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Wanda A. Wallace

Southern Methodist University

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ANALYTICAL REVIEW DEVELOPMENTS IN PRACTICE:  
MISCONCEPTIONS, POTENTIAL APPLICATIONS, AND FIELD EXPERIENCE  

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by  

Wanda A. Wallace  

Wanda A. Wallace, PhD, CPA, CMA, CIA  
Marilyn R. and Leo F. Corrigan, Jr. Trustee Professorship  
Edwin L. Cox School of Business  
Southern Methodist University  
Dallas, Texas 75275  

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Please address all correspondence to Wanda A. Wallace.
When the term "analytical review techniques" is mentioned to the auditor, the first word association made is likely to be "reasonableness tests" and the second, "planning tool." This latter reaction is an unfortunate effect of traditional auditor training that stressed the role of reasonableness checks of account balances in allocating audit time. Yet, Statement on Auditing Standards no. 23, "Analytical Review Procedures," defines such procedures as "substantive tests of financial information made by a study and comparison of relationships among data" (emphasis added, AICPA, 1978, AU sec. 318, par. 2). While accustomed to describing confirmation procedures, inventory observation, and the examination of vouchers and related documents as substantive testing techniques, the auditor is unaccustomed to giving equal weight to analytical review procedures. Perceived apprehension is, in part, justifiable due to the specific techniques which come to mind when an analytical review approach is discussed:

- percentage change in an account from the prior period or from the corresponding time frame in the prior fiscal year,
- the difference between recorded numbers and budgeted figures, and
- the stability of such key ratios as gross profit, return, and turnover statistics.

These are what might be termed "soft evidence" techniques which frequently consider only a few pieces of data, aggregated at the annual or entity level, and require a high degree of subjectivity in their implementation. For example:
What is a reasonable percentage change? 10%?

What if a 40% change were expected? Should it be investigated merely because it exceeds some 10% benchmark? What of those 5% fluctuations that were expected to be 40%?

How accurate should budgets be to justify their use in analytical review?

When is a large change in some key ratio sufficiently "explained," and when is additional testing required?

The subjectivity that permeates currently used techniques is perhaps clearest upon review of a set of working papers for a limited review engagement. The working paper documentation tends to be lengthy, replete with explanatory memos as to what supposedly caused the "unusual fluctuations" observed. Little objective support as to the reasonableness of the explanations received, particularly as to their ability to explain the total dollars of the unusual fluctuations that have been detected, is available. There can be little question that the prevalence of "soft" analytical review procedures has relegated the technique to one on which little reliance is placed throughout the audit process. However, this widespread "mind-set" by practitioners is analogous to the results one would expect if sampling procedures had been introduced into the auditing literature with no explanation of their theoretical foundations or of acceptable systematic sampling plan approaches, and with an emphasis on drawing samples that achieved a 50% confidence level. If practitioners thereby inferred that sampling conclusions were subjective and could provide no greater comfort than a 50% confidence level, CPAs' interest in such techniques might well have diminished.

Analytical review techniques can be placed on a continuum from "soft evidence" to "hard evidence," depending on the particular audit procedure used.
Kinney and Felix (1980) present a summary table that classifies the analytical review methods termed judgmental, rules of thumb, time trend, and structural techniques according to the objectivity of predictions and the determination of the reliability of predictions. Another dimension of these methods is the quantity, quality, and type of data used in their application. The distinction made by Kinney and Felix (1980, p. 102) stressed the use of "any available information" for judgmental methods, "past audited values" for each of the other methods, and "quantifiable environmental information" in structural models. Such a summary both overstates the capabilities of judgmental methods and understates the capabilities of structural models for analytical review. To claim that subjective methods are apparently able to use any data available is similar to saying that because one is not deaf and hears someone speaking Japanese, he is able to understand and assimilate what is heard. The behavioral literature is replete with problems that decision makers have with analyzing large quantities of data (see Libby, 1981), and a conversation with any practitioner will confirm a general frustration with evaluating the reasonable effects of numerous environmental and company-specific attributes upon reported accounting numbers. In fact, if one wishes to include many types of statistics in an analytical review procedure, a more formalized approach to modeling relationships has clear and significant advantages due, in part, to its data management capabilities. The information to be integrated need not be quantifiable, since multivariate models can reflect qualitative dummy variables, and the information used need not rely on stable operations over time, since cross-sectional applications, comparing substantive balances across similar units of operation, as a check on reasonableness, can also be valuable analytical review tools.
Of course, how well a structured analytical review procedure will perform depends on how well structured the selected model is, but that problem relates to all alternative analytical review procedures, i.e., how well a rule of thumb works will, in large part, depend on whether the rule of thumb is well specified and captures the particular operating attribute of interest.

