

## **The Measurement of Business Capital, Income and Performance**

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### **III. Accounting Theory and Alternative Methods for Asset Valuation**

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#### **1. Introduction**

In this Chapter, we study the following problem: *the determination of period by period values for durable assets that are held by the business unit for multiple accounting periods*. There are many possible methods for asset valuation that could be used. We shall consider seven methods:<sup>1</sup>

- (1) historical cost valuations;
- (2) general purchasing power adjusted historical costs;
- (3) net realizable values or appraisal or market values;
- (4) replacement (or reproduction) costs;
- (5) future discounted cash flows;
- (6) asset specific index number adjusted historical cost; and
- (7) valuations based on intertemporal cost allocation methods.

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<sup>1</sup> Daines considered 4 of these 7 methods: “There are four possible bases which might be adopted: (1) liquidation value, or that value which is likely to be realized if the assets were thrown onto the market in the process of an orderly or forced liquidation; (2) original cost with proper allowance for decline in value of current assets and allowances for depreciation and depletion of fixed assets; (3) capitalized income producing value; (4) present market price of replacing or reproducing a similar asset in its present state of condition.” H.C. Daines (1929; 98).

The main method of valuation that is in general use today by financial accountants is the first method: historical cost accounting.<sup>2</sup> However, this method assumes that there is no inflation in the economy (or alternatively, inflation is ignored). The next five methods attempt to deal with the valuation problem when there is general or specific price change over time. The last method deals with the intertemporal allocation of fixed costs and will be explained in section 8.

## 2. Historical Cost Valuation

“Today's dollar is, then, a totally different unit from the dollar of 1897. As the general price level fluctuates, the dollar is bound to become a unit of different magnitude. To mix these units is like mixing inches and centimeters or measuring a field with a rubber tape-line.” Livingston Middleditch (1918; 114-115).

Historical cost depreciation (i.e., decline in asset value over an accounting period) is determined as follows: once a useful life for an asset has been estimated and a corresponding depreciation schedule has been determined, the initial purchase cost of the asset is allocated across accounting periods as a sum of periodic depreciation allowances. The corresponding historical cost value of the asset at the end of an intermediate accounting period is simply the initial purchase cost less the accumulated depreciation allowances over prior periods.

As we have seen in chapter II, the main problem with historical cost valuation of assets shows up if there is a large change in the price of the asset (due to general inflation for example) from the time of its purchase to the end of the current accounting period: the historical cost valuation may bear no resemblance at all to a current market valuation for the asset. Thus in an inflationary situation, historical cost depreciation allowances will be understated, income will be overstated and income taxes may become capital taxes.<sup>3</sup> The

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<sup>2</sup> National income accountants use essentially method 6, which is thought to approximate methods 3 and 5: “10.13. To ensure consistency between the accumulation accounts and the balance sheets, assets recorded in balance sheets should be valued as if they were being acquired on the date to which the balance sheet relates. For example, if fixed assets were to be acquired on the balance sheet date they would be recorded at their current purchasers’ prices, including any costs of ownership transfer, or at their current basic prices if produced on own account. The valuation of fixed assets that were acquired some time before the balance sheet date is more problematic. In general, they are valued by writing down the current purchasers’ or basic prices of new assets by the accumulated consumption of fixed capital on the assets. With good information and efficient markets, the written down values of the assets should equal, or at least approximate, both the present, or discounted, values of the remaining future benefits to be derived from them and their market values when active second hand markets exist. In practice, these values may differ from each other because of lack of information or other imperfections. As already stated, the written down value of the asset is generally the most practical and also the preferred method of valuing an existing fixed asset, bearing in mind that the calculation of consumption of fixed capital should take into account the observed values of secondhand assets when they are actively traded.” *System of National Accounts 1993*, page 219.

<sup>3</sup> On the other hand, if the business unit actually sold the asset at the end of an intermediate accounting period in inflationary conditions, income would suddenly be much larger for that period under the realization conventions of historical cost accounting. This discrepancy in historical cost incomes, depending on whether an asset is held or sold, should alert us to the possibility that something is seriously wrong with historical cost accounting; see MacNeal (1939) for further criticisms of historical cost accounting.

problem is that historical cost accounting implicitly assumes that monetary values at the end of an accounting period are comparable to monetary values at the beginning of the accounting period; i.e., there is an implicit assumption of price level stability. The accountant Middleditch (1918) challenged this implicit assumption, having observed the tremendous inflation that occurred during World War I.<sup>4</sup>

There are two main virtues that are claimed for historical cost accounting: (i) it is objective<sup>5</sup> and reproducible and (ii) it is conservative. Both of these virtues are subject to criticism. Historical cost asset valuations are not reproducible or objective since different accountants will not necessarily make the same assumptions about the appropriate amounts of historical cost depreciation. But the important problem is that historical cost end of period values will be completely meaningless in a high inflation environment; i.e., they will not reflect current opportunity costs or market values. Thus historical cost accounting values might be objective but at the same time, they are irrelevant.<sup>6</sup> Conservatism, on the other hand, conflicts with accuracy; i.e., if we wanted to be super conservative, why not assume all intermediate asset values are zero? The absurdity of this

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<sup>4</sup> The accountant William A. Paton (1920; 2-3) was not far behind in making a similar observation: “The significance of the dollar –the accountant’s yardstick– is constantly changing . . . . One of the fundamental limitations of accounting arises here. The units of physical science are always the same; and hence direct comparisons of situations and phenomena arising at different times can be made in this field. Accountants deal with an unstable, untrustworthy index; and, accordingly, comparisons of unadjusted accounting statements prepared at different periods are always more or less unsatisfactory and are often positively misleading.”

<sup>5</sup> “Its greatest advantage is the fact that an original cost method is most easily subject to objective verification; it is the easiest to use in practice.” H.C. Daines (1929; 98). Littleton comments at greater length on the virtues of *objectivity* and *verifiability* in business financial accounts: “Professional accountants have long struggled with the problems of providing data needed by managements and investors. As a result of an extensive accumulation of experience, accountants have come to several relevant conclusions: that men often want, and need, data which are not within the function of accounting to supply or practitioners to certify; that it should lie within the province of people specially trained and experienced in accounting to set the limits of their technology in the matter of supplying all information a client might find useful; that the professional accountant should confine his professional work of dealing with objectively derived and convincingly verifiable data which have been collected and marshalled by well known procedures from evidence of actual business transactions; that there can be no objection to any desired amount of collateral, interpretive use of properly derived account data, including such devices as averages, ratios, trends and projections.” A.C. Littleton (1956; 365). Thus Littleton reflects the opinion of most financial accountants that historical cost accounting is “best” for financial reporting because of its *reproducibility* properties and hence adjusting the historical cost valuations of assets is best left to management accounting. Of course, if inflation is high or moderate, this will leave investors stuck with an inadequate historical cost income reported by the firm. On the other hand, Chambers, commenting on Littleton’s defence of historical cost accounting, is willing to work with a weakened version of objectivity and verifiability in order to obtain more accurate financial accounts: “Objectivity is, without doubt, a useful notion; one to be used whenever possible. But its use and importance should not be overworked. It seems to be sufficient to stipulate that *initial* entries in accounting records are to be based on documentary (and therefore verifiable) evidence; no such stipulation can be made about subsequent adjustments such as valuation provisions.” R.J. Chambers (1956; 588).

