COLLECTED PAPERS

1977 and 1978 Joint Annual Conferences of The Canadian Academic Accounting Association and The Canadian Region of The American Accounting Association

June, 1977
Fredericton, New Brunswick

May, 1978
London, Ontario

L'Association Canadienne des Professeurs de Comptabilité
The Canadian Academic Accounting Association

December 15, 1978

The Members,
Canadian Academic Accounting Association.

The 1977 and 1978 joint Annual Meetings of The Canadian Academic Accounting Association and the American Accounting Association - Canadian Region were held in Fredericton, New Brunswick and London, Ontario respectively. The proceedings of both meetings are reproduced in this volume for the convenience of members and others.

Peat, Marwick, Mitchell & Co., Chartered Accountants, have generously provided their services and resources to make this volume possible. On behalf of The Canadian Academic Accounting Association, we wish to thank them for their continued support of this publication which encourages Canadian Accounting Research.

The authors of papers presented at the Conference were required to limit the length of their papers to ten pages, and we are aware that this was somewhat restrictive. A substantial number of conference papers were, at the decision of the author, not included here.

It is our hope that this volume will encourage others in the discipline to participate in further research and writing. We look forward to seeing you at our next annual meeting at The University of Saskatchewan in Saskatoon.

L. S. Rosen

L. S. Rosen,
President, CAAA.

J. H. Waterhouse,
Vice-President, CAAA.

COLLECTED PAPERS

THE CANADIAN ACADEMIC ACCOUNTING ASSOCIATION

ANNUAL CONFERENCES 1977, 1978

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University of New Brunswick,
Fredericton, New Brunswick

Monday, June 6

Session "A" Room 303

1:30 - 2:15 p.m. - "Negotiated Transfer Prices in an Uncertain Competitive World" J.E. Butterworth, D.C. Hayes, E.M. Matsumura, University of British Columbia.

2:15 - 3:00 p.m. - "Inflation Accounting & Security Prices: Some Evidence on the Contemporaneous Association Between Accounting Based Risk Measures and Systematic Risk", J. Basu, McMaster University.

3:00 - 3:45 p.m. - "Problems in Assessing the Sufficiency of Audit Evidence" R.J. Anderson, Clarkson, Gordon & Co.

3:45 - 5:15 p.m. Panel Discussion: "Audit Education"
Chairman: Dr. W.P. Lam, University of Windsor
Panelists: D. Chesley, Dalhousie
J. Davidson, Clarkson, Gordon & Co.
D. Derry, Price Waterhouse & Co.

Session "B" Room 305A

1:30 - 1:52 p.m. - "Effects of External Accounting Information and Accounting Versus Market Based Risk Measures: The Trust Companies", Per B. Mokkelbost, University of Calgary.

1:53 - 2:15 p.m. - "Human Resource Accounting", G.O. Headley, Bell Northern Research.

2:15 - 2:37 p.m. - "Accounting and Economic Allocations Compared: Conditions Underlying Objective Transfer Values", J.A. Milburn, Clarkson, Gordon & Co.

2:38 - 3:00 p.m. - "Experiments in Behavioural Accounting - A 'New' Brunswik Approach", J.L. Sweeney, University of British Columbia.

3:00 - 3:22 p.m. - "International Accounting Models: An Empirical Investigation", R.C. da Costa, J.C. Bourgeois, Carleton University.

3:23 - 3:45 p.m. - "The Usage of Notes to Financial Statements: Is the Current CICA Position Operational?", C.P. Lanfranconi, University of Western Ontario.

3:45 - 4:07 p.m. - "An Empirical Assessment of the Accounting Method for Computing Purchasing Power Gains (Losses)", C.T. Lau, Dalhousie University.

4:07 - 4:30 p.m. - "Socio-economic Development of Canada and Accounting" T. Var, Simon Fraser University.

4:30 - 5:00 p.m. - "Budget Making and the Resource Allocation Decision: A University Field Study", R.H. Crandall, Queen's University.

Tuesday Morning June 7. Sir Leonard Tilley Hall

ACCOUNTING AND MANAGEMENT INFORMATION SYSTEMS

8:30 -10:45 a.m. - Annual General Meeting: CAAS - Accounting and MIS Division, Canadian Region - American Accounting Association, Canadian Academic Accounting Association.

11:00 -12:00 noon - "Objectives of Financial Statements", Harvey Mann, Concordia University.

Tuesday Afternoon June 7. Sir Leonard Tilley Hall

SESSION "A" Room 303.

2:00-2:45 p.m. - "A New Direction for Behavioural Accounting", R. L. Daft and N. B. Macintosh, Queen's University.

2:45-3:30 p.m. - "Using Administrative Data Banks for Research Purposes", L. L. Roos Jr., N. P. Roos, Patrick Nicol and Cynthia Johnson, University of Manitoba.

3:30-4:14 p.m. - "A Research Approach to Comparing Aggregate Schedule Reporting in Data base Inquiry Systems", Izak Benbasat, A. S. Dexter, University of British Columbia.

4:15-5:00 p.m. - "Regression Analysis: An Internal Control Evaluation Technique", R. Chesley, Dalhousie University, S. R. Heimann, University of Pennsylvania.

SESSION "B" Room 305A.

2:00-2:22 p.m. - "The External Social Audit: What Are the Pension Funds Doing with Your Money?", R. Anderson, University of Regina.

2:23-2:45 p.m. - "Goal Difficulty in Budgets", V. H. Raval, University of Windsor.

2:45-3:07 p.m. - "Effects of Changing Interest Rates on Capital Budgeting Decisions", W. M. Lemon, University of Illinois.

3:08-3:30 p.m. - "The Need for Adequate Disclosure by Canadian Banks", A. Kahl and A. Belkaoui, University of Ottawa.

3:30-3:52 p.m. - "A Game Theoretical Framework for Auditing", J. L. Krogstad, University of Texas and A. Craig, Arthur Andersen & Co.

3:53-4:15 p.m. - "On The Amortization of Discounts and Premia on Bond Investments", J. S. McCallum, University of Manitoba.

4:15-4:37 p.m. - "A Probabilistic Approach to the Measurement of Contingencies", M. F. Abdel-Magid, Simon Fraser University and R. Chorba, Clarkson College, New York.

4:37-5:00 p.m. - "Audit Procedures and the CBC Act (1975)", C. W. Schandl, Dalhousie University.

M. F. Abdel-Magid
Ron Chorba

A PROBABILISTIC APPROACH TO THE MEASUREMENT OF CONTINGINCIES

Introduction

A contingency is an existing condition, situation, or set of circumstances involving uncertainty as to possible gain or loss to an enterprise that will ultimately be resolved when one or more future events occur or fail to occur. Resolution of the uncertainty may confirm the acquisition of an asset or the reduction of a liability or the impairment of an asset or the incurrence of a liability (FASB, 1975). Examples of gain contingencies include possible compensation under guarantees, and possible damages from pending litigation. Examples of loss contingencies include possible obligations related to product guarantees and product defects, pending litigation, obligations of commercial banks under standby letters of credit, loss of uninsured property, possible obligations from uninsured business risks, threat of expropriation, and guarantees of indebtedness of others.

There appears to be general agreement that the fundamental characteristic of contingencies is uncertainty (AICPA, 1958; FASB, 1975). The uncertain nature of contingencies has been incorrectly blamed for the confused treatment of contingent assets and liabilities in accounting. The real problem is the lack of a scientific approach to the measurement of accounting events under conditions of uncertainty. The failure to use probability theory in the measurement and reporting of contingencies has prevented a full application of the accrual concept to cover all the events of a given period. Consequently, the balance sheet gives an incomplete picture of the financial position of the enterprise because contingent assets and contingent liabilities are excluded from the formal measurement process, the income figures of several periods do not correctly reflect the results of operations because contingent gains and contingent losses are recognized in the period in which the uncertainty is resolved rather than the period in which the contingency has arisen, and inconsistent reporting of the same items by different firms exists because of variable interpretations of ambiguous accounting terms. Some enterprises accrue estimated losses from some types of contingencies by a charge to income before the occurrence of the events that are expected to resolve the uncertainties while other enterprises recognize those losses only when the confirming events actually occur (FASB, 1976, p.733).

FASB Statement No.5

Accounting for contingency gains and contingency losses involves two interrelated problems: (1) measurement, and (2) recognition. It was expected that FASB statement No.5 (1976, pp.732-751) would provide a logical, precise, and complete statement that applies to both types of contingencies. Instead, the FASB issued a standard that is internally inconistent and full of ambiguities.

A logical accounting policy toward contingencies should relate the method

of recognition and disclosure to the measurement characteristics of the contingency without regard to whether the contingency involves a possible gain or loss. The FASB, however, chose to follow the conventional approach and adopted different policies for contingency losses and contingency gains.

In its discussion of the measurement aspect of loss contingencies, the FASB (1976, p.733) used three terms to identify the following three types of loss contingencies: (a) Probable. The future event or events are likely to occur. (b) Reasonably possible. The chance of the future event or events occurring is more than remote but less than likely. (c) Remote. The chance of the future event or events occurring is slight.

The FASB does not provide any precise definitions of the terms likely and slight. Presumably, the determination of what is likely and what is slight is left to the accountant's judgement.

With respect to loss contingencies, FASB statement No.5 (1975) recommends the following accounting policies: 1. Loss contingencies should be accrued by a charge to income if two conditions are met: (a) information available prior to the issuance of financial statements indicate that it is probable that an asset had been impaired or a liability had been incurred at the date of the financial statements, and (b) the amount of loss can be reasonably estimated. 2. If one or both of those two conditions is not met, adequate disclosure of any existing contingency loss shall be made. This policy covers what the FASB defines as reasonably possible and remote contingency losses. 3. Appropriation of retained is not prohibited by statement No.5.

Contingency gains received minor attention in statement No.5. The FASB recommends that the provisions of ARB#50 shall continue to be followed in accounting for gain contingencies. Those provisions recommend only cautious disclosure of contingency gains. Accrual of contingency gains is prohibited because revenue should not be recognized prior to realization.

Two important questions can be raised about the recommendations of statement No.5. First, to accrue a contingency loss, the FASB requires that the loss be probable and that the amount of the loss can be reasonably estimated. But the FASB never defined the terms "probable" and "reasonably estimated". In Appendix C (p.743), the purpose for those two requirements is said to be to prevent accruals in financial statements of amounts so uncertain as to impair the integrity of financial statements. Just what is meant by the term so uncertain is not explained. Second, why is the realization test relevant to the accrual of contingencies gains but irrelevant to the accrual of contingency losses? FASB statement No.5 is a classical example of the way accounting authorities define accounting problems so that the very definition precludes the possibility of a lasting solution.

In recent years, the number and magnitude of contingencies have grown very rapidly. Airlines, drug manufacturers, auto and aircraft producers, and professionals are faced with a problem of significant proportions. The sudden explosion of this phenomenon suggests that contingencies are becoming a recurring business risk. This phenomenon can not be handled by the simplistic and expedient approaches which accountants have followed for so long. A scientific

approach is required.

An Alternative Approach

The following terms and policies are suggested for use in the measurement and reporting of contingencies: (a) Probable contingency. Information is available to define a probability distribution for the contingency. (b) Relative uncertainty. The coefficient of variation measures the relative degree of uncertainty associated with the estimated amount of the contingency. Management and accountants can set an acceptable level for the coefficient of variation before the amount of the contingency is formally recognized for accounting purposes. (c) Possible contingency. The information available is insufficient to define a probability distribution for the contingency.

Three accounting policies can be defined in relation to the terms described above. (a) Accrual. Amounts of probable contingencies should be accrued by a charge or credit to income if the coefficient of variation is less than or equal to a predetermined level set by management. (b) Required Appropriation. An amount equal to the estimated value of a probable contingency must be appropriated from retained earnings when the coefficient of variation is greater than the level set by. (c) Disclosure. Adequate disclosure of all possible contingencies should be made.

Use of Probability Theory

The application of probability theory to contingencies involves two steps. First, each contingency should be viewed as a random variable. Specifically, a contingency is a quantity which may vary over a definite range and its variation is subject to chance. In order to characterize a contingency, the set of all its possible values and the probability of occurrence of each possible value must be determined. These data form a probability distribution for the contingency. To determine the probability distribution of the contingency, the accountant may rely on information developed by the company's experts and/or the company's past experience. Since some contingencies are non-repeatable or unique events, subjective probabilities may have to be used. If a particular contingency has precedences in past experience, probabilities may be assigned on the basis of past experience provided the relative frequencies reflect management's expectations about future events. If historical data are not available or fail to describe the expectations, probabilities may be assigned on the basis of management's personal judgement. In the latter case, the probabilities must be adjusted so that their sum is equal to one. Subjective betting odds may be used for this purpose. Setting these odds is a matter of asking management to express its implicit feeling concerning what is likely to happen. On the basis of the probability distribution, the expected value of the contingency can be calculated. The expected value roughly locates a "middle" or average value for the contingency; it is not a measure of the value which the contingency is expected to assume. In fact, it can be different from all the possible values of the contingency. However, it has a definite advantage in that it gives proper weight to every possible value of the contingency and provides a basis for the calculation of a measure of variation or uncertainty.

The second step in the application of probability theory to contingencies is

to asess the extent to which the expected value is uncertain. This assessment facilitates the establishment of a cut-off point for accepting measures of contingencies in the formal measurement process. A cut-off point is essential if accountants are to avoid wholesale incorporation of subjective measures in financial statements. The standard deviation, σ, could be used to measure the actual amount of variation present in the contingency. The standard deviation, however, is a measure of absolute uncertainty and, therefore, cannot be used directly to compare the uncertainty involved in different contingencies. The measure which is particularly useful for that purpose is the coefficient of variation which is defined as the percentage of the standard deviation and the expected value: $Var_c = \frac{\sigma}{E(x)}$ where Var_c is the coefficient of variation, σ is the standard deviation, and $E(x)$ is the mean of the random variable.

The coefficient of variation relates the actual amount of variability to the size of the expected value. This makes it a very useful measure of the relative uncertainty or the relative variability of the individual expectations about the expected value of the contingency. Use of this measure makes the uncertainty involved in the measurement of different contingencies comparable. Thus, management may express its policy regarding contingencies in terms of the coefficient of variation. For example, if Var_c is greater than 30%, the contingency requires appropriation of retained earnings. On the other hand, if it is 30% or less, there is reasonable ground to accrue the expected value of the contingencies. The criterion for setting the cut-off level of the coefficient of variation should be a managerial prerogative, provided a reasonable arguement can be made for it. The cut-off level should adjusted up or down over time on the basis of actual experience with contingencies. What ultimately counts when assessing the performance of a given policy for contingencies is how good the forecasts over time.

Applications

Considering the case of a contingent asset, the uncertainty associated with the value of such an asset exhibits a number of important properties:

(1) the degree of certainty or dispersion as measured by the standard deviation;
(2) bias or skewness, the degree to which high values are more (or less) probable than low values;
(3) continuous or discrete values, i.e., are all values over a given range possible or only a finite number of specific values?
(4) dependence, where the value of one contingent asset is dependent to some degree on the realized value of another contingent asset.

All of these properties have bearing on the evaluation of a contingent asset and must be identified before proceeding with the evaluation. Ultimately, the degree of uncertainty or standard deviation is the property whose value has direct bearing on the evaluation of the contingent asset, while properties (2), (3), and (4) are important in that they dictate the methodology which must be employed in measuring the mean, standard deviation, and coefficient of variation.

The methodology for a number of important and frequently occurring cases is developed below.

Case I

First consider the case of a single contingent asset whose x is given by the following probability distribution

$$x = \begin{cases} v \text{ with probability } p \\ u \text{ with probability } q = 1 - p \end{cases}$$

Assume that this contingency is independent of any other contingency. Of course this contingency is discrete valued and bias is reflected in the size of p. For this simple Bernoulli trial we have

$$E(x) = pv + qu \qquad \sigma^2(x) = pv^2 + qu^2 - E(x)^2$$

and therefore, $\text{Var}_c(x) = \dfrac{\sqrt{pv^2 + qu^2 - E(x)^2}}{E(x)}$

In the frequently occurring special case where u = o, the coefficient of variation reduces to $\text{Var}_c(x) = q/p$ and thus, is independent of the potential value of the asset, v.

Case II

Consider a contingent asset whose potential value is distributed continuously over a finite range. As in case I, assume that this contingency is independent of any others. A well-documented and widely-used methodology for obtaining a priori asertions about the probability distribution of continuously distributed random variables is employed to obtain time estimates for component activities of large projects (PERT technique for project planning). Managers are queried concerning their optimistic (shortest), pessimistic (longest), and more likely (mode) completion times for activities assigned to them. By analogy, similar subjective estimates can be obtained to estimate the probability distribution for the future value of contingent assets (see Figure X).

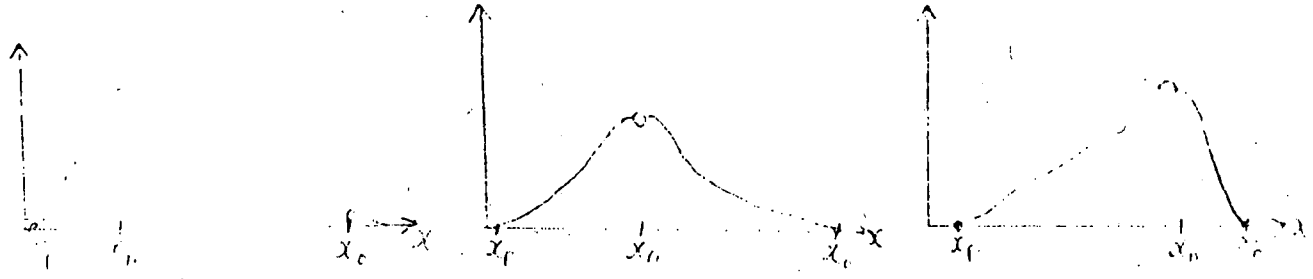

Figure X. Probability density functions for value of contingent assets as derived from PERT - type value estimates.

Let x_o = maximum value of asset, x_m = most likely value of asset, x_p = minimum value of asset.

Note that the difference between x_o and x_p provides a statement of the dispersion, while the relative position of x_m between x_o and x_p gives an indication of the bias in the potential value of the asset.

Using subjective estimates of x_o, x_m, and x_p, the PERT technique asserts that the mean and standard deviation for density functions of the type in Figure X may be approximated as follows:

$$E(x) = (x_o + 4x_m = x_p)/6, \qquad \sigma(x) = (x_o - x_p)/6.$$

Therefore, the coefficient of variation becomes $\mathrm{Var}_c(x) = \frac{x_o - x_p}{x_o + 4x_m + x_p}$.

Thus, we have a direct and generally accepted method of establishing a measure of the relative degree of uncertainty.

Case III

Now consider multiple contingencies of the discrete type in case I. Assume, for this case, that the contingencies are statistically independent. Let there be n contingent assets where the value of the ith asset is described by the following probability distribution:

$$x_i = \begin{cases} v_i \text{ with probability } p_i \\ u_i \text{ with probability } q_i = 1 - p_i. \end{cases}$$

The evaluation of the relative uncertainty of each asset separately would proceed as in case I, and a decision to report or not report made on each. However, such a procedure does not tell the full story concerning the net uncertainty in the financial statement. Let s represent the sum of the potential asset values

$$s = \sum_{i=1}^{m} x_i.$$

Then

$$E(s) = \sum_{i=1}^{m} E(x_i) = \sum_{i=1}^{m} (p_i v_i + q_i u_i),$$

and

$$\sigma^2(s) = \sum_{i=1}^{m} \sigma^2(x_i) = \sum_{i=1}^{m} [p_i v_i^2 + q_i u_i^2 - E(x^i)^2]$$

$$= \sum_{i=1}^{m} (p_i v_i^2 + q_i u_i^2) - \sum_{i=1}^{m} [E(x_i)^2].$$

From the above we can obtain $\mathrm{Var}_c(s) = \sigma(s)/E(s)$

As an example of the kind of problem which might develop with multiple contingent assets consider two identical, independent contingencies where

$$v_i = v_2 = 2 \qquad u_1 = u_2 = 0 \qquad p_1 = p_2 = .8$$

Then $\mathrm{Var}_c(x_1) = \mathrm{Var}_c(x_2) = 0.5$ and, if our criterion for reporting is $\mathrm{Var}_c(x) \leq 0.4$, neither asset would be reported. However, if we consider the sum, $s = x_1 + x_2$, as a contingency we obtain $E(s) = 3.2$ $\sigma(s) = 1.13$ and $\mathrm{Var}_c(s) = 0.35$. Combining the contingent assets reduces the relative degree of uncertainty.

Case IV

Applying the ideas developed in case III to independent, continuously distributed multiple contingencies yields

$$E(s) = \frac{1}{6} \sum_{i=1}^{m} (x_{oi} + 4x_{mi} + x_{pi}) \qquad \sigma(s) = \frac{1}{6} \left[\sum_{i=1}^{m} (x_{oi} - x_{pi})^2\right]^{1/2}$$

and

$$\mathrm{Var}_c(s) = \frac{\sum_{i=1}^{m} (x_{oi} - x_{pi})}{\sum_{i=1}^{m} (x_{oi} + 4x_{mi} + x_{pi})}$$

where x_{pi} = minimum value of ith asset, x_{mi} = most likely value of ith asset,
x_{oi} = maximum value of ith asset.

Case V

Now let us relax the assumption of independence among multiple contingencies. If there is a substantial degree of dependence between contingencies it would be a mistake to evaluate them separately. However, to treat them as a single contingent asset would also be inaccurate unless the degree of dependence was almost total. Finally, the approach of cases III and IV assumes independence and is therefore inapplicable to statistically dependent assets. A valid approach to situations of dependence is to explicitly estimate the conditional probability distributions for the various assets.

It is difficult to enumerate all of the possible dependent situations which might arise and give case-by-case examples here. Some conditional probability distributions are easier to estimate than others in a given situation, temporal sequences of events might exist, and a variety of discrete and continuous valued combinations of assets might be present. Let us, therefore, take a specific example and derive a rational basis for evaluation. The reader can then extrapolate the ideas employed to other specific cases.

Let x_1 and x_2 be the values of two contingent assets which are uncertain and dependent upon each other. Further, let x_1 and x_2 be binary discrete random variables such that x_1 can take on values v_1 and u_1, while x_2 can take on values v_2 and u_2. Assume that the value of x_2 is temporally and/or casually preceded in such a fashion that the probabilities of v_2 and u_2 are dependent upon the value of x_1. Therefore, we must be able to estimate the following probabilities:

$P(v_1) = \mathrm{Prob}(x_1=v_1)$ $\quad P(u_1) = \mathrm{Prob}(x_1=u_1)$

$P(v_2/v_1) = \mathrm{Prob}(x_2 = v_2 \text{ given } x_1=v_1)$ $\quad P(u_2/v_1) = \mathrm{Prob}(x_2 = u_2 \text{ given } x_1=v_1)$

$P(v_2/u_1) = \mathrm{Prob}(x_2 = v_2 \text{ given } x_1=u_1)$ $\quad P(u_2/u_1) = \mathrm{Prob}(x_2 = u_2 \text{ given } x_1=u_1)$

where

$$P(v_1) + P(u_1) = 1, \quad P(v_2/v_1) + P(u_2/v_1) = 1, \quad P(v_2/u_1) + P(u_2/u_1) = 1.$$

Using classical laws of probability and Bayes' Theorem, the above probabilities can be derived from empirical evidence and subjective judgments. The necessary calculations can vary depending upon the nature of the probabilities which can be estimated directly. Assuming that the probabilities above can be derived the evaluation of the coefficient of variation would proceed as follows: $s = x_1 + x_2$ $\quad E(s) = E(x_1) + E(x_2)$,

where $E(x_1) = v_1p(v_1) + u_1p(u_1)$ $\quad E(x_2) = v_1p(v_2) + u_2p(u_2)$,

and $P(v_2) = P(v_2/v_1)P(v_1) + P(v_2/u_1)P(u_1)$ $\quad P(u_2) = P(u_2/v_1)P(v_1) + P(u_2/u_1)P(u_1)$.

Then $\sigma^2(s) = \sigma^2(x_1) + \sigma^2(x_2) + 2\,\mathrm{Cov}(x_1,x_2)$

where $\sigma^2(x_1) = v_1^2 p(v_1) + u_1^2 p(u_1)$ $\quad$ $\text{Cov}\ (x_1,x_2) = E(x_1x_2) - E(x_1)E(x_2)$

and $E(x_1x_2) = v_1v_2p(v_1,v_2) + v_1u_2p(v_1,u_2) + u_1v_2p(u_1,v_2) + u_1u_2p(u_1,u_2)$

It is evident that the calculations for dependent contingencies are quite formidible, even for two binary-valued contingent assets. For more complex, discrete - valued cases it might be helpful to organize the calculations with the aid of a tree diagram as shown in Figure Y for Case V.

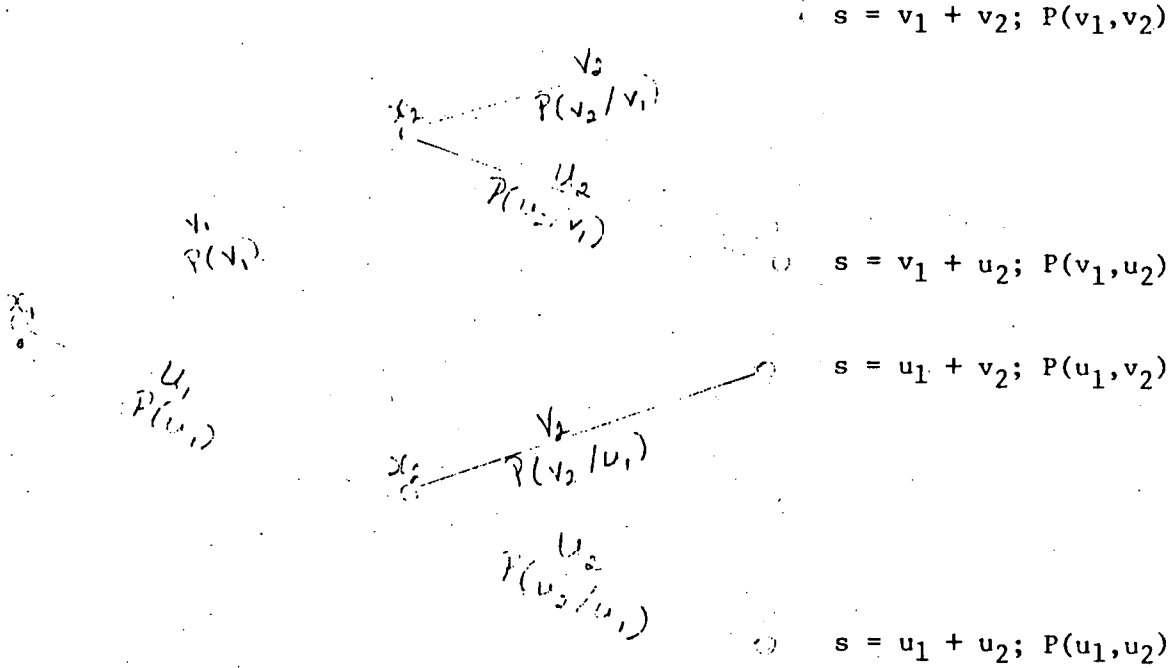

Figure Y. Tree Diagram for Case V

The initial marginal and subsequent conditional probabilities shown on the branches of the tree are specified a priori, either directly from whatever evidence or expert judgment is available. The four possible outcomes for the value of the sum, s, are enumerated at the righthand side of the "tree". Probabilities for each of these outcomes may be calculated by taking the product of the "branch probabilities" on the sequence of branches traced by moving from the specific outcome at the right to the start of the tree at the left. The sum of all these final outcome probabilities should total to unity. By using this tree diagram approach, the analyst can quickly complete the required calculations in even the most complex cases. To demonstrate the method we shall consider an example. To illustrate case V let

$v_1 = v_2 = 2$ $\quad$ $u_1 = u_2 = 0$ $\quad$ $P(v_1) = 0.8$ $\quad$ $P(v_2/v_1) = 0.95$

and $P(v_2/u_1) = 0.4$

Using the tree diagram in Figure Y we can calculate

$P(v_2,v_1) = 0.76$ $\quad$ $P(u_2,v_1) = 0.04$

$P(v_2,u_1) = 0.08$ $\quad$ $P(u_2,u_1) = 0.12$

and $E(s) = 3.28$

To calculate $\sigma(s)$ we begin by obtaining $E(x_1x_2) = (2)(2)(0.76) = 3.04$

$E(x_1) = (2)(.8) = 1.6$ $E(x_2) = (2)(.76) + (2)(.08) = 1.68$

Then $Cov(x_1,x_2) = 3.04 - (1.6)(1.68) = 0.352$

Also $\sigma^2(x_1) = (.8)(2)^2 - (1.6)^2 = 0.64$

$\sigma^2(x_2) = (.84)(2)^2 - (1.68)^2 = 0.5376$

enables us to obtain $\sigma^2(s) = 0.64 + 0.5376 + (2)(0.352) = 1.882$ or $\sigma(s) = 1.373$. Finally, $Var_c(s) = 1.373/3.28 = 0.419$.

Comparison of this example to the calculation in case III is illustrative of the need to account for dependency between contingencies. Case III and case V have $E(x_1)$, $E(x_2)$, and $E(s)$ at approximately the same levels but $Var_c(s)$ is below the critical of level 0.4 in case III and above in case V. Essentially, a positive covariance increases uncertainty (as in case V), while a negative conariance decreases uncertainty relative to independent (zero covariance) contingencies.

The Empirical Problem of Assigning Probabilities

Questions of which real-world situations can be expressed in terms of probabilities revolve around matters of definitions and interpretations. Discussions of the empirical meaning of probability have focused upon two main approaches: (1) the relative frequency approach, and (2) the subjective approach.

Under the relative frequency theory, often called objective probability, probability is applicable only to situations which can be repeated an infinite number of times under the same conditions. The objective theory of probability recognizes that repeated measurements of a stable attribute are subject to random variations. But when the whole sequence of measurements of the attribute is taken together, the average results display a predictable regularity. The foundation of the relative frequency theory is an empirical long-run stability of a given attribute. Thus, an objectivist refuses to assign probabilities on the basis of any kind of evidence other than that which can be verified by repeated trials. Moreover, a probabilistic statement does not refer to any specific events but to a sequence of events.

The subjective theory of probability measures the degree of confidence that a particular individual has in the truth of a particular statement. The subjective approach differs from other approaches in one important point: It does not attempt to specify what probability assessments are correct. The focus of the subjective theory is on two requirements: (1) The assessments of probabilities should be coherent, and (2) the assessments should correspond with the assessor's judgements.

The first requirement, i.e., coherence, is verified by checking the assessor's expressed probabilities against the basic axioms of probability theory. For this reason, the theory is partly logical because it insists upon the coherence of the distribution of degrees of belief. That is, if a particular individual has a degree of belief p in a given statement, then he should have a degree of

belief (1-p) in the denial of that statement.

The personalistic theory is subjective in the sense that different people may assign different probabilities to the same statement. Furthermore, the same person may assign different probabilities to the same statement at different times. This is a logical consequence of the theory since it views a probability assessment as a product of beliefs which exist only in the assessor's mind. Additionally, a particular set of assessed probabilities is definded only at a given point in time and is subject to revision as the assessor obtains new information.

The main concern of a subjectivist is to ensure that the assessor's probabilities correspond with his judgement (requirement 2). Although a subjectivist cannot prove or disprove this correspondence, the subjectivists have developed certain methods to help a decision maker make his assessment of probabilities consistent with his judgment. These methods include direct interrogation, betting odds, lotteries, and graphing probability distributions. It seems that the subjective approach is applicable to a wide range of problems. A subjectivist assigns probabilities to events which meet the requirements of an objectivist and many more. A subjectivist may assign probabilities on the basis of historical data as long as past relative frequencies correspond with the decision maker expectations about the future. Furthermore, a subjectivist may assign probabilities even in the absence of sufficient historical data.

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PROBLEMS IN ASSESSING THE SUFFICIENCY OF AUDIT EVIDENCE

CAAS 1977 Conference
The University of New Brunswick

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Introduction

The title of this session is supposed to be "Problems in assessing the sufficiency of audit evidence". Evidence is a concept which is properly addressed within the discipline of logic so I'll begin with a quotation from one of the great Victorian logicians. "Give your evidence," said the King: "and don't be nervous, or I'll have you executed on the spot." For auditors, as for the shaking witness in the court of Lewis Carroll's King of Hearts, the problem continues that we are not really sure of what or how much evidence is needed. And this makes us understandably nervous - whenever we are forced to think about the problem (and most of us do our best to avoid thinking about it; that is, after all, what junior staff are for). The purpose of this paper, then, is to identify some of the problems auditors (or their junior staff) face in assessing the sufficiency of audit evidence and to suggest some possible areas of future audit research.

By way of introduction, let me first define the context in which I wish to consider audit evidence; second, ask if there are indeed any problems worth discussing; and third, consider, if there are problems, whether they are likely to have a practical solution.

The external audit context

While the evaluation of audit evidence is involved in all kinds of auditing (external, internal, and governmental), I will consider it here primarily in terms of the external audit.[1] External auditors seek to obtain reasonable assurance, based on sufficient appropriate audit evidence, as to whether a set of financial statement assertions correspond to established criteria (usually generally accepted accounting principles) within limits not exceeding materiality.

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1 Some portions of this paper are adapted from material appearing in the author's book, The External Audit (Pitman Publishing, 1977).

Are there any problems really worth discussing?

If auditors are all doing a pretty good job now, do we really need any more papers on audit evidence? A pragmatist might possibly argue: by and large the auditing profession serves the public well. Most audits are reasonably well done. Sure, there are some exceptions - and some of these hit the courts. Probably there always will be a few of these. But surely we have more important problems to worry about than super-refining our auditing concepts.

It is difficult not to agree in part with this argument. There are probably not a large proportion of financial statements accompanied by clear audit opinions which are, in fact, really materially misstated. Of course, one of the frustrating things is that we can never know what this proportion is. Certainly the occurrence of a court case is too delayed and too uncertain to provide a reliable indication of the frequency of improperly given audit opinions. But I think it is likely that the proportion is not large. In any case, a real devil's advocate could argue: what is the real effect of a few materially misstated financial statements? A few investors will win by the error while a few will lose. On average the investor class will not be damaged and the capital market system will continue to perform its function of allocating capital resources. Indeed, the risk of a few incorrectly measured earnings-per-share figures is probably minute in comparison to the other risks an investor bears (unanticipated strikes, unforeseen changes in world commodity prices, sudden technological obsolescence, foreign expropriation, and so on). Perhaps publicized audit failures could detract from the general credibility added by the attest function, but investor confidence has probably been far more shaken by the impact of inflation, liquidity problems, fear of government controls and intervention, and perceived shortcomings in accounting principles, than by worries as to whether the auditors checked the records enough.

All this may be true. But it remains a fact that there is a large price tag attached to the total auditing effort borne by the economy. If this effort is not being channelled in the most effective and efficient manner, the wasted costs could be significant. One could, I suppose, posit an "efficient market" theory of auditing which would hold that the auditing profession in total automatically adjusts to the economic pressures and perceived audit risks of the day and produces today perfectly efficient audits adapted to the conditions of the 1970's - and will do so again, with no great effort on any individual's part, for the new conditions of the 1980's. Whether or not stock markets are efficient, I expect that the auditing market lacks such efficiency in even a semi-demi-weak form. It seems far more likely that the bureaucracy of auditing contains significant inefficiencies which further research could help to eliminate. When in doubt, do too much - particularly with so many lawsuits around.

What are some of the problems that may be leading to audit inefficiency - and perhaps in some, though I suspect fewer, cases to audit ineffectiveness? I would say they include the following:

(1) lingering confusion as to underlying concepts related to evidence
(2) controversy over evidence-testing or sampling methodologies
(3) uncertainties as to the use of other mathematical techniques for assessing evidence
(4) the lack of adequate knowledge of the risks which evidence-gathering seeks to control
(5) need for improved criteria for choosing among the different types of audit evidence available or for assessing their sufficiency once chosen

These questions are discussed individually in the sections which follow. There will not be time to address all five at length and I will touch only briefly on most of them.

Are there likely to be practical solutions?

Yes, I think there can be. In the last two decades the auditing profession has focussed far more on auditing concepts and problems than in the previous half-century.[2] The pioneering work on auditing concepts was done by Mautz and Sharaf in 1961. A more recent addition has been the American Accounting Association's study A Statement of Basic Auditing Concepts in 1972. The same year saw the enunciation of compliance and substantive concepts in the American Institute of Certified Public Accountants' statement on The Auditor's Study and Evaluation of Internal Control. In 1975 the Canadian Institute of Chartered Accountants issued an up-dated version of generally accepted auditing standards, followed in 1977 by Recommendations on Internal Control (which advance many of the original AICPA concepts one further step) and, last month, an exposure draft on Audit Evidence.

I believe that continued study will help to resolve some of the remaining problems and should help us all to produce effective audits at lower cost. The solution of auditing problems has been very much assisted in recent years by both theoretical and empirical research conducted by the academic community, particularly in the United States but increasingly, I hope, in Canada as well. Conferences such as this one and university symposia on auditing methods, a phenomenon of the last few years (and one in which the CICA plans to engage this November at Laval), have helped to direct this research to areas of importance to practising auditors.

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2 Robert K. Mautz and Hussein A. Sharaf, The Philosophy of Auditing (Evanston: American Accounting Association, 1961).

We practitioners need the discipline which impartial studies by the academic community can provide. Sometimes the tools of the academic turn out to be of immediate practical use in our audit work (as when statistical sampling is applied to testing or when regression analysis is applied to analytical review). But even where the academic's yardstick is not of everyday practical use, its role in validating our audit concepts is important. If we construct an auditing model which can be shown mathematically to be inconsistent in principle, then obviously the model must be changed. Mathematical discipline forces us auditors to look at the consequences of the objectives we espouse - and prevents us from simultaneously proclaiming idealistic goals and performing insufficient work to meet them when no rigorous basis has been established for connecting the latter to the former.

At the same time, academics will find the field of auditing to be fertile with unsolved problems (indeed there is an embarrassment of riches) - problems requiring the application of disciplined logical techniques and at the same time having very practical consequences.