Critical Misconceptions Concerning Analytical Review

Figure 1 describes common misconceptions concerning analytical review techniques; I believe these represent obstacles or "blotches" on the profession's road to progress in gathering a sufficient evidential base for rendering an audit report in the most efficient manner. The first two points I have already stressed: analytical review need not depend upon "soft tools" and formal structural approaches can consider all the available relevant information, as defined by the auditor, more effectively than a purely judgmental model. Granted, the cost of formalizing and quantifying certain relevant factors may lead the CPA to select a combined structural/judgmental approach, whereby certain unusual but expected fluctuations are judgmentally analyzed, rather than being "controlled" through the structural model. However, the existence of numerous relevant operating and environmental factors affecting operations does not preclude the usefulness of parsimonious structural models in providing assurance that recorded financial figures are fairly stated. Many of the so-called relevant factors will have a third-or-fourth-order effect that results in no more than an immaterial change in an account of audit interest.

This leads to the third misconception raised in Figure 1 of "no news is better than bad news" which could just as easily be phrased "ignorance is bliss." The misconception reflects a misunderstanding of the audit process and the method by which the auditor assimilates evidence from a variety of
FIGURE 1

MISCONCEPTIONS CONCERNING ANALYTICAL REVIEW TECHNIQUES -- "BLOTCHES" ON THE PROFESSION'S ROAD TO PROGRESS

ANALYTICAL REVIEW TECHNIQUES PRODUCE SOFT EVIDENCE

JUDGMENTAL APPROACHES ARE PREFERRED TO ALL OTHER ALTERNATIVES SINCE NO OTHER TECHNIQUE CAN CONSIDER ALL THE AVAILABLE RELEVANT INFORMATION

THE EXTENT OF ANALYTICAL REVIEW PROCEDURES TENDS TO BE FIXED AND IT IS ESSENTIALLY IMPOSSIBLE TO INTENSIFY A TEST USING ANALYTICAL METHODS IN A MANNER THAT IS ANALOGOUS TO EXTENDING THE SIZE OF A SAMPLE

NO NEWS IS BETTER THAN BAD NEWS: IF THE ACHIEVED PRECISION OF THE TECHNIQUES IS WORSE THAN DESIRED AND SUPPORTING DOCUMENTATION TO THAT EFFECT IS PLACED IN THE WORKING PAPERS, THE CPA IS WORSE OFF THAN IF JUDGMENTAL METHODS WERE RELIED UPON, WITH NO QUANTIFIABLE PRECISION

UNLESS DATA HAS BEEN DETAILED TESTED, IT SHOULD NOT BE INTEGRATED IN A FORMALIZED ANALYTICAL REVIEW PROCEDURE

STRUCTURAL MODELS ARE EXPENSIVE TO IMPLEMENT, UNLIKELY TO BE USEFUL DUE TO THE FREQUENCY WITH WHICH BUSINESS OPERATIONS SHIFT, AND RARELY PRODUCE A SUFFICIENTLY PRECISE EXPECTATION FOR RELIANCE
sources to formulate the final opinion on the financial statements. At the risk of overdoing cliches, the misconception stresses the attitude "it's all or nothing" whereby a tool which helps the CPA to assess the reasonableness of accounting figures is of no use if that tool must be complemented by any other audit procedure. Part of this misconception stems from some illogic that is prevalent in the literature's discussion of analytical review.

