RECOVERABLE COST: THE BASIS OF A GENERAL THEORY OF FINANCIAL ACCOUNTING MEASUREMENT

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ABSTRACT

This paper addresses a very profound question concerning financial accounting. Is financial accounting measurement. as represented by diverse valuation rules. hodgepodge or is it logically developed? Salvary [1985. *p.28. Chap. IV] advances and provides a theoretical development of the concept of "recoverable cost" as the measurement property observed in (underlying) financial accounting measurement. Sa/vary* [1989, *pp.50-51] maintains that "recoverable cost" is the center of "economic gravity" and demonstrates that this valuation is derivable from axioms advanced.*

This paper provides a rigorous proof that "recoverable cost" is the observed measurement property underlying financial accounting measurement. This analysis draws upon: (a) the concept of recovery underlying the investment decision and (b) the distinction between decision theory and measurement theory. It establishes recoverable cost as the measurement property in financial accounting and leads to the conclusion that financial accounting measurement is logically developed.

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INTRODUCTION

Except for Staubus' [1985] positive theory of financial accounting measurement, no argument has been advanced to date to deal with the assessment that financial accounting valuation is a hodgepodge [Canning 1929, p.319; Morgenstern 1963, p.72; Mattessich 1964, p.163; Chambers 1972, p. 488; Johnson and Bell 1976, p.63]. The literature reflects an implicit acceptance by accountants of the view presented by Ijiri [1967, p.88]: "[C]onventional accounting is a collection of many principles and practices, which, in some cases, are mutually inconsistent." Wells [1971,p.180] concludes his critique of Ijiri's [1967] work in part using a quote from Ijiri's Preface [p.ix]: "Conventional accounting has in fact reached the stage predicted for it: it is 'simply a patchy collection of practices'." Ijiri [1980, p.623] refers to financial accounting valuation as a "piecemeal approach to measurement." The contention that financial accounting

measurement is hodgepodge is based on the assumption that financial accounting numbers cannot be meaningfully added together. There are two aspects to the non-additivity issue: (a) the inflation aspect and (b) the diverse valuations aspect. Only one aspect, that of the apparent diverse valuations in financial accounting, is addressed at length in this paper.

Except for four studies which aimed at generalizations, the literature in the 1970s and 1980s simply focus on evaluating specific practices or alternative accounting valuation systems (e.g. replacement cost, current cost, purchasing power, etc.). One work [Sunder 1978] attempted a generalization of exchange valuation rules which would facilitate "the application of the principles of cost-benefit analysis to the choice of valuation systems ..." [Sunder 1978, p.342 (Footnotes omitted)]. The exchange valuation set (which focused on entry and exit values) includes: historical cost, replacement cost, realizable value and general purchasing power rules. The 'lower of cost and market' was considered a hybrid system and was omitted because it did not easily yield to the formal analytical approach of the study. Also omitted was "discounted cash flow" (and the present value of investment model)[1] because "the line between DCF and realizable value rules is not well defined, and replacement or realizable values are sometimes used as surrogates for DCF ..." [Sunder 1978, p.343 (Footnotes omitted)].[2] This paper demonstrates clearly the role of **PVI** (**DCF**) as distinct from that of Realizable Value (**RV**); and the "Lower of Cost and Market" notion is shown to be an integral, but distinct, part of financial accounting valuation.

Tippett [1978] developed a mathematical theory of accounting. Three axioms (control, quantities and measurement) make up the axiom system in which "historical cost, market value, price level adjusted and replacement cost measurement may serve as models of the axiom system" [Tippett 1978,p.271]. Since each of the various valuations observed in financial accounting is treated as being derived from separate and distinct measurement models, the allegation of hodgepodge in conventional accounting measurement remains unchallenged. Willett [1987] advances the proposition, that "anything which gives rise to a debt may be thought of as a resource"[p.165]. The concept of debt provides the basis for cost measurement from a legal standpoint. Willett

[1987,p.165] maintains that the theory "is simply a description of the main qualitative attribute of the economic environment which is measured in financial statements." Extending the earlier work, Willett [1988] advances a transaction based theory of matching, in which the economic activities engaged by the firm provide for the decomposition of aggregate costs by means of statistical estimation procedures, and this statistical estimation approach provides the logical justification for matching in financial accounting. While the focus on debt creation affords a solution to the additivity (of accounting numbers) problem and the transactions based theory overcomes objections to matching raised by the allocation problem [Thomas 1969], they cannot explain the diversity of the valuation rules. For instance, they are incapable of providing the logic of lower of cost and market rule.

This treatise recognizes: (1) the value-judgment issue raised by Perry [1954, pp.612-615] and (2) the search by Mattessich [1964, pp.184-231] to find a value system which would encompass the multiplicity of values that exists.[3] The concern in this treatise is with describing the existing valuation notions in financial accounting within the context of a general theory. Financial accounting rules are based on the fundamental law of recovery: recovery prevents/precludes loss. This law[4] is operational in all models of investment, and it is most obvious in the payback model. The analysis which follows demonstrates that the measurement property observed in financial accounting is recoverable cost.[5] This property, linked to investments and explicated by the capital budgeting model" provides the logic which explains the apparent diverse valuation rules in financial accounting (and the additivity of accounting numbers is established).[6] From the viewpoint of Mattessich [1972,p.487], this is a conversion of rules of thumb into well-grounded instrumental hypotheses.

This treatise is offered as a descriptive theory of financial accounting measurement rules (what their construction permits them to measure). The measurement rules are related to what can be considered observed accounting phenomena. In this manner the logic underlying financial accounting measurement rules is established. However, in terms of current practice, which may diverge significantly from the explanation for the measurement rules, the treatise is normative. In this treatise there is

no discussion of the literature on: (1) "prescriptive theories" of financial accounting measurement which are decision oriented; (2) "income smoothing" (management's selection of accounting methods to control the level and variability of reported earnings); (3) "positive accounting theory" (management's influence in the process of setting accounting standards); (4) "social choice and optimal reporting" (consensus seeking which is confronted with Arrow's Impossibility Theorem); and (5) "efficient markets" (the futility of the search for financial accounting standards).[7]

FINANCIAL ACCOUNTING MEASUREMENT

Financial accounting provides for an observational report and is related to measurement theory; it provides for an abstraction of the entity in context of its decisions. Accordingly, financial accounting attempts to describe observations of "resources" in a "space" and "time" setting. The measurement property is based upon the concept of recovery: an investment made with the expectation of recovering the resources initially committed at the minimum, plus a reward for undertaking the investment. Based upon this scenario, the economic environment can be described by stating how much recoverable cost is embodied in what forms (assets) at what places (accounting entities) at what dates (fiscal year ends). The resource form is independent of the organization; but the recoverable cost property of the resource is dependent on the organization and the time at which it is held by the organization. In essence, financial accounting can be considered as describing: (a) how much investment (money commitment) is undergoing what types of transformations in which organizations at what dates, and (b) in binary opposition, the financing of those commitments. The accounting entity is thus considered as a measurable space.[8] Resources under the control of business firms are heterogeneous spatial configurations that share a common decision-oriented property: "recoverable cost."

Recoverable Cost

Cost, as used herein, signifies the amount of resources expressed in nominal money terms committed to a particular plan. Cash invested in a firm and held as cash is a financial resource form. The cash invested is the initial recoverable cost, since the decision to commit this sum of money is based upon the ability (the expectation) to recover at the minimum this sum of money. When this cash (all or part) is converted to

become more productive, the new asset form takes on the cash value. Further, when the new asset is transferred (sold) and there is a transformation of value (realization of the recovery of the initial sum plus a reward or of an amount less than the initial sum), this new (transformed) value (e.g., accounts receivable) is now a new money commitment, which constitutes the new recoverable cost.

Investments constitute the accounting phenomena, and the manner in which it is modelled provides an explanation of (the basis for) financial accounting measurement rules. *The capital budgeting model provides for the reification of recoverable cost.* While the capital budgeting model has normative underpinnings, it does not preclude a descriptive theory of financial accounting valuation rules which are linked to the investment decision.

Investment and the Function of Recoverable Cost

The interaction between individuals, in terms of production and consumption decisions, testifies to the sociological character of investment. The firm, as a supra-individual formation, takes on the production decisions, while individuals of necessity continue with the consumption decisions. Production and consumption provide the basis for investment - sine qua non. In this setting, recoverable cost becomes reified. Investment becomes crystallized in the form of recoverable cost as an independent structure. The firm is the personified function of investment, and recoverable cost is the reified function of invested resources.

The Representation Theorem. *Investment is a function which depends on recoverable cost. Recoverable cost is an extensive property. Recoverable cost is model-consistent relative to investment.*

Given the capital budgeting model as the frame of reference, recoverable cost represents a real world function--resources committed to production. It embodies the recovery process. *In the absence of recovery, there is no investment.* Every model of investment can be embedded in a model of recoverable cost, and recoverable cost is model complete with respect to investment.

The next section portrays accounting (financial and managerial) as the scientific means by which management observes, predicts, tests and evaluates investment behavior.