LINGERING CONFUSION AS TO UNDERLYING CONCEPTS OF AUDIT EVIDENCE

Let us turn, then to the first of the five listed problems: lingering confusion as to underlying concepts related to audit evidence. Although the relationships of substantive and compliance verification to materiality and to required degree of assurance have been sketched in recent professional pronouncements,[3] there remain a number of questions to answer. Let me suggest a few:

1. Is the objective of substantive verification to place an upper bound on known errors, on most likely errors, or on reasonably possible errors? (surely the last) How is the bound (materiality) to be defined? And how are errors to be defined? (for example, are unbilled shipments which are no longer recoverable to be considered as errors?)
2. Is the degree of assurance demanded of substantive verification to vary only with internal control (which was the classical position) or should it depend also on the inherent risk of error for the type of item in question? (perhaps it should) Is it proper or improper for the degree of assurance also to be influenced by audit cost, audit exposure, and the availability of audit evidence? (surely it is proper but the subject is a touchy one)
3. Precision. Should the measure of materiality itself be influenced by audit findings? For example, if an unadjusted error equal to three-quarters normal materiality most likely exists, can the auditor really incur the cost of limiting all other undiscovered errors to one-quarter of normal materiality? Or must a minimum allowance (such as half normal materiality) always be permitted for undetected errors? (surely it must be)

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3 Notably in the AICPA's 1972 Statement on Auditing Standards No. 54 (now incorporated as Sections 320, 320A and 320B of its Statement on Auditing Standards No. 1) but also in the CICA's 1977 Recommendations on Internal Control and exposure draft on Audit Evidence.

4. Is it reasonable to vary the degree of reliance placed on controls (where any reliance can be placed at all) and should such a variation affect the assurance demanded of substantive work? (surely yes) Of compliance work? (perhaps yes as well)

5. Is the objective of compliance verification to place an upper bound on compliance deviations from prescribed control procedures? But are there not sometimes trivial types of deviation that do not matter? (surely yes, critical compliance deviations must be the key)

6. Precision. If the tolerable upper bound on compliance deviations is to be linked to the probability of the control system preventing or detecting material monetary error, (the classical position) how is the linkage to be established? Can an analogy be drawn between smoke detectors (compliance procedures) and thermometers (substantive procedures) whereby efficiency is gained from the expected large smoke-to-fire ratio? (I think perhaps it can). Does this mean that compliance procedures must find direct evidence of the control itself (they must be able to see smoke) and not merely the accuracy of the related transaction? (It would seem yes).

7. Should the degree of assurance demanded of compliance verification be very high (on the grounds that it provides the foundation for decisions as to substantive work) (the classical position) or can it be moderate (on the grounds that it provides corroborative evidence, less directly related to actual monetary error than is the substantive evidence which it supplements)? (I think the latter).

8. Finally, how do compliance and substantive procedures fit together into a logical decision-model for planning the audit? (Logically one should be able to do less of one and more of the other when the cost/benefit trade-offs so indicate).

These are fundamental questions which must logically be answered before one can arrive at any final basis for deciding how much audit evidence is enough. Until we resolve these uncertainties, we cannot expect our audit staff to gather exactly the right types and amount of audit evidence. In an atmosphere of uncertainty, they may well gather too much just to be on the safe side - or worse, gather sometimes too much, sometimes too little through lack of direction, thus leaving the audit at once inadequate yet excessively costly.

While the conceptual questions are fundamental, I am not going to deal with them further in this paper other than to urge your further consideration of them. The adequacy or inadequacy of some of the proposed answers to these questions (and a number of answers have been proposed by various auditors, including myself)[4] could be investigated by academics uncommitted to the auditing practices of any individual auditing firm. Their investigation could take the form of either (a) simple rational analysis, (the utility of which need not be dismissed merely because it lacks mathematical elegance), or (b) where warranted, a more sophisticated decision-theory type of analysis.

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4 The writer proposed some answers to these eight questions in a paper, The Interrelationship of Compliance and Substantive Verification in Auditing (1976 Symposium on Frontiers of Auditing Research, University of Texas, proceedings published). The points are also covered in Chapters 6, 9 and 11 of The External Audit, op. cit.

CONTROVERSY OVER EVIDENCE-TESTING METHODOLOGIES

Assuming one agrees upon a set of underlying concepts, the most obvious area in which to address the question of how much audit evidence is enough is that of testing or sampling. Here the problem is stated in very simplified terms. We assume we have agreed on the appropriateness of a particular audit step and a particular set of items of audit evidence. How many of those items of audit evidence must we examine to obtain a reasonable conclusion about the whole?

But even stated in these simplified terms we find there is considerable controversy in the auditing profession. Should testing be carried out on a judgmental basis or on a statistical sampling basis? Must a practitioner elect to do it always one way? If not, what are reasonable criteria for choosing between judgmental testing and statistical sampling in any particular case? Where statistical sampling is chosen, should it be a variables-based plan or an attributes-based plan? In the former case, should it be a mean-per-unit projection, a difference or ratio estimate, or some combination? In the latter case, should it be an unpriced classical attributes plan, a stratum-boundary-priced stratified attributes plan, or a dollar-unit sampling plan? Should statistical conclusions be drawn solely on a separate basis for each application (inventories, receivables, fixed assets, etc.) or should some way be found of statistically combining the conclusions for the audit as a whole? In the latter case, how can statistical conclusions in one section of the audit be combined with judgmental testing conclusions in some other section? For that matter, how can the extent of judgmental testing in some sections be made vaguely consistent with the extent of statistical sampling in others?

Again, I will do no more than list some of the questions requiring resolution. Various proposed answers[5] (many of which have been published) await comment and constructive analysis. This is an area where academics with a mathematical background can make an obvious contribution. After the basic questions as to sampling approach are resolved, there are a number of related practical questions. How is sampling to be applied to the multi-location client? (one, for example, with 20 locations) Where an accounting estimate is being audited, (such as an estimated allowance for doubtful accounts) how is the precision range of the audit sampling conclusion to be combined, if at all, with the precision range of the accounting estimate itself? How is a sampling conclusion derived from a test of October receivables to be related to December 31 receivables where the dollar total of the latter is much greater or much less?

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5 A number of proposed answers are suggested in The External Audit, op. cit. Chapters 12, 13, and 22. Some of the controversies can be found in reading (a) J.K. Loebbecke, CPA, and J. Neter, PhD., Some Perspectives on CAV Sampling Plans (CA Magazine, October and November 1974), (b) A.D. Teitlebaum, PhD, D.A. Leslie, CA, and R.J. Anderson, FCA, An Analysis of Recent Commentary on Dollar-unit Sampling in Auditing, (pursuant to a letter to CA Magazine, March 1975 and available on request from the authors), and (c) AICPA Auditing Research Monograph No. 2, Estimates in Sampling Accounting Populations - An Empirical Study by J. Neter, PhD, and J.K. Loebbecke, CPA.

UNCERTAINTIES AS TO THE USE OF OTHER MATHEMATICAL TECHNIQUES FOR ASSESSING EVIDENCE

The third problem area relates to the use of other mathematical techniques for assessing evidence. Foremost among these, perhaps, is regression analysis - often suggested as a more objective method of carrying out the auditor's analytical review (although Chesley is suggesting its use for evaluating internal control as well - in a paper here tomorrow afternoon). But I will limit my attention to analytical review. Analytical review consists of the comparison and analysis of related figures, ratios, and other statistics produced by an organization.

Analytical review procedures may reveal a consistency among the accounting figures which confers a far greater reliability on the records than would normally be accorded to internal evidence. Contrarily, they may reveal an inconsistency which provides persuasive evidence of errors or discrepancies which the individual accounting records in isolation failed to reveal.

All practitioners pay lip service to the importance of analytical review - but many of us worry that we are not doing it very well. Regression analysis may possibly be able to help us 1. by predicting, based on past data, the range in which current results can be expected to fall, 2. by measuring the degree of correlation observed among the past numbers in the series, and 3. by measuring the degree of assurance that a current number falling outside a specified range is a result of other than random fluctuations and therefore warrants investigation.

But practitioners differ as to whether the benefits of regression analysis will really prove sufficient to justify its introduction. Its advantages are that (1) it serves as a discipline to ensure that analytical review is really performed (though perhaps an expensive discipline), (2) it forces the auditor to identify the factors on which some accounting result should depend and therefore to focus more thought on the nature of the relationship, and (3) it helps the auditor to evaluate relationships more complex than he can easily assess judgmentally. On the other hand, some have argued that the more sophisticated regression technique at once involves 1. higher training and application costs and 2. the opportunity for misuse through carelessness or inexperience. The auditor may be tempted to juggle numerical factors mechanically to find a high apparent correlation, which may be spurious. The concentration on past trends may divert attention from a new factor which should be influencing operating results for the first time in the current year. The computerized calculations involved may generate an aura of accuracy out of proportion to the reliability of the evidence actually obtained by this technique. Advocates of regression analysis believe that the advantages outweigh the disadvantages.[6] But this is a question which could be answered

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6 A recent report on audit use of regression analysis by Kenneth Stringer, CPA of Haskins & Sells can be found in the proceedings of the University of Chicago's 1975 Conference on Statistical Methodology in Auditing - see Journal of Accounting Research, Vol. 13, Supplement 1975, p.1. Many other practitioners are currently investigating the use of regression analysis.

by empirical research. If regression analysis merely tells the auditor, at great cost, that rising sales commission expense in a period of falling sales seems strange, its improvement over judgmental analysis may be trivial. If it consistently uncovers anomalies which judgmental analysis failed to identify, its practical benefits may be very real. At the moment, I would suggest that most of us don't really know how good or bad judgmental analytical review is, so we don't know how much it is worth paying to improve on it. Empirical research is needed.

(Parenthetically, I'll add that the same argument could be raised in connection with the alleged benefits of statistical sampling over judgmental testing. In that case, however, many of us think we have already seen ample evidence that human judgment is particularly fallible at estimating the odds of error-detection in sampling - and therefore required sample extents - a fact which may have something to do with lotteries being so popular. Whether the same fallibility is present in analyzing the self-consistency of accounting data seems to me less clear - but the question deserves investigation.)

LACK OF ADEQUATE KNOWLEDGE OF THE RISKS WHICH EVIDENCE-GATHERING SEEKS TO CONTROL

The fourth problem area relates to the lack of adequate knowledge of the risks which evidence-gathering seeks to control.

The proper evaluation of audit evidence depends on (a) starting with reasonable assumptions, (b) making accurate observations, and (c) from these, drawing logical conclusions. It follows that audit risk (the complement of audit assurance) will be a combination of the risks of making faulty assumptions, making inaccurate observations, and of drawing invalid conclusions.

We may talk qualitatively[7] about measures which guard against these several faults. For example, reasonable skepticism is a much-talked-of auditor attitude which is important for controlling the risk of faulty assumptions. The auditor will usually assume that a signature appearing on an account receivable confirmation returned directly to him by mail represents agreement by an existing customer with the receivable amount indicated in the confirmation letter (though, of course, not necessarily the customer's intention or ability to pay on a timely basis). But we can all imagine circumstances in which this signature-assumption is faulty. What are the chances that an auditor will recognize such circumstances? We don't really know. We can only urge him to be watchdoggedly skeptical but not bloodhoundedly paranoic.

Again, reasonable skepticism must be appealed to for the control of certain inaccurate observations - those which arise from observer contamination

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7 A qualitative discussion of such measures is included in The External Audit, op. cit., pp. 123-126.

(inventory count teams are diligent while the auditor is watching, perhaps not when he isn't) and from the non-recognition of suspicious circumstances. Other observational errors can result from bias - "we are inclined to see what we want to see" - for which the traditionally prescribed cure is objectivity. And yet others from ignorance - "we observe only what we know how to observe" - for which the traditionally prescribed cure is competence.

Finally, lack of judgment can lead to overgeneralizations, a particular type of invalid conclusion. A test deck checking programmed controls in a computer system reveals that a hypothetical $5,300 shipment to a Vancouver customer is printed out on a special credit check list, thus apparently verifying an alleged control that all sales orders over $5,000 receive a special credit review. In fact, perhaps, only domestic sales are subject to this control and through inadvertence the program design allows hundreds of foreign sales to go through each month without this control. The auditor has overgeneralized his conclusion.

We can talk qualitatively about these risks of errors in evaluating audit evidence - but we don't really know whether the risks are significant or trivial. We have little if any empirical evidence as to the frequency with which the average auditor is misled in each of these individual steps in the audit process. The gathering of such empirical evidence would not be easy. Even how to structure the research is far from clear. One could produce simulated cases and see how often a sample of auditors were misled by them. But who is to say the simulated cases are realistic? They might only show that auditors are bad (or good) at avoiding evaluation errors in certain types of situations which, in fact, hardly ever occur in real life anyway. Or one could take a representative sample of real-life cases, research them in depth, (to find out what their true underlying error rates were) and then expose them to a representative sample of auditors - a methodology perhaps more meaningful but considerably more cumbersome. Perhaps both types of research would be worthwhile.

NEED FOR IMPROVED CRITERIA FOR CHOOSING AMONG THE DIFFERENT TYPES OF AUDIT EVIDENCE AVAILABLE OR FOR ASSESSING THEIR SUFFICIENCY ONCE CHOSEN

That brings us to the fifth problem area: the need for improved criteria for choosing among the different types of audit evidence available or for assessing their sufficiency once chosen. Audit evidence may be classified in various ways. Under one classification scheme it may be broken into nine different types: (1) observable physical evidence (as of a tangible asset), (2) concurrence of reperformance (or recomputation), and (3) observable actions of client personnel (these first three types all providing <u>direct personal knowledge</u>), (4) statements and representations by third parties and (5) external documentary evidence (both being types of <u>external evidence</u>), (6) accounting reports and records, (7) internal documentary evidence, and (8) statements and representations by management and employees (all three being types of <u>internal evidence</u>), and, finally, (9) consistency with other evidence (this very consistency itself being a form of overlapping evidence).

We may again talk qualitatively about the reliability[8] and the limitations of each of these nine types of audit evidence. For example, we can say that direct physical examination is usually the most reliable source of audit evidence for at least certain objectives (the objectives of proving existence and sometimes, by implication, ownership as well). Thus, actual audit examination of a pile of coal usually provides more reliable evidence as to its existence than does a purchase invoice, a management representation, or a third-party confirmation. Nonetheless, alternative evidence to physical examination may be acceptable in certain situations. The importance of direct physical examination by the auditor increases with the negotiability of the asset and its susceptibility to misappropriation or manipulation. Thus, for fixed asset additions, physical examination by the auditor is least important and may be restricted to inspection of major additions during the year or sometimes omitted entirely. For cash and marketable securities, however, physical examination is usually of the greatest importance. However, where assets are held by third parties, the need for physical examination by the auditor (assuming confirmation is available) will depend on the nature of the asset, the nature of the custodian's responsibilities, the reputation and independence of the custodian, and whether the asset is earmarked or intermingled with other assets held by the custodian.

On the other hand, the reliability of physical evidence is not absolute and in certain circumstances may be severely limited. It depends on the smallness of the risk of observational errors by the auditor. For example, the physical evidence obtained by the auditor's examination of a diamond inventory will be less reliable than the report of an independent and qualified diamond appraiser.

Well, one can go on like this for each of the nine types of audit evidence. But these are all qualitative comments. They might help the auditor, with respect to a specific item to be verified, to rank the nine types of audit evidence in order of declining reliability. But that still leaves unanswered the question of whether the auditor should just take the most reliable type and stop there, or take the most reliable three types, or take all nine types if available. It is true that a standard lore of audit practice has grown up - but this may often be based more on habit than on a sound conceptual foundation.

Every time a new professional pronouncement is issued, there is a tendency for auditors to add one more little bit of evidence to their bag of tricks. In many cases, this may be a desirable upgrading of auditing standards. In some cases, however, it may lead to costly overauditing.

We need, I believe, a more rational set of criteria for deciding when to draw the line - for deciding how much evidence is enough and how much is too much. Within any one individual audit step we may draw a reasonable line with respect to the quantity of the same type of audit evidence we gather (for example, the number of receivables confirmations to be sought) by employing sampling theory. But what theory do we employ to determine

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8 Such a discussion, for example, is included in The External Audit, op. cit. Chapter 10.

whether observation, confirmations, recomputation, enquiries, scrutiny, regression analysis, need all be overlaid on top of each other.

Of course, sometimes the answer is obvious. A bank loan is simply confirmed with the bank. But some cases are less clear. We traditionally observe inventories. We often do not observe fixed asset additions. We never, apart from cut-off tests, observe shipments (that is, sales transactions). Yet, they are all observable. Why the different approaches? Naturally, one can construct some sort of justification - inventory is riskier, fixed assets are safer, and sales transactions are safer because they are indirectly proved by opening and closing balance sheets, and so on. But are these the real reasons? Or is it just that auditing grew up that way (first we just checked ledger entries for everything and then one day McKesson & Robbins came along and we began to observe inventories as well)?

It should, one would think, be possible to develop a conceptual basis for deciding what different types of audit evidence are needed in any particular case. The answer may turn on the question of the audit risks (discussed earlier) associated with each type of audit procedure - and empirical evidence as to how great or small those risks are. An analysis of this problem might well be more successfully conducted from the objective vantage of the academic disciplines than from that of a practitioner with the front-line pressures of churning out audits.

Conclusion

I don't want to overstate the case. I don't believe that audits as a whole are being stupidly or incompetently performed. But there is surely scope for further analysis of how auditors can better make decisions as to the sufficiency of audit evidence. A significant number of conceptual problems await resolution - and some of them call for some amount of empirical research.[9] The economy as a whole spends millions of dollars on audit fees every year. If reliable audits can be produced more economically, this would surely be a worthwhile result.

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9 A number of the possible areas of auditing research have been outlined in Research Opportunities in Auditing (Peat, Marwick, Mitchell & Co., New York, 1976).

CAAS 1977 Conference
The University of Fredericton

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PRELIMINARY RESEARCH QUESTIONS AND FINDINGS ON THE ADEQUACY OF CORPORATE FINANCIAL DISCLOSURE

The Nature of the Problem

In most advanced countries, corporate financial disclosure is a major determinant of the efficient flow of investment capital into productive channels. In general, corporate financial disclosure may be viewed as encompassing the entire information reporting system for investment decision making. Its functions are numerous.

First, it is one of the primary regulatory tools of most securities laws. The information related to financial position, performance, and conduct of the firms whose shares are traded on the open markets contributes, through guiding investor's allocation decisions, to the efficiency of the market. In other words, lack of adequate information in the securities markets may lead to misallocation of resources in the economy (Baumol, 1965, pp. 1-8).

Hence, investors make buy-sell-hold decisions while creditors makes yes-no decisions concerning extension of credit based on forecasts of future cash flows of the enterprise. The decision maker's forecasts are based, at least partially, on information contained in the annual and/or quarterly reports of the firm. If investors make accurate forecasts, the capital market will also make efficient allocation of a nation's limited capital among and between the many competing users.

Second, corporate disclosure is a primary communication tool and determinant of the interaction between three parties: the accountors, the accountees, and the accountant. This "accountability approach" assumes two communication networks: one between an accountor and an accountee, as well as one between an accountor and an accountant (Ijiri, 1975, p. ix). The first relationship establishes the responsibility of the firms to disclose information to the users while the second establishes the scope of the accountant's activities, i.e., to report and/or verify the results of the accountant's activities to the accountee. Obviously, for these communication networks to be efficient, a consensus on the information needs of each party is essential.

The authors would like to express their appreciation to Imperial Oil Co. Ltd. which partially supported this research.

In brief, there is a need for adequate disclosure of information to insure: (1) a proper allocation of resources in the capital market and (2) a proper communication network in the information market.

In the absence of such proper, fair, and adequate disclosure of relevant information, decision makers must allow greater margins of error in their calculations. More adequate disclosure of information reduces this margin and promotes market efficiency. While accounting information may be only one part of the investor's total information system, it is likely to be the most important component. Consequently, any improvement in the nature, scope, and dissemination of accounting information is likely to result in a more efficient market. This article reports on research designed to define disclosure adequacy, determine the information needs of users, evaluate the present disclosure practices, and identify the determinants of disclosure adequacy.

Research Questions

How to Measure Disclosure Adequacy?

This question arises because of the lack of knowledge of the nature of the users and their information needs. First, the choice of a target user may vary from the "sophisticated" financial analyst to the "naive" average investor. Second, given the choice of a target user, the problem then becomes one of identifying what constitutes "adequate" information for this particular decision context.

Do the Users Agree on the Value of the Information Disclosed?

This question arises because of the suspicion that there is inter and perhaps even intra country variability in the perceived relevance of information. Knowledge of the relative importance of each information item to the users may elicit important information about their decision making process.

Do Corporations Differ in Terms of the Quality of Information Disclosed and, if so, why?

This question arises because of the belief that financial factors may be reliable determinants of corporate disclosure adequacy. Knowledge of differences in disclosure adequacy between firms and also of the determinants of these differences may be of great value in the formulation of an optimal disclosure policy.

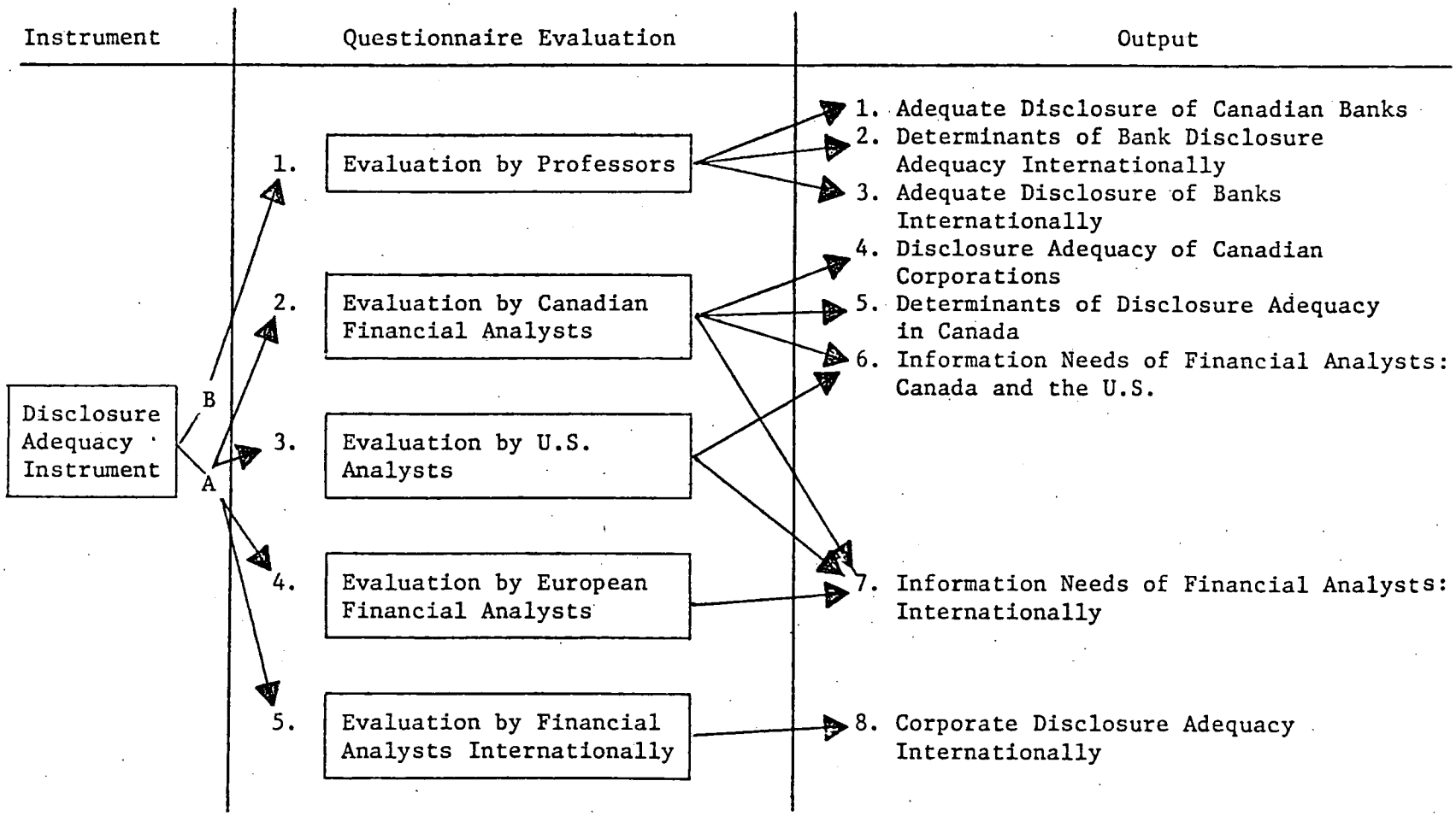
Do These Differences Exist Also Among Financial Corporations and, if so, why?

This question arises because of the belief that different financial factors may explain disclosure adequacy for banks. The results may be of potential value in the enactment of new legislation not only in Canada but elsewhere as well.

Methodology

The methodology followed in this project is shown in Figure 1 which presents a flow chart of the various steps involved.

Figure I. Procedural Steps



First Step

A disclosure adequacy instrument comprised of 30 items of information was prepared for the evaluation of non financial corporations (index A) while a slightly modified version of 29 items was prepared for the evaluation of financial corporations (index B).

Second Step

Index B was evaluated by 15 business administration professors of the University of Ottawa who ranked each item on a five point scale. The mean weights assigned to each item were used to: (1) evaluate the adequacy of disclosure of Canadian banks, (2) investigate the determinants of bank disclosure adequacy, and (3) evaluate the adequacy of disclosure by banks internationally.

Third Step

Index A was evaluated by a random sample of 200 Canadian financial analysts in the same manner as above. The mean weights assigned to each item will allow: (4) evaluation of disclosure adequacy of 200 listed and 200 unlisted Canadian non financial corporations, (5) investigation of the determinants of corporate disclosure in Canada, and (6, 7) comparison of the informational needs of Canadian and other financial analysts.

Fourth Step

Index A was evaluated by a random sample of 300 U.S. financial analysts. The mean weights assigned to each item will allow: (6, 7) comparison of the information needs of U.S. and other financial analysts.

Fifth Step

Index A was evaluated by a random sample of 200 European financial analysts. The mean weights assigned to each item will allow: (7) comparison of the informational needs of European and North American financial analysts.

Sixth Step

Index A, as evaluated by the financial analysts, will be used to (8) evaluate corporate disclosure adequacy internationally.

Preliminary Findings

The findings reported here pertain only to the completed parts of the project and are therefore preliminary. These findings pertain mainly to:

a. The choice of the average investor as the target user.

b. The informational needs of financial analysts internationally.

c. The disclosure adequacy of Canadian banks.

d. The determinants of bank disclosure adequacy internationally, and

e. The disclosure adequacy of banks internationally.

First, in order to measure disclosure adequacy, it is necessary to select the objective of financial reporting. This objective is to supply information for decision making, hence it is necessary to decide on the proper format and content of the information as well as on the target user. The proper format is that which follows generally accepted accounting principles and practices. The proper content can be evaluated by its desirable attributes, such as: relevance, understandability, verifiability, neutrality, timeliness, comparability, and completeness. On a continuum of users ranging from financial analysts at one extreme to the average investor at the other, various contents and formats might be valid.

In this research, the average investor was selected as the target user because: (a) he has the greatest need for accounting information, (b) he is the most important future source of investment capital, (c) he is unable to obtain information directly from companies, and (d) even the financial analyst can be considered as working for him since the analyst's outputs are used by investors along with other information.

Consequently, information can be considered to be adequately disclosed only if it is not misleading to the average investor. The need for more adequate disclosure can be justified on investment, accounting, and public policy considerations. Since there is a worldwide desire for more local ownership of firms which operate within a given country, it is evident that more "average investors" will have to invest ever increasing amounts of capital if economic development is to continue, and these people must be convinced by adequate disclosure to forego current consumption.

Second, in the international comparison of the needs of financial analysts, evidence in support of the existence of two basic approaches to financial analysis, the American method used in North America and the European method elsewhere, was found. The American method stresses income statement information while the European method is more balance sheet oriented. A high degree of consensus was found for Canadian and U.S. analysts while considerably more disagreement existed among the proponents of the European method (Belkaoui, Kahl, and Peyrard, 1977).

Third, for Canadian banks the present level of disclosure adequacy can be improved and probably will be in the next Bank Act. The Canadian banks tend to disclose only that which is required, making only very gradual progress in voluntary disclosure. Items of high value to investors such as: valuation method, market value, and maturity of investments were not disclosed although U.S. banks, for example, regularly provide such information as well as other items (Belkaoui and Kahl, 1976).

Fourth, the investigation of the determinants of bank disclosure internationally indicates that only the variables loans to deposits and deposits to capital were statistically significant at the 1% level with banks having higher ratios more likely to make adequate disclosure (Belkaoui and Kahl, 1976).

Fifth, the investigation of the adequacy of bank disclosure internationally shows that U.S. banks are generally superior, followed by Canadian banks, with the rest of the world, especially Asian banks, the poorest (Belkaoui and Kahl, 1976).

Suggestions for Future Research

Most of the research questions and findings reported in this study are descriptive. They show mainly only "what is" the state of the art of disclosure adequacy rather than "what should be". Future research can build on this study and should be centered on the information aspects of disclosure adequacy and its non financial determinants.

First, the future scope of disclosure adequacy should include answers to such questions as: (1) What is the nature of accounting information in comparison with other information? (2) For whom is the accounting information useful and is it presently being appropriately reported? (3) How much information is appropriate for each decision context? (4) What is the optimal set of information for insuring proper allocation of resources in the market?

Second, it is possible that, so far, unstudied non financial factors may explain why companies disclose. Examples of such variables are: (1) emulation, (2) pressure from analysts, (3) leaderdhip, (4) pride, (5) urging by auditors, (6) presumed impact on the market and on investor's behavior, (7) the benefits to the capital market of improved financial information, and (8) the cost of any changes in economic behavior induced by new accounting rules.

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A RESEARCH APPROACH TO COMPARING AGGREGATE SCHEDULE REPORTING VS. DATABASE INQUIRY SYSTEMS

Introduction

The design of Management Information Systems (MIS) generally results in providing a set of reports, mostly on paper output with a tabular data format, which the system analyst/designer, after discussions with the user, thought was necessary for solving or providing information support to a particular problem. In the late sixties researchers looked for ways of improving information systems by varying the methods and formats used for providing information. Studies on the effects of presentation media (CRT, teletype, paper output), form (graphical, histogram, tabular data), data aggregation and summarization, and on the issues of timing and reporting frequency were undertaken [see (Dickson, Senn, and Chervany , 1975), (Klaus and Jewett, 1974) for a review of such studies]. The underlying goal in these studies was to show that the same information when presented in different ways, such as graphical versus tabular data, could elicit different responses and decisions from the users of the system. They were helpful in showing that the variations in the design of MIS could improve the performance of a decision maker thereby increasing confidence and satisfaction in the systems, thus increasing their use and acceptance.

One deficiency of these studies was the assumption that the users of the MIS were a homogeneous class. Even though some studies considered subject characteristics such as age, training, education, etc., detailed studies to determine and evaluate an underlying set of behavioural variables which impact information usage were not conducted. Ignoring behavioural characteristics can have serious effects as explained in the following quote:

> "What is information for one type of decision maker will definitely not be information to another. Thus, as designers of MIS, our job is not to get (or force) all types to conform to one, but to give each type the kind of information he is psychologically attuned and will use most effectively" (Mason and Mitroff, 1973).

In our research study we are planning to analyze the effects of both the cognitive style of the decision makers and the different information systems they use. The nature of the behavioural variables and the information systems to be used in the experiment are discussed next.

Field Dependence/Independence (Low/High Analytic Decision Style)

Behavioural studies in information systems and decision making have focused on how decision makers gather information and how they evaluate this information in order to make decisions. Decision makers are differentiated into systematic or high analytic thinkers on the one end of a continuum and intuitive or low analytic thinkers on the other, based on how they evaluate information. Analytic thinkers tend to approach a problem by structuring it in terms of some method which will generally lead to a likely solution. Low analytic individuals tend to use hypothesis testing, feedback, and trial-and-error approaches to reach solutions.

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The information gathering or acquisition dimension considers the way an individual gathers data and creates information based on this data. On one extreme is the receptive individual who focuses on detail rather than patterns, and derives implications from the direct examination of data rather than its fitting the individual's precepts. On the other extreme is the preceptive individual who focuses on patterns of information, and looks for deviations from or conformities with these expectations. (Keen, 1973)

The low/high analytic dimension is one which has gained most attention in experimental research. For example, some researchers indicate that high analytic types prefer information with different format and content compared to low analytic types [(Huysmans, 1970), (Lusk, 1973, 1975), (Doktor and Hamilton, 1973)]. A survey of these studies would tend to support Mason and Mitroff's contention that the psychological style of the decision maker should be considered in information system design. Although the studies show that there are decision making style effects, it is quite difficult to get a clear understanding of the direction and extent of their impact for a variety of reasons. Among these are different operational definitions for the decision making or information evaluation models used, differences in test instruments, conflicting experimental findings, and the size and nature of experimental subject samples used. [See (Benbasat and Taylor, 1976) for a critical evaluation of the models and experimental studies.] Nevertheless, it is possible to draw some implications from the studies which would be of interest to information system designers. Analytic decision makers prefer to use decision aids and will reduce their historical report usage if such aids are presented, whereas low-analytics rely on the historical reporting system. Analytics also prefer reports which have formulas imbedded in the text, that is supported by quantitative reasoning. Low-analytic decision makers prefer more detailed disaggregated information since they would like to view the totality of the situation and rely more on feedback. These implications drawn on a limited set of research work show that the differences in styles could be significant, and more detailed and extensive research in this area is needed.

As we have pointed out previously, well researched and carefully developed test instruments which can be used for behavioural research in information systems are very limited. One such test is the Embedded Figures Test (EFT) (Witkin, et al., 1971). In this test the subject's task is to find a given simple figure in a larger complex figure. The test was developed to measure two behavioural styles called field-dependence and field-independence.

> "In a field-dependent mode of perceiving, perception is dominated by the overall organization of the field; there is relative inability to perceive parts of a field as discrete. This global quality is indicative of limited differentiation. Conversely, a field-independent style of perceiving, in which parts of a field are experienced as discrete from organized background, rather than fused with it, is a relatively differentiated way of functioning." (Witkin, Dyk, Goodenough, & Karp, 1962).

Although the basic task in the EFT seems to be associated with perception, Witkin claims the ability to 'break-up' a basic configuration will manifest itself not only in straight forward perceptual situations but in problem solving situations as well. He supported his contentions by findings which show that:

> "The significant relation frequently reported between measures of field-dependence/independence and total standard intelligence test

scores is carried largely by those portions of intelligence tests which require analytical functioning. In other words, the relation is based on the expression of a particular style of field approach in both."....
Therefore...."persons who have difficulty in disembedded Figures Test tend to do less well in solving that class of problems which require isolating an essential element from the context in which it is presented and using it in a different context." (Witkin et al., 1962)

The references cited earlier indicate that there are no well established and universally accepted measurement tools to classify people as low and high analytics. We will follow an approach used by [(Lusk, 1973, 1975) and (Doktor and Hamilton, 1973)], who in order to differentiate between decision styles used the Group Embedded Figures Test (GEFT). They classified the field-independent subjects as high-analytics and the field-dependent subjects as low-analytics. We will use the same test and attempt to verify its results with a post game questionnaire.

Structured/Aggregate Reports versus Database Inquiry Systems

The information system structure treatments used in the experiment will be:

1. structured/aggregate reports (see Exhibit 1)
2. a database inquiry capability (see Exhibits 2 and 3).

(Sorter, 1969) gives the following evaluation of two accounting approaches, the Value theory and the Events theory, which could be used to place the information structure treatments we propose to analyze into an accounting perspective.

"a. The Value Theory

The "Value" school within the committee, or as they would prefer to be termed the "user need" school, assumed that users' needs are known and sufficiently well specified so that accounting theory can deductively arrive at and produce optimal input values for used and useful decision models....

b. The Events Theory

Proponents of the "Events" theory suggest that the purpose of accounting is to provide information about relevant economic events that might be useful in a variety of possible decision models. They see the function of accounting at one level removed in the decision-making process. Instead of producing input values for unknown and perhaps unknowable decision models directly, accounting provides information about relevant economic events that allows individual users to generate their own input values for their own individual decision models. In other words, given the state of the art, less rather than more aggregation is appropriate and the user, rather than the accountant, must aggregate, assign weights and values to the data consistent with his forecasts and utility functions.

c. To Aggregate or Not to Aggregate

As had been indicated, the real difference between the two schools lies in what level of aggregation and valuation is appropriate in accounting reports and who is to be the aggregator and evaluator. The question as to who is to aggregate or value is not unique to accounting. As Ijiri points out "....any aggregation generally

involves loss of information in that the resulting total 'value' may be composed of many--possibly infinitely many--different components." Only the user can decide what is or is not significant, given his loss function."

We do not claim that the information structures to be used in our experiment completely match with the above descriptions. But the structured/aggregate report type has similar characteristics to the report types explained under the "value" approach. It contains aggregates of 20 period figures and it has a certain structure that we, as designers, think is useful for decision making under the given environment. The database inquiry option follows the similar ideas described under the "events" approach. The user of the database inquiry system chooses whatever information elements he/she thinks is useful for solving the problem at hand. In this system there is no aggregation over time; every piece of data generated by the system is available to the user. The inquiry system used in this experiment is a quite limited and simple one [see (Lieberman and Whinston, 1975) for a more sophisticated system], but we think that there is enough justification to believe that these two different information systems would lead to different decision behaviour and have different levels of desirability for different types of decision makers.

The Experimental Framework

The framework proposed by (Chervany, Dickson, and Kozar, 1972) and implemented by (Benbasat, 1974) is chosen to organize the research. The framework has three independent variable categories: the decision maker, the decision environment, and the information system affecting the dependent variables. Variables relating to the decision maker and information system categories will be analyzed in this research. The decision environment is kept constant at the operational level of an inventory-production decision making setting of an organization with a seasonally changing demand for its product.

A total of two independent variables, one relating to the decision maker and one relating to the characteristics of the information system, and their two-way interaction will be analyzed in the experiment. The dependent variables chosen for this analysis are profit performance, time performance, user satisfaction, user confidence, and the amount of information requested. The independent variables are divided into two main groups: the decision maker (low vs. high analytic) and the information system (aggregate/structured vs. data base inquiry) characteristics.

The Inventory-Production Simulator

We shall test our hypotheses by collecting data during the use of an experimental game, where the subjects will interact with an inventory-production decision making simulator. We next discuss the experimental game, the subjects, and the procedures for conducting the experiment.

a. The Physical Facilities and Decision Setting

The inventory-production decision setting is simulated using a computer programme written in FORTRAN by the authors. It is a revised version of a programme used for another research study [(Schroeder and Benbasat, 1973), (Benbasat, 1974)]. The subjects will interact with the simulator through Cathode Ray Tube (CRT) display units. This simulator has preprogrammed editing capabilities so that any illegal parameters entered will be so indicated to the subject, and corrections requested. There will be no hard copy (printer output) reports or instructions provided by the

simulator. Response time is approximately one to three seconds for report requests. An interactive simulator of this type is superior to a batch system, because excessive batch turnaround time may cause subject boredom and lack of interest in the experimental game.

