibilities open to the firm. If the firm can substitute for this inventory other goods that have *not* increased in price, its costs are in effect no higher, it really did get a capital gain, and this real gain is in-

come and ought to be taxed. If the firm cannot substitute, however, its costs have also increased, it really did not get a capital gain and should not be taxed, and the 5 percent can be kept out of taxable income by using the present (optional) LIFO convention. Of the two possibilities, if the various types of inventories the firms can purchase are fairly close substitutes, their prices will probably change at close to proportional rates, the real-gain component is probably rather slight, and LIFO seems to me a more reasonable approach. Thus, I don't see any persuasive reason for eliminating this option, as Shoven and Bulow recommend, although my view hinges on a possible underestimate of the degree to which firms can in fact alter inventory buying patterns in response to changes in relative prices.

The answer to whether general-value depreciation (the analogue to inflated FIFO) is better than replacement-cost depreciation (the analogue to LIFO) for fixed capital depends on the same type of considerations. But there, as Shoven and Bulow argue, markets and prices are so poor that it is probably impossible to use replacement cost even if it is desirable, and general-value depreciation becomes a second-best alternative—although better than the present original-cost system. This conclusion points to a mild asymmetry in the Shoven-Bulow paper: they oppose LIFO and favor inflated FIFO on principle, yet they favor replacement cost on principle and agree to general-value depreciation solely on pragmatic grounds. If replacement cost is better in principle, so it would seem is LIFO.

Two other points should be noted. It does not, I think, matter whether the firm responds to a rise in inventory prices by raising product prices. If the firm does that, the revenue going into measured profits increases automatically and it is still necessary to compute true profits by using the new, higher, real replacement cost of consuming inventories or capital. Second, if all accrued income of corporations were imputed back to stockholders, it may appear that substitution possibilities would expand and hence all the above capital gains would become real; but I don't believe that is true. The firm that has no substitution possibilities may have an inventory asset that appreciates in relative price, but it also has complementary processing equipment that has in effect depreciated in value. Hence, the real profits and relative price of the stock of that firm should be substantially unchanged, and so should the stockholder's real income.

I want next to raise a second important question, regarding the distinction between anticipated and unanticipated inflation. Shoven and Bulow deal almost exclusively with a world of unanticipated inflation, and their

discussion is framed wholly in terms of its impact on firms of various types. When inflation persists, however, it presumably becomes more and more anticipated. As this happens, rational firms and households can take steps to protect themselves against inflation, including the tax treatment of it. With respect to taxation, the policy question changes character: no longer is society trying to protect unknowing fools against random inflation-induced inequities; rather, it is trying to prevent the adverse economic implications of the measures knowing smarties take to protect themselves against inflation.

In the case at hand, original-cost depreciation might be expected to raise the rate of return required on new investment in inflationary times and thus to hamper investment. This development could be undesirable, first, because it implies that the net restrictiveness of a given depreciation law will depend on the anticipated rate of inflation, and, second, because it may reduce the national proportion of output invested. That the first is a disadvantage of the present original-cost system is conceded by most economists. That the second constitutes such a disadvantage is not generally conceded, however, and there the question of adjusting depreciation for inflation lands smack in the middle of the growth issue. Those who believe in the policy relevance of the "golden rule" of accumulation presumably think that the United States is already investing too little; they look with disfavor on anything that raises the cost of capital and hence takes the country farther from the golden-rule path; and presumably they would favor something like the Shoven-Bulow general-value depreciation. Those who are beset by other bugaboos—adverse redistribution of income within generations, environmental damage or resource exhaustion, the consequent macro stabilization problems—would argue against this position and urge that any general-value depreciation be offset by tightening or eliminating other investment inducements such as accelerated depreciation, short tax lives of equipment, and the investment credit. An intermediate possibility, which seems preferable if there is no indexing of the interest costs on debt during inflations, would be to confer general-value depreciation only on the equity-financed portion of new investment.

Whatever changes in tax policy should be made, the Shoven-Bulow treatment of this particular question can be somewhat misleading. Their figures and calculations appear to indicate the rate of inflation at which original-cost depreciation reduces allowances more than the acceleration provisions increase them. Yet one must read very carefully here because Shoven and

Bulow assume for these calculations that the real interest rate is zero, hence assuming away the basic advantage of the accelerated-depreciation provisions from the start. The fact that the Treasury is making a loan at zero interest rate is then of no consequence, for firms could by assumption borrow at that rate from banks. The only advantage of acceleration, then, is that it augments the cash flow of growing firms, a fact that is not very interesting to those who view investment as motivated primarily by a comparison of its expected profitability with financial opportunity costs. It turns out that a mathematical property of the system is that in figure 2 a growth rate of g in cash flows can also be interpreted as an interest rate of g on a given piece of new equipment in a cost-of-capital framework. But with this alternative interpretation, many words and numbers in the paper do not follow, because Shoven and Bulow measure relative gains and losses by firm according to past growth rates of the firms, which presumably are not the same as the real costs of borrowing that firms face. In addition, computing the cash-flow effect in this way prevents Shoven and Bulow from dealing at all with the impact of the investment credit or of changes in the corporate tax rate, as they could have with an approach relying on required rate of return—though again there are changes in interpretation that allow them to say something about the matter.