<sup>6</sup> “Insofar as objectivity is regarded as an indispensable quality of an income concept which is to have any claim to being practical, accounting income is practical enough. But this is of little moment if it does not measure what we want it to measure. Objectivity without relevance is not much of a virtue.” David Solomons (1961; 378). The economist Morgenstern (1963; 66) uses the term “meaningless statistics” to describe historical cost incomes during periods of rapid inflation.

statement should make us realize that accuracy is a much more important virtue than conservatism.<sup>7</sup>

It is perhaps useful to elaborate a bit more on the meaning of “accuracy” in the context of determining period by period values for the assets of a business unit. It seems clear that there cannot be an answer to the problem of constructing period by period values of assets that are in use that are as unambiguous as the actual selling price of an asset; i.e., we can only make estimates of these intermediate values. Thus it might be reasonable to follow the example of Morgenstern (1963; 77) and regard these estimated intermediate values as probability distributions. “Accuracy” in this context could be defined as providing a suitable measure of central tendency (e.g., a mean valuation) along with a measure of dispersion (e.g., a variance). Unfortunately, accounting theory (and practice) has not proceeded along these lines,<sup>8</sup> although occasionally, accountants recognize that introducing statistical concepts into accounting would be useful.<sup>9</sup>

We turn now to a discussion of other methods for valuing assets on a periodic basis, methods that will more closely approximate current market values or opportunity costs.

### 3. Purchasing Power Adjusted Historical Cost

“It is obvious, therefore, that if quantities, whether measured in pounds or bushels or dollars, are to be correctly combined or compared, the unit of measurement must be homogeneous . . . . Yet many men who are not measuring their heights with fluctuating rulers, and who would throw verbal stones at such a silly doing, are complacently living in a similar kind of glass house, a business structure where in the substance of value continues to be measured by a dollar of seriously fluctuating size.” Henry W. Sweeney (1936; reissued 1964; 11).

“Professor Baxter (1976) has characterized the development of Latin American inflation accounting systems as having two stages: firstly, fixed assets and depreciation are adjusted by reference to a general index, and, secondly, at a later stage, the ‘time-log’ error on stocks [inventories] and monetary working capital is corrected by the application of an index.” David Tweedie and Geoffrey Whittington (1984; 243).

This method of constructing a current value at the end of an accounting period originates with Middleditch (1918)<sup>10</sup> and works as follows. Suppose an asset was purchased at the

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<sup>7</sup> “‘Conservatism’, especially when it merely means ‘highly probable understatement’, is not meritorious’.” John B. Canning (1929; 105). “Conservation infers understatement and understatement infers falsity. Falsity cannot be characterized as fundamental truth.” Stephen Gilman (1939; 204).

<sup>8</sup> “It is, of course, unlikely that balance sheets will be drawn up in the indicated manner; this is a matter for the future. But it is clear that present balance sheets already contain an element of expectation and speculation.” Oskar Morgenstern (1963; 78).

<sup>9</sup> “The accountant of the future will be a distinctly different type . . . . Accounting and statistics will be his tools; the entire scope of internal and external business problems that are reducible to mathematical measurement will be his field.” H.C. Daines (1929; 109). “It is necessary for the accountant to realize that his measures of income or financial position are actually probability distributions.” Harold Bierman (1963; 504).

<sup>10</sup> Sweeney (1964; 8-11) reviews the early history of this method. He was also an early contributor to the method: “First, the stabilizing procedure is based upon the index of the general price level, or ‘general index’. The reason is that ‘measurement based on the general price index enables all values to be expressed in accordance with the customary main object of economic activity, namely, increased command over

beginning of accounting period 0 at the price  $P^0$ , the period 0 depreciation rate is  $\delta^0$  and a general rate of price inflation over period 0 is  $\rho^0$ ; i.e., the general price level at the end of the period divided by the general price level at the beginning of the period is  $1 + \rho^0$ . Then the *historical cost accounting value of the asset* at the end of the period is  $(1 - \delta^0)P^0$  but the *General Price Level Adjusted (GPLA) value* is:

$$(1) V_{GPLA} \equiv (1 - \delta^0)(1 + \rho^0)P^0 .$$

The advantage of this method for constructing current asset values on a period by period basis is its relative *simplicity* (adjusted historical cost values at the beginning of the period need only be inflated by the common indexation factor  $1 + \rho^0$ ) and its *objectivity* (once the appropriate indexation factor  $1 + \rho^0$  has been chosen).<sup>11</sup>

In response to rapid inflation or a hyperinflation, GPLA accounting is the main form of current value accounting that has been used historically.

Note the difference between  $\rho^0$ , an ex post general inflation rate, and the asset specific anticipated inflation rate  $i^0$  defined as  $1+i^0 \equiv P^1/P^0$  where  $P^0$  and  $P^1$  are the price of the same asset at the beginning and end of the accounting period. In general,  $\rho^0$  will not equal  $i^0$  and hence the GPLA value for the asset will not equal its end of period market value (unless the general inflation rate  $\rho^0$  is equal to the asset specific inflation rate  $i^0$ ). This is the main weakness of General Price Level Adjusted accounting. However, its strength is that it will adjust for the effects of general inflation.

The remaining topic to be discussed is how to choose the general inflation rate  $\rho^0$ .<sup>12</sup>

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economic commodities and services in general'. Second, stabilized accounting, by its use of price index numbers, estimates the reproductive or replacement costs of merchandise and fixed assets as at any dates for which reliable indexes are available." Henry W. Sweeney (1935; 185).

<sup>11</sup> "Current value accounting is easy to explain and meaningful, but hard to audit. It requires estimates of the current values of all assets and liabilities. More often than not, prices for 'used' assets are hard to get. Auditors would be required to make substantial judgemental decisions in implementing current value accounting. But we live in a litigious age, and auditors are reluctant to exercise judgement in such situations because, occasionally, subsequent events might not bear out these judgements, and costly and embarrassing lawsuits may result . . . . GPLA financial statements are easy to audit and are objective. Two auditors given the same historical records and the same data for the GNP Deflator are likely to derive the same general price level adjusted statements." Sidney Davidson, Clyde P. Stickney and Roman L. Weil (1976; 225).

<sup>12</sup> "The only problem left is the selection of the index. In view of the motivation of the enterprise, it should be obvious that we think the Consumer Price Index is the most appropriate. It is the closest substitute for a utility measurement that is currently available . . . . The other indices which are often described as general, e.g., the implicit GNP deflator, include intermediate goods. Intermediate goods should be excluded from the purchasing power concept, because they are only indirectly productive of utility." Robert R. Sterling (1970; 340-341). Diewert (2002; 556) also argued against the use of the GDP deflator as a general measure of price change due to the fact that imports enter the index with negative weights. This negative weight for imports can lead to the perverse result that an *increase* in import prices leads to an immediate *fall* in the index.