The decision setting used is a multi-period decision making game. Each subject will act as the inventory-production manager of a hypothetical firm. The simulation model depicts a setting where a firm buys raw materials, manufactures a single product, and sells it daily to retailers.

Every day the firm manufactures a quantity of output depending on the production goal set by the manager and on the availability of raw materials in inventory. Any demand that can't be filled is put on backorder, with the probability of lost sales increasing with time required to satisfy demand.

The experimental game is divided into fifteen decision points, where the subjects request information and make decisions. There are twenty days between each decision point, making the total duration of the experimental game equal to three hundred simulated days. At each decision point, after they have looked at the historical reports, the subjects make three decisions: set an order point; set an order quantity; and set the daily production figures for the next twenty days. In addition, each subject is asked his or her satisfaction in the information system and decision confidence level at the end of each decision point. The subjects will not be told the duration of the game in advance to avoid end-of-game strategies. Each subject has the objective of maximizing the total profit (before taxes) of the firm for the three hundred simulated days.

Two exogeneous variables, demand and lead times, are generated by the experimenters and used as an input to the simulator. Lead time is a uniform random variable between 1 and 14 days. The demand distribution is generated by selecting points from a sine curve, with a mean of 275 and an amplitude of 75 units, and adding to each point a random number from a (0, 10) Normal distribution.

b. The Information System

The subjects will be provided with historical information at each decision point before they make their decisions. The information made available to each subject depends on the treatment group. Each subject will only be aware of his or her information system; the subjects will not be told that other subjects have different information.

In the beginning of the game, all subjects will receive the same lead time and demand history report, which shows values for 50 periods prior to the start of the game, to help them with their first set of decisions. During the game subjects in the aggregate/structured group will receive only 1 report (see Exhibit 1) for their decision making. The database inquiry subjects will receive detail reports generated by the information system (see Exhibit 2 for a list of these reports and Exhibit 3 for an example). These provide the manager with information for each of the last twenty simulated days, that is, the number of days elapsed between the present decision point and the previous one. Both information systems allow the users to go back and review from 20 to 50 days' data at a time. However, only the detail reports provide day by day data.

Detail report requests are voluntary; each subject may request any report desired and thought to be necessary for determining problem areas and making

decisions. There are no costs related to requesting information; therefore, the subject may request any detail report more than once at a decision point. The order in which the reports are requested is left up to the subject. The subject will view the reports one at a time, then decide either to request another report or end the decision point by making a new set of decisions.

Hypotheses to be Tested

The objective of the experiment will be to test hypotheses which state the possible effects of the two independent variables previously discussed on page 4, on the five dependent variables.

The following linear model will be used to represent the relationship between the dependent and independent variables:

$$Y = \beta_0 X_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_1 X_2 + E$$

Y represents the behaviour of the dependent variable; β_0 is the overall mean; β_1 and β_2 represent the main effect of the independent variables; β_3 represents the two-way interaction effect; and E is the error term. In the model $X_0 = 1$; $X_1 = 1$ if high analytic; $X_1 = -1$ if low analytic; $X_2 = 1$ if aggregate structured report; $X_2 = -1$ if database inquiry capability.

For the main (j = 1,2) and interaction (j = 3) effects, we will test

$$H_0: \ \beta_j = 0, \ H_1: \ \beta_j \neq 0$$

The null hypotheses, H_0, state that the independent variables and their first-order interaction do not have any effect on the dependent variables. For example, if the hypothesis $\beta_1 = 0$ is not rejected, we will conclude that decision making style does not have any effect on the dependent variable in question. Although, all hypotheses will be set as showing no effects, it is expected that some of them will be rejected, showing the influence of information system and decision maker characteristics on the dependent variables. A total of fifteen hypotheses, two main and one interaction for each of the five dependent variables, will be tested.

We will briefly discuss some of the hypotheses $\beta_j = 0$, that we anticipate will be rejected. We are hypothesizing that the subjects with aggregate reports will make better decisions even though they will have less confidence and satisfaction. This reasoning is supported by previous experimental work where it was found that subjects with summarized information made better decisions but they felt less confident about it (Chervany and Dickson, 1974). The better decisions would be due to less information overload and the subjects' ability to cope with it, whereas reduced confidence would be caused by the inability of the subject to get a complete understanding of the environment due to lack of period by period data.

We think that low analytic subjects would perform better with the database inquiry capabilities. Such a system would give them more feedback and thus let them better understand the structure of the game environment compared with the structured reports. It will be relatively difficult for the low analytics to break up the impact of the individual elements. High analytics, on the other hand, will find the structured reporting system more to their liking. A planned approach where the relationships that will lead to a likely solution are determined before data is collected, is the method analytics like to use in problem solving. We expect to

find the subjects using the database inquiry capabilities to spend more decision time compared to the subjects who use the aggregate reports. This would not be a surprising result because of the time it takes to integrate the data elements from a large number of individual reports.

We will use a post game questionnaire to debrief the subjects. We hope to learn about subjects' decision approach, feelings of usefulness of reports, interest in the game, and the amount of effort spent in making decisions. Finally, the post game questionnaire will allow us to double check the validity of the GEFT. It will consider the stability of the decision maker's approach to the game. The low analytics are expected to use more trial and error, i.e., a less stable decision approach.

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Exhibit 1

Example of an Aggregate Report

Periods 1 to 20

I. RAW MATERIALS (RM)		
RM Inventory - Beginning		1000
RM Received:		
+ RM Orders Outstanding - Beginning	0	
+ RM Ordered during Period	6000	
- RM Orders Outstanding - Ending	1800	4200
RM Available for Production		5200
Less RM Used in Production		4960
Ending Raw Materials Inventory		240
NOTE: Average lead time was 6.44 days.		
II. FINISHED GOODS (FG)		
FG Inventory - Beginning	500	
+Production	4960	
FG Available for Sale	5460	
-Sales	5460	
Ending Finished Goods Inventory	0	
III. SALES DURING PERIOD		
Backorders - Beginning	0	
+Demand during Period	6327	
Total Demand during Period	6327	
-Backorders - Ending	329	
-Lost Sales during Period	538	
=Sales during Period	5460	
IV. REVENUES & COSTS ($)		
Sales Revenues		1638000
Raw Material Carrying Costs:	611	
Finished Goods Carrying Costs:	1409	
Ordering Costs:	1000	
Receiving Costs:	1200	
Raw Materials Used Costs	421600	
Backordering Costs:	480	
Production Costs:	831289	
Total Cost:		1257589
Profit before Taxes		380411

Exhibit 2

Data Elements Available in the Database

1. Demand History
2. Lead Time History
3. Inventory of Raw Materials on Hand
4. Inventory of Finished Goods on Hand
5. Raw Materials Ordered
6. Raw Materials Received
7. Quantity of Demand Lost
8. Quantity of Goods Produced
9. Quantity of Backorders Placed
10. Quantity of Outstanding Backorders
11. Quantity of Outstanding Orders
12. Sales History
13. Raw Materials Carrying Cost
14. Finished Goods Carrying Cost
15. Ordering Costs
16. Receiving Costs
17. Profit Before Taxes
18. Production Costs
19. Backordering Costs
20. Total Costs

Exhibit 3

Example of a Listed Data Format

Report No. 1

Demand History

Periods 1 to 20

1	310	11	319
2	325	12	313
3	293	13	306
4	310	14	317
5	317	15	327
6	304	16	311
7	318	17	331
8	330	18	305
9	324	19	313
10	318	20	336

CAAS 1976 Conference
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Budget Making and the Resource Allocation Decision: A University Field Study

Most of us live in organizations where resources are allocated - in some manner - to accomplish certain ends and, by default, to deny the accomplishment of other ends. By what process is this decision about the allocation of scarce resources made? A variety of possible explanations have been suggested in organization theory, economics, and game theory (to name only three areas where this issue has been considered). It is the purpose of this paper to report on a field study that was designed to see how the respondents in responsible administrative positions perceived the resource allocation decision in their own organization.

Theories of Resource Allocation

Although theories of resource allocation within organizations may at first appear to be unconnected, it is arguable that many of them are complementary, or at the very least capable of being used sequentially. In Weber's bureaucratic model of the firm (Weber, 1947), the resources allocation decision is made by the legitimated leader of the organization for the purpose of furthering his organization's objectives. It is then announced to his subordinates, and is accepted. By contrast, in the "behavioral theory of the firm" put forth by Cyert and March (1963), the allocation of the organization's resources is the end result of bargaining that takes place between the coalitions within the organization, and the resulting budget can be viewed as the peace treaty between them. They suggest that the allocation agreement for one year is usually arrived at by bargaining incrementally from the previous year's agreement.

By contrast, the economist sees the resource allocation decision within an organization as the end result of some rational process such as cost-effectiveness analysis. The utility of the various results that can be accomplished with the same scarce resources is assessed; the central decision maker then arrays the choices that are open to him, and selects those that are most "cost-effective". This approach has been discussed by Merewitz and Sosnick (1971). This approach is consistent with the bureaucratic model since both assume an all-powerful decision maker; the economist simply provides him with a method for structuring his decisions.

The cost-effectiveness approach has been criticized by Wildavsky (1966) who found the Department of Agriculture's staff were prepared to go through the form of preparing a budget on a cost-effectiveness basis, but in reality prepared it on the incremental basis suggested by Cyert and March. Wildavsky suggests that the cost-effectiveness approach made demands that were unrealistic from both a political and computational viewpoint; hence the creation of the double standard to please the boss and yet get the budget satisfactorily completed.

The economist, through the notion of the decentralized firm, has made a second, quite different, contribution to the theory of resource allocation. Under this concept, one divides up an organization into operating segments and measures both the revenues produced and the resources used by each segment. Those segments that produced an excess of revenues over costs would be permitted to expand, and those producing a deficit would be shrunk until the deficit (and/or that organizational segment) disappeared. The core of this notion is that once the original organizational arrangements are set up then detailed resource allocation decisions would be made by the impersonal forces of the market. One might still retain the annual budget review as the formal method of allocation, but the measured results of each individual "responsibility center" would provide the main criterion for resource allocation.

This economic notion was made operational in the introduction of "profit center" management in organizations that are profit oriented. However, many organizations that are not profit oriented (e.g. universities, hospitals) are under pressure to make careful use of scarce resources and the profit center concept has been adapted for their use.

In a recent study Pfeffer and Salancik (1974) used field interviews and examination of archival records to see if the resources allocated to a department were related to the campus power of that department. They concluded that the more powerful the department, the less the allocated resources are a function of the department work load and student demand for course offerings. Their findings thus confirm work already cited in this paper to the effect that in many organizations the allocation of scarce economic resources is thought to be too important to be left to any invisible (and impersonal) hand. Political, historical, and other forces are important too.

Shubik (1969) succinctly summarizes the methods of resource allocation under the brief titles of:

1. The Economic Market with a price system (e.g. the use of "responsibility center", or "profit center" decision making).
2. Voting.
3. Bidding.
4. Bargaining.
5. Allocation by a higher authority (as in the bureaucratic model outlined above).
6. Fraud, force, deceit.
7. Custom, gifts, inheritances (e.g. as in budget making that is based mainly on the previous year's budget, i.e. the "incremental" budgeting of Wildavsky's).
8. Chance.

Hypothesis

In the organization selected, responsibility center budgeting had been introduced and utilized to an increasing extent for three years. Thus it is hypothesized that most department heads in that organization when presented with the Shubik schema, would perceive some or all of the allocation processes to be at work, but would rank the economic market one as among the most important. In a discussion paper[1] intended for wide campus distribution a senior officer of the university made it clear that the budget system should be a system for "implementing academic plans and priorities, not of setting them", but he then went on to say:

> The essence of the budget system is quite simple. Each school or (center) must control its operations so that its net cost does not exceed its share of the General Income. The net cost is the difference between the income each school earns from the activities it decides to undertake and the total expense (direct plus indirect) incurred to carry out these activities. Both earned income and total expenses are in large measure controllable by the school. Budgetmaking, then, is a series of decisions made by the school (or center) to maximize the academic benefits gained through expenditure of its earned income plus its support from the General Income. (Emphasis in original).

Within the Shubik taxonomy of allocation methods, it appears that the statement above is intended to influence the university's allocation decisions by forces of the economic market to be created within the University. The question to be addressed by this study was whether, after three years of implementation, the heads of the academic departments saw economic forces as the main determinants of their departments' budgets.

The Study

The survey instrument used was a set of seven statements designed to interpret the Shubik allocation notions into a budgeting context. One allocation system, Bidding, was omitted since it did not seem applicable in this setting. As an example, the notion of the economic market with a price system was interpreted as: "It's our financial performance that counts - if we keep our revenues going up (through such things as bigger enrollments, and bigger research grants) then we will get more funds to cover our operating expenses." The notion that one year's budget is inherited from the budget established in the previous year was interpreted as "The size of last year's budget allocation in an important factor in determining the size of next year's budget." The complete instrument

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[1] The university studied is a large one in the United States. Its name will be supplied on request to any reader who contacts the author with a proposal for similar research where contact with this University would be useful.

together with the instruction sheet given to each respondent will be supplied by the author on request. Respondents were asked to rank the methods they believe to have the greatest dollar impact on their budget. The order of the seven allocation methods was semi-randomized by arranging them in three different orders and using each arrangement equally in each School.

The study included all departments in two of the professional schools (neither in the health sciences), and a random sample drawn from the faculty of arts and sciences. These three schools include the enrollment of about 60% of the University. To protect the identity of the participants they are referred to as "Schools A, B, and C". A total of twenty-three departments were included in the study.

In each department one of the instruments was completed while the author was present, and after the respondent had read the one page briefing shown in Appendix I. To save time, a second questionnaire and briefing sheet was left with the first respondent for the second member of that department to complete. The respondents were asked not to discuss their rankings with the other department member until after both had been completed. Respondents did not appear to find the instrument at all threatening, and in all cases appeared at ease in discussing the results. The author then interviewed the department member at some length to elicite information as to (1) whether the allocation methods cited in the instrument appeared to be comprehensive (they were), and (2) how the affairs of the department had been conducted differently after the introduction of responsibility centers.

Results

The hypothesis to be tested was that some or all of the allocation processes identified by Shubik would be perceived to be at work by the heads of departments and their administrative assistants, and that there would be some systematic pattern to the allocation processes that were seen to be most important. That is:

H_o: Each ranking of the resource allocation methods is equally likely.

H_1: At least one of the allocation methods is ranked higher than at least one other.

The Friedman Test of rankings indicated that the null hypothesis would be rejected at the .001 level of significance for the departments in total, and at least the .01 level for each of the Schools. In brief, some of the allocation methods did appear to be favored over others at this university.

The degree of agreement between respondents on the rankings was measured by Kendall's Coefficient of Concordance. This is reported on below, but in brief there appeared to be a varying amount of agreement within schools, and some disagreement between schools.

The results are shown in Table 1.

Discussion

It seems intuitively acceptable that some resource allocation methods will be perceived as more favored over others, hence the rejection of the null hypothesis does not seem surprising. Table 1 shows both the raw data and the average ranks assigned to each of the allocation methods, and it will be noted that the allocation methods that were least favored (Chance; Fraud, force, deceit; Allocation by higher authority) also seem likely to be the ones that would be least acceptable (at least over the long run) in a university setting.

Table 1

SUMMARY OF RESPONDENTS' RANKING OF ALLOCATION METHODS

AVERAGE RANKS FOR EACH ALLOCATION METHOD

Method	Chairperson in School				Admin Assistant in School			
	A	B	C	Total	A	B	C	Total
1. Chance	6.00	5.79	6.00	5.91	6.20	6.20	6.00	6.12
2. Bargaining	3.17	3.14	2.25	2.94	2.00	3.60	2.64	2.74
3. Voting	3.50	3.57	3.38	3.50	3.60	4.00	2.71	3.35
4. Custom, Gifts, Inheritance,	2.00	1.57	1.75	1.76	1.80	1.80	2.29	2.00
5. Economic Market	2.83	2.14	3.00	2.59	2.60	2.20	3.71	2.94
6. Higher Authority	5.58	5.79	6.00	5.76	5.70	5.20	5.50	5.47
7. Fraud, Force, Deceit	4.92	6.00	5.63	5.53	6.10	5.00	5.14	5.38

FRIEDMAN TEST STATISTIC - T - AND LEVEL OF SIGNIFICANCE IN AGREEMENT ON RANKINGS

	Chairperson		Administrative Assistant	
	T Statistic	Level of Significance	T Statistic	Level of Significance
School: A	26.11	.005 or less	17.28	.010 or less
B	16.63	.025 or less	30.96	.001 or less
C	24.75	.001 or less	17.55	.010 or less
All Departments	57.18	.001 or less	63.64	.001 or less

What does seem surprising, and of potential interest to those interested in how organizations allocate their resources, is that no single allocation method seemed to be heavily favored. Since the institution in question had been placing heavy stress on allocation by responsibility budgeting ("Each school (or center) must control its operation so that its net cost does not exceed its share of the General Income.") one might expect that allocation by the Economic Market would be seen as the dominant method. On the contrary, it ranks only second, and is closely followed by others, as is shown below:

Allocation Method	Average Ranking by Schools			
	Rank Overall	A	* B	C
1. Custom, Gifts, Inheritance (interpreted in the test instrument as incremental budgeting)	1.76	1/1	1/1	1/1
2. The Economic Market with a price system ("Responsibility Center" budgeting)	2.57	2/3	2/2	3/4
3. Bargaining	2.94	3/3	3/3	2/2
4. Voting (interpreted for the test instrument as gaining a reputation for being a highly esteemed department, and hence more able to win wide support for budget funds)	3.50	4/4	4/4	4/3

One method for measuring the amount of agreement over the rankings between the departments is Kendall's Coefficient of Concordance (Conover, 1971, p. 270). If all departments agreed on their rankings the Coefficient would be unity, and if their rankings were supplied at random it would be zero. The Coefficient of Concordance for each of the Schools and for all departments is shown below.

School	Coefficient of Concordance	
	Chairperson	Administrative Assistant
A	.49	.83
B	.74	.55
C	.72	.50
All Departments	.62	.56

In two of the Schools the Chairpersons seem to be in fairly high agreement as to the relative importance of the resource allocation methods, but there is disagreement between Schools as to what these methods are. School B tends to rank the Economic Market as second most important, while School C favors Bargaining.

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* The rank before the "/" is the Chairpersons', and the rank after is the Administrative Assistants'.

The interview following the completion of the survey offered some insight into the results shown above. The relevant factors that came out in the interviews were:

1. School A is under great pressure to reduce its expenditures further, even though it has already eliminated budget items that are considered essential for long-run viability (e.g. equipment). Last year's budget has not turned out to be as useful a lever to get budget funds as it used to be, and other methods for getting resources (e.g. bargaining, peer pressure) appear to be more important to some members of that School.

2. In School B and School C the Chairpersons are in greater agreement amongst themselves within each School. However, while both groups agree on Inheritance as the factor that ranks first, School B ranks Economic factors as second most important, while School C ranks Bargaining second. The interviews indicated that in School B the Dean had introduced the ideas of responsibility budgeting at the level of his departments, whereas in School C the Dean had deliberately avoided overt comparisons of departmental revenues and expenditures when discussing the budgets with his department chairpersons. There is thus prima facie evidence that the Dean can influence the nature of the resource allocation process, and that he is not a prisoner of the institutional structure that he inherits.

However, it will disappoint the advocates of the Economic Market approach to resource allocation to learn that this author was able to find very little evidence from the interviews that the departments had behaved much differently after the introduction of responsibility center budgeting. If asked what the main difference was after its introduction, a common answer was "There was a lot more paperwork!". Suggestions by the author that various cost-effectiveness evaluations might have been made were met with disbelief. Suggestions that a department might reduce its permanent academic staff to use the funds for other purposes, such as the purchase of equipment, were usually dismissed with the observation that staff reductions would be taken as evidence that the department had been overstaffed; hence they would lose staff and get no offsetting benefits. This expectation would be explainable under the "Inheritance" concept of resource allocation.

Conclusion and Summary

Shubik's suggestion that resource allocation can take many forms was tested in an organization that has recently made an active attempt to introduce economic criteria into its resource allocation decisions. A field survey indicated that the allocation methods were not perceived as random, and interviews with the respondents offered explanations why some allocation methods seemed to be emphasized more than others.

All three Schools indicated that "incremental budgeting" (where last year's budget is the most important determinant of this year's budget) was the single most important method. In two of the schools there was a high

level of agreement within each School as to the second and third most important allocation method, but there was disagreement between Schools. Where the Dean attempted to use concepts of "responsibility budgeting" in his deals with department heads, then economic factors were thought to be second most important; but in the other School where the Dean did not permit the concepts of responsibility budgeting to go past his own office then Bargaining was considered the second most important allocation device. The administrative assistants within both schools largely reflected the same views.

In the third, "A", School the results were more mixed. Incremental budgeting concepts were seen to be of first importance, but the level of agreement between department chairpersons was lowest of any group. It was also the only School in which the chairpersons and their administrative assistants disagreed between the second and third most important factors (the chairpersons thought economic factors were second, with bargaining third; while the administrative assistants perceived it to be the reverse).

As is usually the case, these results raise questions that further research might answer. First, it would be useful to know if the introduction of responsibility center budgeting really made much difference in the perceived importance of the various methods for allocating resources. An organizational structuralist might, for example, argue that such factors as highly imbedded institutional norms (e.g. the tenure system for academic staff), the nature of the technology used (highly labor intensive), and the services to be rendered would make it very difficult to change the relative importance of the allocation methods regardless of the wishes of the officers of that institution. As Campbell (1969) has pointed out, most reforms are carried out without making prior measures of the "before" state that one would later like to have. Such was the case here. Nevertheless, if one could find an organization that was about to make a major change in its resource allocation system the methodology of this field survey should lend itself to a "before" and "after" measurement.

Second, it would be helpful to know if one could predict the relative importance of these allocation methods in different types of industries or organizational structures. Do ostensibly profit-oriented organizations really place a greater emphasis on economic criteria in their internal resource allocation? Do organizations that place greater emphasis on hierarchy (Evan (1963), and Pugh et al (1968)) also change the emphasis on their resource allocation methods?

It is believed that the methodology set out here is robust and adaptible enough to lend itself to research extensions of the kind suggested above.

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INTERNATIONAL ACCOUNTING MODELS: AN EMPIRICAL INVESTIGATION

Three basic accounting models are alluded to in international accounting literature, - the American, the British and the Continental. The first two are exemplified in the practices of the U.S.A. and U.K. respectively. The Continental model is characterized by the relatively rigid prescription of practices which is common in parts of Continental Europe, notably France. It is often suggested that most national accounting practices are identifiable with one of these models. This implies that three international groupings exist in each of which the member countries adhere to similar accounting practices. The existence of three such groupings has never been empirically established. Using an inductive approach, this paper investigates the influence of these three national models in determining accounting practices internationally.

Literature Review

All scholarly investigation must commence by assuming the self-evidence of certain environmental facts, and the nascent literature in international accounting is no exception. One persistent assumption is that a limited number of national accounting traditions, or models, form the basis for practices observed in the non-communist world, particularly those referred to above. The American model has spread with the influence the United States enjoys through direct foreign investment; Britain and France through the institutional impact of their former colonial empires (Radebaugh, 1975).

Frequent references to one or other of the models are found, but no instances where authors question the validity of assuming that these three models do predominate. The existence of these models have been axiomatic to the development of international accounting to date. Citing several examples will illustrate the extent to which these models have become entrenched in the literature.

As early as 1911 there is proof that a tripartite classification of practices was authoritatively endorsed (Hatfield, 1966). In an address to The American Association of Public Accountants at this early date, American, British, and Continental practices were contrasted. Hatfield observed that "Continental book-keeping is more methodical, more cumbrous, more tenacious of inherited forms than the British, and much more so, than the American" (p. 181). Recent works accept this notion of three national models, extrapolating their influence to the international arena.

One encounters references to "the British sphere of accounting influence of Britain, Australia and New Zealand" (Gilling, 1976, p. 70); to "an approach usual in certain parts of Continental Europe but very foreign to the U.K. accountant and ... the American" (Burnett, 1975, p. 27); to "groups or blocks" of countries that are reputed to employ comparable practices (Ameiss, 1974, p. 108); to an Anglo-American model in which "the doctrine of a "true and fair view" and "fair presentation" provides over-all guidance to accounting practices" (Niehus, 1972, p. 95); and to "the French civil-law oriented accounting model and the British accounting traditions (which) were spread to many countries" (Seidler, 1969, p. 36). Other examples are at hand.

It is disconcerting that so central a concept has not been subjected to empirical testing. Though extensively cited, these models are less regularly

defined. This is inconsistent with the development of a coherent body of knowledge in international accounting. Empirical grounds must be found for accepting or rejecting the dominance of these three models.

International accounting must learn, and borrow, from social sciences which have traditionally been concerned with the international dimension of human behaviour. The cross-national study of accounting can contribute to international understanding (Kollaritsch, 1965). Advances require that international accounting be viewed as one manifestation of a global phenomenon, namely the proliferation of transnational activities. Spanning a cross-section of functional contexts, these activities, conducted by various national elites, increase the sensitivity of countries to one another (Nye and Keohane, 1971). Accountants have been criticized for the naivete of their assumptions about the social sciences (Willingham and Sorenson, 1971), and must avoid this pitfall by adopting an interdisciplinary approach. Pursuing linkages with international relations theory will provide insights on fruitful research avenues.

Russett's innovative delineation of international regions (Russett, 1967) provided the inspiration for the inductive approach to be employed in this paper. For eighty-two countries he derived five basic socio-cultural dimensions from a selection of fifty-four characteristics on which nations vary (p. 15). Clusters were then derived in which nations grouped on the basis of their socio-cultural homogeneity (pp. 23-35). These international groupings could then be explained, a posteriori, on the basis of observed and intuitive relationships amongst the members of each international grouping.

It is our contention that a similar approach can be used to discern international "regions" of accounting homogeneity. These regions, or groupings, would establish those countries which subscribe to a similar inventory of accounting practices. Group membership will constitute evidence that countries subscribe to the same accounting model. If international practices are pervaded by the notional American, British and Continental models, three clusters should be derived, in which the United States, Britain and France should be prominent, if not dominant, members.

Research Methodology

Our purpose was to uncover groups of countries which exhibited a homogeneity of accounting practices. The first requirement was to select a set of accounting practices on which countries were likely to vary. Such a data base already exists (Price Waterhouse, 1973). It contains over two hundred accounting principles and reporting practices (collectively referred to here as accounting practices) and the extent of their application in thirty-eight countries. This large selection of practices in the data base was screened in order to obtain the following advantages. The data became more manageable, given computer limitations, and we eliminated some obviously non-discriminatory practices. The result was a sample of one hundred relevant accounting practices. Responses were ordinally scaled from 1 to 5 for the following given responses. The accounting practice:

a) is not permitted or found in practice (1);
b) is followed by a minority of reporting companies (2);
c) is followed by about half of reporting companies (3);
d) is followed by a majority of reporting companies (4); or
e) is required of, or conventionally followed by, all reporting companies (5).

It was felt that practices which were highly correlated could be grouped, as they would probably measure some basic theme underlying accounting practices internationally. In the second step, a principal components factor analysis

(Mulaik, 1972; Nie et. al., 1974) was carried out. This grouped those practices which were highly correlated into a common set of practices. Seven completely independent (orthogonal) factors, or themes, underlying international accounting practices were derived from this analysis. These themes represented a cross-section of possible accounting concerns. They were interpretable and accounted for a significant percent of the variance (63%) in the original practices.

In any subsequent comparison of the practices of our sample countries, we would only need to compare them on these seven themes, rather than on each of the one hundred individual practices. This greatly reduced the comparison task, as well as computer time and cost. It also enhanced the likelihood of interpretable results by providing evaluative dimensions which were not overly specific. Being of a general thematic nature, the results would tend to have a universal, rather than a particular, import.

The third step was the grouping of the countries by the similarity of their accounting practices. First, we calculated each country's sum score on each theme (factor). This was obtained by summing each country's raw scores for practices which exhibited significant theme (factor) loadings. (In this instance a correlation coefficient of 0.4, or greater, with a theme was deemed significant.) These sum scores on each theme, for each country, constituted the input data for a Q-analysis (Nie et. al., 1974).

In the second step, we grouped individual practices into sets of homogeneous practices. Next, we clustered the units of observation (countries) into an unspecified number of homogeneous clusters. (This clustering is based on a similarity index calculated between any two countries. This index is very similar to the simple correlation coefficient between two variables, except that here it is between two countries.) The procedure yielded two clusters - each an international grouping in which member countries exhibited a homogeneity of accounting practices.

The procedures followed, first reduced variables to underlying themes, then clustered countries on the basis of their similarity on these themes. The steps employed are akin to those used by the promoters of the BC TRY system (Myers and Nicosia, 1968; Tryon, 1967; Tryon and Bailey, 1970). Sethi (1971) has shown a similar procedure to be appropriate in international business for delineating clusters of countries that represent homogeneous markets.

Results and Discussion

To our knowledge there is no empirically derived data on basic themes which underlie financial accounting practices in a broadened, international arena. We identified seven underlying themes, for which the following labels seemed appropriate:

1. A measure of Financial Disclosure
2. Company Law as an influence on accounting practices
3. Stress of reporting practices on Income Measurement
4. "Conservatism" as a guiding principle
5. Tax Law as an influence on accounting practices
6. Inflation as an environmental consideration
7. Orientation of reported information towards capital market users.

In themselves these are interesting results, but space limitations preclude a discussion of them. Our prime concern is in discovering those countries whose practices are similar across all seven themes.

Two groups were revealed. These are shown in Exhibit A in rank order, based on their correlation coefficient with the factor (group) with which they

were most closely identified. EXHIBIT A

Countries Grouped on the Basis of the Homogeneity of Their National Accounting Practices

Countries	coefficient with Factor 1	coefficient with Factor 2
Group 1; nc=26		
Japan	0.95	0.28
Philippines	0.91	0.28
Mexico	0.93	0.32
Argentina	0.93	0.32
Germany	0.90	0.42
Chile	0.90	0.41
Bolivia	0.89	0.43
Panama	0.89	0.45
Italy	0.88	0.43
Peru	0.88	0.43
Venezuela	0.88	0.46
Colombia	0.86	0.50
Paraguay	0.86	0.48
U.S.A.	0.86	0.05
Pakistan	0.85	0.49
Spain	0.85	0.49
Switzerland	0.84	0.53
Brazil	0.83	0.51
France	0.83	0.53
Uruguay	0.82	0.52
Sweden	0.81	0.59
India	0.81	0.57
Ethiopia	0.81	0.57
Belgium	0.79	0.60
Trinidad	0.76	0.65
Bahamas	0.75	0.65
Group 2; nc=10		
United Kingdom	0.004	0.98
Eire	0.19	0.96
Rhodesia	0.48	0.87
Singapore	0.50	0.86
S. Africa	0.51	0.86
Australia	0.51	0.85
Jamaica	0.54	0.84
Kenya	0.57	0.81
New Zealand	0.62	0.78
Fiji	0.65	0.75
Factorially Complex Countries - Unclassifiable		
Netherlands	0.66	0.74
Canada	0.66	0.47

The British Model

Former British Empire Members

Most striking is the discovery of a distinctly Commonwealth group (South Africa's and Eire's presence notwithstanding) with the United Kingdom as its "leader". The United Kingdom has 96% of the variance in its accounting practices accounted for, or determined by this factor. With a correlation coefficient as high as 0.98, it seems that Factor 2 is in fact a model of the accounting practices of the United Kingdom. In this group accounting practices converge because of the extent to which national accounting practices are modelled on those of the United Kingdom.

This is plausible, for all the countries in this group have belonged to, or still belong to, an international political entity in which the United Kingdom has been the central influence. Professional traditions in these countries trace their roots to a common metropolitan system of professional education, in which values were allocated centrally. It is no surprise to find that values emanating from the United Kingdom have played a major role in the evolution of accounting practices in these countries. They all formerly belonged to the British Empire. The manner in which this colonial heritage can permeate the accounting institutions and practices of a country are incisively described elsewhere (Perera, 1975).

The first group (Factor 1) of countries did not intuitively lend itself to any categorization, appearing to be of a general nature; at least until a subtle relationship between the groups was uncovered. We argued above that

Factor 2 was a model of British accounting practices. The uniqueness of Factor 2 to British practices can be corroborated as follows. Factor 1 explains none (0.0016%) of the variance in the United Kingdom's accounting practices and, indeed, the United Kingdom is the country most dissociated from Group 1.

The United States enjoys a similar status, vis-a-vis Factor 2. It is the country most dissociated from the British model. The British model (Factor 2) accounts for a mere 0.25% of the variance in accounting practices in the U.S.A. The United States is the country most unambiguously distinguishable as a Group 1 member. This is because of the absence of ties to the British model, and its very high correlation coefficient (0.86) with the alternative factor. The case for looking beyond immediate relationships in this way is pointedly made in Exhibit B. It shows a rank ordering of Group 1 countries on the strength of their dissociation from the British model.

Exhibit B

Group 1 Countries Ranked on the Basis of Their Dissociation From the British Model of Group 2

Country	correlation coefficient with Factor 2
U.S.	.05
Japan	.28
Philippines	.28
Argentina	.32
Mexico	.32
Chile	.41
Germany	.42
Bolivia	.43
Peru	.43
Italy	.43
Panama	.45
Venezuela	.46
Paraguay	.48
Spain	.49
Pakistan	.49
Colombia	.50
Brazil	.51
Uruguay	.52
France	.53
Switzerland	.53
India	.57
Ethiopia	.57
Sweden	.59
Belgium	.60
Trinidad	.65
Bahamas	.65

The American Model

International grouping corresponding closely to concept of a U.S. "sphere of influence"

Amongst these countries the United States is definitely the group leader. American influence in determining accounting practices internationally becomes evident upon viewing the results this way. Countries in Group 1 which follow the American lead in dissociating from the British model are societies which have been especially pervious to American influence. These countries have constituted elements in a U.S. "sphere of influence", experiencing significant amounts of American economic direction, aid, trade and investment. The Latin countries are members of a geopolitical grouping that has been characterized as a region of U.S. hegemony (Furtado, 1969; Sunkel, 1972). Latin American dependence on the United States and its ramifications for the development of accounting have been described by Elliott (1972). Germany and Japan have also experienced a major American influence, notably in the post-war rehabilitation of their economies. Particularly Japan, where a modern accounting profession was founded at the instigation of the American occupation officials (Nakajima, 1973).

Credence is leant to these interpretations by the somewhat schizoid profiles for Trinidad and The Bahamas. These countries have experienced significant American influence in their economic development, even while colonies of Britain. Trinidad, through longstanding American interests in its oil industry (Girvan, 1973) and The Bahamas, through American investment

in its tourist, banking and financing industries. Historically, these countries have good reason to adhere to a metropolitan, British model, The Bahamas gaining independence only as recently as 1973. Consequently one would expect, and does find, less dissociation from the British model, despite their membership in Group 1. Thus, in reordering Group 1, a second intuitive model has been uncovered. It is distinguished by its dissociation from the British model. In terms of national practices it finds its best exemplification in the themes which differentiate American practices from British accounting.

Both the U.S. and the U.K. are countries which have exerted, or still exert, a strong influence in the development of socio-economic values in other countries. American and British accounting firms are the only ones which extend their activities to foreign soil to any significant degree (Queenan, 1965). In doing so, they exert a dominant influence over the development of indigenous accounting practices.

The equanimity between groups displayed by Canada and the Netherlands is instructive here. The Netherlands is a sophisticated maverick in the international accounting community. Its profession has a particular belief that business economics is the correct theoretical framework in which accounting practices should be developed (Mueller, 1967; Davidson and Kohlmeier, 1966). It follows its own unique accounting model and so is unclassifiable in terms of the two dominant models.

Canada is the victim of centrifugal forces. Anglophile accounting traditions have been amended to accommodate the separately rooted legal and cultural traditions out of which commercial and accounting practices have evolved. This confusion of indigenous influences would tend to exclude it from either grouping. But because of the ubiquitous American presence in Canadian economic affairs (Levitt, 1970), Canada tends to the American grouping, yet not so strongly as to meet the criterion of group association. Apparently it did not score high enough on the similarity index alluded to earlier (p. 7, supra). It displays even less affinity with the British grouping with which it shares traditional, but weakened, political and commercial ties.*

Conclusion

The United Kingdom and the United States exercise a major influence over the development of international accounting practices. A group of countries, former British Empire members, follows accounting practices which constitute a distinctly British model. A second group follows the lead of the United States in dissociating themselves from practices common to the British model.

It might appear that United States practices are insufficiently differentiated from British practices, for them to comprise a unique and distinctive model on their own. They do, however, lead the way in offering alternatives to practices found in the British model.

A more likely explanation is that the British model is a basic (original) model underlying contemporary international accounting. The other (American) model is a derivative of it. This is consistent with historic facts surrounding the establishment of the American accounting profession, which owes much to British accounting traditions (Peloubet, 1966).

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*As a matter of fact, where no authoritatively defined Canadian practice exists, it is not an uncommon professional approach to rely on official U.S. pronouncements, applying an American method in Canada. This tendency can only be accentuated by the more centralized organizational structure found in Canadian subsidiaries of American firms (Bourgeois, J.C. and J.P. Siegel, 1974). Management discretion in the choice of accounting policies in these firms would tend to favour adoption of an American practice (Hauworth, 1973).

The United States has, nonetheless, developed practices which distinguish it from those of its erstwhile mentor. These alternative practices have been projected abroad, affecting the development of accounting in countries which comprise an American sphere of influence. We demonstrated that an American model does exist, but it is a derivative of an already extant model - the British model. It might be better to describe this earlier British model as a proto-model, that has spawned a related, but separately distinguishable derivative.

Contrary to common assertions, the dominant role ascribed to a Continental model of accounting appears to be invalid. We uncovered no group of countries which followed a distinctly Continental set of practices. This could reflect a limitation imposed either by the sample of countries, or the methodology employed. But the sample did include major European countries - to wit, Germany, France, Italy. Any combination of these could have provided a Continental axis on which a distinctive set of accounting practices could have been founded. As we described earlier (pp. 2; 3), this methodology has been successfully employed for the purpose of delineating international groupings; both in the context of International Relations, as well as International Business.

Implications for Future Research

In this study we subsumed "accounting principles" and "reporting practices" under one heading - "accounting practices". Probably the two should be distinguished in view of recent research findings. These indicate that approaches to financial disclosure are not significantly different amongst countries in the economically advanced world (Barrett, 1975). Disclosure (and, one supposes, reporting practices) may not be sufficiently different to constitute valid grounds for discriminating amongst economically advanced countries.