MANAGEMENT AND THE SCIENTIFIC METHOD

For management, the starting point in the application of the scientific method would be the financial statements which constitute observational data obtained by means of financial accounting. The anticipation (prediction) of the future experience of the entity is provided by managerial accounting which goes beyond what has been observed and reported in the financial statements [Salvary 1989, p.30].

In this setting, the scientific method (a combined deductive and inductive approach) is used by management. First, an hypothesis (a budget--plan of action), that is expected to result in predictable observable actions--monetary exchange, is developed by management. Projected financial statements (forecasts) are the media for the reflection of such predictions. Evidently, the basic prediction model of management is the budget (hypothesis), and it is the hope of all managers that the budget (hypothesis) as formulated will be achieved (agrees with the real world) [Salvary 1985,p.53].

How does management construct and evaluate the budget (hypothesis)? The cognitive models of managerial accounting provide for hypothesis formulation and evaluation; while the framework of financial accounting, which focuses on the budget as implemented (hypothesis testing), provides for the measuring and recording of the test results--the transformation of transactions/events into data [Salvary 1979,p.375; 1985,pp.53-54].

Assumptions:

1. Firms set their prices to obtain a desired profit (a certain rate of return on their investment over a specified period of time) on the assumption that prices set are the prices that will prevail.

$$\mathbf{PQ - vQ - (f + k)_t = 0} \qquad \textbf{(a)}$$

$$\mathbf{v + (f + k)_t/Q = p} \qquad \textbf{(b)}$$

$$\mathbf{(f + k)_t/(p - v) = Q} \qquad \textbf{(c)}$$

(p = output price; Q = quantity; v = variable unit cost; f = fixed cost;
t = time period; k = desired profit;)

It is assumed that equation (b) is the approach used by price-takers; and equation (c) corresponds to the approach used by price-setters. If p is set, then Q is determined. If Q is set, then p is determined. Regardless of the approach, the price used by a firm reflects an informed judgment on product demand--the expectations of the firm and nothing more. When the price cannot be realized, rebates or discounts are offered.

2. Profit, as one category of earnings (**E**), is a process which emanates from the production and distribution of goods and services which firms engage in. Earnings/profit (**E**) is measurable, and the value of a production and distribution plan is arrived at by the capitalization of the earnings generated by that plan.[9] The valuation at the time of the investment decision is the capitalization of the cash flow stream from the plan. Financial accounting provides a surrogate measure of that cash flow in the measurement of periodic earnings. **E** as measured in financial accounting, is comprised of two elements: (1) a current cash flow component ($\mathbf{E_{cf}}$) (earnings realized in the form of cash--current cash returns) plus (2) a future cash flow component ($\mathbf{E_{ff}}$) (earnings realized in the form of credit--an accrual of estimated discounted future cash returns).

$$\mathbf{E} = \mathbf{E_{cf}} + \mathbf{E_{ff}} \qquad \text{(d)}$$

3. Cash basis financial accounting is entirely different from cash flow process accounting--modelling cash flow under conditions of uncertainty. Cash basis accounting merely requires the recording of cash receipts and cash disbursements. Cash flow process accounting models (under conditions of uncertainty) cash flow through several stages from the inception, gestation, and culmination of the process. It begins with: (a) financing, (b) investing--the acquisition of the portfolio of productive assets, (c) the transformation of the inputs into the consumable product, (d) the distribution of the product, (e) the realization of the vendible value (a receivable established), and finally (f) the collection of the realized value (end of the cash flow process). Accrual basis financial accounting captures these stages of the cash flow process.

4. The entrepreneur is concerned with money replacement and the cost of waiting. If future expectations indicate that money currently invested cannot be recovered, then there will be no replacement of worn out plant facilities. Further, if current prices cannot contribute to a recovery of some portion of invested costs (committed funds), that is if

current prices can only cover current outlays and future prospects are grim, then the entrepreneur will simply abandon the plant. The entrepreneur's calculation focuses on the recovery of total outlays.

5. Items are placed on the second-hand market when they: (i) become obsolete, (ii) are no longer part of an operating plan, or (iii) reflect excess capacity. The next use for most of these items are likely in an industry far removed from the initial industry in which they had been employed--invariably an inferior use. Apart from such uses, these items simply add to junk piles and are sold off as such. Accordingly, different values arise due to intra marginal uses of an asset. Therefore, values in the second-hand market do not reflect values of similar assets in place. The suggestion, that the difference between the new and second-hand market value could serve as an appropriate measure of depreciation, is based upon an assumed interchange-ability of markets (a producer-oriented buyers' market and a sellers' market involving consumer goods).

Depreciation[10] of productive assets is a function of: (1) wear and tear from operating use; (2) physical decay with the passage of time--elemental decomposition; and obsolescence due to technological advances (or a decline in lifetime demand for the output).[11] As such, it is independent of individual periods' revenue amounts and any financing repayment schedule.[12] A second-hand market value is a price determined from an accident, because efficiency (the production possibilities in the industry from which the piece of equipment has been discarded) is not the prime consideration [Hague 1961, pp.314-315]. Since the discarded asset is not part of a recovery plan, it is farfetched to measure depreciation on the basis of the difference between the new and second-hand market values.

6. A firm can sell a piece of equipment without any impact on its operation. An entire division or an entire operation can be sold intact and repurchased without there being any disturbance in customer service. However, a firm cannot sell off all its assets (disrupting its ability to service its customers) and expect to be back in the same business in the foreseeable future. Customers treasure dependability; such behavior on the part of the firm destroys any confidence in that firm for future business.

7. It is management, not assets, that: (i) adapts to changing market conditions; (ii)

recognizes new uses for existing assets--new markets; (iii) decides on the specific uses of assets; and (iv) alters the asset combination in light of developing conditions.

METHODOLOGICAL APPROACH

In the development of the general theory of financial accounting measurement which follows, two distinct theories are employed: (1) decision theory, and (2) measurement theory.

Decision Theory

"Decision theory provides a rational framework for choosing between alternative courses of action when the consequences resulting from this choice are imperfectly known" [North 1968, p.200]. This framework consists of techniques or methods of analysis (viz: utility theory and probability theory) which are useful in decision making under conditions of uncertainty [Jedamus 1969, p.4]. Utility theory provides for a transitive rank ordering (e.g., net present value) [Howard 1968, p.215]. The decision to commit money is modelled by decision theory. Should the investment be made? What use (including the duration) would maximize the returns from the investment?[13] For instance: X is a set of available alternative investment projects, X: $(X_1,X_2 \ldots X_k\}$, where the preference ordering is designated by 1 to k. The utility function is $u\{x_1,x_2 \ldots x_k\}$, where x_k is the return projected for project k in the investment pool, and where $x_1 > x_2 \ldots > x_k$. It is assumed that the firm: (1) seeks to maximize its internal rate of return; and (2) selects the optimal use of the asset over the life (n) of the investment (I). The decision maker will then invest in the investment vector which will maximize his/her utility function.

$$\int_{-\infty}^{+\infty} \mathbf{u(x)\ dF_1(x)} > \int_{-\infty}^{+\infty} \mathbf{u(x)\ dF_2(x)}$$

$F_1(x)$ is the 'expected value' of a present value amount, where $F_1,F_2 \ldots F_k$ are the set of probabilities. F: $(F_1,F_2 \ldots F_k)$ is the probability distribution vector.

After the alternatives have been ranked and the preferred alternative selected, the decision is implemented. Once the investment is made, one is essentially confronted with

investment costs--resources committed to a plan. Quite often, there is no alternative use for the real assets (assets are acquired for specific uses), only sale as scrap; the cash realizable from such a sale is the opportunity cost to the firm.

Measurement Theory

After the investment has been made, the theory, modelling the investment, changes from decision theory to measurement theory.

Measurement is "the assignment of numbers to represent properties" [Campbell 1956, p.1797]. In financial accounting, recoverable cost is the measurable property.

The Uniqueness Theorem. *Investment is a commitment of resources to a specific plan. In the absence of recovery, there is no investment. Investment is a function of recoverable cost. No other measure can serve this purpose.*[14]

The real world function represented is the investment function, which hinges on the recovery process. The deciding factor for the investment is the expectation that the sacrifice of resources committed to the investment will be recovered (and provide for the cost of waiting).[15] Recoverable cost captures the essence of this motivation. As such it is an extensive property.[16] For instance, *when a firm acquires a productive asset it is not the price paid for the asset that is recorded; it is the estimated amount of the investment cost which is deemed recoverable from the use, and not from resale, of the asset that is recorded.*

Bear in mind that estimation is a fundamental part of financial accounting measurement. *Given a rational model for investment, implicitly at the end of each period an assessment is made of each asset to determine the estimated recoverable amount of investment cost. For each and every firm, the need for such an assessment is diminished. However, in periods of falling prices, rapid technological changes, and decreasing demand, the need for the assessment is critical*. However, quite often it is not observed in accounting practice, and the end result is the usual "big bath".

At this stage the concept of measure (which provides for an integration of the relationships among the concepts of investments, assets, liabilities, and the firm) is introduced. The property (recoverable cost) is expressed in nominal money terms. The basis of the exposition follows Faden [1977].