One of the simplest choices is to use the inflation rate for a widely traded commodity (such as gold<sup>13</sup>) as the index of general inflation. Another alternative is to use the rate of increase in the exchange rate of the country against a stable currency.<sup>14</sup> Instead of using the price of gold or any single commodity as the indicator of inflation, the general inflation between the beginning and the end of the accounting period might be better captured by looking at the price change of a “representative” basket of goods. As a further refinement, we could replace a fixed basket price index by a more general price index such as the Fisher (1922) ideal price index, which allows for substitution in response to price changes.<sup>15</sup>

Accountants and economists have struggled with the problem of choosing an appropriate price index to represent inflation for approximately a century. Many of the problems have still not been resolved: (i) Which commodities should be included in the index?<sup>16</sup> (ii) How should the individual price ratios be weighted<sup>17</sup>; i.e., what is the theoretically correct functional form for the price index? (iii) A related problem is whose weights should be used in the index?<sup>18</sup> (iv) If the accounting period is shorter than a year, how can we deal with seasonal commodities that might be present in the index?<sup>19</sup>

Even though the above questions are difficult to answer, we agree with Staubus that adjusting historical costs for general inflation by an imperfect index will generally be an improvement over historical cost accounting:

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<sup>13</sup> This choice was used by German accountants during the German hyperinflation of 1923; see Sweeney (1927) (1928).

<sup>14</sup> This alternative has also been used; see Wasserman (1931; 10).

<sup>15</sup> See Diewert (1976; 117). Diewert (1992; 214-222) also shows that the Fisher ideal index has very good properties from the viewpoint of the test or axiomatic approach to index number theory.

<sup>16</sup> See Hill (1996; 97) and Diewert (2002; 555-560) for recent discussions on this issue.

<sup>17</sup> “The simplest way to convert a money measure into a real measure is through an accepted index of the general price level. No perfectly satisfactory index of the general price level exists, nor can one be conceived. It is not only that price indexes are imperfect because of poor price reporting and inadequate coverage, but even in theory it is impossible to construct a perfect price index no matter how much 555-information one has. Since all prices do not move together, it is necessary to use an average of different price movements. The average must be weighted, and the appropriate weights change as between the beginning and end of the period over which price change is being measured ... . But for practical purposes, the theoretical imperfection of index numbers need not worry us too much.” Sidney S. Alexander (1962; 188).

<sup>18</sup> “Another practical problem, in the use of purchasing power as a common denominator, is the selection of the index to use ... . If the individual were interested in purchasing everything in general, as assumption which is highly problematical, a general price index could be used in converting financial statements into equivalent purchasing power and would be adequate for his needs. But no one is interested in purchasing everything in general; most individuals have a more or less limited and fixed class of goods in which their purchases are made.” Donald K. Griffith (1937; 128-129). “Furthermore, the use of a general price index for the purpose of modifying dollar values and dollar results assumes that all investors are alike, having the same purchasing habits.” Stephen Gilman (1939; 6).

<sup>19</sup> In many cases, seasonal commodities are not available in all seasons and thus there will be no prices for these out of season commodities. “Seasonal characteristics rule out any formal accounting period shorter than a year.” Stephen Gilman (1939; 77).

“The argument that the corporate accountant cannot use the different purchasing power indexes of each individual shareholder must be read as either a weak excuse for inaction or an insistence on a degree of perfection that accountants have not reached in the past and are not likely to reach in the future. Surely a broadly based price index provides a better measure of the change in the measuring unit than the assumption that there is no change at all, as the millions of people who base contracts on such indexes recognize.” George J. Staubus (1975; 44-45).

It is sometimes asserted that General Price Level Accounting adds no additional information over that which is available from reading historical cost accounting balance sheets<sup>20</sup>; i.e., if investors know historical cost values and they can look up the relevant general inflation index, then they can readily calculate the adjusted asset values defined by (A1). This would be true if the business unit made the following information available to investors in each accounting period: (i) the value of new investments made in each period and (ii) the historical cost residual value of all assets that are sold or retired during the accounting period. In general, this information is not provided in balance sheets; hence providing investors with an aggregate GPLA asset value will provide new information that could not be calculated by individual investors.

#### 4. Net Realizable Values or Exit Values

“Some economists, notably Professor Jacob Viner of the University of Chicago, hold the belief that the value which the assets would bring in the market is the only proper basis of value for use in accounting.” H.C. Daines (1929; 98).

“These markets [for assets] can be divided into two kinds, the markets in which the firm could buy the asset in its specified form and at the specified time and the markets in which the firm could sell the asset in its specified form and at the specified time. The prices obtained in markets of the first group we shall call entry prices; the prices obtained in markets in the second group we shall call exit prices.” Edgar O. Edwards and Philip W. Bell (1961; 75).

A century ago, it was not unusual for accountants to value the fixed assets of a business unit at the end of an accounting period by appraised values; i.e., estimates of the net realizable values that the assets would bring in the market at the moment in time:

“[There are] various methods of estimating the Depreciation of a Factory, and of recording alteration in value, but it may be said in regard to any of them that the object in view is, so to treat the nominal capital in the books of account that it shall always represent as nearly as possible the real value. Theoretically, the most effectual method of securing this would be, if it were feasible, to Revalue everything at stated intervals, and to write off whatever loss such valuations might reveal without regard to any prescribed rate ... . The plan of valuing every year instead of adopting a depreciation rate, though it might appear the more perfect, is too tedious and expensive to be adopted ... the next best plan, which is that generally followed ... is to establish average rates which can without much trouble be written off every year, to check the result by complete or partial valuation at longer intervals, and to adjust the depreciation rate if required.” Ewing Matheson (1884; 35).

“One of the first clear references to depreciation accounting was in the annual report of the Baltimore and Ohio Railroad for the year ended September 30, 1835. That report explained that income for the year was

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<sup>20</sup> “When accounts expressed in ‘diverse amounts of general purchasing power’, as in historical dollar financial statements, are restated in terms of the dollar of a single point of time, nothing new is being said. No ‘change’ has occurred, except in the size of the units of measurement employed.” Maurice Moonitz (1970; 466).

determined ‘after carrying \$75,000 to the debit of profit and loss to make good deterioration of the railway and machinery ...’. During the years following 1835, there was no consistent policy followed by any group of companies or even by any one company. Apparently, some companies made a separate provision for depreciation as did the Baltimore and Ohio Railroad, while other companies charged replacement costs to expense in lieu of depreciation.” P.D. Woodward (1956; 71).

“There is little reason to doubt that depreciation was originally calculated on the basis of appraisals. The appraisal, it may be conjectured, was originally on a market price basis in order to obtain a figure roughly equivalent to what would have been realized at the date of the appraisal had the asset actually been sold ... . After general adoption of the accounting period convention, such appraisals were probably made at the end of each accounting period. It must, however, soon have been obvious that such periodic appraisals gave erratic results depending, of course, upon who made them, how they were made and the general state of business at the time they were made.” Stephen Gilman (1939; 488).

