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Chapter Author: John W. Kendrick, David J. Hyams, Joel Popkin

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CHAPTER 6

VALUATION—GENERAL APPROACHES

The valuation of tangible assets poses some of the most difficult problems that must be faced in planning for a wealth inventory. The difficulty stems from the fact that assets are carried on the books and/or records of most firms and other organizational units at cost. Since assets were acquired at different dates, their valuation has no uniformity. For purposes of wealth estimates, market or other present values are desired. Unfortunately, it is not feasible to ask owners to estimate and report the present value of the bulk of their tangible assets. The estimating agency is, therefore, confronted with the problem of collecting book values and using associated or collateral data to adjust them to estimated market values.

In the first section of this chapter, we shall discuss valuation generally—the deficiencies of book values, the limited scope of direct market price data for assets, and the several possible proxies. In the second section, valuation problems are reviewed for each of the major classes of tangible assets, and for financial claims.

Book Values

Economists are in substantial agreement that estimates of wealth in terms of book value, or original cost, are not as meaningful as market or other present-value estimates. If general and/or relative prices have changed significantly over time, original costs lose their meaning. Except for short-lived or recently purchased goods, original costs represent neither the present values of projected net income from the use of the wealth, nor the replacement costs of the man-made capital. Since the age-distribution of assets differs among firms and sectors, book values are not fully comparable. Nor are they comparable through time. Original prices no longer obtain, and book depreciation methods for fixed durables may not reflect the decline in economic values and may incorporate changes in accounting practices occasioned by changes in tax laws.

Yet it must be recognized that book values, generally representing original or acquisition costs, are the hard data available not only for private firms but also for most other organizational units that keep books. Therefore, their collection and compilation will be a necessary prerequisite to or concomitant of estimates on a current-value basis. Some analysts consider it useful to have one set of balance sheets in terms of book values. Presumably, these values have some influence on decisions, even when their limitations are recognized. They affect tax liabilities and, in some cases, rate regulation. A statistical advantage to balance sheets in acquisition cost is that changes from one date to another can be explained in terms of gross investment less capital consumption without adjustments for changes in value of pre-

existing stocks. The FRB partial balance sheets incorporate largely book or par values. Yet the revaluations and current value estimates are also needed.

Current Values

Current market prices provide the most useful and understandable basis for valuing and combining components of the capital stock. The national product is expressed in terms of market prices or proxies for market prices so it would be desirable for wealth to be valued on the same basis for the sake of consistency. Just as relative market prices of consumer goods represent relative degrees of satisfaction anticipated by purchasers, so do relative market prices of capital goods reflect relative present values of the future net income streams expected by the purchasers. Thus, market values of capital assets are comparable as among sectors in terms of anticipated income-producing ability and are consistent with current income. Such values can also be made comparable through time, when allowance is made for changes in market prices so as to convert the stock series to constant market prices of a stated date.

Statement of the general principle that market-price valuation of assets is desirable provides a general goal, but many practical problems are met in its implementation. Is the economist concerned with valuing a collection of individual capital goods, or with the going-concern value of the collectivity of assets? Assuming the former approach is adopted, how are the individual capital goods to be defined, particularly for comparisons through time when technological and other dynamic changes are taking place? Even if we assume that capital goods can be defined in terms of relatively homogeneous units for purposes of pricing and deflation, what can be done when asset markets are unorganized or nonexistent—what are the possible proxies for market prices? These and other general problems will be treated in the following sections prior to examination of special problems and data requirements for each of the major types of wealth.

Going Concern Versus Aggregate Wealth Valuations

In the business sector of the economy, there is a choice between summing the values of the individual capital goods that compose the plant of the producing units and summing the value of those units as going concerns. The latter approach is spelled out in considerable detail by Prof. Vernon Smith in appendix I, part H. Basically, it involves estimating the market value of a corporation's liabilities and equity from quotations on the securities markets, and subtracting the market value of its financial assets in order to arrive at the current value of the assets residing in the enterprise.