Holder and Collmer (1980, p. 32) claim "the absence of unusual fluctuations may not represent adequate evidence to cause the auditor to limit other substantive tests; however, the presence of unexpected fluctuations should normally result in an expansion of other substantive tests." Similarly, Kinney and Felix (1980, pp. 98-99) state, "In a sense, the lack of expected relationships should cause the auditor to extend planned tests. Whether the converse is true may be the subject of considerable debate." The example provided by Kinney and Felix involves the possibility of fraud whereby results are manipulated to match to expectations and, therefore, the capability of analytical review procedures to perform effectively is thwarted. First, I suggest that many audit procedures become defunct in the face of fraud, and that, in fact, analytical review procedures, which utilize data that cannot be manipulated internally, despite poor controls, may prove more effective than other substantive tests in detecting irregularities. This point will be discussed in greater depth later in this manuscript. Second, an inconsistency exists when the claim is made that a tool can tell the auditor where some problem lies, yet, for some inexplicable reason, is incapable of simultaneously telling the auditor where that problem does not lie. An attention-director by definition also diminishes attention elsewhere; to suggest otherwise is asymmetric logic. What has happened, in the literature, is that instead of discussing the capabilities of analytical review or evaluating its actual
performance, the loss function of the auditor has been emphasized, drawing a conclusion that is contrary to SAS no. 23. The auditor must assess the sufficiency of audit evidence and is likely to stress Type II errors; the analytical review tool itself provides evidence concerning whether balances are reasonable, with a stated precision if structural models are utilized, just as it provides evidence concerning whether balances are unreasonable. The fact that additional precision may be required before determining that evidence is sufficient to judge the financial figures to be fairly presented reflects an asymmetrical loss function, not an inherent asymmetrical power of analytical review procedures. When SAS no. 23 suggests the possibility of substituting analytical review procedures for other substantive tests, no asymmetry in the type of evidence provided is implied, as the issue of procedures' performance is kept distinct from the issue of what is sufficient evidence.

This leads to the issue of whether an analytical review procedure that supports "reasonableness" at a 10% level is of any use to an auditor who assesses materiality to be 3%. The answer from an experienced auditor will be "yes," but that procedure will have to be augmented by additional audit evidence to reduce the 10% uncertainty to 3%. Those who respond "no" are likely to misunderstand the 10% statistic. That figure does not mean that an account is "wrong" by 10%; it merely means that the technology in use only has the power to support recorded balances as being within 10% of expected balances. That piece of evidence is a quantifiable, objective reasonableness check which can be used to determine the extent of additional tests as being less than if no such reasonableness test were performed. If a structural model only provided a 50% precision measure, the CPA may find that the business knowledge of client operations is inadequate or the modeled operations are illogical, and an auditing problem can be uncovered which would never be known, had the
analytical review procedure not been applied. If something is in error or if some key aspect of operations or the environment affects recorded accounting numbers differently than expected, such information is of value to the CPA. Similarly, when the balances appear reasonable, at some level of precision, a contribution is made to assessing the overall reasonableness of the financial statements.

A fourth and related misconception concerns the ability of the CPA to extend analytical review procedures. The claim has been made that the extent of analytical review procedures tends to be fixed (see Kinney and Felix, p. 99). This claim reflects existing practice more than it reflects possibilities. Consider Figure 2. Means of varying the extent of analytical review in terms of number of accounts audited, quantity of data used in such analyses, and sophistication of audit procedures utilized are perhaps obvious, but less obvious is the ability to take a particular month of operations that is out-of-line and to extend analytical review procedures by performing an analysis across subunits of operations, to investigate which appears to be out-of-line, in relation to all other units, in that month. Similarly, by stratifying data, as frequently done in sampling, the CPA may be able to achieve desired precision and to better pinpoint trouble-spots, than through some alternative approach. If the CPA has an idea that, for example, the unusual fluctuations were due to the periodic closing of a nuclear plant, such an operating characteristic could be formally integrated into a structural model to see if, in fact, the fluctuations were thereby "explained."

Returning to Figure 1, the fifth prevalent misconception concerns the expense of sophisticated analytical review procedures and the plausibility of applying them to clients, most of whose business operations are in a continual state of flux. The use of structural models requires improved planning,
FIGURE 2
VARYING THE EXTENT OF ANALYTICAL REVIEW PROCEDURES

Are Analytical Review Procedures To Be Applied?

To What Accounts Are They To Be Applied?

What Amount of Data Is To Be Used?

What Type of Procedure Is To Be Applied?

Results of Initial Analytical Review

Precision Less Than Desired

Does CPA Wish To
- Expand Data Set
- Select A More Sophisticated Procedure?