Measure

The concept of measure rests on three other concepts: (i) "sigma-field," (ii)"the extended real numbers," and (iii) "countable additivity" [Faden 1977, p.25].

Sigma-Field: Investments (**I**) are made contingent on the ability to recover. I is a set (investments): {$\mathbf{I_1}$, $\mathbf{I_2}$ ... $\mathbf{I_n}$}. Let C* be a certain property: recoverable cost, and let the symbol {**I** | **I** has the property **C***} stand for the set of all objects having the property C*. A is a collection of subsets (assets) of {**I** | **I** has the property **C***}, where **C*** is represented by cost (**c**); lower of cost and market (**lcm**); and realizable value (**rv**). While **ø** is the empty set. The definition of a sigma-field follows. **A** is a sigma-field with universe set **I,** if and only if:

i. **ø**∈ **A** and **I**∈ **A**;
ii. **A** is closed under complements; and
iii. **A** is closed under countable unions and intersections.

There are two sets, **D** (Liabilities) and **K** (Capital/Owners' Equity), which are in binary opposition to **A**. They provide for the continuous financing of **A**, and appear as financial assets on balance sheets of individuals and other firms. The values of **D** and **K** for any firm are tied to the values of that firm's investment portfolio (**A**).

> **D**∈ **A** and **K**∈ **A**; **D\K**∈ **A**
> (\ = complementarity or complementation)

B is a collection of sets (of firms) whose elements ($\mathbf{B_l}$, $\mathbf{B_2}$ ...$\mathbf{B_n}$) are themselves sets (Each firm, $\mathbf{B_n}$, is a set whose members are $\mathbf{A_s}$, $\mathbf{A_l}$, $\mathbf{A_f}$, A_i, and A_o (s = current assets; l = long term investments; f = fixed assets; i = intangibles; o = other assets). The intersection of **ß**, ∩**B**, = {**A** | **A**∈ **B** for all **B**∈ **ß**}. The union of **ß**, **U**B, = {**A** | A∈ **B** for at least one **B**∈ **ß**}.

Definition: If **A** is a "sigma-field" with universe set **I**, the pair (**I**, **A**) is called a "measurable space;" the members of **A** are called "measurable sets." **ß** is a partition if, and only if, every point of **I** belongs to exactly one member of **ß**. **A** is a finite sigma-field, since **ß** is a finite partition.

The Extended Real Numbers: The extended real numbers system consists of the real numbers together with two new points, **…** + ∞ and - ∞; a > b, a + b, a **.** b, etc., retain

their usual meanings when a and b are both real numbers. The "sigma-field" **A** has a time frame of any of the following forms: **N**, **NU**{∞}, **NU**{- ∞}, **NU**{∞} **U**{- ∞}. **N** = Number of periods associated with assets and liabilities relating to discounting and compounding.

Countable Additivity: A function **f** with domain **E** (earnings) and values in **V**, which is written as **f**: **E** → **V**, is a set of ordered pairs (**e**,**v**), where **e∈ E** and **v∈ V**; each point of **e** is the first component of such pair. For each **e∈ E**, the point **V** thus associated with it is called the value of **f** at **e**, and is expressed as **f(e)**. The set {**v** | **v = f(e)** for at least one **e∈ E**} is the range of **f**. This range need not include all of **V**.

Given a measurable space (**I**,**A**), the function **μ:A** → non-negative extended reals: i.e., **μ** (financial accounting measure) assigns to each measurable set a value that is a nonnegative real number. **μ** is countably additive if, and only if, for any countable packing (i.e., given five measurable sets $\mathbf{A_s}$, $\mathbf{A_l}$, $\mathbf{A_f}$, A_i, and A_0, no pair of which have a point in common) of measurable sets **ß**, we have:

$$\mu(U\beta) = \mu(B_1) + \mu(B_2) + \mu(B_3) + \ldots$$

In which case, $\mathbf{B_1}$, $\mathbf{B_2}$, $\mathbf{B_3}$, ... is any enumeration of the members of **ß** in a sequence, and **μ(U ß)** is the ordinary sum of all the organizations that make up the economy. In this analysis the interest lies in the distribution of assets within a particular firm (**B**), in which case one is to study the restriction of **μ** to **B** (the firm). Each separate and distinct measurable subset (**B**) yields a different restriction. (economic circumstances).

Definition: a measure **μ** is a function

(i) whose domain is a sigma-field **A**,

(ii) which takes values in the non-negative extended real numbers,

(iii) which is countably additive, and

(iv) for which **μ(ø)** = 0

The triple (**I**, **A**, **μ**) is called a measure space; whereas the double (**I**, **A**) constitutes a measurable space.

In the economic environment encompassed by this treatise, the sigma-field **A** is finite. This condition signifies that **A** is generated by a partition **ß**, and it is also assumed

that $\emptyset \in$ ß. In the market process non-negative numbers are assigned at random to the members of ß; each member of **A** has a unique representation **U*S***, (***S*** = asset specificity) where $S \subset$ ß. By assigning to the set **A** the value equal to the sum of the numbers assigned to members of ***S***, a measure is effected.

Investments and Assets: The Measurable Space

A = a collection of subsets of {**I** | **I** has the property **C***}, where **C*** is represented by cost (**C**); lower of cost and market (**LCM**); and realizable value (**RV**). **ß** = a collection of subsets of **A**. Each firm, $\mathbf{B_n}$, is a set whose members are $\mathbf{A_s}$, $\mathbf{A_l}$, $\mathbf{A_f}$, A_i, and A_o. The sum of money invested in a specific asset is usually money committed in an irreversible decision. *Investments in assets (**A**) are made with full and explicit awareness that such investments give rise to cash recovery only through use, not resale*. The absence of the expectation of recovery negates the investment (**I**).

After an investment decision has been implemented, the need to decide on the particular asset form no longer exists. Bygones are bygones! The measurement of performance in the use of the assets in the firm's portfolio is now at hand. An assessment of the asset portfolio, while necessary, is indifferent to the management (old versus new) at the time of the assessment; it focuses on assets' use and market conditions--product demand. The information emanating from the ensuing assessment affects the decision to continue or abandon the operation associated with each asset. It is expectations of future economic conditions which provide guidance on what portion of the remaining unrecovered amount is recoverable. It is not the remaining available service capacity, but the usable service capacity of each asset given market conditions that determines the recoverable amount of the investment cost. At the end of each period, the amount of the existing investment cost (e.g., fixed assets) which is estimated to be recoverable in future periods establishes the amount that should have been recovered, in the current period, whether recovered or not. That is, the depreciation charge for an asset is determined simultaneously with the measurement of the future estimated recoverable cost.

At this stage, one recognizes that recoverable costs transcends the objection raised by Thomas [1969]. The approach described above focuses on a definite identifiable approach to measurement; accordingly, it satisfies the conditions imposed by Thomas

[1969,p.19]: "The minimum requirements for giving theoretical justification to an allocation method are that it should be possible to specify, unambiguously and in advance, the method to be used, and to defend that choice against all competing alternatives..."

The value, the estimated recoverable cost, identified with the asset is attributable to the qualities of that asset--asset specificity--which enables it to perform the functions for which it was acquired in the first place.

In this setting, the recovery process provides a basis for market simulation. While the approach used in this treatise is indicative of a market-simulation theory, it is quite independent of the approach used by Staubus [1985].[17]

MARKET-SIMULATION THEORY

Staubus [1985] has presented a "market-simulation theory of accounting measurement," which attempts to provide a generalization of the diverse financial accounting valuation rules by means of a single cohesive concept: market-simulation. Being only partially successful, Staubus lamented [1985, p.73]: "Any comprehensive, descriptive theory of accounting measurement must explain those deliberate anomalies of the application of market-simulation accounting." The anomalies encountered were: (1) "market discount rates fluctuate" but the accountant uses the original risk discount rate; and (2) "markets pay for prospective cash flows" but the accountant does not use the current value (replacement cost) as indicated by the market assessment of future cash flows.

The analysis which follows demonstrates that recoverable cost underlies the general valuation methods of financial accounting and simultaneously supports market-simulation. The anomalies presented by Staubus [1985] are addressed also.

Investments: Accounting Phenomena

The proposal for an investment is represented by a net cashflow series--the prospective net value--the difference between a prospective benefit series and a prospective cost series. Here one witnesses the specific assignment of numbers (nominal units of money) to the essential property (estimated recoverable cost), which is independently identified. After projects are approved, management packages its

investment proposals and sells them to the suppliers of finance [Salvary 1989,p.49]. The suppliers of finance in the market pay for prospective cash flows.

Production and consumption decisions give rise to investments. Decision theory models investment behavior. On the basis of the Present Value of Investment (**PVI**) model, a decision is made to commit **C*** (the money-outlay which can be made because of its expected recovery from an investment: the estimated recoverable cost). However, until the output of that investment plan is actually contracted for (or guaranteed), future cash flow is only possible cash flow.