In an extension of this study we intend to investigate the possibility that different models apply in separate contexts. Some in the case of international accounting principles, others in the case of international reporting practices. In the first instance, groupings might follow historical patterns similar to those that emerged in this study. In the case of reporting practices, groupings should be more susceptible to contemporary influences, particularly the integration of capital markets (Choi, 1973; 1974). Groupings could well reflect the trend towards, and effects of, integration in the Atlantic community (Deutsch, 1957). This should be especially noticeable amongst European countries with respect to efforts to create common reporting standards (Bedford and Gautier, 1974), and as a result of transnational alliances amongst business elites (Feld, 1970).

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HUMAN RESOURCE ACCOUNTING

Introduction

Human resource accounting can be a positive asset to the company which encompasses its usage. However, for it to be effective, our attitudes as accountants must be drastically changed. We must be willing and able to adjust our thinking when confronted with obvious needs in such a vitally important area.

Conventional accounting methods have penalized managers in the past, and will continue to do so in the future, making them reduce their ability and know-how in terms of proper long-range planning, and their impact on determining company results.

From the earliest days, the value of people in any organization has always been considered, but usually only considered. Quite a bit has been also recorded about the value of this resource. There have been scores of systems and programmes to develop and possibly implement behavioural knowledge and to utilize the latent effectiveness of this resource. Unfortunately, few feasible methods have been really developed and reported on a large scale basis in financial statements.

Accountants and Their Systems Responsible

> "The accounting system is crucial to the problem. The business practitioner's perspectives and behaviur are intimately associated with the accounting treatment of the firm's realities. Yet little attention is paid to the accounting system in the typical behavioural programme. The proponents of these programmes do not become involved with the practical difficulties of describing the human resource in the accounting system....And in the accounting profession itself, there is a growing recognition of the need to improve the accounting system with respect to human resource accounting so that it more properly respresents the firm and facilitates the accumulation of information important to effect management and accurate reporting." (Dimian and Venskus, 1975)

Definition and Objectives

> "Human resource accounting is the process of identifying, measuring and communicating information about human resources in such a way as to facilitate effective management within an organization. In a particular organization, it involves measurements of the acquisition cost, replacement cost, and economic value of human resources and these changes through time." (Brummet, Flamholtz, Pyle, 1968)

The main objectives of human resource accounting are:
- to provide managers with information about human resources which will assist in decision-making,
- to provide managers with feedback on their performance in managing the organization's human assets,
- to provide management with a more accurate accounting of its assets, income, and its return on total assets employed, rather than physical assets only.

The aim of this paper is to show the possibility and probability of the usage to management and accountants of human resource accounting, and to develop a feasible model for the purpose of so doing.

History

The R.G. Barry Corporation of Columbus, Ohio was a pioneer in human resource accounting in 1967. In the same year Rensis Likert devised a system of measuring changes in the value of human assets through time. Lee Brummet, Eric Flamboltz and William Pyle also added their concepts of human capital and human resource value. Mathematical techniques were developed by Baruch Lev, Aba Schwartz in 1971 and further developed in 1974 by Samcha Sadan and Len B. Auerbach. These theorists used the idea of an accounting surrogate to develop the necessary accounting transactions.

Evolved Model

Most theorists have reached a certain point in their development of some kind of model or system to account for human resources. But there is invariably the situation where there is neither continuity nor conclusiveness as to how we should include these values or costs of the people to the organization in the balance sheet, instead of only the profit and loss statement, or some other financial or personnel department statistics.

The accounting model I have developed is set up in two inter-related sections. The initial part demonstrates a design for managing human resources. It is an adaptation of some system designs and the theory of human resources matrixing. Some basic principles must be integrated to make this model functional:
- All information that is pertinent to human resources should be gathered in a manner that permits easy retrieval.
- Plans for future staff recruitment should be smoothed for proper manpower planning forecasts.
- The principle of succession should be paramount.
- All information should be kept up to date.

An integration of these principles must be done to ensure that as the organization changes year by year the information system developed for the purpose of human resources will also keep pace.

The second half of the model involves the mathematical process of evolving transactions to arrive at the end of an accounting period profit and loss statement and balance sheet. The techniques used are a combination of

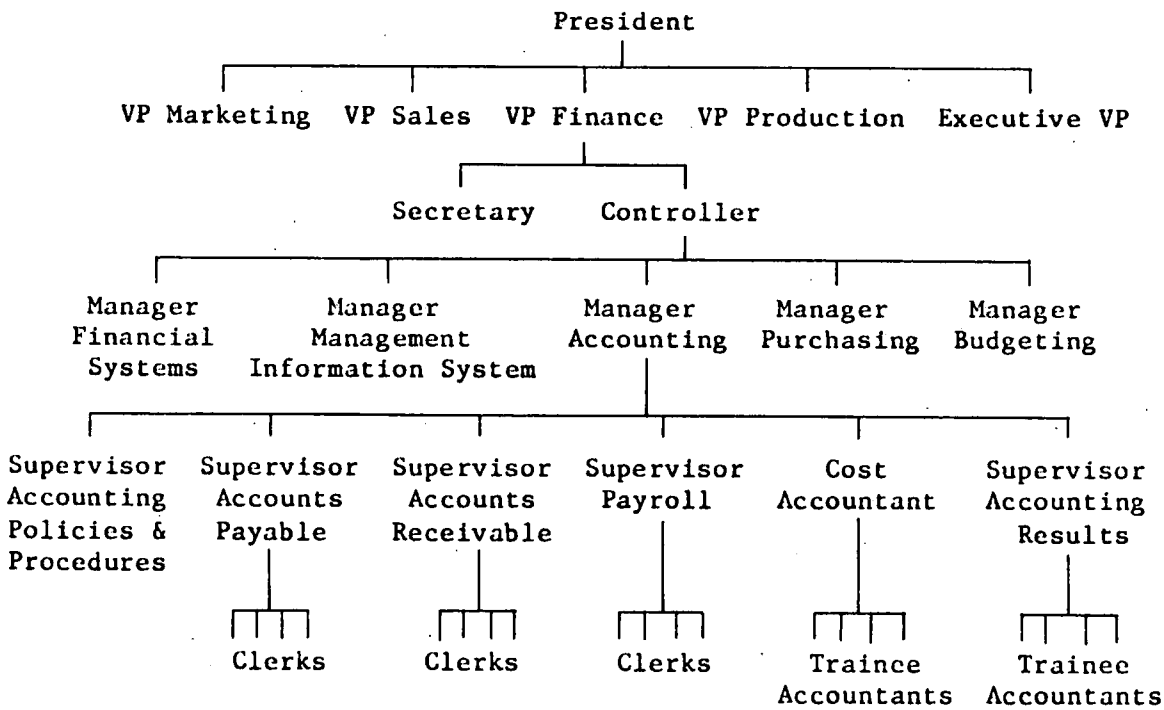
replacement cost, present value of future earnings, and a mathematical model to verify capitalization of "human assets". This is supported by logic to ensure acceptable accounting principles and practice are adhered to where possible.

Organizational Model

Our model is based on the organization chart as it relates to the people's efforts to achieve their individual goals.

Using human resource matrixing, we adapt the format of the career ladder for the administration division of a dummy corporation with a detailed chart of the controller's organization. There is a likely possibility of each clerk or accounting trainee achieving the vice-president's position with the proper career development over an assumed period of time.

ORGANIZATION CHART OF CAREER LADDER



Two charts could be adapted to form usable matrices:

(a) HIRING CHART

SOURCE	Wk 1	Wk 2	Wk 3	Wk 4
Agencies	15	10	12	14
Business	3	16	7	7
College	5	6	4	8
Advertising	0	3	2	4
Personal	4	15	6	8
TOTALS	27	44	29	41

(b) QUALITY OF TURNOVER CHART

Type of Performer or Reason	Wk 1	Wk 2	Wk 3	Wk 4
Gd Perf/Gd Reas.				
Gd Perf/Bd Reas.				
Bd Performer				
Any Reason				
TOTALS				

The time frames on the above charts/matrices will be used for reporting at end of each monthly period. From them we will develop an organizational change model by level of employee.

ORGANIZATIONAL CHANGE MODEL

CLASS OF EMPLOYEE	FINANCE DIVISION	MARKETING DIVISION	SALES DIVISION	PRODUCTION DIVISION	TOTAL FOR COMPANY
Clerk					
Trainee Accountant					
Supervisor					
Manager					
Director					
Vice-President					
TOTALS					

For each of the above divisions will be calculated hiring ratios, promotion and/or demotion ratios, turnover ratios, attrition ratios, and replacement ratios. Accumulated data for the whole company will be compiled for comparison.

Annual performance appraisals, following the right patterns, will be conducted annually. A matrix of each individual ratio of efficiency will also be prepared in the same format as the organizational change model.

From the attrition and turnover ratios, and according to the volumes of work accomplished through the use of work measurement techniques, we will develop a manpower requirement report for the clerical staff on the basis of volume produced and hours worked. This will contain ground work material needed for some of the hiring costs to be included in the cost models.

The key to the majority of the costs associated with human resources is the availability of measures of human value. This will help us to develop the cost contributions of various human resource functions, based upon the value of people to the company. Therefore, a summation of data on earlier matrices showing individual ratio calculation for each resource function will be summarized on this matrix for each of the company's divisions.

SUMMARY OF MATRICES

Available Human Resource Management Strategies	Varying Types of Behaviour Ratios				
	Efficiency Ratio	Turnover Ratio	Absentee Ratio	Productivity Ratio	TOTAL INDIVIDUAL VALUE
Recruitment and Selection					
Classification					
Training					
Development					
Compensation					
Performance Appraisal					
Promotion					
Attrition					
Succession					

All various types of behaviour ratios will not necessarily apply to each management strategy. The criteria proposed for selecting each behaviour ratios will not necessarily apply to each management strategy and were determined by two behaviour specialists:

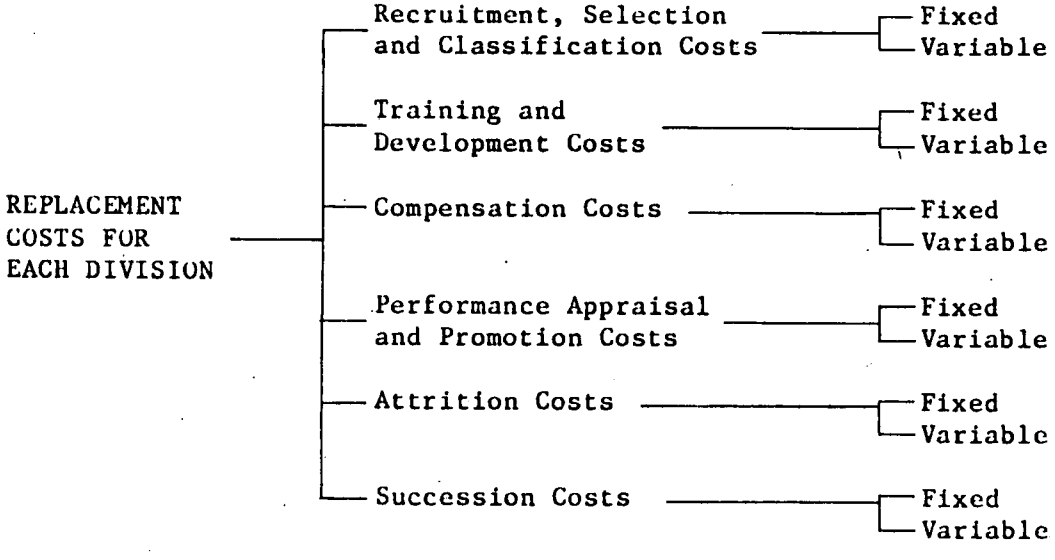
> "....it has to be so defined that it was significantly affected by the work structure;
> it has to be measurable and convertible to significant costs to the organization;
> the measures and costs of the behaviours had to be mutually exclusive." (Macy & Mirvis, 1974)

From our matrix we will determine costs of human resources in terms of recruiting and selection, classification, training, development, compensation, performance appraisal, promotion, attrition and succession, all on the basis of ratios.

One researcher into human replacement costs stated:

> "....In order to make human replacement costs a viable concept, responsibility must be placed on the operational manager for the untimely replacement of his human resources....In dealing with replacement cost we are dealing with investments made in the past in order to help with decisions in the future. If we have a picture of the future we can plan accordingly." (Davis, 1974)

Based on our earlier career model, we propose to use replacement costs as a surrogate measure to arrive at current values of human resources in financial statements, through an adaptation of Mr. Davis' model for the measurement of Human Resource Replacement Costs:



The determination as to the fixed or variable nature of the elements of cost will be measured against generally accepted principles of accounting, and is based on the economic theory of marginal costs.

Mathematical and Accounting Model

Human resources are not renumerated upon acquisition in most cases, thus yielding no monetary measure for their value. They are not, according to most theorists, capable of being entered on a "transaction - measurable accountable event". The theory of asset acquisition, which could be used, is based on two methods:

- the accrual method, which is an accounting transaction involving a monetary renumeration in advance for the asset's future expected services (value).
- the second type of acquisition which does not comply with the conditions of renumeration in advance, and therefore should not be included in financial statements.

Since we cannot use the second type of acquisition method, as it precludes inclusion in financial statements, we need some type of surrogate accounting transaction, to record asset acquisition.

Using the data from our organizational model, it is possible to calculate the value of the employee's expected future services to the company. This represents an individual's conditional value, or his value to the firm if we ignore the probability that he might leave the organization.

Two important surrogates can be measured either in terms of profit which employees contribute to the firm or in terms of revenues which employees bring to the firm. The revenue surrogate appears to be a better one.

The value of the employees for one period of time may be determined by multiplying the number of employees expected to be in each class at the end of the period by the amount of services expected from these employees at their respective classes. The expected number of employees in each class at the end of the period will be determined by multiplying the number of employees at the beginning of the period with the probabilities of career movements. (Jaggi and Lau, 1975)

According to two more theorists, the economic value of an individual to a firm is defined as the present value of the expected future contributions of the individual, discounted by the firm's cost of capital (Sadan and Auerbach, 1974)

The accountant's problem is to find a surrogate for human resources that will reflect the economic value. It is proposed to accomplish this by employing surrogate measures for the components of this value. Since gross income is completely accounted for by costs of economic production in factors in the income statement, the accounting surrogate for the contribution of a production factor is the periodic cost associated with the factor. Our expected value may be reported in the notes to financial statements under expected resources and commitments:

> "The proper pricing (valuation) of assets and the allocation of profit to accounting periods are dependent in large part upon estimates of future benefits, regardless of the basis used to price the assets. The need for estimates is unavailable and cannot be eliminated by the adoption of any formula as to pricing.

> All assets in the form of money or claims to money should be shown at their discounted present value or the equivalent. The interest rate to be employed in the discounting process is the market (effective rate at the date the asset was acquired)."" (Sprouse and Moonitz, 1962)

In discounted value accounting, the general basis is the discounted net product of each asset. In essence all such values are based on sets of hypotheses about the future including the primary hypothesis that the firm's operations will remain substantially the same.

> With replacement cost accounting the general basis is the replacement cost of assets. This entails that replacement is intended and feasible, and is thus akin to Discounted Value Accounting in the assumption that the firm's operation will remain substantially the same. (Chambers, 1967)

It is also proposed here to develop a discounted present value of human assets to be used as current replacement costs for valuation purposes. A sample discounting formula may be stated thus:

$$PV = \frac{FRn}{(1+r)n}$$

where

PV = the value of the human asset to be received in n years.
n = amount of time of service in years available to the firm.
r = discount rate, or rate of expected return from a human asset during that period of time.
FR = amount being paid out currently on the human asset.

FR may be determined from the replacement cost matrix for each division of the company.

n may be determined from the turnover ratio in combination with the efficiency ratio, and the career positions of all employees in the career matrix.

The most difficult to determine would be r. Traditional economic theory determines an interest or discount rate by intersecting the lines of supply and demand. The existing supply of capital (human assets) intersects the net productivity schedule to determine a moving equilibrium rate. All in all, consumption saving decisions plus the technical productivity of capital goods are needed to explain behaviour of expected rates of return over time.

Thus, the ratios calculated on our behaviour matrix could be used to determine interest rates for each division in the organization. To effect a more accurate result, calculate the present discounted value resulting from each possible decision. Then always act so as to achieve the maximum present discounted value.

Our resulting financial transactions will be, knowing that future expected expenditures will be financed by either short-term or long-term liabilities or share capital issued to the public for the financing of the business:

Entry(1) Dr: Cash x dollars
Cr: Loans Payable/Share Capital x dollars
To financing of business from outside sources.

Entry(2) Dr: Human Asset Account PV dollars
Cr: Cash PV dollars
To set up asset account for human assets.

However, we may have utilized certain human assets for an undetermined period of time. These are assets whose "n" in the present value formula is unknown. The matrix of the classification of employees in each division should be used to show the probabilities of the promotion or demotion of employees to higher or lower classes. This will be calculated from previous performance appraisal and promotional data. Our position transition matrix will be used for determining the movement of each class of employees from position to position until their departure from the company.

Acceptability

A surrogate has been determined to arrive at a transaction to enter the 'assets', but how do we treat them in the balance sheet? Some basic tenets have to be resolved:

- What class of assets are they? Tangible or intangible?
- Will they be amortized or depreciated, and if so, by what method, and how long?
- Will it be permissible by the generally acceptable principles of accounting to make the necessary financial transactions associated with assets in a balance sheet?

Fixed assets are those acquired with the intention of being used for the production of profits. They may be either tangible - if they have bodily substance, like a building or a machine, or intangible - if, like a patent or copyright, its value resides in the rights which its possession confers upon its owner. It is more feasible to consider human assets as intangibles.

> "Most fixed assets have a limited useful life. The cost of such an asset should be charged off gradually against revenue during the period of its useful life. The words most commonly used to describe such systematic assignment of fixed asset costs to expense are....Amortization, which is the systematic assignment of the cost of intangible fixed assets to expense." (Finney & Miller, 1963)

Generally accepted accounting principles to be used as yardsticks to test our accounting model for acceptability are:

- Money should be the unit of measurement. This has been adhered to.
- Assets should be shown as their value "to customers". In the majority of cases this will be their current replacement cost, but in some cases be their net realizable value or 'economic value'. The entire mathematical model was based on this concept.
- Liabilities should be measured generally on the same basis as assets. This was done in the mathematical development of the relevant accounting transactions.

- A figure of "operating profit" should be regarded as profit for the year.

One of the objectives of financial statements is to supply information useful in judging management's ability to utilize enterprise resources effectively in achieving the primary enterprise goal.

Accounting principles and objectives act as a kind of filter - through which was passed our models - whose task, amongst others, is to distinguish between accountable and nonaccountable events. These principles and objectives also define measurable methods for the assignment of figures to accountable events. I believe that these accountable events, in spite of traditional accounting beliefs, must encompass the idea or concept of accounting for human assets.

Conclusion

> "More recent behavioural knowledge indicates that human resources can contribute to the firm by engaging in positive performance beyond the capabilities traditionally assumed." (Venskus & Dimian, 1975)

This positive performance should be included in the attempt to change the whole concept of completely ignoring human resources in the balance sheet and profit and loss statement.

In conclusion, there are a number of questions which must be answered about the real effect of this important method of accounting:

What can happen to a company if the accountants refuse to value and account for its human assets?

What are the possible short, medium and long-term benefits available from doing so?

What are the inherent problems associated with attempting to or eventually completing such an effort in terms of methodology to be used, the legal complications, and the constraints of generally accepted accounting principles?

The primary function of top managers, and this usually includes accountants, is to manage resources, particularly human resources. To cope with escalating demands on management for goods and services, business institutions are calling for systems to improve adherence to these requirements. The concept of human resource accounting has the effect of aiding management in responding to the need for practical job related actions that will bring visible, measurable, and reportable results.

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THE USAGE OF NOTES TO FINANCIAL STATEMENTS
"IS THE CURRENT C.I.C.A. POSITION OPERATIONAL?"

Abstract

The Canadian Institute of Chartered Accountants Handbook which specifies the current "legal" usage of notes to financial statements designates notes as a secondary format of disclosure. An empirical study of the usage of footnotes in financial reporting over a 20 year period and a survey of three important producer/user groups of annual reports indicates that there is an inconsistency between the Handbook recommendations and actual usage. The obvious conclusions was that the C.I.C.A. should review its current position regarding note usage and recognize the importance of notes as a distinct part of our total disclosure package by giving notes the same status awarded to the statements themselves. The research findings also led to the conclusion that there should be increased research into the effects of alternate formats of disclosure on the data transmission capabilities of our financial statements in order for the C.I.C.A. to be able to designate the appropriate format for disclosure of information. The overall goal of these recommendations is to achieve a better recognition of the realities of the current state of financial disclosure in Canada.

May 1977
C.P. Lanfranconi

THE USAGE OF NOTES TO FINANCIAL STATEMENTS: "IS THE CURRENT C.I.C.A. POSITION OPERATIONAL?"

BACKGROUND

This paper focuses on one aspect of the usage of notes to financial statements. The basic problem that I will examine is an apparent disparity between the current position of the Canadian Institute of Chartered Accountants (C.I.C.A.) with regards to the usage of notes to financial statements and two empirical findings; 1) a description of the actual usage of footnotes in financial statements and 2) a survey of the perceptions of three important producer/user groups of annual reports in Canada towards notes to financial statements.

The paper will first outline the current C.I.C.A. recommendations with regards to the usage of notes as a disclosure format. The recommendations effectively constitute the current "legal" usage in Canadian public financial reporting. I will then present certain empirical findings which bear an actual usage and which appear to be inconsistent with the C.I.C.A. position. Lastly, I shall point out the implications of this disparity and make some initial recommendations for change.

2

LEGAL STATUS OF THE C.I.C.A. HANDBOOK

The C.I.C.A. Handbook, which contains a compilation of the recommendations of the Accounting and Auditing Research Committees, has become minimum disclosure requirements for public companies in Canada. This is as a result of National Policy Statement No. 27 of the Provincial Securities Commissions issued in 1972. (The Ontario Securities Act and Regulations, 1973, with Policy Statements, 1973). Further proof of the growing legal status of the C.I.C.A. Handbook is indicated by the regulations of the Canadian Business Corporation Act (1976). The regulations state that the financial statements required under the Act should be "prepared in accordance with the recommendations of the Canadian Institute of Chartered Accountants, set out in the C.I.C.A. Handbook"(1976, Section 44, p. 116).

As a result of the changes outlined above, the recommendations of the C.I.C.A. Handbook with regards to note usage has become the current legal requirement. This increased legal status of the C.I.C.A. Handbook with regards to financial disclosure has, in my opinion, also increased the responsibility of the C.I.C.A. for proper disclosure. If notes to financial statements have become an important format of disclosure and there is also a possible inconsistency between the Handbook recommendations and actual usage, there would be a problem that should be resolved by the C.I.C.A.

3

C.I.C.A. POSITION RE: NOTE USAGE

When making a recommendation regarding a specific disclosure item, the C.I.C.A. does not normally recommend either disclosure in the body of the statements or by way of notes. There are, of course, exceptions, i.e., the disclosure of significant accounting policies. Although the C.I.C.A. Handbook uses the term "same significance" when comparing notes to the body of the statements, they still leave the distinct impression that footnote reporting is a second class medium and that first attempts to disclose should be by way of the body of the statements.

> "Notes to the financial statements, and supporting schedules to which the financial statements are cross-referenced, are useful for the purpose of clarification or futher explanation of the items in the financial statements. They have the same significance as if the information or explanations were set forth in the body of the statements themselves. They should not, however, be used as a substitute for proper accounting treatment." (my emphasis) (C.I.C.A. Handbook, 1500.04).

The above paragraph taken from the C.I.C.A. Handbook, especially the last sentence, implies that disclosure by footnotes are not a "proper" accounting treatment if it is possible to disclose either by way of notes or in the body of the financial statements. Notes are not recommended as an "equal substitute". The substantial increase in the usage of notes, to be described in the next section, indicates that either the

recommendation is being ignored or the body of the traditional financial statements is showing an inability to cope with new disclosure requirements in the traditional manner.

CHANGE IN THE USAGE OF NOTES TO FINANCIAL STATEMENTS

In the twenty year period from 1955 to 1974, there has been a dramatic increase in the usage of notes to financial statements. Exhibits 1 to 3 illustrate the changes in usage of notes of 60 companies over the twenty year period referred to above. This data resulted from my examination of the annual reports of 60 randomly-selected public companies (Lanfranconi, 1967). The sample was drawn from companies who were listed on the Toronto Stock Exchange, continuously, for a 20 year period from 1955 to 1974.

Exhibits 1 and 2 demonstrate that over the twenty year period I examined, the absolute number of notes had increased 3.42 and 4 times, percent of pages increased 3.65 times and 11 times and the number of words 5.18 times and 13.44 times, as measured by the means and medians respectively. Exhibit 3 displays the changes in Exhibits 1 and 2 in graphic form.

It could be hypothesized that during this 20 year period there has been an increase in financial disclosure generally and that the increase in notes merely followed this general increase. That is, they reflect a relative change,

EXHIBIT 1

CHANGES IN MEANS OF MEASUREMENTS OF USAGE OF NOTES
TO FINANCIAL STATEMENTS (ALL CASES)
1955 to 1974 (1955 Base Year)

	$\bar{X}$ No. Notes	1955 Base = 100	$\bar{X}$ % Pages	1955 Base = 100	$\bar{X}$ No. Words	1955 Base = 100
1955	2.310	100	.092	100	193	100
1960	3.367	146	.132	143	271	140
1965	4.733	205	.179	195	367	190
1966	5.350	232	.193	210	435	225
1967	5.950	258	.212	230	504	261
1968	6.367	276	.224	243	520	269
1969	6.517	282	.223	242	564	292
1970	6.817	295	.244	265	567	294
1971	7.517	325	.253	275	621	322
1972	7.450	323	.266	289	686	355
1973	7.550	327	.286	311	828	429
1974	7.900	342	.366	365	999	518

(Lanfranconi, 1976, p. 102)

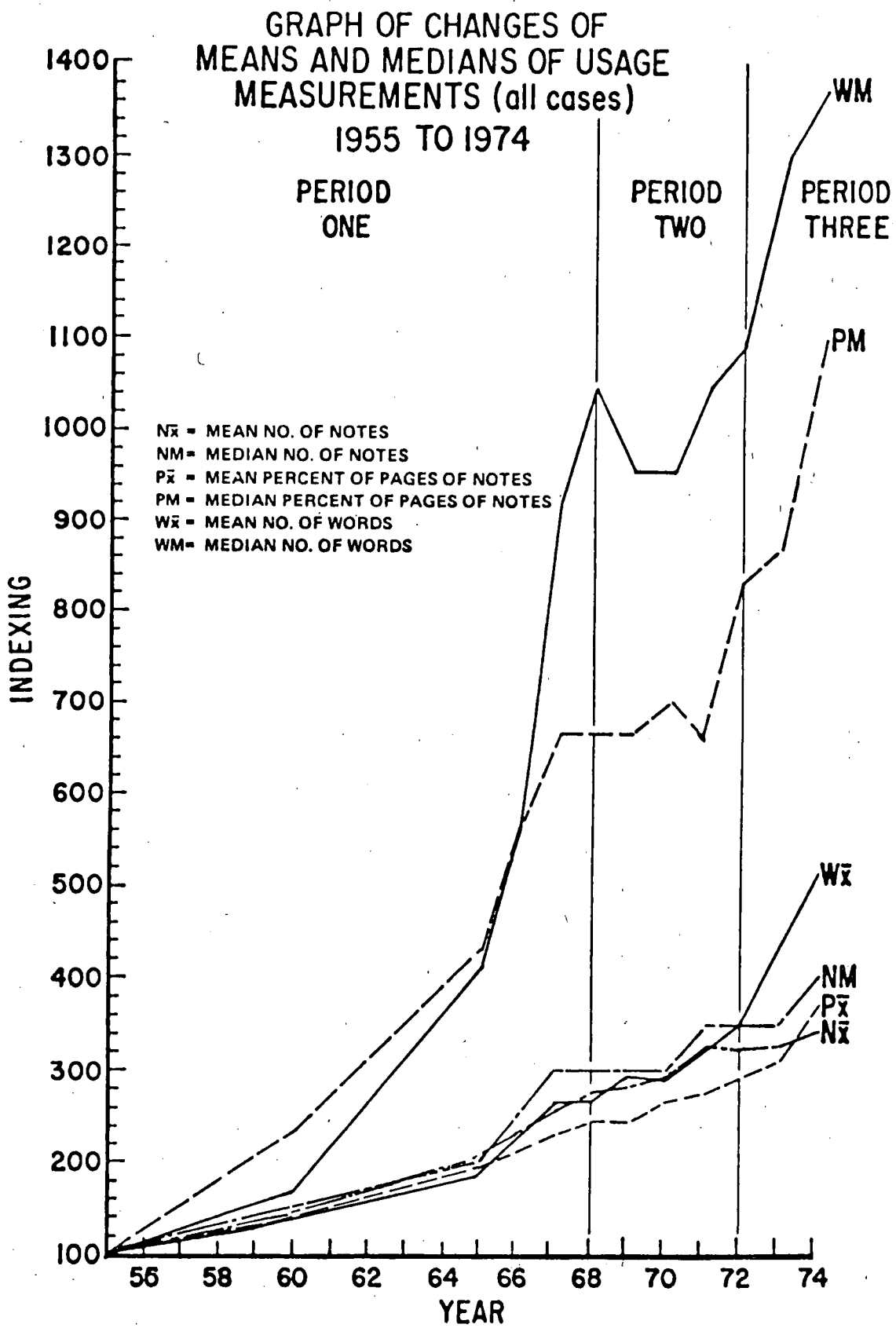
EXHIBIT 2

CHANGES IN MEDIANS OF MEASUREMENTS OF USAGE
OF NOTES TO FINANCIAL STATEMENTS (ALL CASES)
1955 to 1974 (1955 Base Year)

	Median No. Notes	1955 Base = 100	Median % Pages	1955 Base = 100	Median No. Words	1955 Base = 100
1955	2	100	.03	100	45	100
1960	3	150	.07	233	120	267
1965	4	200	.13	433	185	411
1966	5	250	.17	567	255	567
1967	6	300	.20	667	415	922
1968	6	300	.20	667	470	1044
1969	6	300	.20	667	430	956
1970	6	300	.21	700	430	956
1971	7	350	.20	667	470	1044
1972	7	350	.25	833	490	1089
1973	7	350	.26	867	580	1289
1974	8	400	.33	1100	605	1344

(Lanfranconi, 1976, p. 103)

EXHIBIT 3



(Lanfranconi, 1976, p. 106)

not absolute change in usage. However, the Exhibits indicate that there has been an increase in the note format as a percentage of the financial statements (notes plus the tabular portion) therefore, the usage of notes has increased at a faster rate than the tabular portion. By the end of the period under examination, notes had reached a point where they represented 1/3 of the space devoted to the audited section of the corporate financial reports. These findings clearly demonstrate the substantial growth in the usage of notes as a disclosure medium.

INCONSISTENCY - PERCEIVED PROBLEM

I interpret the current C.I.C.A. recommendation with regards to the usage of notes as being a relegation of this disclosure format to second class status. Their position being that notes should be used as a means of further explanation which is essential if the statements are to be understood; a form of integral appendage. The 20 year growth pattern and current massive usage would indicate that footnotes have progressed well beyond the appendage stage towards being a distinct format such as the Balance Sheet, Income or Change in Financial Position statements. A further deviation from the Handbook recommendation would be occuring if some or all of the notes were being used or prepared as additional or special information in the manner of the statements themselves as

opposed to integral further explanation of items in the financial statements.

PRODUCER/USER PERCEPTIONS OF NOTES

Another part of my research produced data which provided some initial evidence which would indicate that this second deviation referred to in the previous paragraph might also be occurring in actual financial reporting. I utilized interviews and a mail questionnaire to examine the perceptions of three important producer/user groups of notes to financial statements (Lanfranconi, 1976, chapters 4,6). The three groups were 1) preparers of public company financial statements, 2) Chartered Accountants in public practice and 3) Financial Analysts. Their responses to questions focusing on their perceptions of the relative significance, effectiveness and efficiency of notes tended to also question whether actual financial disclosure is consistent with the Handbook recommendation.

Analysis of the responses by these three goups indicated that they perceived notes as being equal or more significant than the body of the financial statements. However, they also perceived that less specialized groups than themselves, such as shareholders or the general public, do not perceive notes in the same manner. In fact, they felt that these less specialized groups perceived notes as being less significant

than the tabular portion of the financial statements (Lanfranconi, p. 198).

If this is true, and it must be remembered that these are the opinions of my respondent groups, not a sampling of less specialized users of financial statements, these less expert users might be ignoring or treating notes in a manner contrary to the intention of the C.I.C.A. Handbook. The Handbook directs that notes are as significant as the tabular portions of the statements and constitute an integral part of the financial statements.

Perhaps more telling on the Handbook is the fact that one of my respondents groups is the main group responsible for the construction of the financial statements. That they perceive notes as a separate segment of the annual report whose data are more significant for specialist users, might indicate that they prepare the statements in this segmented manner. If notes are constructed as a distinct section for specialist users it would be hard to reconcile this mode with the current Handbook recommendations. This format i.e. one part, the notes, for more specialist users, was described by one of my interviewers as "staged reports". By this term he meant that the general, less sophisticated users would satisfy their needs by using the tabular portion of the statements as a form of summary whereas the specialist would utilize both formats, using the notes as means towards more complete analysis.

Besides the problem of whether notes are prepared

and used as an integral part of the financial statements, there would be a further possible problem if the competing formats are not equally effective and/or efficient as a means of disclosure. This further problem would arise if one interprets that the lack of direction as to which format be used in disclosing essential information is as a result of a belief by the C.I.C.A., that both formats are considered to be equally effective and efficient in transmitting data. Where an item is capable of being disclosed by way of either format, the lack of specific direction and the view of relative equality would be consistent with the view that notes are an integral part of the statements.

The responses given by the three sample producer/user groups showed that they perceived notes as being less effective and less efficient than the tabular portion of the financial statements (Lanfranconi, 1976, p. 101). Whether the increased usage of notes in the last 20 years is as a result of deliberate choice by the preparers of financial statements, where either format is feasible, or because note disclosure is the only means available to meet certain disclosure requirements, we may be transmitting certain data by means of a relatively less effective and efficient format. This would indicate, that the C.I.C.A. stance of non direction with regards to disclosure format might not be always appropriate for certain data. At the very least this stance of non-direction should be re-examined.

I interpret the perceptions of the producer/user groups to indicate that at least some notes are providing information for more specialized users of financial statements. This could be as a result of choice by some users of financial statements owing to the type of information found in notes, or perhaps because of their complexity as a disclosure format. This leads to a situation where the audited disclosure package as presently constructed is composed of different parts for different users. We might be evolving or have evolved to a situation where the all purpose report is really a series of segments for different user groups. Therefore, while increasing and changing disclosure we might at the same time be reducing the number of recipients of parts of this disclosure package.

CONCLUSIONS AND IMPLICATIONS

I would like to make clear my position on footnotes, namely that I am not opposed to the current trends in note usage as I saw them. In fact, one of my conclusions is that a reduction in note usage would merely result in a step backwards unless alternative forms of disclosure are found. The very felxibility of notes versus the structured format of the tabular portion of the financial statements, has permitted the reporting organizations to provide additional disclosure beyond the restricted capacities of the tabular portion. The flexibility of notes has therefore helped accommodate increased

demands.

What I am implying is that we should not labour under false assumptions regarding the usage of notes and who are the potential recipients of the data they contain. The C.I.C.A. should review its current recommendations as they now stand. Two obvious alternatives available would be to either reinforce the traditional view of note usage or reconstruct the relationship of notes to the statements.

Certainly I am in favour of the second alternative. I believe the first step that should be taken should be positive, namely a recognition of the importance of notes as a distinct part of our total disclosure package. This could be accomplished in the Handbook by giving notes the same status as is accorded to the statements themselves. I would, therefore, also include a specific reference to the notes in the auditors' opinions.

These initial suggested changes should be coupled with increased research into the effects of alternate formats of disclosure on the data transmission capabilities of our financial statements. This would, in my opinion, be a better recognition of the realities of current financial disclosure. We might then be in a position to designate the appropriate format for the disclosure of essential information. This could further result in an improvement of our capabilities of fulfilling one of our perceived and I believe neglected functions as financial accountants, namely as "communicators" as opposed to merely being "measurers" of economic data.

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AN EMPIRICAL ASSESSMENT OF THE ACCOUNTING METHOD FOR COMPUTING PURCHASING POWER GAINS (LOSSES)

The accounting profession has for decades debated the merits of the various forms of current value accounting vis-a-vis historical accounting and vis-a-vis one another. The forms of current value accounting commonly found in the literature include current replacement cost accounting, current realizable value accounting, restating historical accounting for specific or general price level changes or some combinations of these. In view of the current state of continuous world-wide inflation, a move towards some forms of current value accounting seems inevitable. Regardless of what the ultimate form may look, a question of relevance is whether gains and losses on monetary items should be recognized.

Inflation is believed to be beneficial to debtors and detrimental to creditors. In this regard, economists have long investigated the so-called debtor and creditor hypothesis (Kessel, 1956; and Alchian and Kessel, 1959). The essence of this hypothesis is that firms consistently fail to anticipate inflation correctly and the rate of interest negotiated in current loan agreements fails to allow sufficiently for the increase in the general level of prices that in fact occurs. Consequently, a firm loses purchasing power as a result of holding monetary assets as the nominal value of these assets (fixed by contracts or other institutional arrangements) remains the same, while the real value of the dollar declines. Similarly, a firm gains purchasing power to the extent that it holds monetary liabilities in an inflationary period, in that it borrows dollars with greater value than it repays to creditors. Moreover, inflation ought to be more profitable for large debtors than small debtors and more unprofitable for large creditors than small creditors.

Consistent with the debtor and creditor hypothesis, accountants generally assume that purchasing power gains (losses) on monetary items do enhance the wealth of the firm and should be recognized as part of the net income to common stockholders in the period in which the general price level changes (A.I.C.P.A., 1973). On the other hand, no purchasing power gains or losses could result from holding non-monetary items. The traditional accounting method for computing gains and losses on monetary items is predicated on two rigid assumptions, namely:

(1) inflation is totally unanticipated so that gains and losses on monetary items are a simple function of changes in price indexes; and

(2) changes in monetary items would have no effects on the risk characteristics of a firm.

These two assumptions would produce the result of a linear relationship between purchasing power gains and losses and monetary items during inflation and give the impression that it would be advantageous to the firm to be more

deeply in a position of net monetary liability as the inflation situation worsens.