Can The Data Be Stratified Or Disaggregated To Yield Improved Precision?

Unusual Fluctuations Are Detected

Utilize Analytical Review Procedures To Investigate

Can Data Be Disaggregated To Better Pinpoint Problem?

Can The Expected Cause Of Fluctuation Be Integrated And Tested In A Structural Model?
additional training of personnel, computer software, and the collection of more than merely the prior year's data or a small subset of operating units' data. However, the ongoing cost of using such structural models, once familiarity with the technique is obtained, is likely to be nominal. The benefits of the modeling approach relate to audit efficiency and effectiveness. The audit coverage can include an historical perspective from three to any number of years' monthly data, taking all of the monthly figures for those periods to formulate predictions of monthly balances for the current period; similarly, the coverage can compare all one hundred or more operating units to one another, in a systematic manner, which produces a quantifiable precision. While by no means synonymous with a 100% sample, for a particular account, the technique does review the reasonableness of numbers that are intended to reflect 100% of the transactions in that account.

The concern for instability of operations is likely to be overstated relative to the robustness of modeling techniques and the ability to often capture variability in operations in the structuring of the models themselves. The availability of cross-sectional analysis techniques can often be of use to multi-unit operations that are not stable across time but tend, nevertheless, to be comparable across units.

Experience reported to date suggests that structural models are useful in auditing a wide variety of companies and that the effects of normal business fluctuations do not significantly limit the models' usefulness.

An important benefit to a structural modeling approach is the ability to integrate external data that can be effective in exposing the manipulation of internal data, which might otherwise be overlooked. This brings us to the final misconception noted on Figure 1. The question is raised as to whether it is appropriate to use nonaccounting data which has not been tested by the
auditor and which may not be subject to the internal accounting control system that has been reviewed. At least two considerations are relevant. The first is the source of that data. If the question is posed -- should the auditor concentrate on accounting generated data to test the reasonableness of accounting data or should data generated by other departments, such as marketing, production, and long-range forecasting, be utilized, in spite of the risk of error in such data -- the layman is likely to prefer an "independent" check on the accounting department. Economical means of checking the reasonableness of the nonaccounting internal data to be used are frequently available through comparisons to industry statistics, demographic data, and other externally available information. For example, the number of customers serviced can be compared to population statistics and reported market share; kilowatt hours can be compared to production capacity and degree days, as maintained by the weather bureau; and the correlation of company-specific pricing data with industry pricing statistics may establish the acceptability of such information for integration in structural models. Traditionally, using judgmental analytical review procedures, the CPA has implicitly relied on nonaccounting data as useful benchmarks for assessing the reasonableness of accounting information; the formalization of analytical review in no way alters the propriety of such reliance.

The Continuum of Available Analytical Review Procedures and Potential Applications

As the misconceptions outlined in Figure 1 begin to erode, the potential of analytical review procedures in practice can begin to be realized. The continuum of available analytical review procedures is presented in Figure 3, with summaries of the attributes that differ across such procedures and the sources of data that can be used in the various approaches. The continuum
FIGURE 3

THE CONTINUUM OF AVAILABLE ANALYTICAL REVIEW PROCEDURES

A COMPARISON OF
2 POINTS IN TIME
% Change From Prior Period
% Change From Similar Period
In prior year
What Were The Risk Areas
Last Period?
In Which Accounts Were
Adjustments Booked Last
Period?

USE OF A
SINGLE BENCHMARK
Budgeted Amount
Industry Rate of Return
Chief Competitor's Performance
A Turnover Ratio or Similar
Operating Statistic

USE OF HISTORICAL
DATA FOR A SINGLE ACCOUNT
Time Trend Extrapolations
-graphical
-regression
-other ARIMA techniques
Useful Rules Of Thumb From
Past Experience, Such as Known
Cyclical Patterns

USE OF A SMALL
SET OF INTERNAL DATA
Ratio Analysis On Three To
Five Years Of Annual Data
Variance Analysis Over The
Recent Past
Extrapolations From A Short
Historical Base Period, Such
As The Gross Profit Rate For
Three Years Implied A Rate
For Next Year
Comparison Of One Unit of
Operation To Other Similar
Units Of Operation