The present value of investment takes center stage in this section. The **PVI** model in its behavioral form constitutes the basis of financial accounting valuation.[18] The **PVI** model provides the basis for measuring and monitoring the investment. To illustrate, the investment decision presents itself in two basic forms. (1) The decision-maker is faced with a new project for which estimated revenues, expenses and duration are given. In this situation, the maximum amount of money that should be invested (**C***) is to be determined. (2) In the next situation, the decision-maker is introduced to new equipment (to either adopt new technology or upgrade existing technology) whose cost (**C** - the price of the equipment) is established in the market. Since the investment cost (**C**) is known, there is a need to know whether or not **C** is optimal. This situation calls for a determination of the present value of the investment (PVI)--the present value of the net revenues to be generated by the money outlay (**C**) required by the investment in the equipment, or a determination of the internal rate of return based on the discounted cash flow (**DCF**) model.

To provide an answer for decision-scenario (1) equation (1.0) is used.

$$\mathbf{PVI} = \sum_{n=1}^{N} \mathbf{R_n(1+r_n)^{-n}} \qquad \mathbf{(1.0)}$$

(R = benefit stream; n = number of periods; r = the period rate of return)

The Measurement Property

PVI, which is based upon a given recovery plan (a given set of assumptions), is a subjective estimate. **PVI** is the estimated recoverable cost (C*).

$$\mathbf{PVI} = \mathbf{C^*} \qquad \mathbf{(1.1)}$$

Recoverable cost is the decision-motivating factor; it is the measurement property which is captured by financial accounting measurement rules.[19] (As stated earlier, the terms "recoverable cost" and "estimated recoverable cost" are used interchangeably.)

Concerning decision-scenario (2), equation (1.01) is used, since the decision is posed in a different manner from that of scenario (1), in which **C*** was to be determined.

$$\mathbf{PVI} = \sum_{n=1}^{N} \mathbf{R_n}(1 + r^*)^{-n} \qquad \mathbf{(1.01)}$$

In scenario (2), the cost of the investment (**C** - the current money outlay required to acquire a productive asset) facing the firm is a given datum. In this case, a hurdle rate of return (**i***) is used to calculate the **PVI**, then **C** is compared with **PVI**, and **PVI** maybe > or < **C**.[20] The decision to invest will be when **PVI ≥ C**; that is, when the Net Present Value (**NPV** = **PVI** - **C**) is equal to or greater than zero. It should be quite clear that the selling price of any type of machine (which becomes **C** - money outlay to acquire a productive asset--the investment cost) can be sustained in the market place if, and only if, projects entertained by entrepreneurs have calculated **PVIs ≥ C**.

An alternate approach, the **DCF** model, equation (1.2) can be used when **C** is given; in which case, the internal rate of return (**r***) is determined and compared to the hurdle rate **i***.

$$\mathbf{C} = \sum_{n=1}^{N} \mathbf{R_n}(1 + r^*)^{-n} \qquad \mathbf{(1.2)}$$

In this situation, **C** is set equal to **C*** (the estimated recoverable cost).

$$\mathbf{C} = \mathbf{C^*} \qquad \mathbf{(1.11)}$$

However, the two sides of equation (**1.11**), **C** and **C*** are in two different time dimensions. **C*** is an occurrence with a future time dimension. **C** is an occurrence in the present dimension; it represents the amount of money to be given up in the present.

In scenario (**2**), **PVI** = **C*** = **C**, equation (**1.3**) holds.

$$\mathbf{C_I}^* = \mathbf{C} = \sum_{n=1}^{N} \mathbf{R_n}(1+r_n)^{-n} \qquad \mathbf{(1.3)}$$

(**I** = Investment Decision)

In this fashion (**1.3**), the **PVI** model is operationalized in financial accounting.[21] Equations (**1.0**), (**1.2**) and (**1.3**) are behavioural equations; while equation (**1.1**) is an identity. The two sides of equation (**1.1**) are in the same time dimension, the future. In equation (**1.2**), **C** is substituted for **PVI** in equation (**1.0**). In equation (**1.0**), **r** is given; whereas in equation (**1.2**), **C** is given and **r** (the internal rate of return -- the rate of profit necessary to reduce the revenue stream to the current nominal money outlay (**C**)) would be solved. Equation (**1.2**) is used in this manner because **C** is an actual phenomenon in the present. Once the decision is made, **C** is constant.

The money outlay (**C**) made in the past cannot change; but savers' expectations of the future are subject to change; they can and do change. The value (**V**) of "titles to claims" against the investment is subject to change. This condition holds since **R** (the net revenue stream) and **n** (the number of periods) are subject to change in the future. When they change so will **r*** (the internal rate of return); **r* is** an endogenous variable; whereas, **R** and **n** are exogenous variables. These variables--(1) the cash flow (either in the periodic amount or the number of periods or both), and (2) the internal rate of return, which is dependent upon (1) for its magnitude--do change; and when they do, they do so simultaneously.

When there is an upward change in the estimated cash flow subsequent to the commitment of **C**, profit is positively affected. There is and can be no change in **C**, the amount of money laid out yesterday cannot be changed today. Bygones are bygones! **C** is still the **PVI**. This condition holds, because *there now exists a new and higher internal rate of return, determined in equation* (**1.2**), *which reduces the new higher cash flows to the cost of the investment* (**C**). An increase in cash flow is recognized by financial accounting as it is realized in the income statement as higher profits than initially estimated.[22] Since the market pays for prospective cash flows, then the capital market now has a higher cash flow stream to value.

When there is a downward change in the estimated cash flow subsequent to the initial decision to commit **C**, again, profit is affected; this time it is negatively affected. However, the hurdle rate (**i*** - the firm's cost of debt capital) is a threshold level for the investment decision.[23] When a downward revision in cash flow pushes the internal rate

of return (**r***) to a magnitude smaller than the hurdle rate (**i***), there is a revaluation of $\mathbf{C_I}$* (estimated recoverable cost). In as much as one cannot go back to yesterday to change the decision as to how much money outlay is justified by the current market conditions of today, the new measurement results in a write down (reduction) of **C** (the cost of investment) on the books to reflect $\mathbf{C_O}$* (the new estimated cash flows discounted by the firm's hurdle rate)--the amount of money that would have been invested today to generate the new expected cash flow based upon the current information available.

The foregoing accounting valuation approach reflects the amount of money the decision-maker would be willing to invest ($\mathbf{C_I}$*) and would have invested (**C**) had the new information available today been available yesterday; but in an uncertain world, such information could not have been available yesterday. This condition reflects the uncertainty, occasioned by the unpredictable change in market conditions, facing the decision-maker at the time of each decision. The write-down from the initial recoverable cost ($\mathbf{C_I}$*) to a new recoverable cost ($\mathbf{C_O}$*) is a financial loss which is reported in the income statement. This loss represents the amount that is not recoverable; *it is a money outlay that would not have been made had the new information been available at the time of the decision.* Once again, since the market pays for prospective cash flows, there is now a lower expected future cash flow to be valued by the capital market.

The approach (no upward revaluation but downward revaluation) is said by some to be attributable to conservatism.[24] The real reason for this approach is the fact while *"risk of loss" is a meaningful concept, "risk of gain" is not an operational concept*. No one hedges against the risk of gain; but those who can hedge against the risk of loss, usually do. The firm is in business to make a gain. It will reflect a gain as it achieves that gain. When the expected gain is larger than the firm had initially anticipated, the firm has not suffered; the recoverable amount of the invested money is unimpaired. Instead, the firm's internal rate of return would have increased, and the increase in earnings will flow through the income statement. However, when the firm is exposed to the risk of loss of money committed (when circumstances reveal that the firm will not recover its investment), consistent with the concept of "risk of loss", there is no alternative but to write down the investment.[25]

Claims against the Firm

Liabilities of the firm are claims against the firm. All liabilities are financial assets of the claimants, and there is symmetry in valuation.[26] What Firm H owes Firm Z, is what Firm Z shows as a financial asset in its balance sheet. While such financial assets can be packaged (securitized) and sold in the capital market, the obligation of the firm is not altered. However, it is possible for a firm, if its obligations are traded, to repurchase its obligation at a gain whenever there is an increase in the interest rate on similar new obligations. The liabilities of firms are affected by firms' inability to recover costs. The inability of firms to recover costs results in corporate reorganizations, creditor agreements--composition settlements, debt restructuring and bankruptcy proceedings.

From the standpoint of both the obligor and the obligee, the observed approach is simply an acknowledgment that the money initially allocated by the market to the firm cannot be altered. Although the value of claims (V) for interpersonal transfers are subject to change, the claims that are in existence to represent the money entrusted to the firm by third parties cannot be altered.

The following section demonstrates that the observed measurement property (**C***) enables an explanation of the apparent diverse valuation rules in financial accounting and supports a market simulation approach.