This contrasts with the more generally advocated method of obtaining from enterprises estimates of the market value (or original cost, for purposes of revaluation) of individual items of land, structures, equipment, and inventories, by type, by establishment, and summing these by industry groupings.

Statistically, the latter procedure has advantages. The wealth estimates can be broken down by major types of assets. They can be classified by industries composed of establishments, rather than of

companies, which is preferable for production analysis. Further, the going-concern approach is not applicable to the nonbusiness sectors (governments, nonprofit institutions, and households), so the asset-type valuation approach would have to be applied to a significant portion of the economy in any case.

For the corporate sector, the data are almost entirely available for the going-concern approach, while the asset-type approach involves much estimating. But there is some question as to the validity of applying corporate asset/cash-flow ratios to noncorporate businesses, even in the same industry and size-group. Estimates by proprietors of the market value of their enterprise would likewise be speculative.

It has also been objected that stock-market valuations are volatile, and it has been suggested that centered moving averages of stock prices be used to obtain yearend values. Yet Professor Smith argues rather convincingly that volatility of expectations and price fluctuations is of the essence of value.

Finally, as Edward Denison points out in his comments to the Smith paper (also app. I, pt. H), the sum of enterprise values is not adjustable for price changes to get real stock estimates over time for purposes of production function analysis.

Theoretically, there is much to be said for implementing both approaches. Under pure competition (with perfect foresight) the value of the enterprise as defined should equal the value of the invested capital, including intangibles. In the real world, however, even with competition but without perfect knowledge, resources are generally misinvested to some degree, and cannot immediately be shifted, especially when the real capital is both specialized and long lived (as is true of railway roadbed and rolling stock, for example). With unfavorable demand developments, the sum of the value of constituent assets (determined at least in part by alternative-use value) could exceed the going-concern value of a firm, or group of firms, for many years before new investment policies brought the two back in line. In fact, if market shifts were rapid in relation to real-capital adjustments, disequilibrium could persist for decades, as has been true, broadly speaking, in American agriculture for almost half a century. Favorable market shifts could produce the opposite condition, of course. As Professor Smith points out, a comparison of the aggregate value of component assets with going-concern value, by industry, could be very useful in investment-demand analysis.

But as was stressed in the Wealth Study symposium on valuation, the going-concern valuation proposed by Professor Smith is influenced by more than the value of the underlying tangible assets. In the absence of pure competition, it reflects relative market positions of firms as influenced by the degree of monopoly, the foresight of management, and other factors. It also reflects security-market valuation of intangible capital and quasi-rents such as reside in the know-how of staff (resulting in part from company investments in research, development and training), and the peculiar organization of particular firms and industries.

Further, relative stock-market values, and changes over time, are influenced by purely financial factors, such as changes or differences in dividend payouts, income tax and capital gains, tax rates, and changes in discount rates.

Nevertheless, going-concern valuation would seem to be an interesting supplementary approach to wealth estimates in the business, and particularly the corporate, sector. After allowance for the nontangible-asset values, the going-concern values would furnish a rough check of orders of magnitude of wealth in the sector as a whole, and differences by industry would be quite significant analytically. As suggested by Mr. Gorman in appendix I, part F, liabilities plus equity at market values for the business sectors could be carried on sector and national balance sheets, with the differences between this total and the sum of the value of individual assets (including tangibles) at market carried as a separate item. In this way, the Smith approach can be incorporated in national balance sheets, but not as a basis for tangible wealth estimates by industry. In the following sections the focus is on the latter approach.

The Limitations of Capital Goods Markets

In the existing markets for capital goods (other than inventory stocks), total turnover is generally a small proportion of the total stocks of various types. Except in the early phase of production of new types of goods, current output of the new items is generally a small proportion of the total population in existence. Turnover of used reproducible durable goods and nonreproducible goods also generally involves a minor portion of total stocks.