However, during the first 35 years of the twentieth century, many business firms arbitrarily revalued their fixed assets to suit their immediate purposes.<sup>21</sup> By the 1930's, the accounting profession reacted against these abuses by adopting the historical cost accounting methodology for valuing assets, and the accounting profession as a whole has stuck to this position since that time (except when an economy experienced very rapid inflation in which case General Price Level Adjusted accounting has been temporarily adopted). However, most economists and some accountants, such as Sweeney (1936; 44-53), Staubus<sup>22</sup>, Edwards and Bell (1961), Chambers<sup>23</sup> and Sterling<sup>24</sup>, have advocated the use of current values to value assets at the end of each accounting period.

The basic problem with the use of current values is that it is difficult to determine exactly what is the “correct” concept for a current value. Edwards and Bell (1961; 75) distinguish between an *entry value* (the minimum cost of purchasing a replacement for a currently held asset) and an *exit value* (the maximum price a currently held asset could be sold for in the market less the transactions costs of the sale; i.e., the net realizable value for the asset).<sup>25</sup> In this section, we will focus on the problems associated with the use of exit values and we will deal with entry values in the next section.

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<sup>21</sup> For a discussion, see Sweeney (1964; 45-47).

<sup>22</sup> “A difference between net realizable value and replacement cost, other than that related to direct costs of buying and selling such as commissions, transportation and taxes, indicates that the firm buys in a different market from that in which it sells ... . Net realizable value of an asset is the preferable basis for measurement in this type of situation because it takes into consideration the destination of the asset rather than its source.” George J. Staubus (1961; 36-37).

<sup>23</sup> We reach the conclusion that opportunity cost, and not the authors’ current cost, is the appropriate asset measurement basis. Opportunity costs (market resale prices) are relevant to the firm always.” R.J. Chambers (1965; 736).

<sup>24</sup> “Edwards and Bell also build a case for exit prices, but then reject them in favor of entry prices. We were not convinced by their reasons for rejecting exit values, and we particularly disagree with the idea that exit values would be less useful to external users of the data.” Robert R. Sterling (1970; 328).

<sup>25</sup> The distinction between entry and exit values was recognized by the Prussian legal system in the 1880’s according to Schmalenbach: “There is no basis whatsoever for the opinion held by the old school of tax jurists that the user-value allegedly meant is the value in the open market, i.e., the value on a sale. In Prussian land law the user-value was something quite different; it was the value of the property to the average person for use in its present state and therefore approximated in general to the price at which an equivalent property could be acquired.” Eugen Schmalenbach (1959; 20). Economists have also long made the distinction between entry and exit prices: “There are three entirely separate concepts of the basis



Historical cost accountants have two principle objections to the use of (imputed) net realizable values to value assets held by a business unit at the end of an accounting period:

- they are not objective and
- they are not additive.

On the lack of objectivity of net realizable values, consider the following quotations:

“Which alternative should be used as a basis? The highest, or the lowest, or an average? How should the search area, to get offers or find prices, be determined?” Yuji Ijiri (1979; 66).

“‘Forced liquidation value’ is also ill defined, but it sometimes seems to mean the price that could be obtained by selling to the first man on the street that one happened to meet. If this is the meaning, then we agree that it would be absurd to report such values. A less radical notion of immediate exit price is obviously called for.” Robert R. Sterling (1970; 328).

Thus to find an estimated net realizable value for an asset, it is necessary to determine what is the appropriate set of potential buyers and how their price bids could be elicited. If instead of seeking prices from potential buyers of the asset, we resort to appraisal values for the asset, we again encounter a certain lack of determinacy: how many appraisals should be made; what are the credentials of the appraisers; what criteria do the appraisers use<sup>26</sup>; etc.

Rather than saying that hypothetical net realizable values or appraised values are not *objective*<sup>27</sup>, it might be more accurate to say that they do not pass the *reproducibility* test; i.e., two accountants attempting to construct net realizable values for a firm’s assets would not generally come up with the same values. This is the major advantage of historical cost accounting and general price level adjusted accounting; aside from the major problems involved in defining asset lives and depreciation rates<sup>28</sup>, these two methods of accounting can claim that they pass the reproducibility test.

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on which capital can be measured, namely market value, replacement value and cost price.” Colin Clark (1940; 375). Clark’s market, replacement and cost values are the exit, entry and historical cost values of Edwards and Bell respectively.

<sup>26</sup> Essentially appraisers encounter the same sort of difficulties that were mentioned in the previous sentence.

<sup>27</sup> “Market values when obtainable are also objective in character.” H.C. Daines (1929; 99).

<sup>28</sup> There are some additional more minor reproducibility problems with historical cost accounting: (i) if certain asset values are “known” to fall below historical cost, then the offending assets are to be valued at “market” value; (ii) there can be some ambiguity as to when exactly a sale is realized; i.e., it is sometimes difficult to allocate revenues to specific accounting periods and (iii) there can be uncertainty about what proportion of overdue payments will eventually become bad debts. Gilman (1939; 541) noted the inconsistency of historical cost accounting practices with respect to point (ii) above: “It would appear that those who condemn revaluations upward should, in all consistency, condemn downward revaluations. With some exceptions, such consistency is not observed.”

Turning now to the lack of additivity of net realizable values, consider the following quotation:

“The second factor which makes current cost income more disputable than historic cost income is the non-additivity of current costs. The historical cost of Resource A and Resource B is by definition the sum of the historical cost of Resource A and Resource B ... . This additivity does not exist in current cost valuation, insofar as the price of a resource is not necessarily equal to the sum of the prices of its components. If the current cost of Resource A is \$20 and Resource B is \$30 but that of A and B together is \$60, should we use \$50 or \$60 as the current cost of Resource A and Resource B?” Yuji Ijiri (1979; 67).

Thus if we have two assets that can be combined together to produce an extraordinary revenue stream (e.g., a machine and a building to house the machine that together produce a new product with a high profit margin), then the joint asset may have a net realizable value that is much greater than the sum of the separated net realizable values; i.e., net realizable values for assets are not necessarily additive.<sup>29</sup>

In order to overcome the lack of additivity of net realizable values, it will be necessary to make some rather arbitrary judgments. For example, current values could be obtained for each asset that was purchased separately (or for each group of assets that was purchased jointly) on a stand alone basis; e.g., if a tractor were purchased with several supplementary attachments, then we could attempt to find a net realizable value for the entire asset package. Thus the additivity problem is “solved” by restricting the collection of net realizable values to the asset combinations that were actually purchased by the business unit.<sup>30</sup>

To overcome the lack of reproducibility objection to the use of net realizable values is a bigger task and might involve considerable costs.<sup>31</sup> Accounting standards organizations or the government (in its role as a collector of business income taxes) would have to

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<sup>29</sup> This point did not originate with Ijiri as the following quotations indicate, but Ijiri phrased the point in the most elegant fashion: “By and large, the reason why these writers [on asset valuation principles] could not arrive at a satisfactory theory was their premise, that the object of the balance sheet was the ascertainment of the status of capital. They did not realize that it is not possible to arrive at a value for a capital composed of a number of parts, merely by adding together the values of the individual parts.” Eugen Schmalenbach (1959; 20-21). “Capital instruments used jointly with others in turning out goods for sale do not, properly speaking, have separate capital values at all.” John B. Canning (1929; 233). “Although the correspondence between this definition of current cost and the data produced under the above rules of measurement is far from perfect, use of its alternative –market value– would raise far more formidable problems. First, an objective set of rules for measuring the market value of plant assets could not easily be established. Next, although the plant account could be assumed to be at market value, there would still remain the problem that with market value the sum of its parts is not equal to the whole.” Myron J. Gordon (1953; 376).