Prior research had indicated that inflation was least partially anticipated by the market in the past (Gibson, 1970). This seems to invalidate the first assumption and suggests that purchasing power gains and losses on monetary items would at least be partially offset by higher interest rates demanded by the market to compensate for the effects of inflation.

The second assumption also seems unreasonable. As the firm reduces its monetary position by increasing its monetary liabilities, it also usually increases its financial leverage, which in turn would have potential impact on its profitability and risk of insolvency (also referred to as financial risk).

The relationship between leverage, cost of debt capital and value of the firm has attracted considerable attention in the finance and economic literature. Although there are different views about this relationship, the consensus seems to indicate the following chain of events. As the firm increases its financial leverage, initially net income to common stockholders would increase because, at least, interest payments on debt are deductible expenses for tax purposes. However, there exists an optimal point of leveraging beyond which the net income to common stockholders would begin to fall because of increased risk of insolvency which in turn would cause the cost of debt capital to rise. The optimal point is the point where the marginal income to common stockholders due to leveraging is equal to the marginal cost of debt due to leveraging.

It seems logical to suggest that the relationship between net income to common stockholders and purchasing power gains and losses on monetary items is not independent of the effects of leverage. Assuming perfect and efficient capital markets, if a component of net income to common stockholders does indeed enhance the wealth of common stockholders, it would be fully reflected in the market price of common stock. As the firm reduces its monetary position, two opposing forces are at work, one tending to increase the market value of common stockholders' equity because of increases in purchasing power gains (or reduction of purchasing power losses) and increases in net income due to leveraging, one tending to decrease the market value of common stockholders' equity because of increases in the risk of insolvency which would in turn cause its cost of capital to rise. As the firm reduces its monetary position more and more, the net impact on the market value of common stockholders' equity may well be favorable initially but beyond some point the risk of insolvency would begin to dominate and the cost of debt capital of the firm would rise so high that it would not only nullify any advantages from leveraging but would also more than offset any purchasing power gains that the firm may derive.

This paper attempts to study the joint effects of purchasing power gains and losses on monetary items and leverage on the market equity of common stockholders by employing a multiple regression model.

The Model

The relationship between the real rate of return to common stockholders and the rate of purchasing power gains (losses) has generally been derived as follows (De Alessi, 1963. Also see Appendix A):

$$(1)\quad \frac{E_t - E_{t-1}}{E_{t-1}} - k = r - \beta\left[k\left(\frac{M_{t-1}}{E_{t-1}}\right)\right]$$

where M_{t-1} is the net monetary position of a firm at time t-1 (i.e. monetary assets minus monetary liabilities) and E_{t-1} and E_t are nominal (undeflated) common stockholders' equity at time t-1 and time t repsectively. k is the discrete inflation rate, r the real rate of return to common stockholders from sources other than purchasing power gains (losses) and β the degree of anticipated inflation.

Using cross-sectional regression and assuming continuous compounding, equation (1) can be estimated by the following equation (see Appendix B):

$$(2)\quad \left[\ln\left(\frac{E^*_t}{E^*_{t-1}}\right) - \ln\left(\frac{I_t}{I_{t-1}}\right)\right] = a + b\left[\ln\left(\frac{I_t}{I_{t-1}}\right)\left(\frac{M_{t-1}}{E_{t-1}}\right)\right] + u$$

where E* is market equity; I the Gross National Implicit Price deflator and t a subscript for time.

Modigliani and Miller (1958 and 1963) were perhaps the first persons to rigorously study the relationship between the rate of return to common stockholders and the leverage ratio of the firm. They proposed that the expected yield of a share of stock is equal to the appropriate capitalization rate p_w for a pure equity stream (i.e., no debt financing) in the class, plus a premium related to financial risk equal to the debt-equity ratio (D/E) times the spread between p_w and i (i being the rate of return on debts). Symbolically, the expected yield of a share of common stock of a firm j in class w (r_j) is given as follows:

$$r_j = p_w + (p_w - 1)\, D_j/E_j$$

In words, the expected rate of return or yield on the stock of firm j belonging to the w class is a linear function of its leverage.

On the other hand, a group of theorists, as exemplified by Solomon (1963), Baxter (1967), Baumol and Malkield (1967), envisaged a concave yield curve of common stock which is popularly referred to as the traditional theory in the literature. According to this theory, in the early or moderate phases of leverage the cost of capital declines and hence the yield of common stock increases, possibly because of market imperfections but at the very least because of tax effects. As leverage reaches and then exceeds the limits imposed by the risk of insolvency, marginal cost of debt rises rapidly and the advantages of even more leverage is offset by the rising cost of further increment of debt, causing the yield of common stock to fall.

There is general agreement on the idea that the rate of return on common stockholders' equity is a function of leverage. The disagreement centers on the shape of that function. In order to test the concave function as envisaged by the traditional theory, one needs to obtain sample observations with a wide range of leverage ratios. This may not be practical, as the sample data of this study reveals a tendency for the firms in the same industry to have their debt-equity ratios bunched closely. The same observation was made by Weston (1963, p. 211). A linear function representing a small range of the yield curve appears to serve as a good approximation of the underlying function.

There are many different and competing formulations on the measure of leverage (Ghandhi, 1966). Among these, the accounting debt-equity ratio is unquestionably the one that sees the most widespread use. Taking the viewpoint that the common stockholders are the owners of the firm, the accounting debt-equity ratio is defined as follows:

$$L = \frac{D_{t-1} + P_{t-1}}{E_{t-1}}$$

where D is the book value of debts, P the book value of preferred stocks, E the book value of common stockholders' equity, and t a subscript for time.

Inflation tends to reduce the real debt-equity ratio of a firm because the nominal value of debts remains unchanged while that of equity is assumed to change with inflation. Assuming continuous compounding , the debt-equity ratio (in real term) is accordingly defined as follows:

$$L' = \frac{D_{t-1} + P_{t-1}}{E_{t-1}} \cdot e^{-k}$$

The multiple regression model of this study is formulated by integrating the preceding analyses. This is as follows:

$$(3)\quad \left[\ln\left(\frac{E^*_t}{E^*_{t-1}}\right) - k\right] = a' + b_1\left[k\left(\frac{M_{t-1}}{E_{t-1}}\right)\right] + b_2\left[\left(\frac{D_{t-1} + P_{t-1}}{E_{t-1}}\right) \cdot e^{-k}\right]$$

All symbols are as previously defined.

It is recognized that the market debt-equity ratio may be used as the second independent variable in place of the accounting debt equity ratio and similarly the first independent variable may be deflated by the market equity rather than the book equity. However, dividing the dependent variable and the independent variables by a common denominator, i.e., the market equity, may bias the results because of the problem of multicollinearity (Gonedes, 1973). Moreover, Ghandhi found in his study that in most normal cases there is a sufficient degree of stability among the various measures of leverage (including the market and accounting debt-equity ratios) and in practice it would appear to be a matter of relative indifference which measure is adopted. For these reasons, accounting-based information were used to measure the two independent variables.

Research Hypotheses

The research hypotheses of this paper are as follows:

H_1: The real rate of return to common stockholders is not a function of purchasing power gains (losses) on net monetary position in the presence of leverage effects.

H_2: The real rate of return to common stockholders is not a function of the leverage position of the firm in the presence of purchasing power gains (losses) on net monetary position.

Methodology and Data Collection

The population was stratified by industries in an effort to minimize variations due to differences in business risk. An attempt was made to avoid choosing industries that were either regulated or dominated by a few firms. Three industries were chosen for study. They were furniture and fixtures, retail stores - department, and tobacco products. The study was conducted on a cross-sectional basis. In addition, two time periods were studied; these were for the fiscal years ending 1973 and 1974. These two periods were chosen because they were the more recent periods with available data at the time when this research was conducted. The sample sizes included 27 firms from the furniture and fixtures industry, 24 firms from the retail stores - department industry and 19 firms from the tobacco products industry, making a total of 70 firms and 140 observations in the combined sample.

All financial data were gathered from the financial statements of the sample firms for the fiscal years ending in 1973 and 1974 as published in the Moody's Industrial Manual and supplemented by the annual reports of the firms wherever necessary. Closing stock prices on the last trading dates before the end of each fiscal year were obtained from the Wall Street Journal for the firms whose stocks were traded on the major stock exchanges and from the Moody's OTC Industrial Manual for those firms whose stocks were traded over-the-counter. Data on the gross National Product Implicit Price Deflator were drawn from the Survey of Current Business, issued monthly by the United States Department of Commerce. Data on the Dow Jones averages were taken from the Standard and Poor's Trade and Securities Statistics (issued monthly).

The technique of multiple linear regression was used to estimate equation (3). Variance analyses (ANOVA) were then performed on the results of regression to test the research hypotheses.

Because the two independent variables of this study are highly correlated, the approach taken is to estimate the partial effects of each independent variable when the other is held constant. The procedure is to first regress the dependent variable y with the first independent variable X_1 alone and to calculate the F ratio of 'X_1 ascribable to'. Next, the second independent variable X_2 is brought into the regression equation and the F ratio of 'X_2 extra ascribable to' is calculated. Thus, the 'extra ascribable to' is a marginal concept and gives the marginal contribution of one independent variable in explaining the total variations of the dependent variable in the presence of the other independent variable. The same procedure is followed to determine the partial effect of X_2 (X_2 extra ascribable to). The sampling distribution of F is then consulted to test the null hypothesis that a given independent variable (either alone or in the presence of the other independent variables) does not

contribute significantly in explaining the total variations of the dependent variable.

The Results

Table 1 summarizes the results of the analyses of variances necessary to test the two hypotheses. The results in the table indicate that with the exception of the retail stores industry in 1974, the effects of purchasing power gains (losses) were not significant in the presence of leverage effects as shown by the F ratios of extra ascribable to X_1. With the above exception H_1 was not rejectable in all other cases. The sign of all the regression equations were in the predicted direction, i.e., purchasing power gains were generally associated with negative monetary position. The interpretation of the above results was that the degree of purchasing power gains on net monetary liability positions was at best moderate.

TABLE 1

F RATIOS

	Furniture & Fixtures n = 27		Retail Stores -Department n = 24		Tobacco Products n = 19	
	1973	1974	1973	1974	1973	1974
Ascribable to X_1 alone	5.3* (1,24)	1.0 (1,24)	6.3* (1,21)	14.6** (1,21)	5.7* (1,16)	7.1* (1,16)
Extra ascribable to X_2	18.7** (1,24)	25.0** (1,24)	9.3** (1,21)	14.4** (1,21)	1.6 (1,16)	4.8* (1,16)
Ascribable to X_2 alone	22.5** (1,24)	24.0** (1,24)	12.6** (1,21)	21.8** (1,21)	7.1* (1,16)	11.7** (1,16)
Extra ascribable to X_1	1.5 (1,24)	2.0 (1,24)	3.0 (1,21)	7.3* (1,21)	.1 (1,16)	.3 (1,16)
Ascribable to regression	11.8** (2,24)	12.9** (2,24)	7.7** (2,21)	14.6** (2,21)	3.7* (2,16)	6.0* (2,16)

Note

Figures in brackets represent the degrees of freedom.

* Significant at .05 level

** Significant at .01 level

With the exception of the tobacco products industry, the leverage effects in the presence of purchasing power gains (losses) effects - extra ascribable to X_2 - were significant at least at the .05 level in all other cases. Con-

sequently, H_2 was rejected for each industry and each time period except the tobacco products industry in 1973. The results indicate that the leverage effects tended to dominate the purchasing power gains effects in explaining the total variations of the real rate of return to common stockholders.

The model of this study was statistically tested to ascertain whether any other nonlinear forms might provide a significantly better fit to the data. The results indicated that the multiple-linear form with respect to the two independent variables of interest to this study was an adequate description of the data. Statistical tests were also made on the usual assumptions about the errors of regression; namely, independence, constant variance and normal distribution. The results indicated no evidence to deny the assumptions made. As the results referred to in this paragraph are facilitating in nature and for the reason of brevity, they will not be reported here.

Limitations

For the purpose of this study, it is necessary to decompose the total risk of a firm into busines risk and financial risk so that the effects of financial risk on the real rate of return to common stockholders can be studied together with the purchasing power gains (losses) effects. One way of doing this is to appeal to the portfolio theory. Unfortunately, there exists no successful link between the theory of corporation finance and the portfolio theory. Hamada (1969 and 1972) and Bowman (1975) made a commendable attempt of doing this but their works cannot be made operational at this time. Consequently, it was decided to employ the equivalent risk class concept. To the extent that this concept can be criticized as not an ideal method for controlling business risk, this study suffers the same limitation.

When two independent variables are highly correlated as is the case in this study, it becomes statistically impossible to assign the precise effects of each on the dependent variable. The approach taken here to circumvent this problem was to follow the marginal concept, that is to assess the marginal contributions of each independent variable in explaining the total variations of the dependent variable in the presence of each other. The results of the study should be interpreted accordingly.

Implications

The present method for calculating purchasing power gains (losses) as prescribed by the accounting profession in effect assumes that inflation is totally unanticipated and the extent of purchasing power gains (losses) is a simple function of the net monetary position of the firm. The results of this study fail to detect a strong association between purchasing power gains and negative net monetary position as reported in the financial statements. This means that inflation was at least partially anticipated by the sample firms. Moreover, the present method also completely ignores the dominant impact of financial risk on the degree of purchasing power gains (losses) on monetary items. Because of the allocation problem (Thomas, 1969 and 1974) and the difficulty of assessing expectation, it would be virtually impossible to devise a method whereby the purchasing power gains (losses) on monetary items can be measured with proper allowance being made to the degree of anticipated inflation and the effects of leverage.

Recommendation

Subject to the limitations stated earlier, it is recommended that the present method for calculating purchasing power gains (losses) be carefully reassessed. In the meantime, this study recommends the improvement on the disclosure of accounting information with respect to the net monetary position of the firm. This can simply be done by sub-classifying teach section of assets and liabilities in the balance sheet into monetary and non-monetary items.

The above recommendation can be implemented in the framework of historical accounting or any forms of current value accounting which may ultimately emerge as the winner.

Appendix A

Given the following three simple identities at time t-1:

$$M_{t-1} = MA_{t-1} - ML_{t-1}$$

where M_{t-t}, MA_{t-1}, and ML_{t-1} are the net monetary position, monetary assets and monetary liabilities respectively of a firm at time t-1.

$$N_{t-1} = NMA_{t-1} - NML_{t-1}$$

where N_{t-1}, NMA_{t-1}, and NML_{t-1} are net non-monetary assets, non-monetary assets and non-monetary liabilities respectively of a firm at time t-1.

$$E_{t-1} = N_{t-1} + M_{t-1}$$

where E_{t-1} is nominal (undeflated) common stockholders' equity at time t-1.

Assuming continuous compounding, the change (in real terms) in common stockholders' equity for the interval t-1 to t is:

$$\Delta E = rE_{t-1} = r(N_{t-1} + M_{t-1}) = rN_{t-1} + rM_{t-1}$$

where r is the rate of return (deflated) to common stockholders.

Now consider the effects of inflation and inflationary expectations. Given a rate of inflation k, the stream of income attributable to N, net non-monetary assets, is assumed to grow at the rate r + k. If inflation is unanticipated, M, net monetary assets, is assumed to grow at the rate r. If inflation, say at the rate k', has been anticipated, there would be a compensatory increase in the contractual rate of interest and M is assumed to grow at the rate r + k'. Thus, the nominal change in common stockholders' equity is:

(1) $$\Delta E = (r + k)N_{t-1} + (r + k')M_{t-1}$$

Since $N_{t-1} = E_{t-1} - M_{t-1}$, and substituting this into equation (1), the nominal change in common stockholders' equity becomes:

(2) $$\Delta E = (r + k)E_{t-1} - (k - k')M_{t-1}$$

The degree of anticipation β is defined as:

$$\beta = \frac{(k - k')}{k} \qquad \text{or} \qquad \beta k = (k - k')$$

Thus, $\beta = 1$ means that inflation is totally unanticipated; $0<\beta<1$ means that inflation is partly anticipated; $\beta = 0$ means that inflation is anticipated correctly; and $\beta<0$ means over-anticipation.

Substituting βk for (k - k') in equation (2) the nominal change in common stockholders' equity becomes:

$$\Delta E = (r + k)E_{t-1} - \beta(kM_{t-1}) \tag{3}$$

Adding E_{t-1} to both sides of equation (3), the nominal equity at time t is equal to:

$$E_t = E_{t-1} + (r + k)E_{t-1} - \beta(kM_{t-1})$$

The real rate of return to common stockholders over the discrete interval t-1 to t can be derived by dividing the above equation by E_{t-1}.

$$\frac{E_t - E_{t-1}}{E_{t-1}} - k = r - \beta\left[k\left(\frac{M_{t-1}}{E_{t-1}}\right)\right]$$

Appendix B

Let E* be the adjusted market equity and t a subscript of time, then

$$E^*_t = E'_t + V$$

where E'_t = number of common stocks outstanding at time t times market price of common stock per share at time t, and V = cash dividends paid for the period t-1 to t

and

$$E^*_{t-1} = E'_{t-1} \cdot \frac{J_t}{J_{t-1}}$$

where E'_{t-1} = number of common stocks outstanding at time t-1 times market price of common stock per share at time t-1, and J_{t-1} and J_t are the Dow Jones averages at time t-1 and t respectively.

The discrete rate of return to common stockholders (in nominal terms) g for the period t-1 to t is as follows:

$$g = \frac{E^*_t - E^*_{t-1}}{E^*_{t-1}}$$

The equivalent continuous rate of return to common stockholders (in nominal terms) h is as follows:

$$e^h = (1 + g)$$

$$h = \ln(1 + g) = \ln\left(\frac{E^*_t}{E^*_{t-1}}\right)$$

Let the discrete rate of inflation i for a period be

$$i = \frac{I_t - I_{t-1}}{I_{t-1}}$$

where I is the Gross National Implicit Price Deflator and t a subscript for time.

The continuous rate of inflation k can be estimated by

$$e^k = (1 + i)$$

$$k = \ln(1 + i) = \ln(\frac{I_t}{I_{t-1}})$$

Then the real rate of return to common stockholders c, assuming continuous compounding is:

$$c = \ln(\frac{E^*_t}{E^*_{t-1}}) - \ln(\frac{I_t}{I_{t-1}})$$

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A DISCUSSION OF THE EFFECTS OF CHANGING INTEREST RATES ON CAPITAL BUDGETING DECISIONS

Introduction

The existing literature seems to suggest, generally, that capital budgeting decisions be made on the assumption of a static environment. Some authors do suggest allowing for uncertainty in the flows in the model, and some mention is made of incorporating an adjustment for inflation. However, little mention is made of the potential impact on the expected net cash flows of changes in the cost of capital between the point at which the investment decision is made and the point at which the investment life ends. Perhaps typical of the prevalent view is the statement that, "while the assumption of a constant cost of capital certainly does not hold for all firms, and especially not for small, new and rapidly growing ones, our investigations suggest that it generally is approximately correct for most large mature corporations." (emphasis added) (Weston and Brigham, 1974, p. 245).

While such changes in the cost of capital could have a positive (i.e., cost goes down; return increases) or negative (i.e., cost goes up; return decreases) effect on the company's profits, they will have an impact. Ignoring the possibility of such changes is ignoring an important variable that should be considered in the capital budgeting decision. It is the intent of this paper to show why changes in interest rates that cause changes in the cost of capital should not be ignored and to suggest the possible effects of such changes.

In this example and throughout this paper, the possibility of changes in the cost of equity capital are not considered, (i.e., it is considered to be a constant). The reason is not that the cost of equity capital doesn't change, but rather because the focus of this paper is on changes in the cost of debt capital.

Changes in the cost of capital between the date an investment decision is made and the date the investment ceases to generate revenue or expenses are likely if either of the following two conditions obtain:

1. The debt-equity ratio is constant, but the project life exceeds the maturity of the company's debt and:
   a. Market interest rates change and/or
   b. The company's risk class changes.

I would like to thank Professors Holzer and Linke of the University of Illinois and Professor Eckel of McMaster University for their advice and comments.

While this paper will deal only with condition a, the impact of condition b on the company's net cash flows will be similar to that of condition a, in that under both conditions, the company's cost of borrowing will change. The conclusion drawn will thus be also generalizable to condition b.

An example would be appropriate. A firm, with a debt-equity ratio of 1 : 1, has a cost of capital of 10%. The firm's debt amounts to $200,000, has a 6% coupon and matures in 10 years. The firm is considering an investment with a certain internal rate of return of 11% and an expected life of 20 years.

The internal rate of return exceeds the firm's cost of capital and so the firm should invest. After 10 years, the firm would have to refinance its debt. If the cost of debt has risen to 10% and the cost of equity has not changed, the new cost of capital would be 12% and the project would not be profitable. Of course, if the cost of debt had decreased to 4%, the project would be even more profitable than had originally been anticipated.

This paper will first discuss capital budgeting decisions. Then the cost of capital, as it relates to this topic, will be considered. The selection process for a discount rate or hurdle rate will be described. The impact of changing interest rates on the net flows from an investment will be examined along with two methods for accounting for the impact.

Capital Budgeting Decisions

The Models

There are two capital budgeting decision models that are of interest because of their relative popularity with business persons and in the literature. They may both be described as time value of money models for they incorporate the time value of money in their decision processes. The two models are the net present value model and the internal rate of return model.

The former uses a specified discount rate to compute the net present value of cash inflows and cash outflows resulting from the project in question. If the net present value is positive, the project should be accepted. The model is of the form:

$$\text{Net Present Value} = \sum_{t=0}^{L} \frac{P_t}{(1+d)^t} - \sum_{t=0}^{L} \frac{N_t}{(1+d)^t}$$

where: P_t = a cash inflow in year t
N_t = a cash outflow in year t
L = expected life of the investment in years
d = the discount rate where $d \geq c$, the cost of capital to the firm.

The internal rate of return model attempts to find a rate of return that can be used to equate cash inflows with cash outflows. The project should be accepted if that computed rate is in excess of some specified "hurdle rate" which is equal to or greater than the cost of capital. The internal rate of return model is of the form:

$$\sum_{t=0}^{L} \frac{N_t}{(1+r)^t} = \sum_{t=0}^{L} \frac{P_t}{(1+r)^t}$$

where: P_t = a cash inflow in year t
N_t = a cash outflow in year t
L = the expected life of the investment in years
r = the internal rate of return that must be computed.

There are two other models that are more sophisticated versions of the net present value approach. The first model is the risk-adjusted net present value model which recognizes the riskiness of some or all of the cash flows by using different discount rates. A variation on this model as a solution to the problem raised in this paper will be discussed later. The fourth model is the certainty - equivalent model. This model involves either the computation of the present values of the certainty - equivalents of each of the outflows and inflows or an adjustment to the net present value of the flows to account for riskiness.

In recent years, firms have been forced to become more aware of the potential impact of inflation on interest rates, revenues and costs, when they make capital budgeting decisions. It is beyond the scope of this paper to discuss the variety of methods for accounting for inflation that have been suggested.

The Cost of Capital

Much has been written over the past quarter century about a firm's cost of capital - the cost to a firm of "borrowing" by means of debt and equity. There is by no means unanimity of opinion as to the effect of a firm's capital structure on that firm's cost of capital. It is not the intent of this section to enter the fray but rather to describe the components of a firm's cost of capital as they pertain to the central issue in this paper.

For purposes of this paper, I will make the simplifying assumption that the firm has funds available for the proposed investment. A second assumption, that the firm's marginal costs of debt and equity, at the point at which the investment decision is being made, are equal to its average costs of debt and equity will also be made. These assumptions permit the use of a weighted average cost of capital based on the relative magnitudes of the firm's debt and equity. For example, if the firm in question had debt of $100,000 at cost of 8% and equity of $400,000 at a cost of 20%, the firm's cost of capital would be (1/5) (.08) + (4/5) (.20) or 17.6%. The debt component is based on existent debt of $100,000 borrowed at 8%. If the debt matured and was re-financed, the cost of capital would change ceteris paribus. For example, if the cost of debt went up to 10%, the cost of capital would increase to 18%; if the cost of debt decreased to 6%, the cost of capital would decrease to 17.2%.

The capital markets perceive that an investment in a firm's debt and equities entails risk, a certain portion of which is indigenous to the firm in question. These perceptions are reflected in the firm's cost of borrowing via debt and equity. Should the firm's "perceived" risk change, it seems intuitive that the firm's cost of debt (and equity) would change. And thus its cost of capital would change. Interest rates themselves change over time as a result of factors exogenous to the firm. It is unlikely that when a firm re-finances maturing debt, the new cost of debt will be the same as the old. Thus, when a firm re-finances, its cost of capital will probably change. It is this change that is the focus of this paper.

The Discount Or Hurdle Rate

The discount rate used in the net present value models and the hurdle rate used in the internal rate of return model would usually be equivalent for a particular investment for a particular firm. The value used is usually a composite of the firm's cost of capital adjusted for some risk factor. "The appropriate discount rate to use for any given asset is a function of the timing of the cash flows of the project and the risk associated with those cash flows." (Dopuch, Birnberg, Demski, 1974, p. 172).

Mao found that executives tended to set a relatively high discount rate of 18% (Mao, 1976 pp. 176-7) while researchers have found that the long-run return earned on common stock was about 9.3% [1](Lorie and Hamilton, 1973, p. 31). Mao posits several reasons for this difference including a premium as a hedge against error.

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[1]Since the cost of debt is usually less than the cost of equity, the cost of capital would presumably be less than 9.3%.

In summary, the discount or hurdle rate is usually equal to the firm's cost of capital adjusted for the estimated risk of the investment. An additional element for unforeseen risk might also be included.

Potential Impact of Changing Interest Rates On Net Flows

Measurement of the Impact

The assumption is made that the firm in question has a debt issue outstanding that will have to be refinanced prior to the cessation of positive flows from an investment. For example, the debt might mature in 10 years from the point at which the investment decision is to be made while the expected life of the investment might be 25 years from that date. New debt financing would be required for the final 15 years of the investment's existence. A second assumption is made that the firm cannot predict future interest rates with certainty. This assumption is realistic because, although a firm might know the cost of borrowing for 10 years today, it cannot know the cost of borrowing in 10 years.

The "Factor" columns on Tables 1 and 2 show the difference between the present value of $1.00 discounted at 8% and 10% or 12% (Table 1) and 8% and 6% and 4% (Table 2), for differences in maturity between the debt and the investment of from 5 to 25 years. The columns headed "% of 8%" show the absolute value of the "Factor" as a percent of the present value of 8%. These values represent the understatement (when cost of debt increases) or overstatement (when cost of debt decreases) of the cost of debt when interest costs change for the periods indicated. The columns headed "Refinanced Debt" show the magnitude of the under-(over-)statement when debt is 20%, 40% or 60% of total capital.

Table 1 indicates that the impact on an investment of a shift in interest rates from 8% to 12%, as a result of re-financing, when there is 15 years remaining until the investment matures is an understatement of the cost of capital for that 15 years of 12.2%. The maximum understatement for an absolute increase in the interest cost of debt of 8% to 12% and 25 years to be 15.9%. Table 2 shows the potential overstatement of the cost of capital in the event interest rates decrease. The danger in this situation is that of rejecting an investment that might be unprofitable when the cost of debt is 8% but profitable when the cost of debt drops to 4%.

The Re-investment of Cash Inflows

The net present value method usually assumes that a firm will re-invest funds thrown off by an investment at the discount rate used to compute the net present value. The internal rate of return method, on the other hand, assumed that funds thrown off are invested at the internal

TABLE 1

COMPUTATION OF POTENTIAL IMPACT ON CASH FLOWS WHEN COST OF DEBT INCREASES

	Change In Cost Of Debt									
	8% - 10%					8% - 12%				
No. of Years between Maturity of Debt and Maturity of the Investment			Refinanced Debt As a Percent of Total Capital					Refinanced Debt As a Percent of Total Capital		
	Factor*	% of 8%	20%	40%	60%	Factor*	% of 8%	20%	40%	60%
5	.20192	.051	.010	.020	.031	.38793	.097	.019	.039	.058
10	.56551	.084	.017	.034	.050	1.05936	.158	.032	.063	.095
15	.95340	.111	.022	.044	.067	1.74662	.204	.041	.082	.122
20	1.30459	.133	.027	.053	.080	2.34871	.239	.048	.096	.143
25	1.59774	.150	.030	.060	.090	2.83164	.265	.053	.106	.159

TABLE 2

COMPUTATION OF POTENTIAL IMPACT ON CASH FLOWS WHEN COST OF DEBT DECREASES

No. of Years between Maturity of Debt and Maturity of the Investment	Change In Cost Of Debt: 8% - 6%					Change In Cost Of Debt: 8% - 4%				
			Refinanced Debt As a Percent of Total Capital					Refinanced Debt As a Percent of Total Capital		
	Factor	% of 8%	20%	40%	60%	Factor	% of 8%	20%	40%	60%
5	.21965	.055	.011	.022	.033	.45911	.115	.023	.046	.069
10	.65001	.097	.019	.039	.058	1.40032	.209	.042	.084	.125
15	1.15277	.135	.027	.054	.081	2.55891	.299	.060	.120	.179
20	1.65177	.168	.034	.067	.101	3.77218	.384	.077	.154	.230
25	2.10858	.198	.040	.079	.119	4.9430	.463	.093	.185	.278

rate of return. In fact, this assumption under the latter method is one of the claimed weakness of that method.

It is possible that the effect of increased borrowing costs resulting from debt that matures prior to the completion of an investment could be partially or completely offset by increased returns resulting from the increased interest rates. On the other hand, should borrowing costs decrease, the gain would be partially or completely offset by decreased returns. It is also possible that the return from the funds thrown off would not be affected by changes in interest rates and thus would not dampen the disparity resulting from debt re-financing.

Suggestions For Reducing The Impact

A company, that is making a capital budgeting decision involving an investment whose life will exceed the maturity of the company's debt, should compute the potential impact of future interest rate changes resulting from re-financing and include the appropriate premium in setting a discount or hurdle rate. One method might be to use one discount rate, when the maturities are matched, and a second, adjusted for the maximum (possible) expected interest rate change, for the mismatched period. For example, debt is 40% of capital, the present cost of debt is 8%, maturity of the investment is 30 years, maturity of the debt is 10 years, the expected maximum cost of debt is 10%, and the discount rate is equal to the cost of capital is equal to 10%. The discount rate for years 1 to 10 would be 10.0% and for years 10 to 30 would be (.10 x (1.0 + .053)) 10.53%.

I am presently at work on the development of a general model that can be used to quantify the risk that accrues to a company that mis-matches the maturity of an asset and a related liability. The model will compute a risk factor that can be added to the cost of capital along with other risk factors to produce a discount rate that is more defensible than the present models which either ignore the risk of interest rate changes or allow for it by adding an unsubstantiated amount to the cost of capital in computing the discount rate. The model has been developed and tested for mismatched maturities of financial assets and liabilities. I am in the process of adapting it so that it can be used for non-financial assets.

Conclusion

It was the intent of this paper to point out that companies making capital budget decisions where the maturity of some or all the company's debt is less than the expected life of the investment being considered, should be aware of the potential impact of changing interest rates on net cash flows. A means of computing the potential impact of interest rate changes was indicated and two methods of accounting for them were suggested.

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ACCOUNTING AND ECONOMIC ALLOCATIONS COMPARED: CONDITIONS UNDERLYING OBJECTIVE TRANSFER VALUES

Thomas defined "allocation" to include:

> "(1) The assignment of costs, revenues, income, cash flows, or funds flows to individual inputs or groups of inputs to the firm, including assignment to individual periods of time, divisions of the firm, etc., (2) the division of any total into parts, (3) the assignment of costs to revenues, called matching." (Thomas, 1974, p. 1).

He concluded that most allocations traditionally made in financial accounting are both arbitrary and incorrigible, and consequently should cease. It is important to note that:

> "Allocations have here been rejected on a deeper ground than their not being theoretically justified. They have been rejected as being unrelated to the purported topic of financial statements: a firm's economic state and activities. They have no more significance for these economic matters than do the calculations of astrologers. Thus our first conclusions about the referents of conventional allocations is that they are irrelevant to description of the firm's affairs." (Thomas, 1974, pp. 63-64).

This paper will focus on what makes an allocation non-arbitrary and relevant as a measure of "a firm's economic state and activities." It will suggest that accounting allocations which have direct economic effects on independent opposing interest are not arbitrary but do have significance for financial accounting purposes. The approach of this paper does not appear to have been directly considered by Thomas or others, and if it has validity, it should result in some modifications to his conclusions, at least insofar as transfers between international divisions of a firm are concerned. I emphasize that this is not a definitive study; my "conclusions" are stated as suggestions. The objective of the paper is to propose what may be a useful line of inquiry, and to stimulate further thinking along this line.

It is first very important to be clear on how one determines what is arbitrary and meaningless <u>for financial reporting purposes</u>. We are not talking about what allocations might have been, or optimally should have been, or whether a particular allocation is "fair" (whatever that may mean) --- but rather whether a number is theoretically justified and, in the broader sense suggested by Thomas above, has economic significance <u>as a measure of what actually happened</u>.

To illustrate: Suppose A and B jointly produce a product which they sell for $10. How are they to allocate this sum between them? It is clear that accounting theory cannot give a non-arbitrary answer to this question. Many possible divisions will be equally defensible in accounting theory. Yet if we suppose that A and B are independent of one another, they will presumably strike a bargain, and there is no doubt that the allocation[1] decided and agreed upon is the unique measure of that transaction, and that it has significance for the economic state and activities of both A and B. The key to this lies in the fact that the parties are at "arm's-length". "Arm's-length" is here defined in terms of "a buyer and a seller both free to act, each seeking his own best economic interest" (Kohler, 1975). Two points might be stressed here:

1. There is likely to be economic indeterminacy as to where an allocation value could (or should) fall, and this range could be very broad. Further, a number of economic/accounting determinations could have been proposed to try to justify different prices. But this indeterminacy is irrelevant for financial accounting measurement purposes. Obviously, the range of possible outcomes is reduced to a single point by the opposition of the pricing preferences of the independent buyer and seller, and this is what is relevent to financial accounting.

2. The relative power positions of A and B have no bearing on the economic reality of the bargained outcome, providing it is accepted by both parties and the exchange actually takes place. A monopolist may, for example, be able to force a defenseless buyer to accept an unconscionable price. An independent buyer, no matter how weak his bargaining position, is still in opposition to the seller in "seeking his own best economic interest".

Now let us suppose that A and B are not at arm's-length, but are divisions of the same company. They therefore cannot be relied upon to have independent opposing interests; their individual interests, if any, will be subordinated to that of the controlling entity. Therefore there are no competing forces between A and B which will dictate a unique price solution, and we might tend to conclude then with Thomas that any accounting measure of this allocation must be arbitrary and incorrigible.

But is this always the case? Let us add one further dimension to the situation. Suppose A and B are subsidiaries of the same company but that they are located in different countries, and that A manufactures certain

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1. Thomas would be careful to distinguish this as an "external distribution", pointing out that the decision outcome should be clearly distinguished from any accounting allocation schemes that might have been used by A and/or B to justify acceptance of the division. See, for example, Thomas, 1974, pp. 56-57.

component parts which it then transfers to B for further processing and sale. We are still confronted with the same wide range of defensible transfer prices in accounting. Yet in this case the transfer price selection has certain direct economic consequences. Transfer pricing will determine the revenue allocations between tax and tariff authorities in the two countries. Transfer pricing may also have significant effects on other national interests in the two countries. (Given the volume of transfers between Canada and the United States, for example, even a moderate degree of transfer pricing variability could have significant effects on tax revenue allocations and could influence international balance of payments cash flows (Milburn, 1976)).

If we assume that management of the consolidated international entity selects one transfer price for all external purposes including financial reporting,[1] then one may expect that a number of non-accounting considerations will enter into the selection of an international transfer pricing policy. Indications are that international transfer pricing may be viewed as an economic decision function under which rational management, with profit maximization objectives, may be expected to take into account:

1. Opportunities for cost savings (for example, pricing in order to place income in low tax jurisdictions) and/or risk reduction (for example, pricing in order to place funds in strong currency countries).

2. The pricing preferences of national interests, (tax authorities, etc.) where these national interests are perceived to have the power to bring penalties or rewards to bear on the company. (Milburn, 1977).

The studies of the writer and others indicate that both types of factors (cost savings/risk reduction and national interest factors) are potentially significant considerations in management's international transfer pricing deliberations.

Let us look briefly at third party interests as bargaining powers. It is clear that national governments are increasingly aware of the need to monitor and participate in international transfer pricing. (United

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1. Note that a very important assumption has been introduced at this point - that management will select one price for all external purposes. Conceivably, management could attempt to set different prices for the different third party purposes. If successful in so doing, obviously the transfer price for external financial reporting purposes could be isolated or "sterilized" from any effects of the international environment, and thus be completely arbitrary for reporting purposes. Whether this is done, or can realistically be done, is a question for further research. The writer's study of the U.S./Canadian environments indicates that multiple pricing for different external purposes is rare, and that there are likely to be significant difficulties in justifying differences to, for example, a tax authority where the financial reporting number or numbers for competing third party interests would yield more taxes for the tax authority.

Nations, 1974). This participation may be through income tax and customs authorities (as is predominantly the case in Canada and the United States) and/or by other government agencies operating independently, or all operating under common direction with agreed upon national goals. A good case can be made that national interests are a natural part of the international transfer pricing process -- on the grounds that, while the resources may, in a narrow sense, be the property of the companies, they may be viewed as first and foremost belonging to the nations themselves. Studies also indicate that national governments potentially have significant powers to influence transfer prices (Milburn, 1977). The U.S. Internal Revenue Service for example, has been very aggressive in challenging international transfer prices in recent years, and indications are that it has resulted in U.S. companies being much more defensive in their pricing policies. (Duerr, 1972). It should be observed, however, that the extent of the bargaining power or whether the power is effectively used, is not a factor in determining whether the outcome of an arm's-length transaction is corrigible and relevant. It may be questionable therefore, whether the bargaining power of national governments should be taken into consideration in determining whether a transfer measurement is arbitrary or economically significant.

It is suggested, then, that the existence of affected third parties may provide an element of independent opposing interests in the determination of international transfer prices. National interests on each side of a transfer transaction will be in opposition to each other, and one or the other is likely to be in opposition to management's cost saving/risk aversion pricing preferences. The premise is that the existence of opposing third party interests requires that management base its pricing decisions, not only on its own independent preferences, but also on its expectations of third party reactions and on the costs or benefits which may result therefrom. Viewed in these terms, international transfer pricing may be considered a form of bargaining.[1]

To summarize:

1. In all allocations (the "division of any total into parts" (Thomas, 1974)) there will be a range of conceptually defensible accounting possibilities.

2. This indeterminacy is resolved into a non-arbitrary and economically significant single value by the bargaining of independent competing interests in the allocation. (Resource allocation in a free society is presumably based on "free enterprise" bargaining outcomes).