It would obviously be impractical to attempt to market an entire stock of capital goods in a given time period. Thus market prices applied to an entire stock signifies what could be obtained for the goods under orderly, or normal, marketing conditions. Just as the rules of commercial banking are based on the normal behavior of persons with respect to deposits and withdrawals, so the value of a stock of capital depends on normal behavior respecting replacement, resale, liquidation, and so forth.

In the case of many used reproducibles, public land, certain minerals, and several types of collectors items, there may be few if any, market transactions from one year to another. In these cases, present-day values must be estimated by some means other than application of market prices.

The use of constructed values has a counterpart in the national income accounts. The goods and services furnished by general governments and nonprofit institutions, which are not bought and sold in the usual market sense, are valued at cost (usually without allowance for a return to capital, however). Imputations are made for the rental value of owner-occupied houses and various payments in kind, often by applying the prices of similar market transactions to the number of units involved in the nonmarket situation.

Proxies for Market Prices

The possible proxies for market prices of capital goods fall into three chief categories which can be introduced in terms of the several forces determining the market price. On the one hand, the demand schedule for particular capital goods reflects the estimates of potential buyers or holders of the goods of the discounted value of their

expected future contributions to income. The estimator can try to duplicate these calculations. On the other hand, in the case of reproducible capital goods, the supply schedule reflects the opportunity costs of producing or replacing the earning capacity of the item. Again, this can be estimated. Finally, the intersection of the two schedules, which would give the market price, can be estimated by persons familiar with the sporadic transactions in the item which may take place, or with markets or occasional transactions in similar types of capital goods. We shall begin with the the third approach, which may be called an appraisal technique.

APPRAISAL

Estimates of the current value of assets may be obtained from owners—either directly, or indirectly as through insurance valuations—or from outside appraisers who are either professionals, or other persons familiar with the property values.[1] The persons making the estimates will, of course, appraise levels or trends in market prices of similar assets, prospective income-producing ability, replacement cost, and other factors. The expert appraiser tries to estimate the market price that would obtain under certain hypothetical conditions—assuming, for example, willing buyers and sellers.

An approach related to the first is the use of property assessments, a form of appraisal for property tax purposes, blown up by a ratio, representing the estimated relationship between assessed and market values. This was the chief approach used in the early censuses of wealth, 1850–1922. The ratios of market to assessed values, by geographic areas, were determined by U.S. marshals and Census Bureau officials. In recent Census of Government reports, data have been gathered regarding both assessed and sales (market) values of a sample of those properties which changed hands during the year, by type and by area. Obviously, these ratios could be applied to all assessed values, by type by area, if the assumption were reasonable that the ratios obtained from the relatively small proportions of properties entering the market were representative of all properties.

The assessment approach is much more applicable to realty than to personal property. The tax laws of the various States differ much more with respect to the scope of taxable personalty than of real estate, and apparently assessment procedures differ much more widely. For real estate, however, adjusted assessment value represents a possibly attractive supplemental approach and check on estimates obtained directly from industry respondents.

DISCOUNTING ESTIMATED FUTURE INCOME

The second major approach involves discounting an anticipated future net income stream from assets which are income producing, but not generally bought and sold, or on whose marketability legal restrictions may have been imposed. The method is most applicable to certain lands and mineral resource reserves. It is used by the

[1] Tibor Barna has found fire insurance valuations a useful approach to replacement cost in the United Kingdom. See "Alternative Methods of Measuring Capital," "Income and Wealth," series VIII; also "On Measuring Capital," in "The Theory of Capital," edited by F. A. Lutz and D. C. Hague.

Interior Department to estimate the value of certain mineral resources.

This approach involves (*a*) projecting the rate of production, productivity, input and output prices, and thus the gross and net receipts from use of the capital facilities; and (*b*) applying a discount rate to the projected net income in order to compute the present value of the property.

The projection involved is complex, but it is no more than is done whenever private firms assess the prospective profitability of new capital outlays. There is also the problem of the appropriate rate of discount, which has been discussed at some length in the literature with respect to private firms. For public bodies, the average borrowing rate has been suggested for discounting purposes.