<sup>30</sup> More elaborate solutions to the additivity problem could be obtained by adapting the techniques used in the axiomatic cost allocation literature to this revenue allocation context. For references to the cost allocation literature, see Young (1985) (1994) and Moulin (1995). Hedonic regression techniques could also be used to solve the additivity problem; see Triplett (2004).

<sup>31</sup> “I do not object to current cost accounting if one can show that its benefit to society is greater than its cost of implementation. Remember, however, the bill to society for establishing and running such a system can be enormous, considering the cost of assessment, calculation, and auditing (all of which must be done every year) as well as the cost of solving disputes if the firm or the accountants are challenged on the reliability of data or are accused of intending to mislead the public.” Yuji Ijiri (1979; 71).

specify acceptable methods for constructing net realizable values. One possible (partial) solution might be to utilize appraised values for property insurance purposes. Insurance companies have an incentive to insure property up to its maximum value to the business unit (if premium revenue is proportional to insured value) but they also have an interest in not allowing overinsurance (in order to minimize carelessness and fraud on the part of the insured business unit). Another possible solution to the lack of reproducibility problem would be for a national Accounting Standards Board or the Government to develop appraisal criteria and to train and license appraisers.

We leave the final words on possible methods for the objective or reproducible determination of net realizable values to Chambers:

“We will take a more or less common sense view: namely that a statement of financial position as at a date will include singular statements, in respect of plant assets, which are indicative of one or more of the following: the cost at that date of acquiring plant in the condition in which it then stands, the valuation which a lender might place on it as a security for a loan, the valuation which the owner might place on it for insurance purposes, or the price which might be obtained for it if it were decided to change the character of the company's investments. Anyone is at liberty to contend that these would all be different; but they have one thing in common, they are all estimates made in the context of conditions operating about the time at which the financial statements are prepared. They are approximations to contemporary value in the market.” Raymond J. Chambers (1964; 270).

We turn now to a discussion of entry values.

## 5. Replacement Costs or Entry Values

“The replacement cost is the sum of money which would have to be expended at the present time to reproduce a physical property identical with that in existence at the present time and used for the benefit of the public.” Hammond V. Hayes (1913; 618).

“The values which the accountant uses in closing the books and preparing statements ideally should be based upon economic conditions at the moment of closing. If plant and equipment assets were valued at the close of each period on the basis of costs of replacement –effective current costs– depreciation changes would be increased in a period of rising prices and the other concomitant effects would be registered in the accounts in a rational manner.” William A. Paton (1920; 6-7).

The description of an *entry price* or *replacement value* of an asset has already been provided while discussing the previous method: it is the current market cost of purchasing a physically identical replacement for an asset currently being held by a business unit. As can be seen from the above quotations, the concept of a replacement value dates back at least 80 years.

Replacement cost as a basis for asset valuation grew in popularity during the 1920,s due to the inflationary upheavals that took place at that time and in the prior decade:

“In Germany, during the severe inflation period, the orthodox practice of calculating depreciation on the basis of original book costs was eventually swept aside because accountants and business men came to perceive that, in maintaining the substance of capital, it was no longer useful. At first various supplementary measures were adopted, such as charging all new fixed asset costs to expense and creating a special reserve to provide for maintenance of plant value and business efficiency (e.g., the prevalent

Werkerhaltungskonto). Later, computation of depreciation on the basis of reproductive cost grew in popularity, which, indeed, is still evident from a survey of contemporary German depreciation theory.” Henry W. Sweeney (1931; 166).

“Prices go up and prices go down, and with each change in the price level the discussion of replacement cost usage recurs. It appears that businessmen and accountants were willing to experiment with the use of replacement cost in the 1920’s and early 1930’s. But this receptivity to its use has declined steadily since then: in the 1940’s practicing accountants were opposed to its use; . . . Thus if past experience holds true for the future, replacement cost will still receive its share of attention from theoreticians while practicing accountants largely ignore it.” Germain Boer (1966; 97).

Even though replacement cost accounting is no longer used by business accountants in most low inflation countries, it should be noted that it is still used today by some national income accountants as the basis for computing depreciation on a current cost basis.<sup>32</sup>

The net realizable value and replacement cost of an asset can be regarded as the selling and buying prices for the asset in the relevant second hand market. Replacement cost will generally exceed the corresponding net realizable value due to the existence of transactions costs.

There is a variant of replacement cost accounting that at first sight seems to eliminate the need to consider second hand markets: find a current purchase price for a new asset that corresponds to the used asset on hand, apply the same method of depreciation to this new asset price (instead of the original historical cost price for the asset) and the resulting depreciated current price is an estimate for replacement value. However, this method of constructing replacement values implicitly assumes that the correct depreciation rates are known.

Replacement cost can exceed the corresponding net realizable value for reasons other than transactions costs. Consider the following example due to Paton:

“One example will be sufficient to show the ruinous error which may flow from a slavish adherence to the cost-of-replacement theory in appraisals. In 1924, a valuation was made of the properties of the Kansas City Railways by two independent engineers. One of the items to be appraised was three old engines in the power house. These were of the massive type, with enormous flywheels, and were standard equipment twenty or twenty-five years ago, or more. This equipment was in excellent physical shape, but was utterly obsolete, and a couple of the engines were no longer even connected. The company’s power at the time of appraisal was entirely supplied by other and more modern equipment, although the old units were capable of giving service if required. One of the engineers went to the Westinghouse Company, with complete specifications, and secured an estimate of what it would actually cost, as of the date of the appraisal, to construct these engines, on special order. He then made an estimate of the cost of shipment, installation, etc. The result was a cost of replacement figure considerably over a million dollars. The other engineer treated the units as scrap and gave them a net value of \$20,000.” William A. Paton (1931; 95).

What happened in the above example is that technical progress occurred which caused the net realizable value for the used asset to plummet, but the replacement value for the asset was high, since the old asset was no longer being produced. Thus, there is a logical

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<sup>32</sup> Usually, the specific index number adjusted method for approximating a replacement value is used by national income accountants; see section 7 below.

difficulty associated with the use of replacement cost values for unique assets such as a specially constructed machine or an engineering structure that is specific to the business unit: no replacement cost values are readily available in the marketplace for unique assets.<sup>33</sup> A solution to this difficulty is provided by the approach of the first engineer in the above example: simply calculate the estimated cost of building the specific asset using the technology and input prices that pertain to the end of the accounting period.<sup>34</sup>

Replacement cost values are subject to the same two difficulties that were associated with the use of net realizable values: replacement costs are not generally reproducible (different accountants will generally obtain different estimates of replacement cost) and replacement costs are not generally additive (if a group of assets is replaced, the aggregate replacement cost may be less than the sum of the individual replacement costs). The lack of additivity is not a serious problem: we can again impose additivity by seeking replacement costs for assets according to how they were originally purchased; i.e., if a group of assets were jointly purchased, then we attempt to find a joint replacement cost for the same group of assets. However, the lack of reproducibility is a serious limitation on the use of replacement values.