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1. Schelling has noted that in "pure bargaining" (meaning "situations in which a better bargain for one means less for another") "each party is guided by expectations of what the other will accept." (Schelling, 1960, p. 121).

3. Financial accountants have tended to think of this bargained exchange condition as existing only where the buyer and seller are at arm's-length.

4. In certain circumstances (here, international transfer transactions) significant third parties are directly affected by the accounting allocation and such parties may well have potential for influencing the measurement choice.

It is suggested that, in such cases, the accounting allocation is not a completely arbitrary internal allocation, but rather has a certain economic significance implicit in its acceptance by the third parties for their economic purposes.

This implies that accounting allocations are not arbitrary where they determine the sharing of actual benefits or costs between competing participants, and that third party effects of accounting allocations should be considered in determining whether or not an accounting allocation is arbitrary and meaningless for financial accounting purposes.

In this paper, third party participation has been considered only in the context of international transfer pricing. Whether it has any application beyond this has not been addressed.

It is hoped that this paper will help stimulate interest in this line of inquiry and, hopefully, foster further study and research.

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Effects of External Accounting Information and Accounting Versus Market Based Risk Measures: The Trust Companies

Introduction

In recent years, problems concerning materiality in accounting have increasingly included aspects of the Efficient Market Hypothesis. This paper discusses relationships between external accounting information and market reaction including a comparison between accounting and market based risk measures. The methodology used to compare risk measures is adopted from Gonedes (1973). However, the specification and empirical techniques used in this paper are based on those of Kraus and Litzenberger (1976). The impact of external accounting is measured in this paper by an analysis of industry particular information association with inferior or superior growth in market value of common equity.

Methodology

The model used to describe risk measures and stochastic growth of common equity is described in equation 1.

$$r_i = b_0 + b_1 \beta_i + b_2 \gamma_i + \mu_i \qquad (1)$$

where

r_i = average return or growth of equity of firm i

b_0 = an estimate of the return on a risk free asset

$\beta_i = \sigma i_m / \sigma^2_m$ or "beta"

γ_i = a systematic skewness measure

μ_i = inferior or superior growth equity of firm i

$b_1 + b_2 = rm - rf$ = the difference between the market return and the risk free return

The measures in equation 1 are given a postscript (a) when these are accounting based. The postscript is omitted when these are market based.

The estimation of the volatility parameter (β) and skewness parameter (γ) are estimated from time series as described in equation 2.

$$\hat{\beta}_{it} = \sum_{s=1\ s\neq t}^{T} (rm_s - \bar{rm})(ri_s - \bar{r}_i) / \sum_{s=1\ s\neq t} (rm_s - \bar{rm})^2$$

$$\hat{\gamma}_{it} = \sum_{s=1\ s\neq t}^{T} (rm_s - \bar{rm})^2 (ri_s - \bar{ri}) / \sum_{s=1\ s\neq t}^{T} (rm_s - \bar{rm})^3 \qquad (2)$$

where T = number of time periods.

Market based returns are measured as:

$$Rm_t = \frac{Pm_t}{Pm_{t-1}} - 1$$

$$rm_t = (Rm_t - Rf_t)/(1 + Rf_t)$$

Pm_t = value of the Toronto Stock Exchange industrial index at time t

Rf_t = the risk free rate measured by the treasury bill rate at time t

$$Ri_t = Pi_t / Pi_{t-1} - 1$$

Pi_t = value of the Toronto Stock Exchange trust company index at time t

$$ri_t = (Ri_t - Rf_t)/(1 + Rf_t)$$

Accounting based returns are measured as:

$$Ram_t = \frac{\text{Savings by non-financial corporations at t}}{\text{Net worth of corporations at t}}$$

$$ra_{mt} = (Ram_t - Rf_t)/(1 + Rf_t)$$

$$Ra_{it} = \frac{\text{Net income of all Trust Companies at t}}{\text{Net worth of all Trust Companies at t}}$$

$$ra_{it} = (Ra_{it} - Rf_t)/(1 + Rf_t)$$

To test to what extent accounting and market based risk measures are associated, the relationships between volatility and skewness are investigated first by graphics and linear summary statistics such as correlation.

To measure the effects of accounting information (μa_t and μ_t) the residuals from estimating equation 1 on time series returns are compared. If association is found between the two, there is a relationship between market value and accounting information.

Results

Quarterly data for the 18 quarters ending the second quarter 1976 are analyzed.

The market and accounting based volatility measures (beta) are not much related. Systematic skewness on the other hand shows a weak positive correlation. Table I presents the correlations.

Table I. Correlations between Risk Measures

	βa	γa
β	-.10	.24
γ	.24	.26

Source: Author's computations.

Based on these findings one can not conclude that accounting based and market based risk measures are substitutes.

In the particular time period under study, we find that the market has a lower return than a risk free security such as treasury bills. This is therefore a period characterized by a "bear market" as the security market line has a negative slope.

Market based and accounting based returns are positively correlated (r and ra), however, the correlation is not strong (.24). The existance of positive correlation indicates that there a degree of association between the two.

Regressing the residual market based return on the residual accounting based return gives equation 2.

$$\mu_t = .1371E\text{-}7 \quad - \quad 1.244\ \mu a_t ;\ R^2 = .02 \qquad (2)$$

$$(.823E\text{-}1) \qquad (-.5078)$$

The t-statistics are given in parentheses.

The results in equation 2 show that there is no non-anticipated effects of accounting information on the growth in trust company equities in the aggregate.[2]

Conclusions

The market of trust company equities is unaffected by accounting information or accounting information at the time of release is discounted in the equity prices. Thus the market of these securities is efficient and use of insider earnings information should not lead to excess returns. The expected value of such information

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[1] Dividends are not included in the stock returns.

[2] The results are almost indentical when aggregate net income is defined as net savings instead of gross savings.

would in fact be negative if the probability of detection and fine is greater than zero. There is also some indication that general economic conditions influence accounting results and market value in the same direction.

These conclusions are only valid with reference to the methodology and data employed.

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GOAL DIFFICULTY IN BUDGETS

Introduction

The success of a management control system depends on the actions of persons responsible for taking actions when feedback is relayed to them. If appropriate action following the feedback was not taken, such a system would fail to achieve its objectives. As Stedry (1960, p. 12) points out, "the setting of standard is not sufficient of itself to assure or even invite compliance. The problem of directing activity toward a goal is one of "motivation"."

Porter and Lawler's (1968) model of managerial attitudes and performance incorporates variables and relationships among them, as they pertain to the manager's motivation to perform his job. According to this model, the extent to which the manager is motivated to execute his functions is determined by the interaction between (1) value of reward, and (2) perceived effort-reward probability. The latter, in turn, is determined by (a) the probability that reward depends upon performance, and (b) the probability that performance depends upon effort. This latter variable, seems to be in accordance with the concept of goal difficulty and its relation to performance.

If a person responsible to achieve a budget (budgetee) perceives that his efforts would lead to a satisfactory performance, he would be motivated enough to put forth his best efforts to achieve it. If, on the other hand, the budget is impossible to achieve, he would tend to ignore the budget. It can thus be hypothesized that: the budgetee should perceive the budget as attainable if he is to be motivated to achieve it.

The need for perception of the budget as attainable is emphasized by other researchers. Searfoss (1972), in his empirical investigation, found a moderately significant positive correlation between "perceived attainability of the budget" and the budgetee's motivation as measured by his efforts in guiding his subordinates toward the achievement of the budget. Hofstede (1967) hypothesized that up to a certain level of difficulty higher goals would be accepted with resulting improved performance. Beyond that, the goal would be rejected and performance would decline. Dunbar (1971, p. 89) argues that "it is this possibility of goal rejection that makes a positive feedback mechanism necessary to ensure a controlled increase of the budget which can be accepted as feasible by the goal achieving budgeted individual."

The acceptance of a goal as feasible is not likely to be linearly related to goal difficulty.[1] It is possible, for example, that a difficult

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[1] Stedry (1962) in his water-jar experiment, distinguished three levels of goal difficulty and found that acceptance was not linearly dependent on difficulty.

goal is accepted and achieved whereas a relatively less difficult goal is not accepted and, therefore, not achieved. It seems reasonable to expect that, besides goal difficulty, variables such as participation in the formation of the goal would affect perceived attainability of the goal.

An empirical investigation was conducted to test the hypothesis that acceptance of a budget (by the budgetee) as feasible is positively related to the budgetee's performance. Other aspects, such as the relationship between goal difficulty and acceptance of a budget as feasible (perceived attainability of the budget) were also examined. The research design and results of the study are discussed in the following paragraphs.

Research Design

In this study, subjects participating in the study were personally approached to fill out certain questionnaires. The sample consisted of 15 superintendents and 35 subordinates of these superintendents (general foremen), and represented 13 manufacturing plants, located in midwestern United States, of nine different industries.[2]

The general foremen were the primary subjects in this study. They were asked to respond to a 20-item, Likert-type five-point scale ranging from "strongly agree" to "strongly disagree." A factor analysis of the responses to these items produced a six-item factor which was expected to measure attainability of the general foreman's budget as perceived by him (Perceived Attainability). These items, with respective factor loadings, appear in Table 1. The sum of responses to these items was considered as the respondent's Perceived Attainability score. A high score on this variable meant high Perceived Attainability on the part of the general foreman.

To obtain measures of general foremen's performance with respect to the budget (Budget Performance) and of the level of goal difficulty they faced in the budget (Index of Goal Difficulty), superintendents of the general foremen participating in the study were approached. Each superintendent was asked to evaluate his general foreman's performance with respect to the budget in respect of capacity utilization, manpower utilization, raw materials usage, and departmental expenses. To illustrate, the item for capacity utilization is reproduced in Table 2. He was also asked to provide weights assigned by him to each of these budget factors in evaluating his subordinate's performance. In obtaining overall Budget Performance measure, these weights were applied to the indicated performance with regard to each aspect of the budget.

Additionally, each superintendent was asked the following in relation to each of the four aspects (capacity utilization, manpower utilization,

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[2]For a complete discussion of the study, see Raval, V. H., Certain Aspects of Budget Related Behaviour as Moderated by Locus of Control and Environmental Uncertainty, unpublished doctoral dissertation at Indiana University, 1976.

TABLE 1

Individual Items, With Respective Factor Loadings, Used to Measure Perceived Attainability of the Budget

Items	Factor Loadings
9. The budget for my department can be attained with reasonable effort.	0.56
12. The budget for my department reflects an unrealistic optimism.	0.81
14. My department's budget is such that my best efforts will not be enough to attain the budget.	0.84
15. When results are as budgeted, the budget for the next period is generally tighter.	0.56
18. The budget is usually set too tight.	0.80
19. Achieving the budget indirectly results in a reduced chance to make friends.	0.48

TABLE 2

Partial Reproduction of Performance Evaluation Questionnaire

You are to evaluate your subordinate on the basis of his budget performance. While making such evaluation, it may be helpful to review variances from the budget for which he is responsible. For such a review, consider your subordinate's budget performance over the past 3-4 months.

If your subordinate's budget was revised in the course of the budget year, consider such revised budget (in place of the original budget) for evaluation of your subordinate's budget performance.

Capacity Utilization

In productively utilizing capacity of his department,

He either surpassed or fell short of the budget by

☐ up to 1% of the budget.

He surpassed the budget by

☐ over 1% and up to 3% of the budget.
☐ over 3% and up to 5% of the budget.
☐ over 5% and up to 10% of the budget.
☐ over 10% and up to 15% of the budget.
☐ over 15% of the budget.

He fell short of the budget by

☐ over 1% and up to 3% of the budget.
☐ over 3% and up to 5% of the budget.
☐ over 5% and up to 10% of the budget.
☐ over 10% and up to 15% of the budget.
☐ over 15% of the budget.

raw materials usage, and departmental expenses) of the general foreman's budget:

> Considering how tight or loose the budget was I would have expected him to perform BETTER/WORSE (circle one) than budgeted[3] performance by
>
> 0% 1% 2% 3% 4% 5% 6% 7% 8% 9% 10% 12% 15%
> (circle one)
> of the budget.

Using responses to this item and the weights obtained for the budget aspects (as explained in the previous paragraph), an overall Index of Goal Difficulty was derived for each general foreman. The items in this measure were scored such that a higher Index of Goal Difficulty represented a less difficult budget.

In examining possible relationships Pearson Product-Moment Correlation Coefficients were used. Performance was correlated with both Perceived Attainability and Index of Goal Difficulty, which were correlated with each other.

Results

Table 3 presents the correlations obtained along with their statistical significance (one-tailed probabilities)[4]. The results indicate that Perceived Attainability is positively related to Budget Performance. This relationship, however, appears to be weakly significant. The Index of Goal Difficulty is positively related to Budget Performance and the relationship is statistically significant. Recalling that high (low) Index of Goal Difficulty indicated achievable (less achievable) budget, a positive correlation between this variable and Budget Performance indicates that as long as the superintendent considered his subordinate's budget as feasible (or better than feasible), the subordinate shows improved performance. In other words, where the superintendent expected the budget to be tight (less than feasible), the subordinate's performance was low, and vice versa. Finally, no linear relationship between Perceived Attainability and Index of Goal Difficulty was found.

It should be noted that items 15 and 19 were not expected to appear on a measure of perceived attainability of the budget. The presence of these

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[3] At least in one case, a superintendent read "actual performance" in place of "budgeted performance." This may have contaminated the data somewhat. Degree of such contamination, and its effects on results obtained, are unknown.

[4] Nie, et al, (1975, pp. 282-283), suggest that the one-tailed test is normally used when there are rather explicit expectations about the direction of the coefficient, that is, whether it will be positive or negative.

TABLE 3

Pearson Product-Moment Correlation Coefficients

Variables	Perceived Attainability	Index of Goal Difficulty
Budget Performance	0.22 ($p < .11$)	0.35 ($p < .02$)
Perceived Attainability		-0.05 (N/S)

items on the Perceived Attainability factor may be interpreted as follows: In evaluating the degree of attainability of a budget, the general foreman considers not only whether or not the budget is achievable but also whether it should be achieved. The latter is important to the respondent in that the achievement of a budget - given an attainable budget - may result into some negative consequences, such as facing tighter budgets in future.[5]

Conclusion

The findings of the study suggest the possibility that a subject who perceives the goal as attainable registers a performance higher than the one who perceives the goal as unattainable. Moreover, there is some evidence that performance of a subordinate is positively related to the degree of feasibility of achieving the budget as seen by his superior.

No linear relationship was found between a subject's perception of budget attainability and his superior's rating of the feasibility of achieving the budget. Although the two variables are somewhat dissimilar, they could reasonably be expected to be positively related. In fact, if both the superior and his subordinate do not agree on the goal difficulty faced by the latter, there may exist constant conflict between the two on this matter. Stedry (1960, p. 40) points out a possibility of conflict situations where there is disagreement on standards between the budgetee and others involved in setting the standards.

Inviting the budgetee to participate in the budget setting process may be one important medium to influence the budgetee's perceptions regarding

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[5] Stedry (1960, p. 19) states: "The fear of a lowering of the budget if he performs too well will undoubtedly dominate a desire to impress management with superior performance."

attainability of the budget. Further investigation in this area is warranted. Most studies have considered individuals as subjects, without explicitly recognizing influence of peers in the same area of operation. Peer group influence on the budgetee's perceptions of attainability of the budget also needs to be studied.

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EXPERIMENTS IN BEHAVIOURAL ACCOUNTING - A "NEW" BRUNSWIK APPROACH

Attempts to apply social science findings and methods to accounting problems have proliferated in the last decade. From the early study of Stedry (1966) to recent studies such as Ansari (1976), social psychological laboratory experiments have been an important source of our knowledge of human motivation, information processing, decision making, and performance. Though the situations have not been directly related to accounting, analogues have been made and inferences drawn. Recently there has been some criticism of the practice of applying findings from non-accounting problems and non-business oriented subjects, to accounting data and business related subjects (Swieringa, et al., 1977). This paper goes somewhat further and suggests that even when the problems of surrogation and reality of content are dealt with, the experimental findings must still be interpreted in the context of the applied problem.[1] The concern of this paper is only with one type of experiment and draws heavily on one particular study, but these may be considered as representative of a broader category of applied social-psychological experiments and the problems raised indicate central weaknesses in the method.

Experimental designs based on the Brunswik Lens Model are currently popular in decision-making studies. Developed by a psychologist (Brunswik, 1952, 1956) attempting to introduce realism into experiments, its potential for accounting research was soon recognized (Devine, 1961), and it has been utilized in several studies. A full description of the model and a thorough review of the literature is given by Slovic and Lichtenstein (1971) and will not be repeated here. The full model compares the subjects weighting of various pieces of information (cues) in the decision model with the environmental validity of the cue. The subject's decision outcomes are compared with the actual outcomes (achievement index) and the subject's linear model is compared with the underlying linear model (matching index). In many problems, however, the true outcomes and the environmental validity of the cues are not known and the studies have concentrated simply on capturing the decision model of the decision maker without relating those models to environmental validity. The user's decisions are the dependent variable, and the cues form the independent variables in a regression analysis (or some variant of regression such as ANOVA or Discriminant Analysis).

The statistical analysis is critical in the experimental design. Finding the precise weight of each cue (i.e. the percentage of variance in outcome explained, ω^2) requires independence among the cues. Such situations almost never occur in reality but can be created statistically by making the cue values categorical and using a factorial, or fractional replication of a factional, design. While increasing the precision of measurement, the experimenter loses reality in the number of cues, the number of levels and the true intercorrelations of the data. Though orthogonal designs have been more popular than non-orthogonal, the value of such precise measurement is dubious, mainly because as Dawes and Corrigan (1974) have shown, the weights of significant variables in a decision-maker's model can be replaced with random weights of the same sign and still predict outcomes more accurately than the decision maker whose decisions are being modeled. Furthermore

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[1] The influence of the statistical properties of the environment on decision-making studies using the Brunswik approach was addressed by Hursch, Hammond and Hursch (1964), but the problems they pointed out are seldom addressed in applied studies.

ω^2 tends to exaggerate the differences between the least and most important cues and exaggerate the difference between subjective assessments and the experimentally derived weights (slovic, 1969, p. 261).

In all the studies the data are analysed on an individual basis so that, within the limits of the statistical method, some measure of the importance of each cue to the outcome and the user's strategy for combining cues can be found. The individual models are aggregated to find the overall cue utilization or combination method. Thus the proponents of the method claim that the experiment reveals what the decision maker's actual strategy as opposed to what he says he does (or will tell!). Four previous studies will illustrate the use of the technique in the accounting and finance areas. They, together with a fifth study which will be described in detail shortly (Sweeney, 1977), provide the material for a discussion on major shortcomings in this technique as a tool for practical problem solving.

Slovic (1969) utilized an orthogonal design in a study of the decision models of two young stockbrokers. The decision data consisted of eleven dichotomized cues selected from Standard and Poor's Reports. The design was a 1/16 replication of a 2^{11} ANOVA design with 128 hypothetical companies upon which the subjects made recommendations on a nine point scale. They took 9-10½ hours to complete the task (between 4 and 5 minutes per company), found it enjoyable and reasonably realistic but differed quite considerably in the mean and variances of their ratings. The agreement in outcomes between subjects was only .32 and there were differences between the subject's assessment of cue importance and the statistical weights found by the regression analysis of their actual decisions. The decision makers did not use all the cues they claimed to use; there was a significant amount of configurality but the configural use of data was not consistent across both subjects.

In a similar subsequent study of thirteen stockbrokers and five MBA students, subjects in ¼ fractional replication of 2^8 factorial ANOVA design (Slovic, Fleissner and Bauman, 1972), the subjects assessed 64 companies for capital appreciation on a nine point scale. The information for each company consisted of eight dichotomous cues drawn from Standard and Poor's Reports. The average time spent in evaluating the companies was 2½ hours (less than 2½ minutes per company). Cue utilization differed between subjects and agreement on outcomes was low. On average, main effects accounted for 75% of variance of each subject's ratings and configural effects accounted for 4%. The brokers agreed with each other less and had more discrepancy between their subjective weights and the weights calculated in the experiment; moreover the discrepancy increased with experience.

A more ambitious study which incorporated both sides of the lens model, more realistic data and a non-orthogonal design was conducted by Kruse (1974) with five financial analysts as subjects; however, he was concerned with accuracy and matching more than describing their models. Each subject estimated the future rate of return on 35 companies by giving a probability distribution. The subjects were told that the companies were hypothetical, but they were in fact real. The cues were historically accurate, and intercorrelated, necessitating the use of regression rather than Analysis of Variance. There were also more cues (19) than in ANOVA studies, and they were continuous rather than dichotomous variables. Four of the cues related to the economy in general, six to the industry and nine to the firm. The increased numbers and continuous nature of the cues were probably responsible for increasing the time spent on the task; four of the analysts took 2-6 minutes per company, one took 12 minutes per company. The linear regression models of the decision accounted for between .85 and .95 of the variance in outcomes, and outcomes

were consistent in a test-retest sense. Accuracy was quite low, but the best analyst outperformed the average of five cross-validated regression models built on the same data.

Finally, Ashton (1974) studied the decision models of auditors using an orthogonal, one-half fractional replication of a 2^6 factorial experimental design. Sixty-three auditors assessed the strength of the payroll internal control subsystem for 32 hypothetical companies on a six point scale (from "extremely weak" to "adequate to strong"). The assessment was based on a general description of the company and six dichotomous cues. The auditors typically took 30-40 minutes for the task (approximately one minute per company). The procedure was repeated six to fourteen weeks later to assess consistency of the individuals' judgments over time. Considerable variation in the weighting of the cues was found across auditors. These differences were not related to the firm worked for or the amount of experience. There was also a difference in outcomes which was related to different cue weightings. Stability over time varied from .43 to .96 but in general was high. On average the six main effects accounted for just over 80% of the variance in outcomes (ranging from 48% to 96%) while interactions on average accounted for 6.4% (range 0-17%) and were not consistently used.

These studies were concerned at least in part with finding which information the decision maker used, without having a specific problem in mind. This technique also appears ideally suited to studying the problem of selecting user-based criteria for materiality. Finding the user's decision model would allow the accountant to base his criteria for judging materiality on the actual use rather than the supposed use of the data in question. "Materiality" as an accounting principle allows the accountant to aggregate or ignore insignificant information.[2] Errors and omissions must be "material" to be actionable. Definitions of materiality are based on the effect the information might have on the decision of a user. Traditionally decisions on the materiality of an item have been left to the professional judgment of the individual preparer and auditor.

Increasing litigation by third parties against accountants in recent years has sounded an alarm in the profession concerning any area where the "rules" of the accounting model are unclear (Isbell, 1970; Chasen and Solomon, 1975; and Palmer, 1975). Empirical studies have shown no consistent standards for materiality decision in accounting and auditing practice (Frishkoff, 1970; Bernstein, 1967; and Neumann, 1968). Together these factors provide a strong inducement for the profession to devise "user-based" criteria for formalizing materiality decisions. The Financial Accounting Standards Board Memorandum, "Criteria for Determining Materiality", attempts to provide a basis for setting such criteria.[3]

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[2]See SEC Regulation S-X Rule 1-02 "The item 'material', when used to qualify a requirement for the furnishing of infomation as to any subject, limits the information required to those matters about which an average prudent investor ought reasonably to be informed." A similar definition has been set forth by the Accounting Research Committee of the Canadian Institute of Chartered Accountants (1974): "materiality may be judged in relation to the reasonable prospects of its significance in the making of decision by the readers of the financial statements. If the item might reasonably be expected to affect the decision, it should be deemed to be material."

[3]For a different approach to materiality decisions, see Holmes (1972).

The "average prudent investor" is generally taken as the yardstick both for legal decisions concerning third-party responsibility and professional attempts to set materiality criteria. Though there are many other groups of users of financial statements who deserve consideration, financial analysts and portfolio managers were chosen as the focal group for the study described here. This group is an important user in its own right. The institutional investment industry accounts for a large and growing proportion of stock transactions (Drucker, 1976) and employs professional analysts to make the investment decisions. Though they do not represent a random sample of all investors, they should be at least "average" in their abilities and knowledge. They might, therefore, be considered a good starting point in discovering the relative importance of information in investment decisions.

Twenty-six practicing analysts and portfolio managers (about 1/3 of them Canadian and the rest from New York) volunteered as subjects for the experiment. Each subject was asked to decide the top price at which he would buy, or recommend, twenty-four hypothetical securities.[4] Each security consisted of two typed pages of information, including abbreviated financial statements, on the company, the economy and the stock market. All the hypothetical securities, based on one actual company (a Canadian company listed in the U.S.), had the same basic growth and the same items of information. A large number of less important variables were held constant over all companies by a general two-page description. Eleven items were systematically manipulated, but the variables were not constrained to be orthogonal so that each security presented would not be unrealistic. The eleven items were carefully chosen to be those most crucial to the investment decision on the basis of personal interviews with investment analysts and on past studies (Kruse, 1974; Pankoff and Virgil, 1970; Martin, 1971; Nerlove, 1968; Benston, 1967). The items included the size of the company, percentage change in sales figure from original, percentage change in net income, percentage change in book value, percentage change in cash flow, a description of the company's management, the company's market beta, industry sales trend, forecasted change in industry sales for next twelve months, industry price-earnings ratio; forecasted change in the gross national product in the next 12-24 months, and forecasted change in the Standard and Poor's Index.

For each subject both linear and configural models (interactive models suggested by the subjects' protocols) were fitted. The overall importance of each cue was assessed from the overall number of times it was significant in the user's model, either as a main effect or interaction. This method avoids the problems associated with trying to find the exact proportion of variance explained when the cues are intercorrelated (Darlington, 1968; Dawes and Corrigan, 1974). It has been suggested by several studies that the majority answer is more accurate than the 'average' answer (Goldberg, 1970; Wiggins and Kohen, 1971). Thus, though rough and ready, this measure of importance is considered adequate for the job. Without going into detail, sales, size, quality of management and industry, P/E were the most frequently significant variables, and changes in the GNP and S & P Index were important in the interactive models but had few discernable main effects.

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[4]Four of the twenty-four securities were exact repeats of other securities, to check for reliability of the decision makers. In general the reliability was very high.

Discussion

It is common in studies using the Brunswik Lens approach to capturing the decision-maker's model, to find that the experimental results are not in accord with the subject's descriptions of his decision process. While the subjects of this study were not asked to give subjective weights to each cue, there were discrepancies between the experimental results and the general descriptions of the analysts which ought to be reconciled. For example, the experiment indicated relatively low priority assigned to net income and a high weight placed on sales.

This confirms some of the gross market observations of Benston (1967) and Nerlove (1968), and supports the suggestion of the Canadian Study Group on Audit Techniques that gross profit rather than net income should be the yardstick against which materiality decisions should be made. However the findings seem to run contrary to the statements of analysts and portfolio managers that net income is an important determinant of their decisions. These statements are confirmed by unobtrusive measures. A content analysis of financial analysts' reports, selected randomly, indicates that income (particularly cash flow from normal operations) is an important input in the prediction of future income streams. A similar content analysis of the published answers to the C.F.A. examination (Part II, enterprise analysis) also indicates that income is more often used in the analysis than is sales, though by an insignificant amount.

Several studies have noted that subjects' descriptions tend to involve more decision variables, weighted more evenly and combined in a more complex fashion than is revealed experimentally (Hoffman, 1960; Slovic, 1968). For example, Slovic, Fleissner and Bauman (1972) noted that the more experienced stockbrokers in their sample were less well able to provide accurate assessments of their cue utilization than did less experienced stockbrokers and MBA students. While Slovic et al. point out that the use of ω^2 as a measure of importance of the cue tends to give relatively more weight to the most important cues and relatively less to those less in importance, most of the studies have tended to assume that the experimental weights are the true indicators of the subjects' decision model and the differences are due to the subjects' misperceptions of their own behaviour.[5]

Such an assumption seems dubious. While the experiment allows for accurate "measurement" of effects of the independent variables on the decision, it is not clear that a quick decision on a hypothetical case, using restricted data base, reflects the decision process of actual decision any more accurately, than does a subjective decision protocol. True, as the decision maker becomes more experienced and his decision model more internalized and complex, he may find it will become more difficult for him to describe it accurately, but this does not justify the conclusion that the experimental model more properly represents the decision-maker's "actual decision" than does the subjective description. No matter how realistic the data, the time frame is entirely different. In the previous studies reviewed earlier the time per decision ranged from one to twelve minutes with most subjects at the lower end of the range. In the "materiality" study the subjects were asked to make decision on twenty-four securities, each security consisting of two pages of "constants" which have to be held in mind. For a busy man or

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[5]There also seems to be an implicit value judgment on the part of researchers that a decision based on a few cues must be in some way 'inferior' to a decision based on more information. I infer this from the tone of comments rather than actual statements.

woman to spend more than a few minutes deciding each case would be incredibly burdensome. A mere five minutes spent on each case calls for two hours of work on the part of the subject. How can a five-minute decision be said to represent a decision which an analyst or portfolio manager might take several weeks to make? He is forced to concentrate on the most relevant items and make a quick decision based on these. Under such conditions we find subjects using few cues with high weights. An equally plausible explanation for the differences between the experienced stockbroker's decision, description and the outcomes of the experiment (noted above), is that the method fails to adequately capture the richness of the decision model. The more experienced the subject, the greater the difference between what he actually does and what he can do under experimental conditions.

The belief that the experiment is 'right' also assumes that the decision maker is motivated to perform in the experiment in the same way as he would be in his actual decisions. In the experiment there are no penalties for being wrong. A portfolio manager can choose a stock in order to maximize returns for a given level of risk. In reality, however, there are substantial penalties; the decision criterion appears to be the minimization of risk rather than the maximization of return. While it may be satisfactory for a psychologist to make assumptions about the objective function of the decision maker, the applied researcher cannot assume an objective function; he should investigate the decision-makers' loss function empirically.

Although actual decision makers rather than student subjects and real data are used, without a careful examination of the actual context in which the decisions are made, there are many problems in interpreting the experimental results. The researcher cannot be sure that all the relevant variables are included. In Ashton's study, for example, perhaps the most important consideration in deciding the internal control of payroll is the auditor's subjective assessment of the quality of the management, even personal liking between individuals. It would be very difficult to include all the relevant variables in a study; and if they were included, some variables operative in real conditions might be denied or repressed by the decision maker in the experimental conditions. It is impossible to know if the subject in the experiment is making the decision as he would like to make it if all the forces within reality impinge on his decision were absent. The decision maker in question may not actually make the decision given in the experiment. It may require consensus of one or more people; such decisions are essentially different from individual decisions. The "decision" may not be a decision at all but a post hoc justification of an action. The financial analyst may use growth in net income as a justification for purchasing a share; the auditor may complete the checklist on internal control on his way home from the audit rather than before the audit commences.

Such problems demand that a careful empirical study of the real world decision must accompany the experimental simulation of that decision if the results of the experiment are to have meaning. Real data and real subjects are not enough. Although in Kruse's study there were nineteen items of historically accurate data for each company, his subjects found the task "unrealistic". Similar complaints were made by the subjects in the materiality study despite the fact that the data were also based on a real company. Simon (1964) has claimed that, with sufficient constraints, the decisions that an individual makes are predetermined. What are the organizational constraints on the decisions of financial analysts and portfolio managers, and how do these influence decision outputs?

The institutional investment business is a multi-million dollar industry and growing. As Drucker (1976) points out, ownership patterns in the U.S.A. have changed

substantially, from a few powerful individuals with a lifetime's knowledge and their own substantial fortunes, to a mass of workers with very little knowledge of the market represented by their unions. Economic changes in the 1970's have made most investors in the market risk averse. In other industries of similar size and complexity there is not question that decisions involving so many variables, and of such magnitude in terms of dollars, would not be left to individuals. Despite the analysts' and portfolio managers' claims to professional status, there are too many variables for one individual to handle through from raw data to final decision. Like other industries, division of labor occurs, primarily into the research and investment functions.

By and large, the research is carried out by financial analysts in brokerages (for whom the reports are sales boosters) and the actual investment decision is made by a portfolio manager in a bank, trust company, mutual fund or other institution. Within the research function, analysts are specialized by industry. Within the investment function, portfolio managers are specialized by type of account, e.g., pensions, trusts, insurance funds, endowment funds, mutual funds, individual investment accounts, etc. Specialization reduces complexity, but as elsewhere gives rise to the need for integration. Salesmen and liaison personnel act as go-betweens but lengthen chains of communication. Attempts at integrating financial analysts into the trust companies or portfolio accounts into the brokerages have not been very successful. The division of the industry into these two parts does have advantages, but ease of communication is not necessarily one of them; and while the analyst who is mainly concerned with accounting information, it is the money manager who makes the investment decision.

The two institutions have quite different goals and constraints. The brokerage will benefit from definite recommendations to buy and sell--partially if it gains a reputation for accuracy--and has little to lose from an erroneous recommendation; therefore it makes few conformity demands on the analyst. Possible losses to an investment firm from the error of a portfolio manager could be very large. Decisions can only be decentralized to the extent that the institution's controls over the decision ensure that they will be made in accordance with the overall goals of the organization. The main element of control is a management or executive committee, which is responsible for listing stocks which can be traded and often classifies them in terms of their income or growth potential. Standardization and routinization are two common methods of achieving organizational control. What is surprising is not that they exist, but that accountants and others have overlooked their impact on the so-called decision making of the individual.

This brief description indicates that the structure of the institutional investment business is such that the part played by the individual in the final investment decision is marginal. While there may be a few charismatic individuals who survive for a short while by consulting their ouiji boards, the decisions of the average analyst and portfolio manager have been routinized and bureaucratized. Decisions made in accordance with these set procedures are legitimated, even if wrong. Decisions made by non-authorized means are suspect even if correct and might be ignored, or more probably swallowed up by some committee or procedure and never be known! Consequently when an individual is asked to make decisions without the usual organizational constraints, he is likely to find the decision "unrealistic" even if real data is provided.

In the unlikely situation that the organization had no vested interest in imposing strict controls on the individual portfolio manager, his own desire to avoid

unnecessary risk would surely lead to formally or informally "approved" decisions. The informal network in small investment companies typifies this approach. Among analysts, for whom the institutional constraints are less restrictive, there exists an informal network across brokerages to friends and colleagues on whose judgment one might rely, to confirm or deny one's own conclusions. The very existence of two professional bodies who are attempting to set up standards of competence and ethics and induce some uniformity of procedure is evidence of the desire to acquire an "approved" methodology.

Finally the data and task are both unrealistic in the experiment in that the decision maker almost never sits down with data for a company that he does not know. Even the new analyst or manager has some notions about the companies with which he is dealing. Those in the business some time have built up a basic picture of the company to which new information is added virtually piece by piece. Decisions are not based on a volume of material which must be sifted, weighted and combined, but are incremental decisions--"does this new piece of information change my previous evaluation?" If it does not, the value of this additional piece of information is zero; if it does, then its value is one. These weights depend on the information which was previously known. Analysts claim to make incremental decisions. They check vast volumes of information but only when they find something exceptional does it enter the decision process. In examining analysts' reports, unique criteria for specific companies are all important; for example, barriers to entry, monopoly of capable personnel or merger benefits. Such unique features cannot be incorporated into a Brunswik experiment, nor are they useful in deciding on an objective criteria for materiality decisions, but these limitations of the experiment have to be considered when utilizing the results.

Concomitant with the incremental nature of decisions and the value of information is the lack of independence of decisions. The recommendation made in time t is not independent of the recommendation made in t-1. The information required to confirm an opinion is likely to be quite different in quality and quantity from that needed to change an opinion. Imagine that one person had previously recommended a stock and the other had not; both receive the same information, neither may change his recommendation, or one may. If neither changes, the information clearly had different meanings since it confirmed both a recommend and a non-recommend decision. If one changes, the information was highly relevant and meaningful to him, but to the other it had no value.

These abstractions do not have to be pursued here; the point is that in applied situations the use of experimental methods has to be predicated on far more than using "real" subjects with "real" data. Actual decisions under consideration have to be carefully investigated before the experimental decision task can be presumed to represent the true situation. Close scrutiny of the organization, professional and interpersonal constraints on the decisions will add richness to our understanding of decision making. It assists the investigator to make rational assessments between, rather than assumptions concerning, the value of the subjects' descriptions vis a vis their performance in the experiment. A good experimental method is no substitute for careful analysis of the decision in its context.

Conclusion

It appears difficult for experimental techniques such as the Brunswik Lens Model to adequately simulate "real" decision making and consequently the usefulness of such techniques are limited as practical tools for solving applied problems. The use of

real data and real subjects is necessary but not sufficient. The conditions or constraints under which "actual" decisions are made have to be considered carefully; these include organizational structure, professional orientation, the individual's loss function and the time frame. Ultimately these could be more important in determining the decision outcome than either the input data or the decision maker. This is not to say that research into individual decision models is irrelevant. The individual decision models can add an important piece to the jigsaw puzzle of the decision, so long as it is remembered that it is only part of a much larger picture.

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AMERICAN ACCOUNTING ASSOCIATION
CANADIAN REGION
CANADIAN ACADEMIC ACCOUNTING ASSOCIATION
ANNUAL MEETING
May 26, 27, 1978
THE UNIVERSITY OF WESTERN ONTARIO
LONDON, ONTARIO

Friday, May 26

8:30-10:00 a.m. - CAAA-AAA Canadian Region: Annual Business Meeting, (Room 40, Business School).

10:00-12:00 noon - Plenary Session: "Report on the CICA Special Committee to Examine the Role of the Auditor," Mr. J. Adams, F.C.A. (Room 40, Business School).

12:00- 2:00 p.m. - CAAA Luncheon, Address by Dr. Herb Miller, Rainbow Room, Somerville Hall.

2:15 -4:00 p.m. - Special Session: "Office of the Auditor General: Centennial Conspectus," J. J. Macdonell, Auditor General of Canada, (Room 40, Business School).

4:15 -5:30 p.m. - Session A: Round Table Discussion: "A Cash Flow Theory of Accounting," B. E. Hicks (Room 40, Business School).
- Session B: "No Mere Farce," Philip Creighton (Room 156, Business School).

Saturday, May 27

9:00-10:00 a.m. - ASAC Annual Meeting, (Room 40, Business School).

10:00-12:00 noon - ASAC Plenary Session, "Teaching and Researching Business Management: The Western System," The University of Western Ontario, "A New Approach: The Conglomerate Ph.D. Program in Administration," Jean-Marie Toulouse, Henry Mintzderg, (Room 40, Business School).

1:15- 2:00 p.m. - Session A: (Room 160), A. A. Atkinson and W. R. Scott, "Depreciation: A Programming Perspective"

2:10 -2:55 p.m. - R. J. Lord, "Improving Management's Ability to Cope With Uncertainty Through Probabilistic Budgeting."