USE OF A SMALL
SET OF INTERNAL DATA
Comparison Of Recent Experience
To The Industry, Including
Ratio Analysis
Market Share Performance
Economic Benchmarks
- for the Industry
- for the company
- for particular regions
Operating Statistics' Comparison
To The Environment, e.g. A
Utility's Comparison To Weather
Statistics
Extrapolations From A Short
Historical Base Period, Such
As The Relationship Of Degree
Days to Gas Production Statistics
For Three Years Implied A
Relationship For Next Year

USE OF A LARGE
NUMBER OF DATA POINTS
GENERATED INTERNALLY
Structural Regression Models
- time series comparisons
of accounts and internal
operating statistics
- cross-sectional comparisons
of units of operation
Judgmental Comparisons

USE OF A LARGE
NUMBER OF DATA POINTS
GENERATED INTERNALLY AND EXTERNALLY
Structural Regression Models
- time series comparisons
of accounts, internal
operating statistics,
industry statistics,
environmental attributes,
and economic barometers
Judgmental Comparisons

ATTRIBUTES THAT DIFFER ACROSS AVAILABLE PROCEDURES
- EASE OF USE
- NUMBER OF DATA POINTS UTILIZED
- SOURCE OF DATA INTEGRATED
- BUSINESS APPROACH FACILITATED
- HISTORICAL PERSPECTIVE PROVIDED
- OBJECTIVITY OF INHERENT RISKS
- RELIABILITY OF PROJECTIONS FORECASTED

SOURCES OF DATA FOR USE IN ANALYTICAL REVIEW PROCEDURES
- ACCOUNTING DEPARTMENT
- CLERK'S LONG-RANGE FORECASTING DEPARTMENT
- MARKETING, PRODUCTION, AND OTHER OPERATING DEPARTMENTS
- GOVERNMENT
- TRADE JOURNALS, PRIDY'S, STANDARD & POOR'S,
VALUE LINE AND SIMILAR SERVICES
- ON-LINE DATA BASES, INCLUDING
- MAERS
- DISCL
- NETIS
- DIALOG & ORBIT
- THE NEW YORK TIMES INFORMATION BANK
- THE DOG JONES NEWS/RETRIEVAL SYSTEM
- CITIBANK
extends from the left end, representing fairly simple, "soft evidence" approaches, to the far right, representing more sophisticated, "hard evidence" approaches. As practice develops toward the right end of the continuum, the intent of SAS no. 23 will begin to be fulfilled. Current practice has emphasized the first two points along the continuum with only occasional attention to the remaining available procedures. Yet, despite the use of only a small subset of available analytical review procedures, the potential applications of analytical review techniques are an integral part of auditing standards and are suggested throughout the literature, as useful approaches in auditing clients' judgments, revenue recognition practices, and audit risk exposure (for example, see Kida, 1980). Mathematical models to predict client failure (see Altman and McGough, 1974) are being used by Touche Ross (1975) and Arthur Andersen & Co. Figure 4 provides excerpts from the literature, references to auditing standards that suggest the application of analytical review procedures, and examples of specific issues which could be addressed with analytical review techniques to provide more reliable evidential matter than would be provided from testing only internally generated data.

The Relative Effectiveness of Analytical Review Procedures

An important obstacle to effectively addressing the issues that are summarized in Figure 4 with "strong evidence" analytical review approaches is the bias that exists in the field to do what was done last year and not to place one's self in the position of justifying why a past audit procedure was no longer necessary. The latter position assumes risk; what if that omitted procedure would have uncovered a defalcation which subsequently comes to light? The CPA is typically not concerned that liability responsibility will arise from not using a more effective and efficient approach, as long as that approach has never been used in prior years' audits. Yet, history has suggested
The auditor often is aware of account balances and transactions that may be more likely to contain errors. He considers this knowledge in planning his procedures, including audit sampling. (AICPA, 1981, p.1)

Audit risk tends to increase as the issue involved is:
- Nonroutine,
- Subjective,
- Uncontrollable, and
- Subject to manipulation

Past cases involving such issues include:

**CASE** | **ISSUE**
--- | ---
Mill Factors | Collectibility of Receivables
Talley Industries, Inc. | Estimates of future contracts to be awarded and future cost reductions
National Telephone, Inc. | Estimate of provisions for future maintenance costs
Fisco, Inc. | Estimates of insurance loss reserves

*Source: "Auditing the Client's Judgments" by Cohen and Pearson, Journal of Accountancy (May 1981)*

**AUDIT SAMPLES**

**AUDITING CLIENTS' JUDGMENT PROCESS**

**COMPLYING WITH STATEMENTS ON AUDITING STANDARDS**

**ANALYTICAL REVIEW** can be a useful directing technique, or presampling methodology; more mileage is obtainable from sampling "unreasonable" accounts.