In this section, we considered the use of replacement costs and in previous section, we considered the use of net realizable values as a basis for valuing the assets held by a firm at the end of an accounting period. Is there a rational basis for choosing between these alternative valuation methods? One way of answering this question is to consider whether the business unit is likely to buy additional units of the asset in the near future (in which case an appropriate opportunity cost would appear to be replacement cost) or whether the business unit is likely to sell the asset in question (in which case the relevant opportunity cost would appear to be net realizable value). Thus several accountants<sup>35</sup> have argued for the use of replacement values for raw material inventories and for net realizable values for inventories of finished products. Following this same logic, an expanding firm might value its fixed capital stock components at replacement values while a contracting firm might use net realizable values. While this line of reasoning does not provide a complete answer to the question of which valuation base to use, it does seem helpful.

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<sup>33</sup> “In some cases, such as permanent investments, plant sites, construction jobs, etc., almost no reliable data may be obtained for use in market valuation.” H.C. Daines (1929; 101). There is no active trading market for large aggregates of fixed assets which have been put together into a specialized production design for specialized use. Any attempt to assign a market value to the aggregate of land, buildings, machinery, equipment and motive power constituting the average industrial plant is obviously impossible.” Stephen Gilman (1939; 80).

<sup>34</sup> Statistics Canada has used this methodology for years to estimate a construction price index; i.e., engineering and construction firms are asked to provide estimates for the cost of building a specific asset in the current survey period.

<sup>35</sup> Robert R. Sterling (1970; ix) seems to have been the first accountant to argue along these lines: “It seems clear, for example, that one can postulate a continuing firm which is operating in two different markets (say, a retailer) and make a good case for valuing inventory at replacement cost. Under those circumstances the ‘opportunity cost’ of a unit is the cost of replacing it, since the firm must restock.” Edwards (1975; 240-241) argued for the use of entry values for those markets where a firm is usually a buyer and exit values for those markets where the firm is usually a seller and Davidson, Stickney and Weil (1976; 211) endorsed this argument.

We turn now to a brief discussion of yet another basis for interim asset valuations.

## 6. Future Discounted Cash Flows

“The flow of services issuing from an article of capital may have any duration and any distribution of rate. In every case the capital value of the article is the discounted value of its anticipated services.” Irving Fisher (1897; 527).

“If one could approximate the whole future series of money outgoes and of money receipts of an enterprise, one could find, given a rate of discount, a direct capital value of that enterprise.” John B. Canning (1929; 207).

The view that the appropriate value for an asset is the *discounted stream of the future net revenues* that can be attributed to it was actively advocated by Irving Fisher (1897) (1930).<sup>36</sup> In the accounting literature, estimating a current asset value as the discounted stream of its future expected returns is known as the *economic approach* to asset valuation.

Of course, a current purchase price for an asset can be thought of as representing a lower bound to the asset’s economic value to the purchaser, but in this section, we will define an asset’s economic value as an estimated discounted stream of net returns that can be attributed to the asset.

Accountants pointed out that this “economic” approach to asset valuation suffers from two flaws:

- future discounted net returns are generally not known with any degree of certainty and hence the resulting estimates will not be reliable<sup>37</sup> and
- even if we did know future revenue flows with certainty, revenue flows are produced by the joint efforts of all assets and it is generally impossible to allocate the resulting joint net revenue flows to individual assets.<sup>38</sup>

Another way of phrasing the first objection is to say that economic values will not generally pass the *reproducibility test*; i.e., different accountants will generally obtain different estimates for economic values. In principle, the second objection to the economic approach can be overcome; an econometric model could tease out shadow prices as derivatives of an intertemporal profit function with respect to the components of

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<sup>36</sup> In chapter II, we noted that Böhm-Bawerk (1891; 342) seems to have been the first to notice this principle.

<sup>37</sup> “The non-availability of the future series of data, except for certain fragmentary items attaching to the near future, not only prevents the systematic development of realized income statistics to the point of large usefulness but prevents also a full development of capital valuation. For without reliable estimates of all future series to be discounted, reliable present valuations are impossible.” John B. Canning (1929; 321).

<sup>38</sup> “It [the capitalization of the income producing value of the net assets] is impractical of application, since from the very nature of the case, the earnings of a business are the joint product of all the assets, conditions and services which the business possesses and uses. It is impossible, therefore, to impute on the basis of total earnings any particular value to any given asset.” H.C. Daines (1929; 98).

the fixed capital stock. Needless to say, there would be reproducibility problems with the resulting estimates: the resulting shadow prices would depend on somewhat arbitrary assumptions about future technical progress and about future expected input and output prices that the firm is expected to face plus assumptions about functional forms and stochastic specification that are sure to vary from econometrician to econometrician.

In spite of the above rather negative evaluation of the economic approach to asset valuation, accountants<sup>39</sup> have recognized that for certain unique assets held by a business unit, the economic approach may be the only relevant approach for obtaining current asset values. For example, a reasonable estimate for the value of a unique oil field held by an exploration company might be the estimated discounted net revenues generated by the crude oil pumped out of the field over the life of the field. In order to obtain these estimates, it will be necessary to: (i) estimate how much crude will be extracted in each future period; (ii) estimate future spot prices per barrel of crude (less applicable taxes); (iii) estimate future extraction costs and (iv) provide an appropriate discount rate. In fact, there are engineering firms that will provide such estimates and accountants accept their valuations in order to put an estimated value on oil reserves. As another example, suppose a business unit holds the rights to a movie or a patent; (both are unique assets). Then a reasonable current asset value for the movie might be the discounted value of future expected rental income and for the patent might be the discounted value of future anticipated royalty payments.

In order for economic valuations to pass the objectivity or reproducibility test, it seems necessary that these valuations be done by specialized valuation firms, which could be accredited by the relevant accounting standards board or by the relevant governmental authority.

We turn now to another promising class of methods for valuing assets.

## **7. Specific Price Level Adjusted Historical Cost**

“Actual cost, for example, because of its stability and its consequent effectiveness in attracting capital, might be chosen as the basis on which to compute the return; while reproduction cost, or possibly some index number designed to rise and fall with the general level of commodity prices, might conceivably be chosen as the proper basis by which to regulate charges.” James C. Bonbright (1926; 305).

“On account of the expense involved, to argue for yearly appraisals of fixed assets, would sound impractical. When price levels remain fairly constant they would prove to be unnecessary. During periods of price fluctuation an adjustment could be made in previous appraisals to reveal this condition or an entirely new appraisal resorted to. In this connection, price indexes may prove very helpful in the future to both the accountant and the appraisal engineer.” H.C. Daines (1929; 101).