If facilities are not used to an optimal degree of intensity, and net income is correspondingly reduced (particularly apt to be true of public wealth), the question may be raised as to whether the capital value is not underestimated by capitalizing net incomes projected at probable rates of utilization which are less than the most efficient ratio. Assuming there is no supplemental nonmonetary income, the answer appears to be in the negative, since values are relative to actual and projected income given the probable types and intensities of use. A public body is merely reducing the value of its assets to the public when it limits the use without compensating side gains.

If an actual user charge is below the optimal charge (that which maximizes present value), as is the case with some leased public properties, the latter (subsidy) may be estimated, and an imputed valuation made. The problem is even more difficult if a major portion, or all, of the services of the facilities are furnished gratis. Rather than estimate the net value of the services, less error might be involved in estimating the value of the facilities (such as a national park) in terms of its value in alternative uses (possibly as indicated by values of similar properties adjoining, or located elsewhere, but comparable).

REPLACEMENT COST

The most common way to approximate the market value of fixed reproducible goods (structures and equipment) is through the estimation of depreciated replacement cost. Briefly, this involves taking the purchases of each previous year, by type of good, multiplying by the ratio of the current price to the prior year's price (or price composite) to obtain gross replacement value, and then deducting depreciation, computed in accordance with the presumed pattern of loss of value as a durable good of the given type ages, in order to obtain net, or depreciated, replacement value.

The Wealth Study staff has generally favored this approach, but believes that the theoretical implications and qualifications are not often recognized. In this section, we shall explore these, and in the section on valuation of major classes of wealth we shall be concerned with the major statistical problems posed by this approach.

Gross stock in current prices.—First, consider the revaluation of original cost to gross replacement value to take account of price changes. In order to revalue capital goods to present (replacement) values, price indexes of new items are needed. This immediately raises the question as to what is the unit being priced or revalued. This

question is important in a dynamic economy in which the productivity of the capital goods industries is changing at the same time as are the physical characteristics and the output- and income-producing capacity of capital goods.

In viewing this problem, we agree with Edward Denison that the unit to be priced and revalued must be specified in terms of its physical characteristics, with adjustments when changes in specification are associated with differences in real production cost between the old and new models (the "ideal" procedure used by the Bureau of Labor Statistics in pricing).[2] It is important that the physical units of a capital good not be confused either with the inputs required for its production, which generally decline through time, or with its output capacity, which frequently increases over time.

The first confusion can be dispelled easily. Take, for example, one machine tool whose physical specifications and output capacity do not change between two periods of time, but in the production of which total productivity has doubled (real input requirements per machine cut in half). We should not say that the quantity of the capital equipment had been cut in half—this would imply a doubling of the machine tool's productivity whereas none had in fact taken place. The quantity of the machine should represent its real cost given the level of technology (productivity) in its production in the base period.

Assuming an increase in efficiency in producing a standard machine over time, its price will move to the degree that the movement of average factor price (including profit) deviates from that of the average productivity of the factors used in its production.

Next, suppose the physical characteristics and output capacity of the capital goods change, as with a model change. On this score, Denison (and the "ideal" procedure of the BLS) would adjust the real cost of the machine by the percentage difference in the real cost.

This procedure preserves the meaning of real cost as representing the cost or input at base-period technology, if we can posit that the differences in real cost of new and old models would also have obtained in the base period.

The general effect of this procedure, which is dictated by the characteristics of the price indexes, is clear. Suppose that at the end of the year 1970 the value of new depreciable assets installed during 1970 is $100 billion. Suppose that in 1970 it would cost $2,000 billion to reproduce (new) the depreciable assets produced prior to 1970 that still remain in the stock, but that only $1,500 billion would be required to replace these older assets with others, incorporating current technology, that would contribute just as much to current production. By the procedure described the gross capital stock at the end of 1970 will be measured as $2,100 billion, not $1,600 billion. In other words, older capital will be equated with new by comparing reproduction cost at a common date, not ability to contribute to production.