3:05 -3:50 p.m. - P. R. Graul, "Pension Costs: An Evaluation of Selected Actuarial Cost Methods"

4:00 -4:50 p.m. - G. Feltham, "Optimal Incentive Contracts: Penalties Costly Information and Multiple Workers."

1:15 -2:00 p.m. - Session B: (Room 161). G. R. Chesley, "Communication of Uncertainty in Audit Files."

2:10 - 2:55 p.m. - C. P. Lanfranconi and Mary Anne de Kergommeaux, "Accounting Changes and Income Manipulation by Canadian Firms"

3:05 - 3:50 p.m. - Sumit Sircar, "Effectof Data Base Management Systems at the Forest Level"

4:00 - 4:50 p.m. - Panel Discussion: G. R. Chesley (Chairman), Auditing Research in Canada.

ASAC 1978 Conference
The University of Western Ontario

George Richard Chesley
School of Business
Dalhousie University
Halifax, Nova Scotia

COMMUNICATION OF UNCERTAINTY IN AUDIT FILES

Working paper files prepared by auditors are supposed to document the evidence collected to support the opinion expressed about the financial statements by the audit firm. An opinion is necessitated on the financial statements because the evidence does not provide conclusive proof of the fairness of these statements. Uncertainties of varying degrees exist all through the audit process. Because the audit files represent the evidence the firm has in support of its opinion and because review time of partners and supervisors or managers is expensive, firms often train audit staff in how audit files should be prepared. Staff personnel, thus, have the responsibility of accurately communicating the results of their efforts and inferences.

The Cohen Commission (1978, pp. 71-75) has provided recent evidence about the continuing dissatisfaction with the standard forms of the auditor's opinion on financial statements. While this topic is an important one, the question addressed in this paper relates to the communication within the audit working papers between various members of the audit team.

Two types of situations can exist in practice with respect to the internal communication within the audit working papers. The evidence collected for the staff person can be left to speak for itself or a mini opinion can be added. This mini opinion is often a summary of the firm's opinion in the aggregate specifically tailored to the segment of the audit involved. What purpose is served by this mini opinion is not clear. Since some firms do not use it but rather let the evidence speak for itself, obviously no useful function is felt to be achieved which outways the small cost of writing the words. Other firms may feel the writing provides a training vehicle, or maybe contains information not otherwise captured in the evidence. Maybe the inference reflected in the staff opinion on the segment can collect together the various pieces of evidence contained in the audit of the segment and thereby contain additional information not otherwise available in the file.

Because the question of the information contained in the staff opinion has not been addressed to my knowledge, I will postulate that the opinion can contain useful information. In addition, I will postulate that meaningful expression of this opinion can serve a useful training function for the audit staff person expressing it. From these two postulates, I propose to examine two procedures for making explicit the uncertainty suppressed in the standard form of these opinions.

If a staff person wishes to make his felt uncertainty about the reported results of his section of the audit, he needs some form of scale on which to do it. Because a personal opinion would be represented by this scale, it is logical to look at existing research which has examined this question. Two suggested scales are evident: 1) a word scale, and 2) a probability scale. The word scale approach adopts a common language such as possible, uncertain, and unlikely to reflect varying levels of uncertainty about a given situation. The probability scale approach would use subjective probabilities (for a discussion see Chesley, 1975) to express the uncertainty about the errors, however defined, contained in a subsection of the audit. Thus decimals or percentages between 0 and one (or one hundred) could reflect the felt uncertainty.

The relevant existing research has generally investigated the variation in interpretation persons have attached to various words which were used to reflect uncertainty. For example, Lichtenstein and Newman (1967) studied one hundred and eighty-eight persons from Systems Development Corporation in terms of their consensus in interpreting words. They found that words such as very likely had a mean probability of .87, a standard deviation of .06 and a range of .45 to .99. Very unlikely, its complement, had a mean of .06, a standard deviation of .05 and a range of responses from .01 to .30. The word probable was found to be given a mean of .71, a standard deviation of .17 and a range of .01 to .99. Kelly and Peterson (1971) conducted a field study with military intelligence analysts and expressed their opinion that if these analysts received training as to the meaning and implication of the use of odds in communication, that they felt these numerical qualifiers could significantly aid their interpretation in their communications and there was little hesitancy in the use of these numerical qualifiers. Samet (1975) studied probability interpretations of the standard rating system for intelligence information of the United States Army and its NATO allies. Using thirty-seven intelligence officers he found their subjective probability responses to a set of words such as completely reliable had a mean response of .86 and a range of .65 to .99. He suggested that the use of either a decimal or percentage response scale in order to reduce ambiguity, to avoid a context effect with word responses, to make responses compatible with other formal systems and to increase the sensitivity of responses at the extremes of the probability scale. Because it is possible that a bias might be introduced by the experimenter selecting the words subjects were asked to interpret which in turn could affect the variability of responses, Wise (1976) undertook an experiment wherein he let the subjects assign their own words to probabilities and then used other subjects from the same population to assign numbers to the words provided. The results indicated only a 12.5 percent overlap of words with those used by Lichtenstein and Newman (1967) and for twelve of twenty-nine probability levels he found a $\pm$ 10 percent or less transmission error in median estimates of his group of subjects. Whether this is fine enough for audit files is an open question. This study suggests that a group of subjects may have a language available which could be used to facilitate uncertainty communication. Anecdotal support for this is provided by Coffinier (1975) who suggests seismologists and geologists at Shell Oil prefer words to probabilities to express uncertain feelings.

Existing research leaves unanswered a number of questions relevant to this study. Does an interacting group of persons have a language which can accurately communicate levels of uncertainty? Common sense would suggest that if such a language exists attempts should be made to use it in audit file communications until serious reasons for not doing so are encountered. Existing research has not examined the mode of numerical response if such a response is needed. Chesley (1975, 1977, 1978) has investigated numerous aspects of this question so further study of this question will not be made.

The purpose of this research is to ascertain if an interacting group of persons without special training in uncertainty communication has a commonly understood language for expressing uncertainty levels. Variations in responses to a series of questions will be used to observe any substantial differences in the use of word or numerical uncertainty scales. The study will enable the observation of bench mark results from an accessible and relevant group of subjects to the auditing practitioners and researchers.

The remainder of the paper will firstly examine the responses from a questionnaire survey of practicing firms which will be used to confirm the existence of the file practice of reporting staff opinions on segments. Next the experimental design is described followed by the experimental results and the conclusions of this research.

FILE PRACTICE SURVEY

In order to establish the existence of the use of segment opinions, a questionnaire was sent to the six largest Canadian firms with offices in Halifax, Nova Scotia and to five locally oriented firms with national applications. The sample selection and specific nature of the questionnaire was used to establish the existence of the practice as opposed to its value or extent. These latter questions were felt to be beyond the scope of the study at this stage because both would require extensive analytical and or empirical efforts.

Five anonymous responses were received from the eleven firms solicited. Three of the five responses indicated staff persons do express opinions on sections of the audit. An example of an opinion was "Based on the work, I am satisfied that accounts receivable are fairly stated at $xxx in the financial statements of the period." Qualifications, if any, are explicitly stated in terms of the nature of the item in question. Two of the five indicated that managers in addition to audit staff express opinions on the fairness of statements after they have reviewed the field staff work and before the final review by the partner of the firm. Although asked, none of the respondents indicated that they used numerical responses to quantify uncertainty contained in their file opinions. Therefore, the amount of uncertainty is either ignored or it must be inferred by the reviewers without the benefit of an explicit statement of it by the preparer.

EXPERIMENTAL DESIGN

An experimental design like any research design is conditioned by the resources available, and the research question, thus is subject to numerous value judgements. An experiment was used to conduct this study because of the initial exploratory nature of the question, the ability to achieve high internal validity, and the feeling that the research question was outside the usual practices of the profession. Because the study was concerned with a relatively large and homogeneous group of persons, the subjects were selected from a senior year auditing class during the month of March of a September to April undergraduate course. These subjects were relatively homogeneous in their backgrounds and training, and had been exposed to a single colleague for the tenure of the course. While the population might not have the enternal validity of a group of audit partners, they were accessible at a reasonable cost and were relevant to auditing researchers because most would enter the practice of auditing in a few months. By this point in the course, the subjects had covered auditors reports, internal control reviews and standard audit review practices. All subjects would have completed a two semester course in statistics and should appreciate the lack of certainty present in audit opinions and other phrases.

Insert Table I about here

Once the group was selected in order to achieve the desired relevance, homogeneity of background and degree of interaction, the design was predicated on the economical use of the subjects to study the question of numerical versus verbal responses to various levels of uncertainty. After considering numerous factors, it was decided to conduct the experiment using questionnaires administered during a single fifty minute class session. Besides gathering the necessary demographic and post experiment information as indicated in Table I, two different types of words or numerical responses were elicited. One type allowed free word responses to a set of ten percentage levels ranging from seven to ninety-three. Three contexts were used in the ten questions which restricted comparison between questions but not among subjects. The contexts were chance of snow, chance of passing and chance of error. The variety of contexts was used to avoid monotony. Table I, part 3(1) and 5(1) shows the positioning of these questionnaires. Schedule 5 contained the same questions as schedule 3 but in a different sequence in order to provide a second observation while minimizing the opportunity of recall. Schedules 3 and 5 also contained five questions requiring numerical percentage responses to five different audit phrases. These responses would permit observation of any commonality of interpretation about the uncertainty communicated in these typical audit phrases.

Schedule 3 in Table I asked for either word interpretations of numerical statements or numerical interpretations of word phrases depending upon which of the two groups was involved. The questions using numerical qualifiers were exactly the same as those used in schedules three and five. While the probability levels might be felt to not represent levels relevant to auditing, they were used because they did not require very fine discriminations and yet would serve the purpose of providing the initial bench mark required for the study. The words used to express uncertainty in the other set of questions

TABLE I

EXPERIMENTAL OBSERVATIONS

Schedule Number	Schedule Nature	Comment
1	General Instructions	Both Groups
2	Demographic Details	Both Groups
3 Part 1	Free Word Responses	Both Groups
Part 2	Numerical Responses Audit Qualifiers	
4	Selected Word Responses	One Group
	Selected Number Responses	Other Group
5 Part 1	Free Word Responses and Numerical Audit Qualifier Responses	Both Groups
Part 2	Post Experiment Questions	

were selected from those found by Wise (1976), and Lichtenstein and Newman (1967) as representing levels of uncertainty approximating the numerical percentages used for the first group. The difference between the response requirements in schedule three and those of schedule four was that the responses had to be selected from a set of either fifteen words or fifteen numbers as the case may be. This restriction was made in order to achieve a common sized response set which would have been impossible otherwise. The fact that the same questions were used for one group in both schedule three and four obviously biased the responses in favour of words but it was felt this could be dealt with in the analysis and would provide a check on the relative familiarity of the words selected by the experimenter.

Subjects present on the class day were randomly assigned to the two experimental groups to avoid a subject selection bias. Schedules were distributed at obvious points to avoid forward or backward observations. A pretest of the experiment was conducted on a graduate class prior to the actual experiment and resulted in a few minor modifications in the material.

RESULTS

Responses to the demographic questions indicated twenty-two males and seven females with a median age of twenty-one performed the experiment. All subjects were seniors and all had completed or were about to complete their required two semesters of statistics. Subjects indicated a median of six classmates they had spoken to at length during the past two weeks. Sixteen subjects expected to enter public practice, one to industry, five to government and seven to miscellaneous occupations.

Insert Table II about here

The numerical responses to the specified audit phrases are summarized in Table II. The phrase "in my opinion the statements are fair" elicited a range of responses after discarding single subject ones from 1.00 to .60 with a median for all subjects of .80. As indicated by Table II, the other phrases were equally variable. For example, the phrase "My work is sufficient to assure me that accounts payable is accurate" ranged from .90 to .70 for multiple responses with a median of .75. The unusually low responses came from three subjects two of whom indicated some difficulty interpreting uncertainty. One corrected his earlier problems in schedule five.

Insert Table III about here

A summary of the free word responses to the numerical questions is presented in Table III. All twenty-nine subjects responded to each of the ten numerical questions. An examination of this table will indicate the variability of words subjects used as a synonym for the various probability percentages. Twenty-three of twenty-nine different words were used for the .07 level while fourteen of twenty-nine words appeared for the .47 level. An example of the responses for .18 showed the three words improbable, unlikely and possibility

TABLE II

AUDIT PHRASES

Key Word	Response Statistic Median	High	Low	Schedule 3 Frequency *	Response Statistic Median	High	Low	Schedule 5 Frequency *
Opinion	.80	1.00	0	1.00(4); .95(2); .80(4); .75(3); .70(5);	.80	1.00	.01	1.00(3); .95(4); .85(4); .75(4); .80(5); .70(2); .60(2)
Subjects accounted for				/18				/24
Sufficient	.75	1.00	0	.90(3); .85(3); .80(4); .75(4);	.75	1.00	.05	.99(2); .90(2); .80(4); .75(6);
Subjects accounted for				.70(5) /19				.70(6) /20
Rely on	.95	1.00	0	1.00(5); .99(2); .95(7); .90(6); .80(3);	.93	1.00	0	1.00(4); .99(2); .95(6); .93(2); .90(3); .85(3);
Subjects accounted for				0(2) /25				.80(3) /23
Satisfied	.85	1.00	0	.99(2); .90(6); .85(5); .80(5); .75(3); .70(2);	.80	1.00	.05	.90(2); .85(4); .80(5); .75(4); .70(4); .60(3)
Subjects accounted for				0(2) /25				/22
Reasonably	.75	.95	.05	.95(2); .90(3); .85(3); .80(5); .75(11); .70(2)	.75	.95	.10	.95(2); .85(2); .80(7); .75(7); .70(3); .60(2)
Subjects accounted for				/26				/23

* Frequency ( ) of subject responses and level of response to phrase containing key word. Reported only multiple responses. 29 subject responses possible.

TABLE III

WORD RESPONSES IN UNRESTRICTED CASE

Probability Level	Schedule 3 Number of Different Responses	Schedule 3 Frequency	Multiple Response Words	Schedule 5 Frequency	Schedule 5 Number of Different Responses
		2	No chance	2	
		2	Very unlikely	2	
		4	Improbable	3	
.07	23/29	2	Almost no	-	21/29
		-	Impossible	2	
		-	Highly unlikely	2	
		-	Little chance	2	
		-	Rare	2	
		3	Improbable	4	
		6	Unlikely	6	
.18	21/29	2	Possibility	-	15/29
		-	Very unlikely	3	
		-	Maybe	3	
		-	Good	2	
		-	Slight	2	
		5	Unlikely	7	
		2	Possible	3	
.37	19/29	3	Improbable	2	18/29
		3	Might	-	
		-	Fair	3	
		5	50-50	3	
		6	Maybe	3	
.47	14/29	3	Possible	9	12/29
		2	Improbable	-	
		2	Might	4	
		2	Probable	-	
		2	Good	-	
		-	Fair	3	
		4	50-50	5	
		2	Possible	7	
.51	21/29	2	Probable	-	12/29
		2	False	-	
		3	Nearly certain	-	
		-	Fighting	2	
		-	Fair	7	
		3	Reasonable	-	
		5	Nearly certain	-	
.67	17/29	5	Probably	3	15/29
		2	Good	4	
		2	Hopefully	-	
		-	Fairly good	4	
		-	Fighting	2	
		-	Fair	4	
		-	Likely	3	
		3	Nearly certain	-	
		6	Probably	3	
.74	20/29	2	Likely	4	16/29
		3	Good	6	
		-	Quite likely	3	
		-	Unlikely	2	
		4	Good	6	
		4	Nearly certain	-	
.79	17/29	2	Almost certain	-	14/29
		4	Probably	4	
		2	Unlikely	3	
		2	Likely	2	
		-	Very good	2	
		-	Possible	2	
		-	Quite likely	2	
		-	Pretty good	2	
		2	Good	-	
		5	Nearly certain	-	
.87	17/29	3	Unlikely	-	15/29
		3	Going to	-	
		4	Probably	4	
		-	Very likely	3	
		-	Most likely	3	
		-	Very good	4	
		-	Excellent	2	
		-	Quite likely	2	
		-	High probability	3	
		4	Almost certain	-	
		3	Nearly certain	-	
.93	18/29	3	Probably	-	14/29
		4	Certain	4	
		2	Highly probable	-	
		2	Very probable	-	
		-	Excellent	12	
		-	Very likely	2	

accounted for eleven of twenty-nine responses. The use of the word unlikely for the .87 chance of an event happening is obviously inappropriate because of a reversal of the scale. This problem has occurred in many other experiments. Comparing the number of different responses from schedule three to schedule five, a reduction in variability is evident and it is statistically significant at the .001 level as measured by the Wilcoxon Sign rank statistic (Hollander and Wolfe, 1973, pp. 27-28). Obviously some learning effect was present in the performance.

Insert Tables IV and V about here

When responses were restricted to a choice of ten from an available set of fifteen words or percentages, a large amount of variability was still evident. For example, Table IV indicates four different responses of a possible fifteen to a word excellent and a range of .93 to .07. On the other hand, the word fair had nine different responses with a range of .87 to .07. Table V indicates that the number .93 elicited five of fourteen possible word responses with very likely appearing three times and excellent eight times. The number .70 elicited six of fourteen different responses with pretty good, quite likely, very likely and unlikely (a scale reversal) representing the multiple responses. The variability of responses indicated by the two tables can also be examined by ascertaining the number of subjects who did make a complete scale of the words or numbers when answering the ten questions from the fifteen responses provided the subject. Only two of the word respondents and four of the numerical respondents were able to completely discriminate their responses thereby avoiding the use of the same word or number in adjacent locations.

Comparisons were made between the word list provided subjects in schedule four and the free response words used by subjects. Before seeing the list, approximately eighteen percent of subject responses were the same as the word list while after seeing the experimenter's list approximately forty-eight percent came from the same words. Since no attempt was made to define synonyms, the response level does not appear low especially compared to the twelve and one half percent overlap found by Wise (1976).

The post experiment questions suggest a large majority (20/29) experienced no serious difficulty with the language or questions. This together with the results indicate subjects were operating in a situation which was generally familiar to them and not beyond their capabilities.

CONCLUSIONS

Can a staff person as part of an opinion on a section of the audit capture information not otherwise readily accessible to a reviewer of the file? Does this staff opinion serve some other useful function? The results of the research conducted cannot answer these questions except to say that some Canadian firms do require staff persons and managers to write mini opinions on segments of the audit. To answer the open questions is a topic for future research. In the present study, we postulate the reasonableness of the use of these opinions and look at two response methods to explicitly state the felt uncertainty about the conclusion the staff person will make.

TABLE IV

NUMERICAL RESPONSES TO WORD QUALIFIERS

NUMBERS RESTRICTED TO SET OF FIFTEEN

Word Asked	Median Response	Range of Responses	Number of Different Responses
Quite likely	74	89 - 37	8/15
Good	72	87 - 7	7/15
Fair	72	87 - 7	9/15
Possible	37	79 - 18	7/15
Excellent	93	93 - 7	4/15
Pretty good	68	89 - 18	9/15
Unlikely	20	74 - 7	6/15
Rare	7	93 - 7	5/15
Fighting	51	87 - 7	8/15
Very probable	87	93 - 7	7/15

TABLE V

WORD RESPONSES TO NUMERICAL QUALIFIERS

WORDS RESTRICTED TO SET OF FIFTEEN

Number Asked	Word Responses in Excess of two	Number of Different Responses
.07	Unlikely 7, Not very probable 4, Rare 2	4/14
.18	Not very probable 6, Possible 2, Unlikely 3	6/14
.37	Possible 4, Not very probable 2, Unlikely 2	9/14
.47	Possible 6, Fair 5	5/14
.51	Possible 3, Rather likely 2, Fair 4, Likely 3	6/14
.67	Good 3, Fighting 2, Pretty good 2, Fairly likely 2, Likely 2	8/14
.74	Good 2, Unlikely 2, Quite likely 3, Likely 2	9/14
.79	Pretty good 4, Unlikely 2, Quite likely 3, Very likely 3	6/14
.87	Very likely 6	9/14
.93	Very likely 3, Excellent 8	5/14

Prior research suggests two approaches to uncertainty communication: (1) word qualifiers and (2) numerical qualifiers. Because this research does not answer the question as to which is better and leaves open the possibility of finding a developed word language in an interacting group, the question of the existence of a consensus interpretation of uncertainty in a class of senior undergraduates who have been exposed to a single text and instructor in auditing for six months is explored. This group can certainly represent a bench mark group for subsequent studies because of its reasonably well defined nature. If this group had a language then one would probably capitalize on it unless other operational and as yet unexplored reasons would prevent its use. The research results suggest such a language does not exist in the group under study except in a very crude sense. The variability of responses confirm this conclusion. Possibly these subjects cannot interpret .07 or some other such number and this led to their results. However, given the statistics background of these students and the range of required responses, this latter conclusion is not as likely as the former. Certainly this study and others referenced earlier would suggest the need for training in order to achieve the type of fine probability discriminations auditing might require but the question of interest here is the language one should use to conduct the training and, in terms of which, responses could be elicited.

The present study would suggest no major advantage should be claimed for verbal uncertainty qualifiers. Numerical responses seem to be as easy for comparable subjects as verbal ones. If one extrapolates to the whole population of a national firm, one advantage of numerics becomes obvious. Universality together with manipulative capability should be enough to weight the decision in terms of subjective probabilities in the absence of a well developed language. How to define the independent scale of the subjective distribution will be the topic of future research. The difficulty here is evident if the ambiguous concept of a material error were used. Exact definition should be left to the requirements of the model which will use these subjective probabilities but it is evident that subjective probabilities should be flexible enough to handle the requirement and should be adequate to serve as a response medium if called upon after cost benefit studies.

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"NO MERE FARCE": AN EARLY QUALIFICATION TO AN AUDIT REPORT

George F. Jewell of London, Ontario in a thesis prepared in 1885 to secure his fellowship in the Institute of Chartered Accountants of Ontario, described the auditor's appropriate conduct where he did not feel he could give a clear opinion on his client's representations. Speaking of difficulties encountered by the auditor he said:

> "For some of these difficulties there may be no remedy, but where improvement is possible, it is the duty of an auditor to suggest, and even to urge it — to positively refuse his sanction to any variety of misrepresentation, no matter how plausibly maintained, and if this is persisted in to represent the matter clearly to those who have appointed him, using every possible precaution that in so doing he may not jeopardize their interests." (ICAO, Nov.4, 1885)

Jewell was successful in his quest for a fellowship so that it appears reasonable to assume that he represented the opinion of the majority of the senior members of the Institute.

The acknowledged expert in auditing in Ontario in the 1880's was Francis William Pixley. In the first discipline action before the Council of the Institute of Chartered Accountants of Ontario, both prosecution and defence quoted him. His great work Auditors: their duties and responsibilities had been published in London, England in 1881. He wrote:

> "One of the most unpleasant situations in which an auditor can be placed is when he feels that he cannot append his certificate to the accounts he has audited without qualification."

He continues:

> "The best plan an auditor can adopt under these circumstances is to address to the members a full report of the accounts, setting forth clearly therein the points at issue between the directors and himself, and then sign the accounts as auditor in the usual manner subject to this report."
>
> "This auditor's report should be forwarded to the shareholders of the company with the accounts. They will then have the opportunity of considering what steps they shall take at the meeting..."
>
> "The auditor must of course use his discretion as to the necessity of using a special report of this nature..."
>
> "It is not sufficient for the auditor to merely forward this report to the Board of Directors. He must be satisfied that either a copy or an intimation of its existence has been forwarded to every shareholder with the accounts." (Pixley, 1881)

It is clear then that Pixley saw the auditor as having a responsibility to report any reservations he might have about the adequacy of the presentation of his client's financial statements to the shareholders. Further, Pixley viewed the need for the auditor to establish what, to his mind, was the fair presentation of the financial position and the results of operations. Also, the auditor could not discharge this obligation by simply directing his concerns to the President and the Board of Directors.

There was a reluctance on the part of the early auditors to get involved in anything that looked like management's responsibility. Speaking to a meeting of the Institute of Chartered Accountants of Ontario in the fall of 1891, the then President, W.C. Eddis, said:

> "An auditor cannot be expected to entrench upon the functions of a manager or directorate, and while he must fearlessly fulfill the duties which come within his border, he must be careful not to overstep these limits. In a loan society he cannot be expected to decide upon the character of a loan, or the title or valuation of the securities. In an insurance company, upon the rates of insurance or the classification of risks...yet under all these varied circumstances he must not consider his duty as an auditor as finished, when he finds the balance sheet corresponds with the various books of the company."
>
> "In an insurance company he must be familiar with the principles of earned and unearned premiums and the government insurance reserve."
>
> "And under all circumstances that a statement presented to the shareholders is an honest exposé of the company's affairs, and especially that no ascertained losses are covered by imaginary valuations." (The Monetary Times, v.25, p.1250)

Prior to 1900 the majority of audit appointments were to financial companies. It was only in joint stock companies such as banks, savings and loan and insurance companies, both fire and life, where there was a sufficiency of shareholders to make auditing necessary.

> "The financial corporations usually had by-laws providing for the appointment of one or two auditors, but these positions were filled by clerks of other offices and the duties performed after hours. There was, however, nothing in such appointments to stimulate endeavour in the direction of technical efficiency..." (Edwards, 1915)

Close on half the audit appointments in the 1880's in the listed public companies in Toronto went to people who were not professional accountants. The list of occupations of such auditors included mathematics teachers, stockbrokers, real estate agents, insurance agents, bookkeepers, professional financiers and accountants in the provincial and municipal governments.

The general standard of auditing in the 1880's was not such as to give confidence to the financial community. The Monetary Times of Toronto said in 1884:

> "Recent disclosures in this city...show that the work of auditing is too often done in the most perfunctory manner. Complacent auditing, which merely skims over the surface

of accounts, is a useless farce. It is misleading to the public and sometimes the cause of loss to those who ought to know, and think they do know, just how the accounts, of which they are the guardians, ought to stand. An audit to be of any value should be done in the most thorough manner by one who is entirely competent to do the work he undertakes. The auditor should be a man of undoubted character, the strictest probity. If he possesses the qualities just named he should be allowed unmolested by those who employ him, the free exercise of his own judgment in matters pertaining to accounts; and if irregularities of any kind are discovered they ought to be promptly reported without regard to the fear or favour of any person interested. Such an audit is of practical value. During the next few weeks, many of our public companies will appoint their auditors, and we ask such companies to consider with care the subject we are discussing. The names we see attached to the reports of some public companies, unfortunately do not strengthen public confidence in the minds of the business community. It is to be feared that in some instances the auditor owes his position to a few friends on the board, rather than to his skill and knowledge of accounts." (The Monetary Times, v.17, p.852)

The editor continued, then, comparing the Canadian auditors unfavourably to their English counterparts.

"By looking over the list of auditors in this city, it will be found that the majority consists of persons who are not professional accountants, but who are occupied as bookkeepers in other establishments. Without wishing to question the efficiency of many of these gentlemen, it would be better, that in the selection of auditors preference should be given to those who devote their full attention to public duties of this character, and have thus a public reputation to maintain. In institutions in which the capital is reckoned by hundreds of thousands of dollars, it is not an unusual thing for directors to show their economical propensities, not in reducing their own fees but in cutting down the cost of fees paid to the auditors, who, in the majority of cases are very inadequately remunerated, when the responsibility attached to their duties is taken into account. The plea often assigned is that plenty of men can be got to undertake the duties at almost any price, and this parsimony has, in cases which have come under our notice, been carried to such an extent that the officials of wealthy corporations have been known to keep a count of the hours employed and to measure the fees paid, not by the responsibility attached to the office and the experience and reputation of the auditors but by the time occupied in the work." (The Monetary Times, v.17, p.852)

One of the auditors of the Confederation Life Association of Toronto for the year ended December 31, 1889 was W.R. Harris, who had been an Assistant Treasurer in the provincial government and early in 1890 became personal accountant to E.O. Bickford, the President of the Erie and Huron Railway. Harris was not a member of the Institute of Chartered Accountants of Ontario. He had been one of the joint auditors of the Confederation Life for some four years.

The other auditor was John M. Martin, who was in practice by himself as a public accountant. He had been a member of the Institute of Chartered Accountants of Ontario since 1883 and had recently become a Fellow. He had held the position as auditor of the Confederation Life for some ten years. Harris and Martin performed the audit for the year 1889 and drew their salary. Somewhere in February of 1890 Martin decided that he was not able to sign his auditor's report. He had a number of reservations about the 1889 accounts. However Harris had no such qualms and on March 18, 1890 he issued the following report.

> "I hereby certify that I, with my late co-auditor, have audited the books of the Association for the year ended 31st December, 1889 and have examined the vouchers connected therewith, and that the above Financial Statements agree with the books and are correct." (Confederation Life, 1889)

They also examined the securities represented in the assets, which were safely kept in the Association's vault. The auditors had met in April of 1889 to discuss the allocation of the audit effort. Martin took the interesting stuff for himself and left Harris with the additions and the dog work generally. It was at this meeting that Harris was moved to quote the Managing Director's views about the uselessness of Martin's audit approach. The fact that the auditors did not conduct their audit together was criticised at the time. "...that the whole was not done together as is the more usual and better practice." (Confederation Life, 1889)

On March 7th, 1890 and again on March 22nd Martin made a series of charges in two letters addressed to the shareholders and policyholders of the Confederation Life Association. (Confederation Life, 1889) These charges constitute Martin's reservations as to the fairness of the presentation of a series of individual items in the Confederation Life Association's Financial Statements. Further, Martin relieved himself of some comments as to the adequacy of the Confederation Life's administrative machinery. The Confederation Life had, as at that date, assets of $2,900,000 approximately. Martin's reservations range from missing vouchers for $80 to the propriety of netting realized losses on the disposition of real estate with unrealized gains on revaluation of other real estate. All the reservations appear immaterial by even the strictest interpretation. Martin's charges did not impress his contemporaries in the business community in Toronto in 1890. The editor of The Monetary Times said:

> "Granted that some of the faultfinding is petty, and that the general tenor of his report, charged as it is with insinuation, must be exasperating to the management..." (The Monetary Times, v.23, p.1292)

The facts alleged by Martin to justify his refusal to sign his auditor's certificate are as follows:

1. Two members of the office staff of the Confederation Life received commissions on loans placed with the company.
2. A voucher of $83.51 was mislaid and in Martin's view some part of the expenditure was questionable, as being, perhaps, for the personal benefit of the Managing Director of the Confederation Life.

3. Money was loaned to office staff and agents to the grand total of $530 in defiance of the charter and by-laws. This is 0.02% of total assets.
4. The necessity for a large part of the audit was disputed by the Managing Director who described the audit of the agents' vouchers, as suggested by Martin, as a "work of supererogation".
5. Some suggestions for improvement in the bookkeeping system. (Seen by a contemporary as being of "doubtful expediency")
6. The use of a suspense ledger.
7. Valuators should be debarred from receiving applications for loans.
8. Writing off $450.08 in the agency control account to miscellaneous revenue. Martin wanted to take it to suspense.
9. The netting of unrealized gains against realized losses in real estate resulting in a credit to profit and loss of $8,694 as follows:

realized losses	$3,141.25	
realized gains	610.00	$ 2,531.25 loss
depreciation by valuation	$29,474.24	
appreciation by valuation	41,000.00	11,225.76 gain
		$ 8,694.51 net gain

Contemporaries thought that this was a discussable point but hardly a material one. The question raised was what is the auditor's responsibility to press for greater disclosure.

10. An unrecorded liability for $35,000, but as contemporaries pointed out the offsetting asset was unrecorded also, as the investment was carried at only cost actually disbursed.
11. Misallocation of surplus between policyholders and shareholders. The editor of The Monetary Times had a fine time with this item because, even if Martin was correct, the adjustment is minuscule.
12. Harris didn't do the part of the audit he said he would. Harris said he did.
13. Audit work in the 1889 accounts, as recorded in the "Auditor's memo book" was incomplete. The other auditors, that is Harris and W.E. Watson, Martin's successor, said they completed it.

Martin addressed his reservations to the shareholders and policyholders. He forwarded a copy "as a courtesy" to the President of the Confederation Life. At that time there was some confusion as to whom the auditor's report should be addressed to. Of the eight life insurance companies whose annual reports are presented in The Monetary Times during the year ended June 30th, 1890 that confusion is readily apparent. Four of the eight reports contain no direction whatsoever. Three are addressed to the President and Directors and only one is to the shareholders. In all the cases the auditors were appointed by the annual meeting of the shareholders. (The Monetary Times, v.23)

After the President of the company, the Honourable Sir W.P. Howland, a leading Liberal politician, (he had been the federal Minister of Finance and the Lieutenant-Governor of Ontario, and was currently president of a bank and a savings and loan company), received the report the senior executives were asked to comment on the charges made by Martin and to report their findings back to the President. This they did in the middle of March, 1890. The Board of the Confederation Life then passed a resolution to the effect that "these statements of their officers convey full and satisfactory replies to the statements contained in Mr. Martin's communications". (Confederation Life, 1889)

At the annual meeting of the shareholders on March 25th, 1890 the President, in giving his report, made a lengthy analysis of the background to the dispute between Martin and the company and to the investigative efforts of the Board of Directors to discover the truth of the charges. No effort was spared by the President or the senior officers of the company to present Martin and his charges in an unfavourable light. For example,

> "...it was stated in the presence of us all that Mr. Martin's conduct was the outcome of a personal matter that had arisen between Mr. McDonald [the Managing Director of the Confederation Life] and himself in connection with their own private affairs, and that had nothing whatever to do with the business of the company, and I cannot help but say that when Mr. Martin was called in here, he exhibited a feeling anything but Christian or moderate, giving evidence of very bad temper..." (Confederation Life, 1889)

And further on in the President's report

> "I ought also perhaps to add that we have had a good deal of difficulty since Mr. Martin has been acting in the capacity of auditor here. There has been no head accountant with whom he has not had trouble. The head accountant here previously has come to us and stated that he could not and would not remain in the office, he would rather resign his position than be subjected to the unpleasant and disagreeable treatment he had to receive at Mr. Martin's hands..." (Confederation Life, 1889)

Martin himself was not very effective in his presentation. Principally because he had seriously lost his temper and really didn't have very much of a case. The President of the company introduced to the meeting of shareholders the report of the directors, the accounts and the report of the auditors, together with the directors' soothing resolution. He refused to read the reports of Martin. It was stated that the reports, together with the company's response and other supporting documents, were available for inspection by the members present. There was considerable discussion at the meeting as to whether or not Martin's charges should be read. The two sides were relatively lukewarm. There was one group that thought that it would do no harm to read the reports and that it might clear the air. This group had expressed some considerable concern about the possible bad effects of the publicity on the Confederation Life's image. The other group, which was composed mainly of the directors, seemed to feel that reading Martin's reports would do no good and that the directors had read them anyway and decided that they were groundless and that the directors were solid people whom you could trust. Anyway, as the President said, it would take more time than the gentlemen had available to read the reports because if the reports got read the answers would have to be read too. This seemed perfectly reasonable to the shareholders gathered so they voted to accept the President's suggestion. Poor Martin was driven to a frenzy by this tactic and had repeatedly to be called to order by the chairman. Thus the annual meeting finished. J.B. Edgar, a lawyer who was one of the directors, moved the appointment of next year's auditors: W.R. Harris and W.E. Watson. He said

> "...neither Mr. Martin, nor anyone else in this room, I imagine, will expect that it is likely that his name will be mentioned in this connection..." (Confederation Life, 1889)

But neither side was really through yet. Martin, on his part, wrote to The Monetary Times in order to establish his position. In this letter he took a very high moral tone as to his duties as auditor. (The Monetary Times, v.23, p.1297) He did note the fact that his report had been suppressed but did not repeat his various reservations in the letter to the editor.

The company invited its new auditor, W.E. Watson (a bookkeeper with W.C. Robertson and Company, the wholesale stationers, who later became a full-time public accountant), to examine the accounts for 1889 and in effect to redo the audit. Further, the company, on the advice of its new auditors, that is Harris and Watson, retained the services of E.R.C. Clarkson to conduct an evaluation of the audit performed by Harris and Martin and further to assess the worth of Martin's reservations. Clarkson was unable to perform the duty himself and assigned W.H. Cross, his junior partner, to the task. As you might expect, the review by Cross revealed no substance of any material sort to Martin's reservations. And it is hard, from this vantage point, to think that Martin's reservations were other than personal pique, although the foundation of his dislike for McDonald is not known. The directors then published the annual report of the Confederation Life in the newspapers, including the audit reports of W.R. Harris, the remaining auditor for 1889, and of W.E. Watson, the newly appointed auditor for 1890, who had redone the 1889 audit and also the report of Clarkson and Cross. As the directors said:

> "The whole matter was also submitted for expert opinion to Messrs. Clarkson and Cross, who after strict scrutiny made a compendious report from which the following is quoted: After weighing the whole evidence we conclude that the certificate of Mr. W.R. Harris to the annual statement is and ought to be accepted as sufficient! Signed Clarkson and Cross." (The Monetary Times, v.23, p.1298)

The editor of The Monetary Times thought that the whole thing was a tempest in a teapot. He felt that Martin's statements should have been read to the annual meeting and the problem left there. He evidently thought there was little if any substance in the Martin charges and felt that the response of Clarkson and Cross was more than adequate. (The Monetary Times, v.23,p.1292)

Cross was a man of choleric temper. He was so annoyed at Martin's behaviour that he brought a charge of professional misconduct against Martin in the Council of the Institute of Chartered Accountants of Ontario. Both Martin and Cross were prominent Toronto accountants, both were on the Council of the Institute. After a great deal of effort the Council came to a decision which Solomon would have admired. (ICAO, April 28, 1890) It censured Martin for bad tempered and ill chosen comments on the Confederation Life, it censured the Confederation Life for failing to recognize and support the position of the auditor, it affirmed it belief that the auditor must be independent and must be allowed to report as he saw fit and the Council wound up by censuring Clarkson and Cross for permitting a part of their report to be reproduced in the newspapers out of context. This result enraged Cross so that he eventually resigned from the Institute's Council.

In one of the anomalies for which history is famous John M. Martin read a paper to the regular monthly meeting of the Institute of Chartered Accountants of Ontario in 1888 on "The duties and responsibilities of an auditor here and in Great Britain". One of his conclusions was

> "Should the final accounts be grossly inaccurate and misleading the auditor should refuse to certify them until such time as they are made correct and an honest presentation of the business done and the position of the company's affairs are set forth therein." (ICAO, April 11, 1890)

We are told that this was "an able speech" and that the vote of thanks was moved by W.H. Cross.

