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Use of Decision Theory in Auditing— A Practitioner's View

James K. Loebbecke

Touche Ross & Co.

In 1974, Bill Felix delivered a paper at this symposium entitled "A Decision Theory View of Auditing," for which I was the discussant. At that time Howard Stettler asked if we would consider reversing roles in 1976. This paper is the result of our agreement to do so, with the caveat that I could speak only from the point of view of a practitioner since I am neither an academic nor a mathematician.

In planning this paper, I made a limited review of current academic literature on the use of decision theory in auditing and, in addition to Bill Felix' 1974 paper, found several notable works. These will be referred to below. I also formally surveyed a group of my peers to determine 1) their familiarity with decision theory and 2) their advice on how it might be used in auditing. Their response indicates that a very small proportion of practitioners have considered the subject formally. Without going into great detail, 70% stated they have no truthful idea of what decision theory is, 15% acknowledged having a general idea, and 15% stated they could specifically define decision theory as presented in the literature.

These findings should not be interpreted as evidence that auditors are ignorant or that they are making poor audit decisions, but rather that decision theory is a relatively new concept which has not yet been widely exposed to them. My feeling, as was expressed in 1974, is that if decision theory were presented to practicing auditors on a broader basis (e.g., in *The Journal of Accountancy*), the introduction would be successful only if the more technical aspects could be presented in the auditor's own terms. Since this introduction, to the best of my knowledge, has not yet been made, I consider the purpose of this paper to be input to that future undertaking. Accordingly, I have tried to identify a decision frame that I believe many auditors are using in a way that relates to formal decision theory, and to examine some of its implications.

Review of Decision Theory in Auditing

A broad definition of decision theory is an essential starting point. Decision theory is a systematized approach to problem solving such that the choices made will produce the optimum outcome. Formal decision theory utilizes statistical techniques extensively. Thus, relative to auditing, the use of statistical sampling,

particularly in the form of hypothesis testing, would be classified as part of decision theory.

As Felix and others¹ point out, however, the definition of the optimal decision should consider not only relative probabilities, but also the costs and benefits involved. These considerations are combined with the probabilities so as to lead the decision maker to take whichever available action will most likely provide the greatest payoff (or least cost). Kinney presents the following general model:

$$E(W|a^*) = \min \Sigma W(s,a)P(s)$$

Where E(W) is the cost expected to arise from action a*, the optimum action (i.e., the one producing the lowest cost) from all possible actions a with cost W associated with states s given the probability P(s) that each state s exists.

As illustrated by Felix, this can be related in auditing to two states and respective actions (Figure 1):

FIGURE 1

Basic Audit Decision				
	States			
Actions	s ₁ —Material Error Exists	s ₂ —No Material Error Exists		
a ₁ —Render Unqualified Opinion	20	-7		
a2—Require Adjustment or Qualify Opinion	-3	1		

In this illustration, the matrix contains the net cost W (positive) or benefit -W (negative) associated with each possible a/s combination. If $P(s_1) = .1$ and $P(s_2) = .9$, we have the following:

Thus, a₁ is optimum in this case as it produces a negative cost (benefit), and the auditor would choose to render an unqualified opinion.

Felix and Kinney have both examined a logical extension of the model at this point—the problem of deciding whether to examine additional audit evidence before the decision is considered final. Kinney further processed hypothetical assumptions through the model to determine its sensitivity to the various factors involved.

Dacey² has studied a problem that I raised in my 1974 discussion—that of the model leading to a premature decision. Dacey recommends that auditors consider a model based on conclusion theory, which provides for acceptance of all hypotheses which meet certain criteria, not just one "optimal" hypothesis. The possibilities are held open until adequate conclusive evidence about a single hypothesis is obtained.

Scott⁸ has also examined these problems and has attempted, as have Demski and Sweringa,⁴ to relate this internal model to outside models. In the case of Scott, to the capital market, and in the case of Demski and Sweringa, to a joint problem of the auditor and management.

For my purposes, however, I shall consider two key aspects in the basic

model in Figure I: the cost of making the wrong decision and the probability that a material error exists. I shall then consider the implications of these aspects on the decisions commonly made by practicing auditors.