THE MEASUREMENT PROPERTY AND MARKET SIMULATION

The measurement property identified (and explained earlier) is recoverable cost. This observed measurement property enables an adequate generalization of the diverse valuation rules (μ) found in financial accounting. Staubus [1985, p.68] maintained that no one of the eight (or possibly nine) general valuation methods was dominant.[27] That condition holds, because each method is the specific means to arrive at the recoverable cost given differing circumstances. The seven qualities (reliability, economy, conservatism, flexibility and control, stability, comparability, and understandability) of financial accounting measurement methods observed by Staubus [1985, pp.65-66] are all *qualitative characteristics of recoverable cost as a measurement property.*

Staubus [1985, p.68] identified wealth as being a homogeneous property

(accounting subject matter), and maintained that "homogeneity of method is elusive...". Wealth items are not a homogeneous grouping, but a heterogeneous grouping. It is a uniform valuation system with money as a homogenizing measure that homogenizes wealth. There are two broad classes of wealth: (a) passive wealth--personal wealth; and (b) active wealth--business wealth. The valuation of personal wealth (e.g., the price of a work of art) always involves valuation at the margin in a seller's market. However, the creation of wealth by the entrepreneur (i.e., the increase in the value of the firm) simply involves the augmentation of a sum of money over time. Increasing the sum of money entrusted to the business involves two markets: (1) a buyer's market, and (2) a seller's market. The creation of wealth in financial terms depends upon the spread that exists between the two markets. The valuation of business wealth essentially simulates the buyer's market, since that market reflects the financial risk (money commitment) exposure of the business. The seller's market is taken into consideration but it is not directly simulated, since that market reflects expectations of the future: the potential for gain. The seller's market provides for a prospective gain; however, for business wealth to be created, this gain must be achieved and not be merely possible.

Values and Valuation Models

The acquisition of physical inputs (the factors of production) in one market to create physical outputs for disposal (sale) in another market does not entail a transformation of values, but it clearly establishes monetary input values as the sacrifices involved. Since there are many possible uses for a given unit of physical output, the output value (utility) of a physical unit of output is subjective; it is dependent upon the particular usage of that output. Usage determines personalistic output value, and usage is only determinable upon transfer by contractual right or by physical transfer. Thus, input value is a stored money value. This condition holds whether the items are or are not to be sold (e.g., fixed assets--items to be used in a complementary manner as part of a plan). Monetary exchange establishes value, be it input or output value. Economic efficiency is contingent upon usage; since output usage is subsequent to output creation, input and output values are values differentiated by time. Once as input, the physical unit is not separable from the input value measure (**C**), which is the amount at risk. The separation

of the physical unit from its input value comes only upon usage; and it is monetary exchange that paves the way for the new (output) value.

In the capital market, the *market valuation* (price) of a particular firm's security *reflects expectations* of that firm's future multiperiod earnings. *Financial accounting valuation reflects:* (1) the results of single period's *performance* (one stage in the firm's operating plan to make a money profit) and (2) the financial risk exposure of firms (the *estimated recoverable amount of money invested).*

Uncertainty and Estimation

Jevons [1905, pp.131-132] maintained that capital (money received by the firm in exchange for financial assets: claims against the firm) is nothing but advances which bridge the interval between production and ultimate use; since all this effort is for the sake of the consumer (though in anticipation of profit), the output must be paid for by the consumer. So, it is only when consumers purchase or make irrevocable commitments for a firm's output that value has changed; only then does the transformation of value occur - from input value to output value. Under these conditions, money committed is recovered: (a) in part; (b) in full; or (c) in full plus an increment on the sum of money committed. Also, in the simulation of the buyer's market when certain other conditions exist, indicating an impairment arising from consumers' behavior, a modification of the input value becomes necessary. Simply put, if consumers do not require and acquire the firm's output, it is then obsolete. In this extreme case, the input value is reduced to zero.

Investments are made under conditions of uncertainty. The uncertainty facing the firm necessitates the estimation of the amount of cost recoverable from consumers; and it is this estimation process, given asset heterogeneity, which creates an apparent diverse set of valuation rules.

INVESTMENTS, ASSETS, V ALUATION RULES: THE MEASURE SPACE

Investments give rise to assets, which are measured using financial accounting valuation rules. The valuation rules (μ) in financial accounting follow a basic market simulation process, which is depicted by the following equations representing three distinct but sequential decisions facing the firm: (1) the investment (entry) decision (**I**);

(2) the operation (use) decision (**O**); and (3) the termination (exit) decision (**T**).

$$C_I^* = \sum_{n=1}^{N} R_n(1+r_n)^{-n} \quad \textbf{(1.3)}$$

$$C_O^* = S - M \quad \textbf{(2.0)}$$

(S = selling price; M = markup)

$$C_T^* = RV \quad \textbf{(3.0)}$$

(RV = Realizable Value)

These three models underlie the three decisions encountered in economic undertaking: (i) measurement of recoverable cost (C_I^*) at time of initial investment (entry decision); (ii) subsequent measurement of recoverable cost (C_O^*) during the course of operations (use decision); and (iii) terminal measurement of recoverable cost (C_T^*) at the time an asset is no longer part of the recovery plan (exit decision).

Present Value of Estimated Future Cash Flows

The first valuation rule observed (present value of estimated future cash flows) is derived from the market simulation model. It is the use of the money received in exchange for claims against the firms as the basis or value of the claims (the first valuation rule invokes the inflation debate; in this context, money loses value over time; this argument has not been addressed in this paper). The recoverable cost approach is evident at the inception of all investment decisions. It is implied by or at least inferred from equation (1.4).

$$PVI - C = NPV \quad \textbf{(1.4)}$$

In accordance with the Net Present Value Method, the decision, if rational, to commit **C** is made if, and only if, anyone of two conditions holds: **PVI = C** or **PVI > C**; in other words, if $NPV \geq 0$. The financial accounting rule holds that if a decision is made and **C > PVI** at the time of the transaction, then **C** (the cash input value) is written down to **PVI**. As stated earlier, since **PVI** is equal to **C*** (the estimated recoverable cost), then **C** is set equal to **C***.

An asset received in exchange for another asset, or acquired for cash, or self-constructed, or acquired in exchange for titles to claims is recorded at the lower of the fair market value received and the fair market given up. The established logic behind the observed practice is that it is unlikely that someone will give the firm more value and receive (accept) less value in return. Although a firm may give another party more for an asset than its present value, that asset cannot be recorded at an amount in excess of its fair market value. In the case of the self-constructed asset, any amount expended in excess of a market determined based outlay is excluded from the asset's recorded value. Equation (**1.3**) guides the financial accounting recording process. The rule ensures that the consequence of a bad decision (loss on self-construction of asset) is reflected in the income statement. In equation **(1.2)**, a market based value **(C)** is related to a subjective value **(PVI)**. **PVI** is derived from two subjective factors: **R** and **r**. Equation (**1.3**) is a market simulation approach for initial (entry) valuation. It is the basis of new decisions. Decisions at the margin reflect market conditions, and prices (**S**) in the seller's market is a critical variable. $\mathbf{C_I^*}$ (estimated recoverable cost for the entry decision) is the decision-maker's risk exposure based upon his/her expectations of what **S** will be over the life of the investment.

Lower of Cost and Market Valuation

After the asset is acquired, equation (2.0) serves as the basis for use valuation. Equation (**2.0**) provides the basis for the second (Lower of Cost and Market) valuation rule.

$$\mathbf{C_O^* = S - M} \qquad \mathbf{(2.0)}$$

S (selling price of investment's output) is market determined. **M** (margin or markup) is the potential for gain which is contingent upon **S**. Subsequent to the entry decision, the operating decision is influenced by current and expected **S**. Given the firm's (or industry's) normal **M**, then $\mathbf{C_O^*}$ emerges as the amount recoverable based upon the prevailing market conditions.

Generally, the output of the business enterprise is of no utility to the enterprise [Arrow 1981, p.142]. Consequently, the firm experiences a period of storing (and the cost

of that storing is measured in nominal money terms) until such time as those persons (to whom the firm's output has utility) are ready to exchange either money or a claim (receivable) for such output. Therefore, after the entry decision, the amount of money committed (**C**) that can be recovered ($\mathbf{C_O^*}$) is conditioned by changing consumer demand for the firm's output.

The recovery process is based upon the ability to charge consumers the planned selling price (**Sp**). Consequently, the amount recoverable is dictated by the market. When the conditions under which the plan was laid materialize, money committed in an irreversible decision will be recovered, plus the rewards for undertaking the commitment. However, market conditions may be worse than that projected. Accordingly, when an asset no longer fits into the firm's operating plan, it is subjected to the third valuation rule: realizable value.

Realizable Value

The third valuation rule, which is observed, applies whenever any asset of the entity becomes divorced from the operating plan of the firm. Realizable Value (**RV**) is market based; it is the amount obtainable from disposal of the asset in the seller's market. For exit valuation, **RV** determines $\mathbf{C_T^*}$ (recoverable cost). The amount that will be recovered ($\mathbf{C_T^*}$) is no longer based upon the cash flow from the use of the asset (equations **1.3** and **2.0**), but only the cash flow from the sale of that asset.

Equation (**3.0**) completes the simulation process:

$$\mathbf{C_T^* = RV} \qquad (\mathbf{3.0})$$

Equation (**3.0**) is market simulation for terminal (exit) valuation (for terminal and obsolete processes, etc.) The firm at this stage recognizes that the asset is no longer part of the recovery plan; to minimize future adverse consequences, the firm disposes of the asset.