General Discussion

The paper's discussion of the appropriate definition of income brought forth a number of comments. Joseph Pechman favored the Haig-Simons concept of income for business-accounting purposes because, in his view, a firm's performance cannot be evaluated without taking into account its accrued capital gains and losses. The definition of income would differ from the one used in the national income accounts, which does not include capital gains and losses because it is intended for a different purpose. He also advocated, as did Shoven and Bulow, the adoption of uniform accounting procedures to facilitate interfirm comparisons of performance. Although James Tobin agreed with Pechman in principle, he offered a qualification. Since capital gains may not be recurrent, the concept of permanent or sustainable income—that income that could be expected to be earned year after year—may be more relevant in assessing the position of a business firm than the authors' concept of accrual income in

purchasing-power terms. For example, sustainable income could be calculated simply as the Shoven-Bulow net-worth figure with some real rate of interest applied to it. That amount should be sustainable regardless of the source of the incremental net worth—capital gains or retained earnings—or of the extent to which it was accumulated in the past year.

Lawrence Klein was concerned about any accounting adjustments that would upset the usual identities of the balance sheet and income statement by deflating components separately into real units. A nominal accounting system (which would still revalue assets and liabilities) seemed preferable to him because it is difficult for real identities to hold for a complete system, especially for residual items such as profits or net worth. Those subaggregates that have physical counterparts could be expressed in real terms. But in some sense, there is no such thing as real profits or real income; the concept of purchasing power depends on what spenders want to do with their incomes.

Donald Nichols criticized the paper and previous discussion for assuming that there is a theoretically acceptable and objective way to measure income when prices are changing over time. Capital gains induced by changes in interest rates and by other intertemporal changes in relative prices should not be treated as income to all stockholders since not all stockholders will be made better off by the change. Each stockholder has an intertemporal consumption plan, but the present-value method proposed by Shoven and Bulow assumes that all stockholders want to consume everything this year. Such problems exist with any income measure, and inequities will result if all income must conform to one definition. In a tax system that uses consumption rather than income as a base, these insoluble problems are finessed, Nichols concluded.

Arthur Okun pointed out that the conventional balance sheet that was adjusted in the paper ignored one important type of "real" asset or liability —orders placed at fixed prices for inputs, and orders taken at fixed prices (or other commitments to a definite price—say, through advertising). Such obligations by sellers represent, in effect, a kind of future-market sale out of inventories; among firms that have a large volume of such commitments, FIFO offers a more accurate description of performance than does LIFO.

The remaining comments dealt with the practices and the purposes of accounting. Gardner Ackley pointed out that a key purpose of accounting is to provide information on which to base management decisions and wondered what effect the changes proposed by the paper would have on

those decisions. Michael Lovell felt that the implications for the business cycle of changing accounting procedures merited more consideration by the authors. He noted that businesses could have been encouraged from a tax viewpoint to accumulate more inventories during the period of double-digit inflation if more firms had been using LIFO; yet such behavior would have aggravated instability. On the other hand, after-tax profits net of the inventory valuation adjustment were lower than dividends in 1974. Had investors been fully aware of the distortions of FIFO accounting, the stock-market decline could have been worse than it was.

Charles Holt and Daniel Brill stressed the need for better communication between accountants and economists. Accountants believe that the validity of their numbers rests on their reliance on actual transactions rather than on personal judgment. Since they will be responsible for implementing any changes in accounting procedures, they must be convinced that switching from a nominal to an inflation-adjusted system will not violate their conventions. Economists must clarify the point that the basic operations of addition and subtraction that accountants now use make sense only in a world of constant prices or under a system of standardized units. Holt thought that accountants might be reluctant to revalue assets and liabilities without actual transactions to guide them. In response, Brill maintained that accountants already exercise enormous judgment in that area, especially for financial institutions, in deciding when and how much to write off financial assets that bear unrealized capital losses. They are expressing opinions on what portions of a past decline in value can be ultimately recovered.

The authors responded to several points raised in the discussions. Fellner's comment about the uncertainty associated with estimates of unrealized accrued capital gains led Shoven to reiterate his position that, for long-lived assets, inflation makes original cost a very inaccurate representation of the value of an asset. He considered Gramlich's distinction between anticipated and unanticipated inflation highly relevant in determining the behavioral impact of any accounting system, but felt that it has no bearing on the appropriateness of a particular accounting procedure. He agreed with Gramlich that capital gains on inventories accrue to a firm only when there exist substitute inputs whose prices have not risen. However, the purchasing-opportunity set of a firm should be distinguished from that of a stockholder since any one stockholder can sell his interest and thus engage in partial liquidation. Lastly, Bulow pointed out that, although the growth

rate and the real rate of interest are substitutable in some sense, figure 2 reflects the ratio of two depreciation schedules and thus is independent of the real rate of interest.