Cost of Making the Wrong Decision

Figure 1 indicates two possible wrong decisions: the issuance of an unqualified opinion when a material error exists (a_1, s_1) , which I will henceforth call a *Type I* error⁵; and requiring an adjustment or qualifying when no material error exists (a_2, s_2) , which I will call a *Type II* error.

When a Type I error is made, the results can be disastrous. The auditor can be held liable for damages suffered by the client on the basis of a tort action for negligence, or the auditor can be held liable to third parties on the basis of gross negligence, or be held liable for violation of the securities law in certain instances. Of particular concern, is the further possibility of criminal charges under both federal and state laws. This occurred in circumstances in which most auditors would hardly believe that a *crime* had been committed, in both the Continental Vending and National Student Marketing cases.

To illustrate the possible magnitude of direct loss, suppose the auditor were required to pay damages to a third party for gross negligence and incurred legal fees for a grand total of \$5,000,000. (Amounts of this general magnitude have been incurred in several instances.) Also suppose the audit fee for the engagement was \$500,000 per year. Based on my experiences with the operations of an international CPA firm, I estimate it would take over forty years of net income from audit fees to recover this loss.

The indirect costs of a Type I error are not as easy to measure, but they are of great concern. A tremendous amount of energy is sapped from the firm by a serious lawsuit. Attention of a number of high level partners is required, and the attention of others is diverted. Not only is there a loss of these persons' time, there is a loss of the leverage they command as well. There is also the possibility that a special peer review would be required which would cost several hundred thousand dollars and require considerable time. A negative environment can be created. Additionally, the firm's reputation can be damaged to the point where potential opportunities and even existing clients can be lost. One serious Type I error can overshadow good work done on ten thousand other clients. It can ruin careers and even lives.

Type II errors are individually less costly, but at a relatively uncritical level, more likely to be incurred. There is a great deal of pressure in auditing to control hours worked. This results from client fee concerns and engagement scheduling problems caused by turnover and work peaks. Often, where apparent errors are uncovered, the auditor will approach the client to request an adjustment. The client may react by refusing, and additional work will be done to resolve the situation. Where the matter is resolved in favor of the client, a Type II error has been made and corrected. The client may or may not agree to pay the auditor for this additional work. If this strategy is followed extensively, the auditor may irritate the client to the point where the auditor is replaced.

If the client accepts the auditor's request for an adjustment or if a qualified opinion is issued when a material error does not exist, the Type II error reaches

the critical stage of impacting the published financial statements. Although low chance of discovery is a factor, it is possible the client could suffer damages, and a lawsuit against the auditor could result.

Another aspect of the Type II error problem is the possibility that an auditor may seek additional protection by extending the amount of work performed. If the engagement is for a fixed fee, there is a cost to the auditor for any unnecessary work that is performed. If per diem rates are charged, the client bears the cost, but if the auditor's fees become excessive, the loss of clients becomes a possibility, with the attendant cost to the auditor.

In contrasting the relative magnitudes of the two types of errors, as a practitioner I would certainly want to control both of them, but in the final analysis, Type I far overshadows Type II. The lawsuits resulting from Type I errors have dominated our environment for several years now; they are a study in and of themselves. Although we carry large amounts of insurance to cover losses that can occur, such insurance is only a long-term financing mechanism. Any large loss will be rebilled to us in future years with interest.

For these reasons, I believe that when auditors make the decision to issue a report, the losses associated with Type I errors are foremost in their minds. They first decide: "Is there any real chance the opinion should be qualified?" If the answer is affirmative, they will go to great lengths to be satisfied. If the answer is negative, it is unlikely that much additional work will be performed beyond the minimum level associated primarily with tradition or internal policy.

This approach is at least partially consistent with the formal decision theory model. The differences are:

- 1. The decision to extend work is biased toward a one-sided expected cost consideration—i.e, the cost of a Type I error.
- 2. A third decision point can be reached where the auditor cannot substantiate the basis for a qualification, yet is afraid to give an unqualified opinion because of the circumstances. Here the alternatives may be to disclaim an opinion or withdraw from the engagement.