MARKET ECONOMIC PRINCIPLES: ANOMALIES EXPLAINED

In the foregoing analysis, **C*** in each situation (**I**, **O**, and **T**) represents the amount of money that would be committed by the decision-maker consistent with existing market

conditions. In equation (**1.11**), $\mathbf{C_T^*}$ is captured by a deterministic process. However, in equation (**1.3**), which reflects a decision-theoretic setting:

$$\mathbf{C_I^*} = \sum_{n=1}^{N} \mathbf{R_n(1+r_n)^{-n}} \qquad \textbf{(1.3)}$$

$\mathbf{C_I^*}$ is influenced by a stochastic process - **R** and **r** are stochastic variables. Since **C** (the investment cost), **S** (the output's selling price), and **RV** (the scrap value) are all market based values, then **C*** can be considered as derived from a market simulation process. Accordingly, the valuation rules produce a measure of recoverable cost, based upon a buyer's market simulation approach. The heterogeneous conditions, that give rise to the three valuation rules, reflect the fact that *planning is undertaken under conditions of market uncertainty.*

The description of the market simulation process reveals that the alleged violation of the two principles of market economics are apparent and not real.

Diverse Rules Necessary to Attain Convergence of Values

The different valuation rules followed in financial accounting are the means of establishing an estimate of the aggregate recoverable cost of investments as of a specific point in time. Under this valuation process, the heterogeneity of assets converges to a homogeneity of value. In each and every situation (*cost, lower of cost and market, and realizable value*), one is looking at a measurement to arrive at the estimated recoverable amount of an original invested sum of money. The diverse measurements applied are necessary to reflect (measure) the recoverable amount of the money invested which is represented not by one homogeneous grouping of assets, but by a heterogeneous group of assets ($\mathbf{A_s}$, $\mathbf{A_l}$, $\mathbf{A_f}$, A_i, and A_o). In this regard, financial accounting is comparable to physical chemistry.

FINANCIAL ACCOUNTING AND PHYSICAL CHEMISTRY

The role of "Laws of Thermodynamics" in the measurement of gases [Martin 1986] sheds light on the diverse valuation rules of financial accounting.

"One of the important and interesting aims of physical chemistry is to explain the

properties of matter in terms of motions and spatial arrangements of atoms and molecules" [Kauzman 1966,p.l]. A gaseous substance is characterized by four properties: mass (m); volume (V); pressure (P); and temperature (T). If any three of the four primary properties are known for any substance, the value of the fourth will be determined: P(V,T,m); V(P,T,m); T(p,V,m); and m(P,V,T) [Kauzman 1966,p.8].[28] It is quite interesting to note that "[v]olume measurements on gases are usually referred to as what they would have been had they been made at standard conditions" [Haight 1964,p.237]. "Knowledge of the gas laws is applied chiefly to calculations of what happens to the volume of a gas as the temperature and pressure are changed" [Haight 1964, p.237].

The measurement of recoverable cost (the estimated recovery of cash from an initial cash commitment) is analogous to measuring the volume of gas with *cash as the standard condition.* Just as it is necessary to adjust for temperature and pressure conditions when measuring the volume of gas, likewise the various valuation processes constitute the means by which adjustments are made for the varying current conditions to estimate (measure) the recoverable cash as represented by the heterogeneous group of assets.

Cash being the standard condition is measured as is; no adjustment is necessary, since it is at present value. Accounts receivable (long term is discounted), which is a new commitment of money in a different asset form from the asset whose value was transformed (the realization of value) to produce the receivable, is net of an amount estimated to be uncollectible (an allowance based upon the asset, not on sales). Since uncollectibility is a condition analogous to pressure change in the case of a gas, the adjustment for this condition is necessary. Fixed asset is an estimate of the amount recoverable. Accumulated depreciation is the amount of money no longer recoverable. When assets are tied to a plan, the amount recoverable is estimated based upon the viability of the plan as evidenced by market conditions. For assets no longer part of a plan, the amount recoverable is the amount it would sell for in the second hand market. It must be emphasized that the LIFO approach to inventory valuation and the immediate expensing of research and development expenditures contradict the recoverable cost model.

Since receivables on one set of books are the liabilities on another set of books, then assets and liabilities are measured in the same manner. This does not mean that all liabilities are reflected as assets (e.g., estimated liabilities under warranties, estimated liability for vacation pay, etc.). Implicitly, though not expressly, they are reflected in balance sheets that are not prepared. The absence of an expressed reflection in a balance sheet does not in any manner affect their valuation.

When the accounting valuations are taken individually, the qualities (stability, conservatism, etc.) offered by Staubus [1985] are necessary to explain or justify the existence of these diverse valuations. However, when the concept (measurement property) of recoverable cost (the basis of all the financial accounting valuation rules) enters the picture, then the qualities (ascribed to the individual accounting valuation rules) emerge as qualitative characteristics of the measurement property.

CONCLUSION

Financial accounting numbers are derived from a homogeneous, though variable, property: estimated recoverable cost, which is a decision oriented property. It is a measure based upon what money commitments would have been made, given current market conditions; it is a buyer's market simulated measure. Just as the summation of the volume measurement on gases as adjusted for different states is valid, likewise financial accounting measurement is valid. Similarly, the measurement of a heterogeneous group of assets is reduced to a homogeneous form, the estimated recoverable cost, by means of the various accounting valuation rules.

Financial accounting valuation rules appear to be diverse because of asset heterogeneity; those rules (as demonstrated) produce a logically defensible measurement, which is definitely not hodgepodge. What emerges in the financial accounting measurement process is a convergence to a homogeneous form and not a divergence to a heterogeneous form.

ENDNOTES

1 Although DCF and PVI are used interchangeably, the two models do differ. For instance, Hotelling [1925,p.264] used two equations (1) and (la) which show the difference between PVI and DCF. The DCF model assumes a constant rate of return over the life of the investment [Kay 1976; Fama and Miller 1972,pp.137-142]. The PVI model is based upon variations in the periodic rates of return, even with negative returns in some periods over the life of the investment.

2 If DCF provides the valuation for a net revenue stream, and replacement cost (RC) signifies the cost of replacing an existing operation, then DCF would be a guide to replacement. Therefore, replacement cost would not be a surrogate for DCF.

3 Mattessich [1964,pp.143-231] has shown that a general theory of value in an economic sense is elusive, and that there are many values depending upon the given circumstances. Valuation is context bound, while all valuations constitute "a community of objectives" [Mattessich 1964,p.145]. Accordingly, "[a] solution of this dilemma might be found in a functional approach to valuation which recognizes different objective-oriented valuation models but which emphasizes the common features of them all" [Mattessich 1964,p.205].

4 This law encompasses the accounting laws (productivity, capitalization, continuity and bankruptcy) identified by Salvary [1989].

5 Throughout this treatise, the terms "recoverable cost' and "estimated recoverable cost" are used interchangeably.

6 Readers, who may have reservations about the additivity of recoverable cost, are referred to Krantz, et al [1971,p.l] who maintain that: "it is surely wrong to think that there is only one fundamental system of properties adequate to lead to numerical measurement. We present many quite different systems that are all fundamental by the intuitive criterion of independence of other measurement."

A very enlightening observation is made by Krantz, et al [1971,p.524]: "[T]he axioms for particle mechanics .n treat time and mass as real numbers …. [S]o, from a purely mathematical standpoint, it makes sense within such an axiomatic framework to add a time and mass, even though physically this is considered meaningless."

7 The following works are cited as representative of the areas mentioned above. *Prescriptive Theories:* Edwards and Bell [1961]; Chambers [1966]; and Sterling [1970]. *Income Smoothing:* Hepworth [1953]; Beidleman [1973]; Weil [1980]; Koch [1981]; Lambert [1984]; and Moses [1987]. *Positive Accounting Theory:* Watts and Zimmerman [1978,1986]; Deakin [1979]; Christenson [1983]; and McKee, et al [1984]. *Social Choice and Optimal Reporting:* Demski [1974]; and Demski, et al [1984]. *Efficient Markets:* Beaver [1972,1981].

8 The development of this discussion is based upon the line of reasoning presented by Faden [1977,pp.7.37.38].

9 Beaver [1989,pp.88-91] maintains that earnings is a by product of valuation; but due to incomplete markets, valuation based earnings is not an operational concept. However, a very rich literature exists which points out that: (l) transactions constitute the basis of economic activities, and (2) the firm is a surrogate market, which is accompanied by a valuation process focusing on the reduction of transactions costs [1937; Williamson 1981]. The firm and markets are alternative governance structures [Williamson 1981].

10 Ayer [1964,p.152] has commented on: (1) the importance to all sciences of "clear and definitive analyses of concepts", and (2) the difficulties experienced by those sciences whose terms are not precisely defined. In the discipline of accounting, the use of the term 'capital cost consumption (to signify the wear, tear, elemental decomposition, and obsolescence affecting fixed assets) is more appropriate than is the term 'depreciation'. The use of the term 'depreciation' appears to give rise to unnecessary misunderstandings. In this situation, one is confronted with a problem of language--it is the use of the language which introduces the problem.