“Knowing the exact composition of the client's property as at the date for which the new appraisal is to be made, the appraisal company then values such property at the prices prevailing on that date ... . A method that may very conveniently and profitably be used as a quick and cheap substitute under certain conditions

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<sup>39</sup> “The familiar accounting dilemma of relevance versus reliability emerges for the question of how do you produce another unique asset, such as Snow White or a particular oil field.” John Leslie Livingstone and Roman L. Weil (1982; 253).

is the index-number method. This method is a phase of ‘stabilized accounting’, which is concerned with the use of index numbers to restate accounting figures in a uniform price level before combining or comparing them.” Henry W. Sweeney (1934; 110).

The specific price level method for constructing current values for an asset held by a business unit through successive accounting periods was suggested by Daines (1929; 101), Sweeney (1934; 110) and many other accountants.<sup>40</sup> The method works as follows. First, assets held by the business unit at the beginning of period 0 are classified into a finite number of distinct asset classes. Secondly, it is supposed that index numbers that pertain to each asset class are available at the beginning and end of each accounting period. Finally, suppose that an asset was purchased at the beginning of accounting period 0 at the price  $P^0$ ,<sup>41</sup> the period 0 depreciation rate is  $\delta^0$  and the asset inflation rate for the relevant asset class over period 0 is  $i^0$  (i.e., the specific asset index number at the end of the period divided by the specific asset index number at the beginning of the period is  $1 + i^0$ ). Then the *Specific Price Level Adjusted (SPLA) value of the asset* at the end of period 0 is defined as

$$(2) V_{SPLA} \equiv (1 - \delta^0)(1 + i^0)P^0.$$

Comparing (2) with (1), we see that the present specific price index number method for constructing an end of period estimated asset value is very similar to the General Price Level Adjusted asset value defined earlier by (1); the only difference is that now a presumably more relevant specific price index is used for revaluation purposes rather than an index of general inflation.

If the same set of asset specific price indexes is given to all accountants, then Specific Price Level Adjusted values will satisfy the reproducibility test. The SPLA asset value should also be closer to its end of period market value (i.e., an end of period purchase cost or net realizable value) since presumably, the index numbers reflect a sample of market transaction prices for new units of the asset (or similar assets) during a time period that includes the end of period 0. Thus SPLA values will tend to be reproducible and relevant.

We also note that Specific Price Level Adjusted accounting is not completely impractical since it has occasionally been used historically in business financial accounting.<sup>42</sup> It is also essentially equivalent to the Perpetual Inventory Method for constructing capital stocks in the National Accounts.<sup>43</sup>

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<sup>40</sup> “Inasmuch as the price level is not stable for any great length of time, and since this calculation is contemplated for each fiscal period, the only feasible procedure for a company with thousands of assets is the use of price index numbers.” Albert L. Bell (1953; 49). “Where no market exists for new fixed assets of the type used by the firm, two means of measuring current costs are available: (1) appraisal, and (2) the use of price index numbers for like fixed assets to adjust the original cost base to the level which would now have to be paid to purchase the asset in question.” Edgar O. Edwards and Philip W. Bell (1961; 186).

<sup>41</sup> More generally,  $P^0$  can be the estimated beginning of period 0 current value for the asset.

<sup>42</sup> “Fixed assets, as distinguished from current assets, had to be revalued by means of index corrections. The indices ..., which had to be used for any given fiscal year, were published in an official government publication. These index coefficients were computed on the basis of the wholesale price indices for



There are some problems associated with the use of Specific Price Level Adjusted values:

- (i) None of the available specific price indexes may be relevant for the particular asset on hand.<sup>44</sup> A related problem is that different accountants may classify the same asset into different asset classes thus destroying the reproducibility property for the method.<sup>45</sup>
- (ii) The asset specific index numbers will generally pertain to a discrete interval of time instead of the precise date at which the accounting period ends. Under these conditions, the exact adjustments (if any) that the accountant should make to the specific indexes is ambiguous.<sup>46</sup>
- (iii) The related issue of the timeliness of the specific indexes should also be raised: annual specific price indexes for capital stock components that appear with a half year time lag will be useless in the context of quarterly accounting.<sup>47</sup>

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construction materials, lumber and steel products.” H. Peter Holzer and Hans-Martin Schönfeld (1963; 383).

<sup>43</sup> “6.189. The perpetual inventory method requires an estimate to be made of the stock of fixed assets in existence and in the hands of producers. This is done by estimating how many of the fixed assets installed as a result of gross fixed capital formation undertaken in previous years have survived to the current period. Average service lives, or survival functions, based on observations or technical studies may be applied to past investments for this purpose. Fixed assets purchased at different prices in the past have then to be revalued at the prices of the current period. This may be done by utilizing appropriate price indices for fixed assets. The construction of suitable price indices covering long periods of time raises difficult conceptual and practical problems, but these technical problems of price measurement are not peculiar to the PIM method and will not be pursued further in the present context.” *System of National Accounts 1993*, pages 148-149.

<sup>44</sup> “The fact that the purchasing power shown will be in terms of the index used, and not in terms of the actual purchasing power available to a given enterprise for making its purchases, is a decided limitation to the use of the index numbers in accounting.” Donald K. Griffith (1937; 126). “Not many years ago standard telephone cables consisted of numerous wires encased in a lead sheeting. In the present microwave era it would be just as wrong to apply replacement-cost index numbers to the cost of the old cable and call the resulting value for the purpose of arriving at depreciation expense as it would be to apply price-index numbers to the cost of the famous twenty mule team and call the result the cost of automotive transportation.” Charles W. Smith in G.O. May and others (1952; 126).

<sup>45</sup> Note that GPLA accounting is not subject to this problem since there is only one asset class. Of course, the countervailing problem associated with GPLA accounting is that it is less relevant or accurate as an approximation to actual current values: “A simple general purchasing power index is proposed, but that has no real relevance to the value of capital goods.” Solomon Barkin in G.O. May and others (1952; 115).

<sup>46</sup> Suitable rules of thumb would have to be developed. Gilman raises similar timing and domain of definition issues in the context of finding suitable estimates for end of period values for the inventory components of a business unit’s capital stock: “Another cause of profit distortion is to be found in the methods used for determining selling prices as the preliminary basis for the proportional cost calculation. Should market quotations on the last day of each month be used? Should the daily quotations for the entire month be averaged? Should the averages for the past three months be used? Under mercurial market conditions these questions become important. The purpose of the popular three months’ average plan is, according to McKee, ‘to eliminate temporary market fluctuations, and reflect costs by market trends instead’.” Stephen Gilman (1939; 333).

<sup>47</sup> “Accountants are fully aware of the difference between ‘dollar accounting’ and a conceivable ‘purchasing power accounting’, and would prefer just as the economists do, a purchasing power accounting. But the adjustment data can never become available at the time records are originally made, nor do they become available in time for report making. Whether or not it would pay to make such an

- (iv) The construction of SPLA values is mainly suitable for the valuation of fixed capital stock components and not circulating capital stock components.<sup>48</sup> How then should end of period prices for inventory stocks be constructed? The problems involved in constructing current prices for inventory items are generally not as severe because relevant market prices for inventory components held by the business unit are often available in the records of the business unit: market prices for used fixed assets are more difficult to obtain.<sup>49</sup>
- (v) The SPLA values for assets at the end of the accounting period are still dependent on the rather arbitrary depreciation rates (recall the depreciation rate  $\delta^0$  in (2)) that are associated with historical cost accounting.<sup>50</sup> To cure this lack of reproducibility in the method, the Agency that provides the asset specific index numbers should also provide “standard” depreciation rates for assets in each class (or alternatively, provide index numbers for not only new assets but also used assets). The adoption of this last suggestion will not only lead to reproducible SPLA values, but it will also lead to reproducible estimates of depreciation.