This second aspect is explored in more detail in the next section.

Probabilities Associated with Type I Error

Given that the decision framework just described is legitimate in the current auditing environment, a logical audit strategy would be to:

- 1. Allocate audit resources as efficiently as possible to minimize the risk of giving an erroneous unqualified opinion.
- Establish a standard for an acceptable level of such risk beyond which an unqualified opinion would not be rendered regardless of the inferences that may exist (i.e., unless a qualification is clear, disclaim an opinion or do more work).

Generally accepted auditing standards aim at these objectives, but they are far from specific. With regard to the first, there are definitions about general types of audit tests and procedures (i.e., compliance, substantive, analytical, confirmations, etc.), but little indication as to mix or preference.

With regard to the second objective, the minimums set by generally accepted auditing standards should provide at least a qualitative floor for acceptable risk. Certainly the discussions about competent evidential matter, independence, due care, and statistical sampling, for example, give some idea of what is expected. However, these become largely abstractions when a single examination is involved; and the abstraction is made more severe by the absence of clear-cut guidelines for determining materiality.

Thus, the auditor is in a position where the audit risk cannot really be measured, and the notion of the risk being taken must be compared to a presently undefinable standard. Is this bad? No, it is simply the way it is, and as time goes on clearer standards should evolve. In the meantime, how can the auditor minimize risk?

As indicated in SAS 1,6 the risk of making a Type I error can be viewed as comprising two separate risks: Ia—the risk that a material error is committed and exists in the financial statements, and Ib—the risk that the auditor fails to discover that fact. A complexity to this formulation is that when the Ia risk is great, it may also be that Ib is great due to the circumstances that relate to Ia. For example, if the Ia risk is great because of an inadequate record keeping system, Ib may be great because the system does not provide audit evidence to inspect. It is important to recognize this interaction because it implies that in certain circumstances where Ia is great and the interaction exists, it is not possible to perform an audit in accordance with professional standards. In such situations, the auditor should recognize this at the outset and withdraw from the engagement, rather than attempt an audit for which the fee may not be collected, incur extreme client/user dissatisfaction, and/or be faced with a high risk of Type I or Type II errors.

The specific magnitude of Ia risk cannot, of course, be measured objectively. However, conditions which will indicate its general magnitude can be appraised. Thus, where Ia is low or moderate, certain strategy alternatives relative to controlling Ib can be available; whereas, if Ia is high, disengagement or a special set of procedures should be considered.

Figure 2 presents the factors which affect the propensity for a material error to exist, the possibility of interaction with Ib risk, and the steps available to the auditor to make an appraisal of the risk and/or to achieve some control over it.

Thus, we see that there are very strong interactions between the integrity of management and the design of internal control, and the auditor's ability to gather sufficient competent evidence. If management is dishonest, it may conceal evidence or make false representations to the auditor, which cannot be overcome with evidence-gathering procedures. The common thread in many of the notorious lawsuits against CPAs is the presence of dishonest managements. Finally, if the design of the system of internal control is such that economic events can occur and yet escape capture by the system, adequate evidence may not be available for the auditor to examine.

A possible interaction exists where the industry is unique and an industry expert is not available; perhaps the audit should not be undertaken. In cases where the company is having problems with excessive growth or possible insolvency, or if client personnel lack competence, errors may be more likely, but the auditor's ability to find them may not be affected. On the other hand, where

Factors Related to Existence and Detection of Material Error		
Factors Which Increase Propensity for Material Error	Interaction with Risk of Nondiscovery	Steps Available to Auditor (or Audit Firm) to Appraise or Control Risk of Material Error
• Nature of industry	Possible	Use of industry expertsControl of industry mix
 Nature (condition) of business 	Possible	Financial analysisClient profiling techniques
• Integrity of management	Strong	 Client investigation procedures (new and repeat) Score card (retrospect) of client representations
 System of internal control—i.e., design 	Strong	 Table of transactions and sources of evidence Preliminary evaluation
 Competence of client personnel 	Possible	Observation Tests of data

the condition of the business causes management to compromise its integrity, or where incompetent personnel make auditing such a painful and time-consuming process that the auditor takes unwarranted expediences, interaction occurs.