Gross stock in constant prices.—A series for the value of the gross stock in constant prices, covering a series of years, can be obtained by substituting the prices of some one base year for current prices in the calculations. The result is to equate the goods standing in the stock

[2] See Edward F. Denison, "Theoretical Aspects of Quality Change, Capital Consumption, and Net Capital Formation," in "Problems of Capital Formation," vol. 19 of "Studies in Income and Wealth"; also app. I, pt. J, to this report.

at different dates in terms of the cost of producing these goods at some one date. Thus if the gross stock of depreciable assets valued in 1970 prices should turn out to be $2,000 billion in 1968 and $2,100 billion in 1970, this would mean that in 1970 it would cost 5 percent more to replace the 1970 stock than the 1968 stock. But the 1970 stock would presumably be able to contribute more than 5 percent more to production than the 1968 stock because of quality improvement. In gross stock measurement, the method of equating depreciable capital produced in different years is identical in current and in constant prices.

We can illustrate the points we have been making in another way. Suppose that a given date, model t has a 10 percent higher real cost than model t–1; that the price of model t is 15 percent higher than was the price of model t–1 in year t–1; and that model t contributes 20 percent more to production than model t–1. By our adjustment procedure the "pure" price increase is estimated to be approximately 5 percent $\left(\frac{1.15}{1.10}\right)$, and model t represents 10 percent more real capital than model t–1, even though it can contribute 20 percent more to production. This is the result whether it is obtained by price deflation or by weighting cost-adjusted physical units by base-period prices. It is the only result that can be obtained with the price indexes or quantity data that now exist or that we know how to construct.

It must be kept in mind that the essence of the value of capital lies in its ability to produce net income, not to produce output per se. As the output capacity of a new machines rises faster than its real cost, so, too, may the net income from its use by its early buyers. But economic theory teaches that, given workable competition, abnormal profits will gradually be competed away. Thus, prices of new machines tend to approximate their costs, including a normal profit, and net returns to new investment would tend to move much more nearly in proportion to the costs (including normal markups) of successive models of capital goods, than to their output capacities.[3]

In the example cited above, purchases of the new model t's would be carried to the point where they tended to yield the same rate of return as the older model t–1 had in the previous period—and thus the absolute real net income per machine would tend to be 10 (not 20) percent higher than that on the older models when they were new. The greater output capacity of the model t's relative to their real cost would, however, be reflected in a decline in the current value of the model t–1's. This is an important aspect of depreciation and the estimation of depreciated replacement cost, which we discuss in the next section.

In conclusion, it will be recognized that, even apart from the treatment of quality change, the gross reproduction cost of a stock of different vintages of capital goods in the prices of a given period does not reflect its anticipated capacity to produce net income, since the decline in the future net-income-producing powers of aging durables is not reflected. It does reflect what it would cost to produce the stock new in the given year. Movements through time of the gross stock in constant prices do reflect changes in the physical volume of items still in the stock, given their base-period relative prices (and adjusting for

[3] See John W. Kendrick, "Some Theoretical Aspects of Capital Measurement," American Economic Review, Vol. LI, No. 2, May 1961.

model changes in the manner specified). The estimates have an economic as well as a physical basis in that it is the economic and not the physical lifespans of the various durables which determine the dates of their retirements, and thus the size of the gross stock.

Net stock in current prices.—Having obtained estimates of the gross value of depreciable assets in current prices, it is possible to estimate depreciation and by deducting it, obtain the depreciated or net value. As an approach to market value, the net stock seeks to approximate the present value of the future income stream that may be expected from the capital goods. It is the measure of the value of depreciable assets that is appropriately combined with other market value estimates to arrive at the national wealth. It has also been regarded as a real net-cost measure, but allowance for depreciation is essentially an economic measure reflecting the decline in the value of an asset as it ages. That value, and indeed the lifetime, of capital goods, is a market-determined phenomenon; so also is the depreciation allowance and the net-stock estimate.