In the discipline of economics, depreciation is the antonym for appreciation. The depreciation associated with consumer goods deals with the changes in psychological perception of goods in consumers' eyes: new versus old. The decline in value or the loss of value, once a car is taken from the automobile showroom is referred to as depreciation. In this sense the second-hand market provides a measure of the decline in consumer utility for an object. The increase in value of a vintage automobile is referred to as appreciation. Some accountants assume that the difference between the second-hand value of a depreciable asset and the value of that asset new constitutes the depreciation associated with the productive process. Evidently, those accountants have become the victims of terminological confusion.

11 See Uhr [1960,p.67] with reference to depreciation as disinvestment by wear and tear with product output. Frisch [1965,p.33] maintained that depreciation is "the *decline in the ability to produce output* or the *decline in value* of the capital objects, which results from wear and tear or simply becoming out of date." Hotelling [1925,p.263] and Walras [1926,p.268] both treat obsolescence as an insurable risk and exclude it from the measurement of the annual depreciation charge; they maintain that insurance should be taken out against such risk.

12 For Peasnell [1984], depreciation is determined by market forces producing periodic changes in the replacement cost of the asset. The reasoning follows: Value to the firm [VF] is treated as the economic rationale for valuing assets at replacement cost [p.173]. The VF depreciation charge is a period rather than product charge [p.183]. It is obtained by estimating the decline in asset value of the asset during the period, and not by matching a proportion of (updated) entry price against revenue. Replacement costs are not matched with revenues from period to period [p.179,footnote 13].

13 Hotelling's [1925] work is very useful in providing added clarity to this point. In that work, two perspectives are used in developing a general theory of depreciation. In equation 1, Hotelling [1925,pp.264-265] used the decision theoretic perspective: What unit sales price and what useful life would maximize the internal rate of return on an investment? Once these two parameters are established (they have no impact on the cost of the investment), they serve to determine a depreciable asset's output and duration. Hotelling [1925.pp.268-269] then proceeded in equation 5 to formulate a measurement technique for the depreciation charge (the amount of cost of investment consumed or chargeable) for each period over the life of the investment. It is the invested cost (C) which Hotelling spreads in a maximizing fashion, systematically linking depreciation to the revenue stream.

14 For a discussion of the uniqueness of recoverable cost, see Salvary [1989,pp.49-52].

15 'The criterion for investment in a competitive industry is the expectation of a flow of surpluses between revenue and current operating costs which, over the life of the investment, are sufficient to recover the principal of the investment and earn a normal rate of return" [Salter 1966, p. 55].

16 Vickrey [l970,p.738] maintains that: "if an extensive accounting property cannot be identified, we must conclude that accounting can never be classified as a measurement discipline in the strict sense." The property herein identified is extensive; hence, one can conclude that accounting is a measurement discipline.

17 An earlier and much shorter version of this paper was submitted to one of the leading accounting journals for consideration of publication in October 1984. The comments received in February 1985, from an anonymous reviewer, stated: "I reviewed this note after reading George Staubus' article in the latest (January 1985) AR. This note deals with a similar theme (the search for a fundamental measurement rule in financial accounting and it provides a different answer (recoverable cost). . .I find this note potentially interesting and useful..."

Comments received in May 87, pertaining to a review of a later version of the paper, indicated that: 'The basic idea . . . behind this paper makes much sense ..." The same reviewer, in comments received July 1987 on a revised version of the paper which addressed the concerns raised in the initial review, maintained that: "In spite of some objections, I think the paper has enough originality and importance and should be accepted."

18 Beaver [1989,Chaps. 4,5] uses the PVI (DCF) model to discuss the relationship between economic earnings and security prices and establishes the link between accounting earnings, dividends and security prices. While a comparison is made between economic earnings and accounting earnings, the connection between the PVI model and financial accounting is not established.

19 Peasnell's [1984] position on "Value to the Firm" (VF), the sum of the discounted value of future replacement costs and incremental future user costs (RC), does appear to be similar conceptually to the recoverable cost model. However, there is a subtle difference. The VF approach focuses on a replacement of existing asset, using new or used asset values of a similar nature. The recoverable cost approach focuses on the net revenue stream related to the specific asset given existing market conditions at two decision points, entry and use. On that basis, the amount that justifiably would be invested according to the capital budgeting model at the specific decision point is determined. The amount so calculated is the recoverable cost. The exit decision occurs when the asset is divorced from an operating (recovery) plan. In this situation, realizable value is the recoverable cost.

20 For the purposes of screening projects submitted for funding, a hurdle rate of return (i*) is used. Projects are then ranked on the basis of net present value (NPV).

21 The DCF model, which produces a constant return, can be used as a proxy for the PVI model. However, it is important to note that the PVI model captures on irregular annual returns; consequently it is a better representation of the real world phenomena. than is the DCF model, which is concerned with an approximation as reflected by constant annual returns. Needless to say, the PVI model is the correct model for modelling the investment decision [Fama and Miller 1972,pp.137-142].

22 In some countries (e.g., Germany, Japan, and the US), there are no upward revaluations. In other countries (e.g., France, Italy, and the UK), upward revaluations are recognized as capital adjustments in the balance sheet. Upward revaluation is not consistent with the recoverable cost property. However, no attempt is made to address the approach of the latter countries in this paper.

23 For simplicity the cost of debt capital is assumed to be the threshold level. Some firms probably consider the interest rate obtainable from investing their available funds in high grade commercial paper as the threshold level.

24 For instance, see Ijiri and Nakano [1989].

25 A very sound exposition on the logic of the treatment in financiaI accounting of the "consequences of financiaI risks" is provided by Andrews [1949,pp.42-43].

26 Most [1982,p.349] explains liabilities by means of the "social consolidation model".

27 Staubus [1985,pp.61-63,67-68] enumerated thirty-two valuation solutions for thirty-one situations (one situation involved two possible solutions). The solutions were derived from eight valuation methods (nine methods, if immediate expensing is included.)

28 Gas Laws are the "laws relating the temperature, pressure and volume of an ideal gas" [lsaacs 1985,p.l04]. The ideal (universal) gas law is a composite of three laws: Boyle's Law, Charles' Law, and the pressure law. Its use permits the determination of the molecular weights of real gases [Beyer 1966,p.617]. The ideal gas law is described as: PV = nRT [Isaacs 1985,p.l04]. R is a universal constant, which is gas specific. R is a thermodynamical constant, i.e., a quantity depending on the chemical nature of the gas but not on the variables of the state of the gas [Massey 1975,p.144]. n is the number of molecules of gas occupying a unit of volume. All pure gases have the same n (Vn = Density). All changes of density involve thermodynamic effects. The density of a particular volume of gas is a function of the absolute pressure and temperature affecting that gas [Massey 1975,p.371. "Doubling the pressure on a volume of gas results in halving its volume" [Frisch 1972,p.21]. This condition is made explicit in Boyle's Law, which is defined as: PV = A(m,T); where A(m,T) is a quantity whose magnitude is fixed when the mass and temperature of a gas is fixed, but which does not depend explicitly on the pressure and volume of the gas. It depends on the nature of the gas [Kauzman 1966,p.1l].

REFERENCES

Andrews, P. W. S. *Manufacturing Business.* Preface by Sir Henry Clay. London: Macmillan & Co. Ltd., 1949.

Arrow, Kenneth J. "Real and Nominal Magnitudes in Economics." *The Crisis in Economic Theory.* Edited by Daniel Bell and Irving Kristol. New York: Basic Books, Inc., Publishers, 1981.

Ayer, A. J. *Language, Truth and Logic.* London: Victor Gollancz Ltd., 1964.

Beaver, William H. *Financial Reporting: An Accounting Revolution.* Second Edition. Englewood Cliffs, New Jersey: Prentice-Hall, 1989.

_____. "Market Efficiency." *Accounting Review* (January 1981): 23-3

_____. "The Behavior of Security Prices and Its Implication for Accounting Research Methods." Report of the Committee on Research Methodology in Accounting. *Accounting Review* (Supplement 1972): 399-437.

Beidleman, C. "Income Smoothing: The Role of Management." *Accounting Review* (October 1973): 653-667.

Beyer, George L. "Molecular Weight Determination." *Encyclopedia of Industrial Chemical Analysis. Volume* 2. *General Techniques.* Edited by Foster Dee Snell and Clifford L. Hilton. New York; London; Sydney: Interscience Publishers - Joh Wiley & Sons, Inc., 1966.

Boulding, Kenneth E. *A Reconstruction of Economics.* New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited, 1950.

Campbell, Norman. "Measurement." *The World of Mathematics.* Volume Three. Edited by James R. Newman. New York: Simon and Schuster, 1956.

Canning, John B. *Economics of Accountancy: A Critical Analysis of Accounting Theory.* New York: The Ronald Press Company, 1929.

Chambers, Raymond J. *Accounting, Evaluation and Economic Behavior.* Englewood Cliffs, New Jersey: Prentice-Hall, 1966.

_____. "Measurement in Current Accounting Practice: A Critique." *Accounting Review* (July 1972): 488-509.

Christenson, Charles. "The Methodology of Positive Accounting." *Accounting Review* (January 1983): 1-22.