Some of the steps listed opposite each factor are familiar ones. Others may be new. Following are comments on the relatively unusual steps:

Financial Analysis. This is not new in itself, but more advanced models are beginning to be used by auditors. Specifically, bankruptcy prediction techniques are being used for the purpose cited here. Two techniques used by Touche Ross are a discriminant analysis by Altman⁷ and a gambler's ruin model developed by Wilcox.⁸

Client Profiling Techniques. Some audit firms recognize that certain client characteristics are related to greater risks, and a profile is maintained citing these characteristics for audit clients. This is kept current and reviewed at least annually to consider whether the audit program adequately considers the risks involved.

Score Card of Representations. Throughout an audit, certain representations are requested and made by responsible client personnel. For example, the collectibility of specific accounts receivable and the ultimate outcome of construction projects in process. A record of these by person is maintained in the permanent file, and in subsequent periods the actual results are entered to judge the accuracy of the representations.

Table of Transactions and Sources of Evidence. This technique requires the auditor to identify all possible economic events which are likely to occur with regard to the entity. These are generally described as types of transactions and are constructed into one axis of a two-dimensional matrix. The other axis lists all sources of evidence available to the auditor about those events. These are generally divided into specific internal control subsystems of the entity and other sources, such as outside confirmation, board of directors' minutes and direct

physical observation. The body of the matrix indicates the relationships between the axes and allows the auditor to make preliminary appraisals and plans. Specifically, it is possible to see whether there are any transactions which lack substantive evidence sources, to determine which systems must be evaluated and the extent of potential reliance on internal control, and to plan the proper sequence of audit steps.

Figure 3 presents in a fashion similar to Figure 2 the factors which affect the auditor's risk of failing to discover material errors should they exist.

FIGURE 3

Factors in Failure to Discover Material Errors		
Factors which Affect the Auditor's Risk of Non-Discovery of Errors Scope and terms of engagement	Steps Available to the Auditor (or Audit Firm) to Control Risk Engagement letter Audit plan	
Reliability of audit evidence	 Selection of evidence— direct vs. indirect 	
a. Nature (effectiveness)b. Timingc. Extent		
• Performance by auditor	• Training • Instructions	
a. Capabilities	StaffingTools	
b. Conditions	• Review	

The factors shown relate to the auditor's achieving the position where there is clear agreement about the examination to be performed and the feasibility of such performance, and where there is certainty that the audit conclusions are sound. This latter aspect relates to the evidence itself and the proper interpretation of the evidence. Interpretation is used in the broad sense of not only evaluating what is observed, but observing what is available. Interpretation is behavioral. Proper interpretation requires knowledge, experience, alertness, and similar personal strengths in the individual auditors involved. However, the conditions under which interpretation is accomplished are also a factor. The physical form of the documentation of the evidence gathered influences interpretation; also, any time constraint under which the interpretation must be made has an effect. It is interesting to speculate how the need to meet tight deadlines for a registration statement or an early annual report issuance during the "busy season" affects the auditor's judgment in this area.

Selection and Evaluation of Evidence

With regard to the steps available to deal with the factors, the most pertinent set deal with the selection of evidence. The theory of evidence can be presented in various ways; I have chosen here to distinguish between *direct* and *indirect*

forms of evidence. (I do not intend, however, to present a comprehensive theory of evidence.)

Direct evidence is defined as evidence of the monetary amounts recorded in the financial statements, as of the financial statement date. Indirect evidence is defined as all other evidence. One might argue that an ideal audit would contain all direct evidence, i.e., risk would be minimized. On closer inspection, however, this may not be true, because the relative *quality* of the available indirect evidence may be better than that of the available direct evidence, and obtaining indirect evidence might enhance improved performance by the auditor.

First, let's consider the quality of the evidence. The quality of a single type of evidence relates to the source of the evidence and effectiveness of the audit procedure used to obtain it. For example, with an account receivable confirmation, the source of the evidence is an outside party—a high quality source. The effectiveness of the audit procedure, however, will vary depending on the reliability of address information, the design of the request, the nature of the industry, and the characteristics of the customer. On the other hand, a management representation may not constitute adequate evidence because of its source, even though the auditor's interviewing techniques are effective.