Market prices of used plants and equipment would be the most direct method of valuing depreciable assets. But since most items do not trade on organized secondhand markets, depreciation must be estimated. The past lengths-of-life of various types of capital goods can be determined from various surveys and data on scrappage. More difficult is the estimation of the shape of the depreciation curve to be applied to new purchases. This can be deduced from data on used prices of those assets which are traded, and imputed to those which are not.

It is clear that deviations between depreciated replacement cost and true market price (if it existed) could occur for two main sets of reasons. One set of reasons has to do with the inadequacy of data upon which depreciation curves are based, the stylized nature of these curves, and the fact that they are extrapolated beyond the period which furnished the data upon which they are based. The problems of estimating depreciation are discussed further in a subsequent section.

Taken in conjunction with the indirect nature of depreciation estimates, strong and persistent changes in relative demand will tend to cause market values of existing fixed assets to fall below, or rise above, the estimated depreciated replacement cost of particular assets for extended periods of time. If expectations regarding earnings of a particular class of capital goods were not realized, the market value of the used goods would fall below depreciated reproduction cost. But the deviation would be temporary, as purchase of new items fell until the return rose to the previously expected level. The relative decline in the supply of used items would tend to cause these values gradually to rise back toward depreciated replacement cost. The same sequence, pari passu, would tend to bring down the prices of used goods where earning power exceeded expectations through an increase in purchases of new goods and thus a gradual increase in the supply of used goods.

It is apparent that estimates of depreciated replacement cost are only more or less rough approximations to market values, actual or hypothetical. Despite their approximate nature, useful analyses have been made with wealth estimates based on the perpetual inventory method.

It is important to recognize that the method of treating quality change in equating the value of new and old capital goods to measure the net stock in current prices is the exact opposite of that implied in measurement of the gross stock. The net value of a depreciable asset falls below that of its gross value not only because it physically wears out, so that it may become physically less efficient as it ages and the remaining physically possible service life declines, but also because its ability to contribute to production declines relative to that of new capital if there is quality improvement in capital goods. This comes about because the accumlated depreciation that is deducted allows not only for physical exhaustion but also for obsolescence. Statistically, this occurs because service lives used in computing depreciation are actual lives as shortened by obsolescence, not physical lives, and because obsolescence, is, or should be, taken into account in choosing a depreciation formula. The result is that, aside from the allowance for physical factors, depreciable assets produced in different years are, in principle, equated by ability to contribute to production, not by production cost at a given date. Suppose a model t–1 and a model t would both cost $100 if produced in year t, but model t can contribute twice as much per year to production. Suppose the physical life of model t–1 is half exhausted (but its ability to contribute to production is not impaired). In year t the gross stock value of the two items together is $200. The net stock, however, is not (ignoring the discounting factor) $150 but only $125, the difference representing obsolescence. It is for this reason that net stock estimates can be considered approximations to current market values.

Net stock at constant prices.—What has just been said does not carry over to comparisons of the net stock at constant prices in different years. The obsolescence allowance affects the level of the net stock but, since a similar allowance is made in all years, it does not affect the movement of deflated net stock in anyway relevant to the treatment of quality change. Hence the interpretation to be placed upon a 5-percent increase in deflated net stock is (insofar as this point is concerned) that, in the base year, the cost of replacing the net stock of the second year would be 5 percent greater than that of replacing the net stock of the first year. If there has been quality improvement the net stock of the second year can contribute more than 5 percent additional to production.

Multiple Approaches to Estimating Present Values

If it is feasible for the estimating agency to use two independent approaches to estimates of present value, this would be desirable. In cases when owners estimate market values of depreciable assets, alternative estimates of the depreciated replacement cost by the estimating agency would be interesting. In addition to such owner or constructed estimates of market values, assessed values adjusted to market by the ratios indicated by the sample of sales would be a worthwhile check.

Reasonably close correspondence of alternative estimates would tend to confirm the validity of the numbers. Discrepancies should lead to further investigations that could result in improvements in data collection and/or estimating techniques.