Which Agency should provide the relevant index numbers and depreciation rates? Three possible choices are: (i) the relevant National Statistical Agency; (ii) the relevant Accounting Standards Board or (iii) an Agency or Department of the relevant National Government (e.g., the income taxation authority).

We note that historical cost valuations for fixed assets have proved to be very resilient from a historical perspective, being temporarily abandoned only in the face of dramatic inflationary shocks when the method clearly became absurd.<sup>51</sup> It seems likely that the

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accounting currently, is doubtful; but the cumulative effect of a depreciating currency upon valuations of long-lived assets and debts may be such as to require partial readjustments at relatively long intervals.” John B. Canning (1929; 196-197).

<sup>48</sup> “In order to make the accounts reasonably reflect current conditions and to avoid abrupt value changes, numbers of accountants have recommended that fixed asset accounts be regularly adjusted by means of an index number. Gradual changes thus computed would be better than the irregular revaluations which have occurred in the past, but the recording of index number adjustments on the books conceals historical costs and at best constitutes only a partial solution to the general problem of valuation. Even though fixed asset values were satisfactorily determined by index numbers, the more important problem of inventory valuation would still remain.” Ralph C. Jones (1935; 172).

<sup>49</sup> For a worked example of how to deal with inventory index numbers in the context of a user cost approach to the measurement of inventory services, see Diewert and Smith (1994). We will deal with the treatment of inventories in more detail in chapter V.

<sup>50</sup> “For each account requiring adjustment the price index is of a homogeneous class of assets which includes those in the account. The use of a specific index for each account rather than a general index for all accounts follows from the use of current cost rather than purchasing power historical cost as the basis of valuation. The appropriateness of the index used for each account is, of course, limited by the knowledge of the assets included in the account, the index numbers available, and by the criterion of objectivity . . . . This [specific index number adjusted] quantity differs from market value in that (1) historical deferred cost is arrived at by means of arbitrary, generally straight-line, depreciation charges; (2) an index of the cost of new assets is used to adjust used assets; and (3) the impact of technological change on a firm’s assets may differ radically from the recognition of technological change in an index number designed to cover a broader group of assets.” Myron J. Gordon (1953; 375).

<sup>51</sup> “These factors may account for the present status of the index number accounting practice in Europe. It had its start in seemingly fertile soil, because the monetary system in Europe at that time was completely

alternative asset valuation methods based on current values described above as Methods 2-6 have failed to be adopted permanently in business financial accounting for a number of reasons:

- (i) the alternative method was thought to be too inaccurate (General Price Level Adjusted valuations);
- (ii) the alternative method was thought to be too nonobjective or not reproducible (all other methods) or
- (iii) the alternative method was thought to be too expensive or too complex.

However, it seems possible that all of these objections could now be overcome with the use of Specific Price Level Adjusted values, provided that a National Authority could provide the accounting profession with the relevant asset specific index numbers and standard depreciation rates.

Our final method of asset valuation is rather different in nature from the previous methods.

## **8. Prepaid Expense “Assets” and their Allocation**

The nature of a capital asset used in production is that a production unit makes an expenditure in the current period but the benefits of this asset expenditure are not confined to the current period. Up to now, the types of asset expenditures that we have been considering were of the *tangible* type; i.e., investments in reproducible capital equipment like structures and machinery and equipment along with investments in land and inventory. However, many investments are in *intangible assets* such as *advertising and marketing expenses, research and development expenditures* and *firm investment in training*. All of these categories of expenditures have the character that the present period outlays will create incremental revenues in the future for the firm that undertakes them. These current period expenditures on intangible assets have a different character than expenditures on tangible durable inputs, which can be used for a number of periods and then sold to other users.<sup>52</sup> The problem with intangible asset expenditures is that they usually have the nature of a fixed cost. Thus these fixed costs, once incurred, are usually of no consequence for a firm's future strategic behavior; i.e., fixed costs are irrelevant to the firm's intertemporal profit maximization problem, provided that the firm is not driven to bankruptcy by these fixed costs. However, again the problem of trying to determine the period by period income of the firm emerges in this context: it is not “fair” to charge all of these intangible asset expenditures to the period when they were incurred: it would be “fairer” to distribute these expenditures over future time periods when the benefits of the investment materialize. Thus the problem emerges of how to *allocate* the cost outlays

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broken down, but the index number methodology has failed to develop and bear fruit. It seems reasonable to conclude that, since the index methodology has become dated, it failed to meet the fundamental and lasting needs of business. If it had met a fundamental need it would surely not have disappeared from business usage.” Donald K. Griffith (1937; 131).

<sup>52</sup> In some cases, the stream of future revenues created by an intangible investment can be sold on the marketplace (e.g., patents, trademarks and franchises), but this still does not solve the problem of how to distribute the intangible investment costs over future periods if the asset is not sold.

on intangible investments over future periods. Thus the accounting problems in the present section have a different character than in the previous sections, where a straightforward opportunity cost approach was used. In the present section, the approach taken is one of *matching* current costs with future expected revenues.<sup>53</sup>

The problem of intertemporally allocating intangible investment expenditures to future periods when the benefits might be realized is similar to other intertemporal cost allocation problems that are associated with *prepaid expenses* and *transactions costs*.

Prepaid expenses as an accounting asset class occurred quite early in the history of accounting. Thus Hatfield (1927; 16) gave several examples of this type of “asset”, including insurance payments which apply to multiple accounting periods, the stripping away of surface rock for a strip mine and prepaid expenses in general. Hatfield (1927; 18) correctly noted that this type of asset is different from the usual sort of tangible asset since this type of asset cannot readily be converted into cash; i.e., it may have no opportunity cost value.

Transactions costs as an asset class are recognized by some national income accountants. Thus in Australia, the transactions costs associated with the purchase of a residential structure are capitalized and written off over the expected length of time that the average resident is held by the same owner.

We will not give a detailed treatment of possible methods for accomplishing this intertemporal cost allocation problem in this chapter. The following chapter will do this for an R&D asset but the same principles can readily be adapted to other types of prepaid asset.<sup>54</sup>

We leave our last words on the subject of asset valuation to one of the pioneers of current value accounting:

“Even crude attempts should result in an improvement over present depreciation practices. During periods of rapidly changing prices crude measurements of a relevant item are likely to be much more meaningful than accurate measurements of an irrelevant one (in this case, historic cost).” Edgar O. Edwards (1954; 268).

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<sup>53</sup> Paton and Littleton (1940; 123) argued that the primary purpose of accounting is to match costs and revenues. For an excellent early discussion on the importance of matching costs to future revenues, see Church (1917; 193).

<sup>54</sup> The basic framework is outlined in section 11 of Diewert (2005).

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