Where the quality of a single type of evidence is lacking, the auditor must generally obtain evidence of other types. If all indicate the same conclusions, their aggregate quality will be significantly enhanced. This is a point that should be noted because traditionally some auditors have confused evidence quality with evidence quantity. As a result of this confusion, they have attempted to compensate for a relatively ineffective audit procedure by taking large samples. It should be quite clear that the bias introduced by improper measurement of sample values has a severe effect on the sampling distribution regardless of the sample size. Thus, the auditor may be better off taking relatively small samples of more types of evidence whenever the quality of a single type is not clearly superior.

Many of the types of indirect evidence relate to testing the internal controls of the client organizations and balances at interim dates. Both of these approaches allow a large amount of audit work to be spread throughout the fiscal year preceding the financial statement date. This enhances planning and control and effective staffing—conditions which can reduce audit risk. Internal control testing also has the advantage of providing evidence of a second type relative to other direct evidence.

The danger of these approaches is concerned with the difficulty of relating the conclusions to the financial statement balances. Where reliance is placed on internal controls, an appraisal must be made relating the effectiveness of the various subsystems to potential monetary errors in the accounts. This is a complex task and it is questionable whether it can really be done subjectively except in vague terms.¹⁰ The problem with interim-date tests relates to the risk that conditions may change between the interim date and year end. The appraisal of this risk is closely related to the evaluation of internal control.

Non-Sampling Error

Non-sampling error—the result of incorrect performance by the auditor—causes bias in the same manner as an ineffective audit procedure. Non-sampling

error can result from assigning the wrong person to a specific audit task, or from subjecting the auditor to conditions where fatigue, boredom, or other personal weaknesses might occur. These can be controlled by a variety of approaches as shown in Figure 3.

It would appear that the aspect which most closely relates to the formal decision theory model is the determination of the extent of procedures—i.e., sample size. Both the costs of sampling and probabilities can be specified for a decision model in much the same way as with classical sampling. The difficulty would occur in attempting to specify the cost of a Type I error (as I have defined it) because this relates to the aggregation of *all* evidence, not just the results of a single test. The jump from individual tests to the overall aggregation appears to be the greatest challenge to formal model usage.

Summary

The concepts of formal decision theory are extremely useful to auditors as a means of recognizing which elements of audit effort should receive available audit resources. Traditionally, there have been observations that too much time is spent on trivial areas or areas which are "the easiest to audit." I have attempted to present the audit framework in such a way that various elements can be discussed relative to their effect on the risk of issuing an unqualified opinion when material error exists in the financial statements, as I believe this risk is of pervasive concern among practicing auditors.

In controlling this risk, it was indicated that the auditor should appraise the client's propensity to commit a material error. Most significantly, two factors—integrity of management and design of internal control—have strong interactions with the auditor's ability to discover errors. If these factors are negative, disengagement or disclaimer is advised. It is also possible that other factors—nature of the industry, condition of the business, and competence of client personnel—could have similar interactions in some circumstances.

Based on the importance of this aspect of risk, one would expect auditing firms to establish standards and procedures for the initial and continued acceptance of clientele, the use of financial analysis on all audits, and the development and use of industry experts. One interesting social consequence of all auditing firms adopting such policies would be to set minimum standards for managements to qualify for audits.

In examining the various aspects relating to the auditor's discovery of errors, it was indicated that the effectiveness of procedures and control of non-sampling error were essential prerequisites to further assumptions relating to sample size. Although these factors are most often discussed in the context of statistical sampling, they apply to judgmental samples as well.

The key point to be made regarding the risk of non-discovery, however, is that the proper combination of all elements is not clear, and would not be universal for all audits. The phrase "appropriate in the circumstances" has real meaning here. The auditor's skill provides as meaningful and effective a basic recipe as can be contrived, and further assistance should be available through firm and professional standards, guidelines, and tools. In this regard, auditing firms can be expected to deal with such issues as:

- What training costs will be incurred.
- What minimum duties and responsibilities should be defined for partners, managers, and staff.
- When specialists must be consulted.
- When certain tools, such as questionnaires or statistical sampling, must be used.
- What audit procedures must always be done at year-end.
- What constitutes minimum reliance on internal controls.
- What types of workpaper review are necessary.
- How technical issues are resolved.