Coase, R. H. "The Nature of the Firm." *Economica* (November 1937): 386-405.

Deakin, Edward B. III. "An Analysis of Differences Between Nonmajor Oil Firms Using Successful Efforts and Full Cost Methods." *Accounting Review* (October 1979): 722-734.

Demski, Joel S. "Choice Among Financial Reporting Alternatives." *Accounting Review* (April 1974): 221-232.

Demski, Joel S.; Patell, James M.; and Wolfson, Mark A. "Decentralized Choice of Monitoring Systems." *Accounting Review* (January 1984): 16-34.

Edwards, Edgar O. and Bell, Philip W. *The Theory and Measurement of Business Income.* Berkeley; Los Angeles; London: University of California Press, 1961.

Faden, Arnold. *Economics of Space and Time: The Measure Theoretic Foundations of Social Science.* Ames, Iowa: Iowa University Press, 1977.

Fama, Eugene F. and Miller, Merton H. *The Theory of Finance.* Hinsdale, Illinois: Dryden Press, 1972.

Frisch, Otto R. *The Nature of Matter.* London: Thames and Hudson Ltd., 1972.

Frisch, Ragnar. *Theory of Production.* Chicago: Rand McNally & Company. Holland: D. Reidel Publishing Company/Dordrecht, 1965.

Georgescu-Roegen, Nicholas. *The Entropy Law and the Economic Process.* Cambridge, Massachusetts: Harvard University Press, 1971.

Hague, D.C. "Summary Record of the Debate." *The Theory of Capital.* Proceedings of a Conference held by the International Economic Association. edited by F. A. Lutz and D. C. Hague. London: Macmillan & Co. Ltd. New York: St. Martin's Press, 1961.

Haight, Jr., Gilben Pierce. *An Introduction to Physical Science: From Atoms to Galaxies.* New York: The Macmillan Company. London: Collier-Macmillan Limited, 1964.

Hepworth, Samuels R. "Smoothing Periodic Income." *Accounting Review* (January 1953): 32-39.

Hotelling, Harold. "A General Mathematical Theory of Depreciation." *Journal of the American Statistical Society,* Vol. XX (1925). Reprinted by R. H. Parker and G. C. Harcoun. Cambridge: Cambridge University Press, 1969.

Howard, Ronald A. "The Foundations of Decision Analysis." *IEEE Transactions on Systems Science and Cybernetics.* Vol. SSC-4, No.3 (September 1968).

Ijiri, Yuji. "An Introduction to Corporate Accounting Standards: A Review." *Accounting Review* (October 1980): 620-628.

_____. *The Foundations of Accounting Measurement: A Mathematical, Economic and Behavioral Enquiry.* Englewood Cliffs, New Jersey: Prentice-Hall, 1967.

Ijiri, Yuji and Nakano, Isao. "Generalizations of Cost-or-Market Valuation." *Accounting Horizons* (September 1989): 3-11.

Isaacs, Alan. Editor. *Concise Dictionary of Physics.* Oxford; New York: Oxford University Press, 1985.

Jedamus, Paul and Frame, Robert. *Business Decision Theory.* New York and other major cities: McGraw-Hill Book Company, 1969.

Jevons, W. Stanley. *The Principles of Economics: A Fragment of a Treatise on the Industrial Mechanism of Society and Other Papers.* Preface by Henry Higgs. Reprint of 1905 edition. New York: Augustus M. Kelley, Publisher, 1965.

Johnson, L. Todd and Bell, Philip W. "Current Replacement Costs: A Qualified Opinion." *Journal of Accountancy* (November 1976): 63-70.

Kauzman, W. *Kinetic Theory of Gases.* New York: W. A. Benjamin, Inc., 1966.

Kay, J. A. "Accountants, Too, Could be Happy in a Golden Age: The Accountants Rate of Profit and the Internal Rate of Return." *Oxford Economic Papers.* New Series (Volume 28, 1976).

Koch, Bruce S. "Income Smoothing: An Experiment." *Accounting Review* (July 1981): 574-586.

Krantz, David H.; Luce, R. Duncan; Suppes, Patrick and Tversky, Amos. *Foundations of Measurement Volume I: Additive and Polynomial Representations.* San Diego and other major cities: Academic Press, 1971.

Lambert, Richard A. "Income Smoothing as Rational Equilibrium Behavior." *Accounting Review* (October 1984): 604-618.

Martin, Martin C. *Elements of Thermodynamics.* Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1986.

Massey, B. S. *Mechanics of Fluids.* Third Edition. New York; London: Van Nostrand Rheinho1d Company, 1975.

Mattessich, Richard. "Methodological Preconditions for Problems of a General Theory of Accounting." *Accounting Review (1972):* 469-487.

_____. *Accounting and Analytical Methods: Measurement and Projection of Income and Wealth in the Micro- and Macro Economy.* Homewood, Illinois: Richard D. Irwin, Inc., 1964.

McKee, A. James Jr.; Bell, Timothy B.; and Boatsman, James R. "Management Preferences Over Accounting Standards: A Replication and Additional Tests." *Accounting Review* (October 1984): 647-659.

Most, Kenneth S. *Accounting Theory.* Second Edition. Columbus, Ohio: Grid Publishing, Inc., 1982.

Morgenstern, Oskar. *On the Accuracy of Economic Observations.* Second Edition. Princeton, New Jersey: Princeton University Press, 1963.

Moses, O. Douglas. "Income Smoothing and Incentives: Empirical Tests Using Accounting Changes." *Accounting Review* (April 1987): 358-377.

North, D. Warner. "A Tutorial Introduction to Decision Theory." *IEEE Transactions on Systems Science and Cybernetics.* Vol. SSC-4, No.3 (September 1968).

Peasnell, K. V. "Technological Change and Other Aspects of the Definition of Replacement Cost for Managerial Purposes." *Replacement Cost for Managerial Purposes.* Edited by J. Klaassen and P. Verburg. Holland: Elsevier Science Publishers B.V., 1984.

Perry, Ralph Barton. *General Theory of Value: Its Meaning and Basic Principles Constructed in Terms of Interest.* Cambridge, Mass.: Harvard University Press, 1954.

Salter, W. E. G. *Productivity and Technological Change.* Second Edition, 1966. Addendum by W. B. Reddaway: Cambridge: Cambridge University Press, 1969.

Salvary, Stanley C. W. *An Analytical Framework for Accounting Theory.* McQueen Accounting Monograph Series, Volume 5. Fayetteville, Arkansas: University of Arkansas, 1989.

_____. *Accounting: A Library of Quantifications.* McQueen Accounting Monograph Series, Volume 1. Fayetteville, Arkansas: University of Arkansas, 1985.

_____. "Tracing the Development of a Conceptual Framework of Accounting - A Western European and North American Linkage: A Partial Examination." Working Paper No. 40 (1979). *Academy of Accounting Historians Working Paper Series, Vol.* 2. Edited by Edward N. Coffman, Virginia Commonwealth University, 1979.

Staubus, George J. "An Induced Theory of Accounting Measurement." *Accounting Review* (January 1985): 53-75.

Sterling, Robert R. *Theory of the Measurement of Enterprise Income.* Lawrence; Manhattan; Wichita; London: The University of Kansas, 1970.

Sunder, Shyam. "Accuracy of Exchange Valuation Rules," *Journal of Accounting Research*, Vol. 16, No. 2 (Autumn 1978): 341-367.

Tippett, Mark. "The Axioms of Accounting Measurement." *Accounting and Business Research* (Autumn 1978): 266-278.

Thomas, Arthur L. *The Allocation Problem in Financial Accounting Theory.* Studies in Accounting Research #3. American Accounting Association, 1969.

Uhr, Carl G. *Economic Doctrines of Knut Wicksell.* Berkeley, California: University of California Press, 1960.

Vickrey, Don W. "Is Accounting a Measurement Discipline?" *Accounting Review* (October 1970): 731-742.

Walras, Leon. *Elements of Pure Economics or Theory of Social Wealth.* 1926 Edition. Translated by William Jaffe. Homewood, Illinois: Richard D. Irwin, Inc., 1954.

Watts, Ross L. and Zimmerman, Jerold L. *Positive Accounting Theory.* Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1986.

_____. "Towards a Positive Theory of the Determination of Accounting Standards." *Accounting Review* (January 1978): 112-134.

Weil, Roman L. "Managing Earnings Using an Insurance Subsidiary: A Case of Restraint by Sears/Allstate." *Accounting Review* (October 1980): 680-684.

Wells, M. C. "Axioms for Historical Cost Valuation." *Journal of Accounting Research* (Spring 1971): 171-180.

Willett, R. J. "An Axiomatic Theory of Accounting Measurement Part 11." *Accounting and Business Research* (Winter 1988): 79-91.

_____. "An Axiomatic Theory of Accounting Measurement - Pan I." *Accounting and Business Research* (Spring 1987): 155-171.

Williamson, Oliver E. "The Modem Corporation: Origins, Evolution, Attributes." *Journal of Economic Literature* (December 1981): 1537-1568.