George F. Jewell drafted the Council's decision in the Cross-Martin dispute. Jewell's views on the auditor's reporting responsibility have been quoted above. His audit report on the London Life was the only one to be directed to the shareholders, explicitly, of the eight reports noted previously in this paper. Jewell, and through him the Institute's Council, saw the Confederation Life's action as limiting the auditor's independence. Council's decision reads in part

> "Let it be once understood that the Auditor's cognizance and criticism of the transactions which go to make up the business of the Company is to be limited at the will of the executive or directorate and his office becomes valueless, nay even a solemn farce, as it can never be known, especially if he is not to be allowed to communicate with his clients, to what extent his examination of the work has extended, and a door will be opened for the possibility of evil doing which the history of human morals tells us but too surely will be utilized to its fullest extent. We cannot agree that this limitation is permissible, and it is surely strangely at variance with the spirit of the present custom, which claims from auditors the fullest and most perfect examination of the business referred to them." (ICAO, May 23, 1890)

Both W.H. Cross and the Confederation Life Association felt strongly that Martin was either unprofessional in the manner of his communication or discussing matters which were the sole prerogative of the management. Cross charged Martin with professional misconduct. The Confederation Life was so incensed that it included a verbatim report of the shareholders' meeting and <u>all</u> the relevant documents in its annual report for 1889.

The Ontario Institute's Council was exasperated by Martin's use of the public press, but accepted his explanation that there was no other way that he could communicate with the shareholders.

What we have in this fracas between the Confederation Life and John Martin, F.C.A., is an early example of one of the endemic problems of public accounting. The problem is: how do you support an important principle, in this case the independence of the auditor, when the public accountant involved insists on behaving foolishly? Both Martin, in his actions

and Jewell, in his draft decision for the Council, had a vision of the rightful place and importance of the auditor which far exceeded that which the management of the Confederation Life was prepared to accord.

But John M. Martin must have the last words. These are taken from his stirring speech to the Confederation Life's annual meeting on March 25th, 1890.

> "If they choose to condemn me, then I must be condemned, but I tell you all, the day is not far distant, but has already dawned when auditing is going to be no mere farce, as it is in too many instances, in this country." (Confederation Life, 1889)

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IMPROVING MANAGEMENT'S ABILITY TO COPE WITH UNCERTAINTY THROUGH PROBABILISTIC BUDGETING

Anticipating what tomorrow will bring may be the most important challenge managers face today. Changes in government regulations, technology, consumer tastes, and availability of resources are increasingly providing new business opportunities and creating serious threats to existing operations.

During the past fifteen years the accounting literature has suggested that probabilistic budgeting can encourage a manager to anticipate uncertainties he faces, and can lead him to the development of appropriate plans and programs to offset the impact of these uncertainties. (Jaedicke 1964, Hall 1966, Ferrara 1970, Lowes 1973, Chang & Liao 1977)

The Approach

In simple terms a probabilistic budget represents merely an extension of current budget practices. Instead of basing a budget on specific estimates of revenues and costs, a probabilistic budget is based on the realization that most of these parameters of the budget are uncertain. While management may desire sales of $1,000,000 next year, actual sales may fall anywhere in a range between $800,000 and $1.1 million. Likewise while we may desire costs to be the same as last year, actual costs may be 5, 10 or even 15% greater. Because the parameters input to the budget are uncertain, the firm's results are also uncertain. A probabilistic budget estimates the potential range of this uncertainty.

The Research

While simple in concept, important questions remain concerning the practicality and usefulness of probabilistic budgets. For the past year I have attempted to investigate these questions. The first phase of the research, within a small transport firm, was concerned with the development of a methodology for preparing a probabilistic budget (Lord, 1978). Briefly, developing a probabilistic budget entails several steps:

1) building a model of the firm
2) eliciting estimates of the uncertainties the firm faces
3) simulating the operation of the firm
4) interpreting the implications of the model estimates for the firm's operations.

These steps, summarized by the Floral Transport model (figure 1), generated the Floral Transport 1977 Probabilistic Budget (table 1).

FLORAL TRANSPORT

BUDGET MODEL SCHEMATIC

FIGURE 1

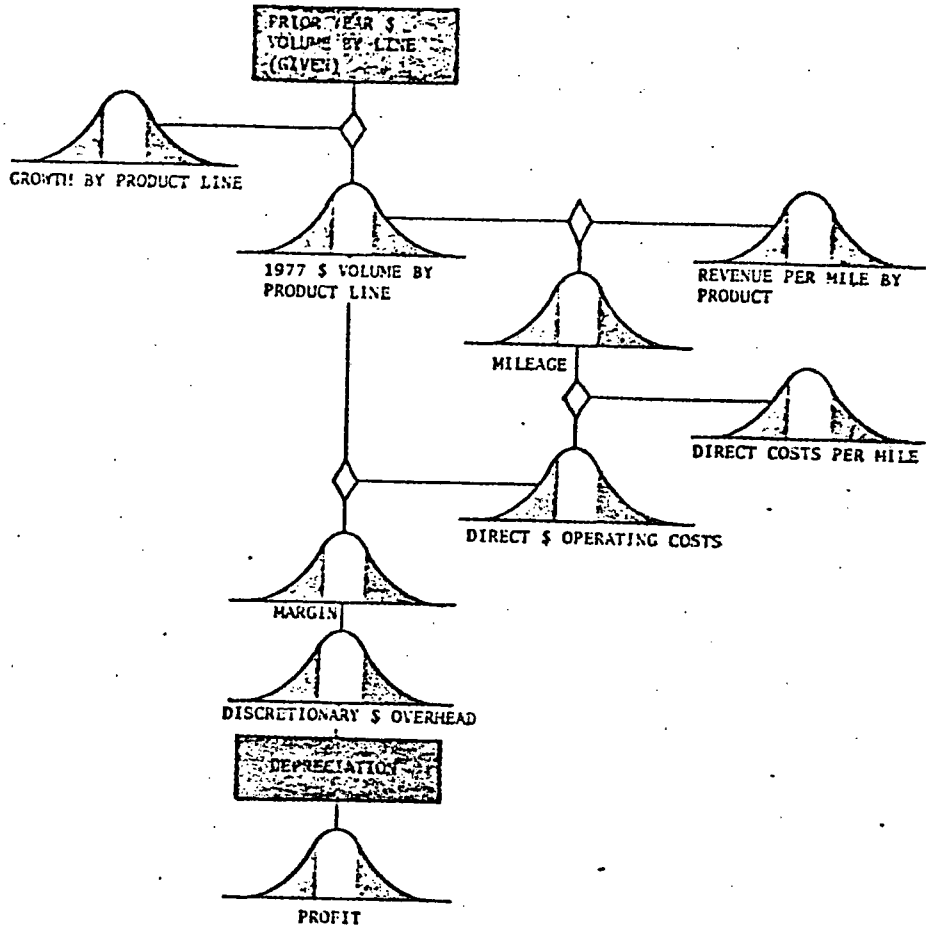


Table 1

FLORAL TRANSPORT FISCAL 1977 PROBABILISTIC BUDGET (Based on 500 Trials)

	Cumulative Probabilities				
	.00	.25	.50	.75	1.00
		(budget amounts in 000's)			
Mileage	778	846	874	908	1058
Revenue Per Mile	$1.098	$1.226	$1.27	$1.307	$1.375
Transport Revenue	1040	1086	1108	1132	1191
Manpower	161	189	197	207	253
Maintenance	55	71	77	83	102
Fuel	109	131	139	146	172
License & Insurance	38	45	48	50	59
Hired Vehicles	145	185	199	215	275
Redelivery	71	90	99	109	145
Total Transport	666	734	761	794	925
Transport Margin	223	317	347	374	446
Sales Margin	21	26	27	30	38
Total Margin	249	344	376	402	472
Utilities	7	7	7	8	8
Telephone	24	28	29	31	38
Facilities	7	7	7	8	8
Office Wages	69	86	90	95	106
Office Expenses	15	16	16	17	18
Running Supplies	4	4	4	4	4
Warehouse Expenses	5	6	6	6	6
Property Taxes	1	1	1	1	1
Total Operating	144	160	165	170	183
Salaries	27	28	29	29	31
Professional Fees	9	9	10	10	10
Interest	24	25	25	25	27
Travel	8	9	9	9	10
Advertising	1	1	2	2	2
Total Admin.	71	75	76	77	80
Depreciation	55	55	55	55	55
Total Expenses	273	291	296	301	314
Profit	-45	50	78	106	182

While table 1 indicates that Floral's profits for 1977 could range from a loss of $45,000 to a profit of $182,000, the firm's regular format (or point estimate budget) indicated a predicted profit of $75,000.

A Second Study

Following development of the probabilistic budget methodology illustrated by the Floral model, a second test of the approach was undertaken within one of Canada's largest firms. Management of this large firm was concerned about the future profitability of one segment of their business. To address this problem, a model which looks out over the next ten years was constructed (table 2). While similar in concept to the Floral model this ten year model is much more complex. It indicates revenue estimates for eleven products in fifteen market territories; manufacturing costs for each of the eleven products and distribution and manufacturing overhead costs for each product segment and corporate general overhead costs.

Table 2

THE LARGE COMPANY
PROFIT MODEL

Product Unit Costs	$\tilde{U}_j = \tilde{I}_i U_{ij}$	Where: U_j = expected cost per unit of product j I_i = acquisition cost of component i U_{ij} = proportion of component i in product j i = 1 to 14 input components j = 1 to 11 products
Territory Volumes	$\tilde{V}_{jt} = v_{jt} \tilde{\alpha}_t$	Where: V_{jt} = expected volume for product j in territory t v_{jt} = planned volume for product j in territory t α_t = anticipated volume variance in territory t t = 1 to 15 market territories
Product Volumes	$\tilde{V}_j = \sum_{t=1}^{15} V_{jt}$	
Revenue	$\tilde{R} = \sum_{\substack{t=1 \\ j=1,11}}^{15} P_{jt} \tilde{E}_t V_{jt}$	Where: R = Total dollar revenue P_{jt} = planned price for product j in territory t E_t = anticipated price variance in territory t
Product Costs	$\tilde{C} = \sum_{j=1}^{15} U_j V_j$	Where: C = Total product costs
Selling Costs	$\tilde{S} = \sum_{\substack{t=1 \\ j=1,11}}^{15} \tilde{Z} V_{jt}$	Where: S = Total Selling Costs z = Commission cost per unit sold
Transportation Costs	$\tilde{T} = \sum_{\substack{t=1 \\ j=1,11}}^{15} \tilde{F}_t V_{jt}$	Where: T = Total Freight Costs F_t = Freight rate per unit to territory t
Margin	$K = R - (C+S+T)$	Where: K = Operating margin
Net Income	$N = K - (\tilde{H}_1 + \tilde{H}_2)$	Where: N = Net Income H_1 = Plant Overhead Costs H_2 = Corporate Overhead Costs

To support this complex model data was gathered on over 500 uncertainties which are included in the model. Developing this volume of assessments clearly was beyond the capacity of any single employee. For this reason data was obtained from several sources. Market expectations were gathered from the field sales force. Manufacturing costs and resource input costs were developed at the plant level, while overhead costs were estimated by divisional financial personnel.

Based on this data limited profits are expected through 1980, but future profits are expected to increase dramatically (figure 2). While profits are expected, losses could occur, (particularly in 1979) and it is not until 1980 that the $20 million profit corporate management desires from this project even becomes probable.

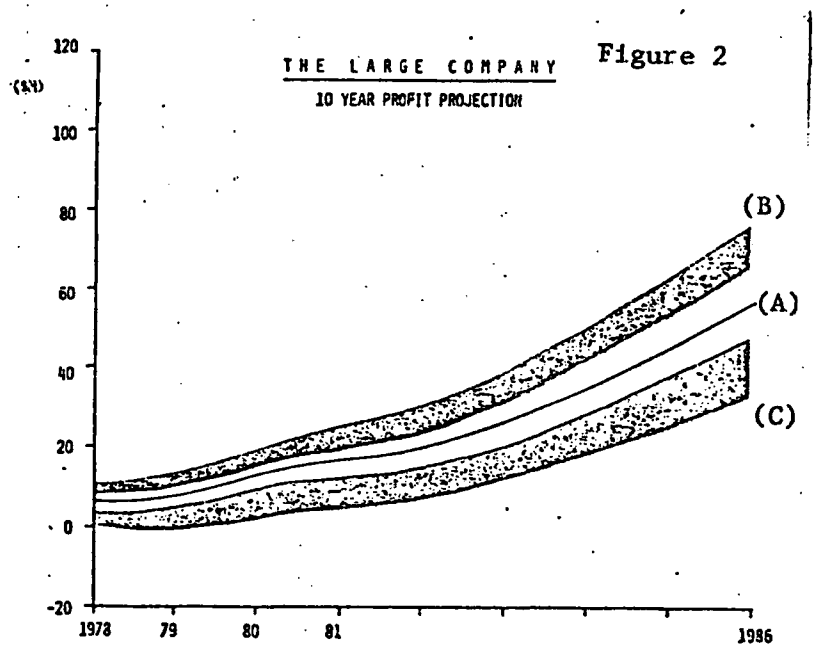


Figure 2

In figure 2, the solid line in the middle of the figure (A) represents the expected results the firm will achieve. The top line (B) represents the absolute upper limit of possible profits while the lower line (C) represents the lowest level of profits (losses) predicted to be possible. The grey areas represent the upper and lower quartiles of the probability distributions which describe the possible range of outcomes during each year. There is a 25% probability actual results will fall within either of these areas within a given year.

The Problem of Stability

While the large firm model indicates substantial profitability by 1986 development of this model raised substantial questions about the validity of the subjective estimates upon which figure 2 is based. A preliminary earnings forecast (figure 3), prepared during the early development of the large company model portrayed a significantly different future than that portrayed in figure 2. The preliminary forecast projected losses throughout the next ten years. Losses which increased in magnitude each year. Perhaps even more significantly, while breakeven operations were possible, their likelihood was very low.

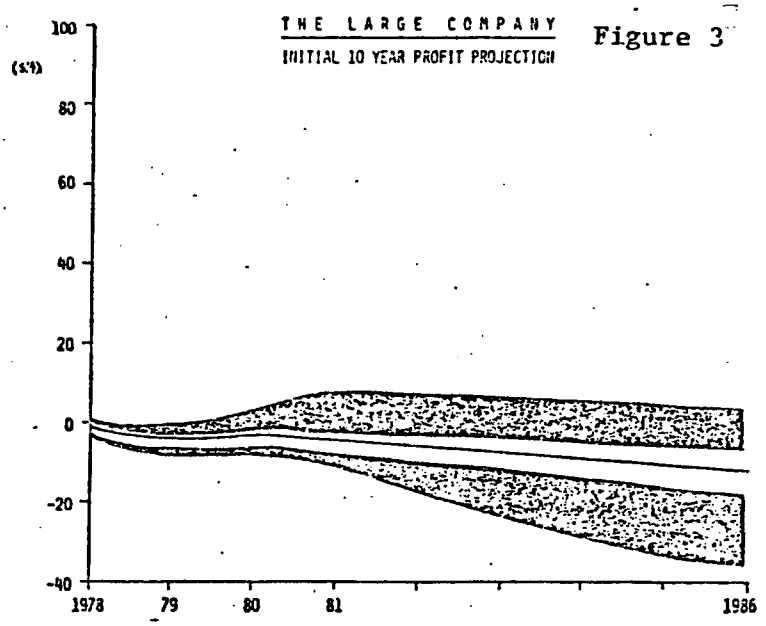


Figure 3

The obvious question arising from a comparison of the preliminary forecast and the final projections must be which of these pictures of tomorrow is more reliable. The division manager's answer to the question why had the division's perspectives on the future changed so dramatically, was simply "We changed our minds." During the year prior to the gathering of the first set of estimates the division had been under extremely severe competitive and cost pressures. Profits had dropped dramatically from a record high the previous year and the organization was extremely pessimistic. This pessimism, it was suggested, had been reflected in the preliminary earnings forecast.

Fortunately, for the division, market conditions improved during the year. These improved conditions are reflected in the final projections for the next ten years -- projections which have been provided to top management.

The explanation that members of the firm had over compensated for the pressure of poor results, may well explain why the two forecasts are so dramatically different. However is it not equally possible that since disinvestment was a probable outcome of providing a bleak forecast to top management that the rosy future projected may be extensively biased in the division's favor? Or at least might not the real uncertainty which this division faces be better described by some balance between the optimism and pessimism of the division managers?

Subsequent discussions with this firm's personnel suggest that this latter assertion may be at least partially correct. Division staff expressed substantial discomfort with the 1986 projected results. They commented

> "We just can't see that far into the future. The estimates for the next three to four years are reasonable, but beyond that we simply do not know."

Floral -- A Year Later

The problem of stability of the estimates identified in the large company model, highlights a broader question concerning the overall validity of the probabilistic budget approach -- Does a probabilistic budget provide any realistic estimates about the risks facing the firm?

While it is extremely difficult to answer this question, Floral Transport's experience begins to suggest the probabilistic forecast may have value. 1977 has now passed and we can compare the projections for Floral with Floral's actual results. This comparison is summarized in table 3.

Floral did not earn the $75,000 budgeted. Rather it lost $24,000 in 1977. How good then was the Floral budget? The typical point estimate $75,000 forecast was simply wrong. Floral did not generate that level of profits. On the other hand, actual results did fall within the range predicted by the probabilistic budget. However since the model estimated that there was slightly less than a 5% change that a loss as great as $24,000 could occur we cannot argue that the probabilistic approach is accurate. We would have liked the actual results to fall within the model's inner-quartile (ie. between the 25th and 75th fractile of the cumulative distribution of table 1). However, it certainty appears more useful than saying profits will be $75,000.

While the Floral probabilistic estimates are not totally reliable this can partially be attributed to the way in which the model was constructed. It is the overhead costs which the model fails to handle well. Partially the failure can be explained by an unfortunate surprise -- we simply did not believe the Canadian dollar was going to shrink by 10%. For this reason Floral's interest and exchange costs exceed the estimates included in the model. Moreover the simplifying assumption, that overhead costs would be normally distributed with standard deviation of 10% obviously was invalid.

TABLE 3

FLORAL TRANSPORT

ACTUAL VS PROJECTION 1977

	PROJECTED RESULTS			ACTUAL RESULTS
	LOW	EXPECTED	HIGH	
Mileage	778	880	1,058	858
Revenue	1,040	1,110	1,191	1,012
Manpower	161	199	233	195
Maintenance	55	78	192	66
Fuel	109	148	172	123
Licenses and Insurance	38	48	59	61
Hired Vehicles	145	201	275	161
Redelivery	71	100	145	121
Total Transport	666	766	925	727
Transport Margin	223	344	446	285
Other Product Margin	21	28	38	26
Total Margin	249	372	472	311
Total Overheads	273	297	314	335
Profit (Loss)	(45)	75	182	(24)

Implications of this Research

For the Firms

For both Floral, and the large company the projections provided by the probabilistic simulation should lead management to ask serious questions. Particularly for the large firm where management is already concerned about the ongoing viability of their current investment, the discrepancies between the early pessimistic and later optimistic expectations require attention. It is indeed possible that divisional management did change their minds about the future in the six months between the gathering of the pessimistic and optimistic inputs. It is also possible that the two sets of expectations were based on different underlying assumptions. When the first set of data was gathered the division perceived a hostile environment. Six months later a more benign market was expected.

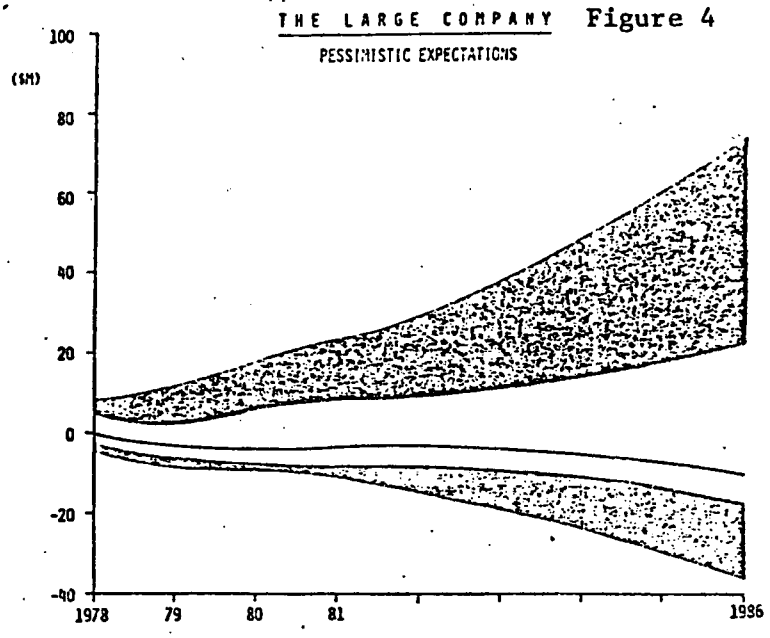
The important issue for the firm isn't that the division changed its expectations, but that the firm realize these two worlds are possible, and that it be prepared to act appropriately if either world becomes fact.

The real danger is that top management was only told about the optimistic expectations. The pessimistic projections were not communicated. The issue for top management is not that the market may be hostile, but whether that hostility is highly probable. If the division's pessimistic expectations are more probable, ie. a 75% chance that the pessimistic scenerio will occur, the

future does look bleak (figure 4). A great deal of opportunity appears to exist for the division for there is a 25% chance 1986 profits could be between 20 and 75 million, however, there is more than a 60% chance the division will incur a loss in that year.

THE LARGE COMPANY Figure 4

PESSIMISTIC EXPECTATIONS



For the firm the issue becomes which scene is more realistic. Perhaps no one really knows. But that should only enforce top management's concern for the division's operations. Both the optimistic and pessimistic expectations were based on specific assumptions about costs, competitor behavior and market trends. At the very least management should explore these assumptions. If a positive future is dependent upon a radical rationalization in the industry, or upon massive social or political catastrophies top management should assess their own expectations that these events will occur.

Top management may also want to monitor the actual trends which the division is facing. If the division's optimistic expectations are based upon a market turn around, early signs of that turn around may help top management decide which outlook is more reasonable.

If, on the other hand, the pessimistic scenerio is more realistic, the challenge becomes one of ensuring operating results are within the upper half of the possible distribution of expected results, rather than in the lower half. This challenge requires more specific identification of factors which contribute to favorable and unfavorable results, and then the creation of programs to take advantage of the favorable and to minimize the unfavorable.

For Developing Practical Probabilistic Budgets

The variability which exists in a Monte Carlo simulation may be attributed to several factors:

Elicitation Errors

The effect of errors in the estimation of the probabilities upon which the simulation is developed may be small on the estimation of means, but is large on the estimation of the standard deviation, or the range of outcomes reported. Only minor changes in the estimates provided the model change the degree of variability significantly. The picture of risk presented is highly susceptible to the accuracy with which we are able to develop management's initial assessments of uncertainty.

While simple tests for internal consistency can be applied by the computer programs which manipulate the simulation model, such tests do not adequately deal with problems of bias and instability in the manager's estimates. Until these serious behavioral questions can be answered, the feasibility of establishing accurate estimates of the manager's perceptions remains in doubt.

Problems of Independence

When developing a Monte Carlo simulation an important question concerns the model's assumptions about the relationships between the data introduced to the model and amongst the components of the model within the simulation. More precisely, what has been assumed about the interdependence of the data and the manner in which it is being manipulated.

The issue of independence has important implications for the modeller. If independence cannot be assumed then we face the practical problems of assessing joint probabilities, or of asking managers to describe the correlations between the elements of the model.

In Floral, while it was realized interdependencies could exist, all data gathered was elicited on an "independence" basis. In the large ten year forecast it was not possible to ignore the significant interdependencies between the elements of the model.

In Floral, while it was realized interdependencies could exist, all data gathered was elicited on an "independence" basis. In the large ten year forecast it was not possible to ignore the significant interdependencies between the elements of the model. Management strongly believed that product volumes and selling prices were related. Given the nature of the firm's products if demand was high prices also would be high.

While we could not ignore this relationship between price and volume, it simply was not possible to obtain estimates of the joint probabilities from the firm -- there were simply too many. Instead we asked management to think about the four quartiles of their estimates for sales volume and product prices. We asked:

If volume is in the upper quartile would you expect prices to be within the same quartile?

Based on responses to this question the simulation was constrained to generate correlations of .5, if management believed prices and volumes would reside in the same half of the distribution; correlation of .75 if management believed prices and volumes would reside in the same quartile.

While exceptions to this rather crude approach which forces an "expected" dependence on the model may be raised, historical estimates of intervariable relationships may provide a more reliable basis for coping with the inter-dependence problem. Sufficient empirical data did not exist to estimate price/volume relationships for the large firm model, but at least conceptually there appears to be no reason why the modeller could not investigate the historic relationships between these variables, and if management believed historic patterns would continue in the future, to require his model to replicate these correlations in the future.

Implications for Planning and Control

The development of probabilistic budgets should lead managers to recognize that operating results are highly volitile. Such recognition may lead managers to attempt to at least understand, and at best control that volatility. At least, this recognition should lead to a more thorough exploration of the underlying causes of the volatility. At best, managers may create plans to cope with these uncertainties. To the extent that the creation of such contingency plans can lead to better management, probabilistic budgeting may have an important future. The challenge now is to demonstrate that knowledge of uncertainty will lead managers to manage that uncertainty.

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EFFECT OF DATA BASE MANAGEMENT SYSTEMS AT THE FOREST LEVEL

Introduction

The management of large tracts of land involves the collection of substantial amounts of data from the field, storage and updating of the data, and finally, its manipulation for decision-making (mathematical modelling, statistical analysis, report generation, etc.) at different levels of management -- local, regional and national. Although computers are being used increasingly for all aspects of natural resource management, e.g. in monitoring, environmental control, or data processing, a systematic and integrated approach to information handling for land use management is lacking in most organizations (Ouellette, et al. 1975).

The development of the integrated data base concept, which attempted to solve the problems inherent in traditional data processing techniques, appeared very attractive to, amongst others, organizations involved with natural resource management, such as the U.S. Forest Service, which has been in the process of implementing a data base management system since 1969. It was thought that the data management problems plaguing the Service at all levels -- forests, Regional Offices and Washington Office -- could be greatly alleviated because of the advantages theoretically derived from data base techniques.

The foundation of a Service-wide information system would have to be laid at the field, i.e. the National Forests, because that is where the bulk of the operational data is generated. An interesting question that arises, therefore, is how exactly the data base approach affects the tasks performed there.

The objective of this paper is to evaluate the data management requirements for three major interrelated activities at the field level in an attempt to answer the question. Since all tasks could not be investigated, three were chosen for their particular importance, viz. a timber sale, a road plan and a fire plan for the sale. The utility of data base technology for these activities will then be evaluated.

Advantages of Data Base Systems

The benefits derived from the data base approach can be broken down into the categories listed below.

A. Consolidation and Integration. Much effort is wasted by functional personnel who collect data already procured by others, for their own analyses and reports. The integrated data base approach offers two advantages in this respect: (a) its use of a Data Dictionary allows all users to know what data is available, and (b) the independence of the data allows different users to access the same data. The elimination of unintentional data redundancy results in greater consistency in reporting.

The benefits that can be derived from consolidating and integrating the data are of two kinds. One is concerned with the problems of using the same data in multiple computer systems and of simultaneously updating all the systems. The other is concerned with the duplication of effort that goes into gathering data which has already been collected by others. There are, therefore, potential savings in both computer systems and manually maintained data files.

B. Flexibility and Adaptability. In the long run, this is perhaps the greatest benefit of the data base approach. It offers flexibility in terms of increased responsiveness to changes in user demands. Unlike the conventional approach, a data base readily permits existing data to be used for purposes not envisaged when it was collected. Similarly, it is readily extensible to allow for new hardware and larger volumes of data. These characteristics stem from the property of data independence.

C. Quick Response. The on-line terminals and query language capability of advanced data base management systems, provide the capability for users to obtain answers to a number of structured questions in minutes. The report generating capability also allows the preparation of reports in minutes. This can be done by non-programmers. In comparison, report generators without an integrated data base would take hours or days to prepare a report. The use of ordinary programming languages to produce reports usually takes weeks. Both these alternatives require the use of programmers, and therefore would not be useful out in the field.

D. One Shot Jobs. The preparation of special reports or one-time analyses becomes possible since it is easier to access the data required. Under previous conditions, the time and cost involved were often significant deterents to such analyses.

E. Standards and Documentation. The preparation of a Data Dictionary, which is essential for designing the data base, can have wide ranging benefits. End users can consult it to determine data availability. Programmers can use it to derive a data map of their portion of the data base structure. This documentation and other controls provided by the system can form the basis for enforcing data standards and reducing problems of coordination between applications (Palmer, 1975).

F. Data Privacy and Security. The DBMS software will have facilities to control access to data. This ensures that only users who are authorized to either simply read certain data or to update it, will be able to access the data (Cohen, 1975).

G. Program Maintenance and Development. When considering cost savings alone and not increases of managerial efficiency and effectiveness, this is by far the largest cost saving factor. However, in terms of effect on user tasks, this is not a relevant factor.

Data Management at the Field Level

To determine data management requirements at the field level, a representative National Forest was selected, viz. the Stanislaus in the California Region.

The tasks selected are performed by three different departments: (a) timber management (timber sale), (b) engineering (road plan), and (c) fire management (fire plan). The importance of these activities, when aggregated, can be gauged from the following figures: of a total 1976 budget of $6.3 million for the Stanislaus, 40% was spent on these items.

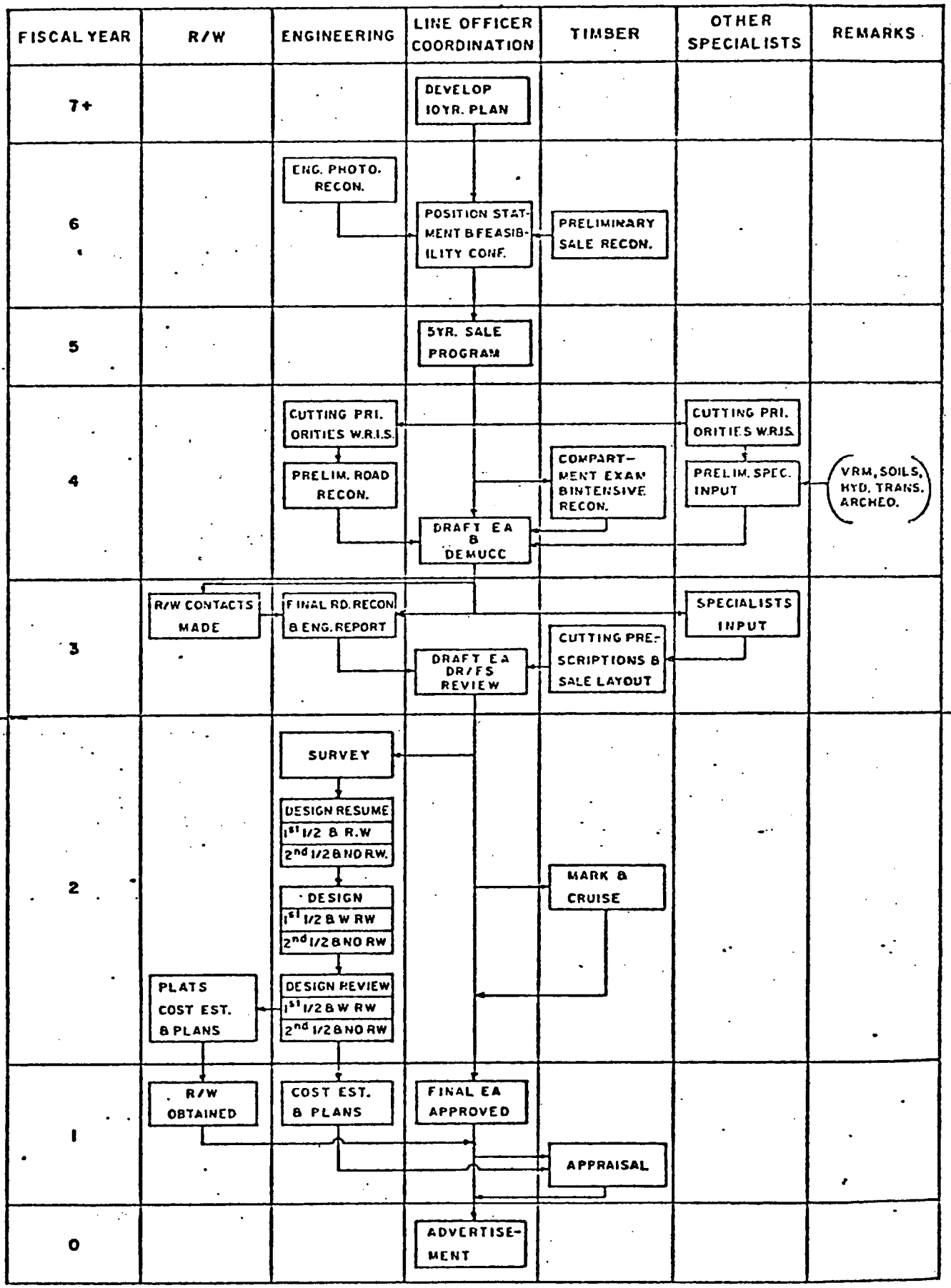
Another reason for the choice of these tasks was the interrelationship between them which would presumably highlight potential advantages of data base management systems. (A timber sale requires new road construction and also poses fire management problems arising out of slash disposal and human activity.) Interviews were conducted at the forest to determine the data management requirements of a timber sale and the corresponding road and fire plans.

The number of timber sales consummated every year ranges from 16 to 20, with the bulk of the actual work being performed by the District Ranger's office. Figure 1 shows a flow chart of the activities performed chronologically for a timber sale by different departments and their interrelationships. It helps to track the flow of information required for the three tasks of interest. The flow chart is explained below briefly, with the entries in italics.

The 10-year plan incorporates planned timber sales ten years into the future, but preliminary work on a timber sale begins only six years before the sale is made. The engineering department in the Supervisor's Office uses aerial photographs and topographic maps to determine the options for road construction. Meanwhile, quite independently, the timber clerk on the Ranger District does a preliminary sale reconnaissance. Information collected at this stage includes such things as special use permits, mining claims, range allotments, fishery resources, proposed recreational developments, known archaeological sites, private property, rights of way, section corner notes, experimental plots, superior and seed trees, etc. The reconnaissance forester works on maps during the winter preceding the intensive reconnaissance. He determines the intersection of timber types; sets up a reconnaissance notebook; has copies of maps made. All the information collected thus far is assembled and analyzed, and forms the basis for the sale five years later.

On the basis of the preliminary reconnaissance, the reconnaissance forester also designs the sample for the timber stand inventory. Sampling points are plotted on the map and copies made. On this basis, cruising teams are sent out the following summer to conduct the compartmental examination. This provides the data which is input to the computerized resource inventory system. The reconnaissance forester also conducts an intensive reconnaissance of the sale area, going into the field to verify what had hitherto been used on maps. A Reconnaissance/Layout Checklist is prepared to record the data collected. Its purpose is to provide a place for recording information and observations about each cutting unit as the sale planning and preparation work proceeds.

TIMBER SALE FLOW CHART



On the basis of the stand examination, an analysis of timber production is done by running data through the computer. The potential yield estimates are revised. These are then submitted to the Forest Timber Management Planner who has to coordinate all sale outputs to meet the allocated goal in the Timber Management Plan.

The preliminary specialist's input comes from the Visual Resource Management (VRM) people, the soils scientist, watershed scientist, and the archaeologist at the Supervisor's Office. The fire management department enters the picture at this point because they have to investigate the fire-related aspects of the sale. As a result of their analysis, the timber cutting prescription may be modified or the slash disposal proposals changed.

The Draft EA (Environmental Analysis) is in fact the project proposal in report form. This is reviewed by the EMUCC (Environmental Multiple Use Coordinating Committee). On the basis of the preliminary report, the contacts are made for R/W (Right-of-Way) clearance.

After the Project Proposal is reviewed and approved by both the District Ranger and Forest Supervisor, the engineering and timber departments get down to the nitty gritty of the sale. The roads are actually marked out on the ground and a road survey is made. The roads are then designed and their costs estimated. In conjunction with these activities, the layout forester on the district will mark the boundaries of the sale area, so that cruise teams can take sample measurements of the timber to be cut. This cruise data is then processed to determine the potential output of the sale.

Preparation of the Appraisal is the last major step before the sale. It specifies all costs pertaining to the sale and the rates at which timber will be sold.

Utility of the Data Base Approach

In examining the data management requirements at the level of a particular timber sale, it becomes apparent that the usefulness of the data base approach is confined to the first advantage, viz. consolidation and integration of data. The requirements for quick response, report generation, data privacy, etc. which are the other capabilities of data bases, are not present. In other words, the benefit from the data base is to provide site specific data on resources and activities, especially for the Timber Management and Engineering departments. In particular, the following steps would be affected: (a) Preliminary Sale Reconnaissance, and (b) Intensive Reconnaissance. A data base would provide a centralized store of information concerning the tract of land on which the sale is to occur. Information on constraints and completed on projected activities by all staff groups would be available by management cell.

An important factor is the quantity of data transferred from task to task (integration). It turned out that the transfer of information was merely in the form of discussions and mutual decisions. For example, the fire management staff would express their opinion on slash disposal procedures and this would be recorded in the Environmental Analysis. These decisions are made fully three years prior to the sale. Subsequently, there is little

transference of data between the three departments regarding the sale. The interaction between the three departments, therefore, does not require the data base approach because of the absence of queries, reports and transference of data.

When examining the interaction between a timber sale and the fire and road plans for that sale, it should be remembered that the data base approach has a profound effect upon them well before an individual timber sale is acted upon. This is because the total fire management plan, the total road network, and the timber management plan, are designed considering the forest as a whole. The integrated site specific data and mapping capabilities provided by the data base approach are required even above the level of an individual timber sale. Thus, new roads are laid out with the existing network as a starting point and the location of planned timber sales several years into the future. A major benefit of the data base approach lies in providing site specific data required to optimize the total road network.

A similar situation exists for the fire management plan. The data base would help in providing the data to optimize the overall plan, e.g. in running computer simulation models, which simulate forest fires and ascertain whether existing fire fighting resources are sufficient. A single timber sale may cause only a minor change in the Fire plan, if at all. (Of the total Fire Management budget of $379,100 for 1976, only $10,000 was earmarked for Timber Sale preparation.)

Conclusions

Data base technology is being increasingly used to help solve data management problems of organizations, including those concerned with natural resource management. It is assumed that it will have major beneficial effects on the performance of the organizations' tasks. However, the analysis of three major activities at the field level showed only a minor effect of using data base techniques. Of all possible benefits that can be theoretically derived, consolidation and integration of data are beneficial, particularly in the planning stages. The magic of data base technology should be viewed with this perspective at the field level.

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