Some of these issues have passed to the professional level. A review of pronouncements indicates a predominant concern with control of Type I errors. SAS 4, Quality Control Considerations for a Firm of Independent CPAs, for example, cites areas where firms should have policies established and gives examples. And the current Auditing Standards Executive Committee agenda includes additional such items, such as management's illegal acts and the auditor's responsibility for detection of fraud. Little that has happened in the profession of late has resulted in less auditing.

All of this leads up to the point of the next logical question—"what is the relationship of the costs and benefits of auditing?" Are the benefits sufficient to justify those costs?¹¹ Can the cost factors be changed, e.g., through legislation of legal liability statutes? Until such issues are made more clear, it will be difficult to gain agreement on what constitutes reasonable assurance in auditing. And until reasonable assurance and materiality are more clearly defined, auditors will continue to take their present defensive position of acting to minimize the Type I risk.

One of the issues of the Commission on Auditor's Responsibilities¹² is the cost-benefit issue. Successful efforts by the commission will facilitate more formal use of decision theory in auditing.

Footnotes

- 1. Throughout this section I have drawn on three excellent sources for material on decision theory in auditing:
 - -Dyckman. T. R., "Some Contributions of Decision Theory to Accounting," Journal of
 - Contemporary Business, Autumn 1975.

 —Felix, W., "A Decision Theory View of Auditing," Contemporary Auditing Problems, ed., H. Stettler, University of Kansas School of Business, 1974.
 - -Kinney, W. R., Jr., "A Decision-Theory Approach to the Sampling Problem in Auditing," Journal of Accounting Research, Spring 1975.
- 2. Dacey, R., "A Conclusion-Theoretic Resolution of the Auditor's Detection Problem," Working Paper No. 75:13, University of Oklahoma Center for Economic & Management
- 3. Scott, W., "A Bayesian Approach to Asset Valuation and Audit Size," Journal of Accounting Research, Autumn 1973.
- 4. Demski, J. and Sweringa, R., "A Cooperative Formulation of the Audit Choice Problem," The Accounting Review, July 1974.
- 5. I realize that under conventional hypothesis testing, this may be labelled as a "Type II error." To the auditor, however, it is the error of greatest concern, and the definition "Type I" would seem more consistent with his view. This has been my experience in teaching statistical sampling to auditors. Where the hypothesis test has been framed so that the "alpha risk" represents the risk of accepting a materially misstated account balance, it has enhanced understanding.
 - 6. Statement on Auditing Standards No. 1, Sec. 320A.14.

7. See Altman, E. I. and McGough, T. P., "Evaluation of a Company as a Going Concern," Journal of Accountancy, December 1974; and Altman, E. I., "Corporate Bankruptcy Prediction and Its Implication for Commercial Loan Evaluation." The Journal of Commercial Bank Lending, December 1970.

8. See Wilcox, J. W., "A Gambler's Ruin Prediction of Business Failure Using Accounting

Data," Sloan Management Review, Spring 1971.

9. See Loebbecke, J. K. and Neter, J., "Considerations in Choosing Statistical Sampling Procedures in Auditing," Proceedings of Conference on Statistical Methodology in Auditing, University of Chicago, May 1975 (to be published in Journal of Accounting Research Supplement).

10. See Burns, D. C. and Loebbecke, J. K., "Internal Control Evaluation: How the Com-

puter Can Help," Journal of Accountancy, August 1975.

- 11. As but one example, this is particularly pertinent to the current issue of auditor involvement with interim financial statements in deciding whether 1) all reviews should be voluntary (initial AICPA position), 2) reviews should be mandatory (SEC position re publicly held companies), and 3) public reporting should be allowed on the basis of a review vs. a regular examination.
- 12. Statement of Issues: Scope and Organization of the Study of Auditors' Responsibilities, AICPA, Para. G-1, D.