**JUDGMENTS CANNOT EASILY BE SUBJECT TO DETAILED TESTING:** REDUNDANT ANALYTICAL REVIEW TECHNIQUES ARE PARTICULARLY APPROPRIATE. STRUCTURAL MODELS CAN BE USED TO TEST THE REASONABLENESS OF ASSUMPTIONS, AND SENSITIVITY ANALYSIS CAN BE PERFORMED TO INVESTIGATE THE EFFECT OF ASSUMPTIONS. IN ADDITION, WHENEVER CLIENTS PROVIDE EXPLANATIONS OF UNUSUAL ACCOUNT BALANCES, SUCH EXPLANATIONS OFTEN CAN BE TESTED THROUGH INCLUSION OF ANOTHER EXPLANATORY VARIABLE IN THE MODEL BEING APPLIED.

**ANALYTICAL REVIEW PROCEDURES ARE DISCUSSED THROUGHOUT THE AUDITING AND REVIEW LITERATURE, OFTEN WITH REFERENCES TO PARTICULAR RATIOS OR RELATIONSHIPS TO BE EVALUATED. IF "SOFTER, MORE FUTURE-ORIENTED DISCLOSURES" CONTINUE TO GROW IN NUMBER, ANALYTICAL REVIEW PROCEDURES MAY VERY WELL BE THE ONLY AVAILABLE AUDIT PROCEDURE TO EFFICIENTLY ASSESS THE REASONABLENESS OF SUCH INFORMATION**

**GOING CONCERNS**

SAS No. 34 "The Auditor's Considerations When a Question Arises About an Entity's Continual Existence"

**SUPPLEMENTARY DISCLOSURES**

SAS No. 33 and 40 "Supplementary Oil and Gas Reserve Information"; "Supplementary Mineral Reserve Information"

**INTERIM REVIEWS**

SAS No. 36 "Review of Interim Financial Information"

*[see also, Statement on Standards for Accounting and Review Services No. 1 (December, 1978) and the AICPA Guide for a Review of a Financial Forecast (1980) for the techniques used in providing review services and in reviewing forecasts.]*
Bill and Hold Sales
Layaway Sales
Sales/repurchase agreements
Publication and record subscriptions
Servicing fees included in the price of the product
Admission fees relating to the subscription to a number of special events like artistic performances

"When evidential matter can be obtained from independent sources outside an entity, it provides greater assurance of reliability for the purposes of an independent audit than that secured solely within the entity."
(SAS No. 31, pp 5 and 6)

- Bankruptcy Models, if the Type I error rate could be reduced.
- Market reaction tests of news announcements, particularly to support rate case requests.
- Perusal of media stories on prospective clients to evaluate their image, business associates, performance, and liabilities from existing claims and litigation, as well as to formulate expectations as to recorded financial figures and predictable patterns.

**Figure 4 (Cont'd)**

**Revenues Recognition Practices**

**Analytical Review** Facilitates the Use of a Broader Scope of Data in Ratio Analysis, the Review of Industry Level Trends, and the Formulation of Structural Models, Thereby Yielding More Assurance Than Provided from Testing Only Internal Data.

**Audit Risk Detection**

otherwise. In the "Salad Oil King" discovery, an important question arose of why wasn't the client's inventory compared with the reported world's supply of salad oil? Similarly, in Equity Funding, the public questioned why someone did not notice that the implied growth rate in reinsurance would have shortly led to 100% of the market being controlled by a single company? Surely such techniques would have been preferable to many of the detailed tests which were performed on bogus documentation to evaluate the fairness of financial statements. The CPA must evaluate the quality of evidence currently being collected and the effectiveness of alternative procedures, particularly analytical review procedures, in providing assurance as to the reasonableness of account balances.

The Equity Funding type of case is an obvious example of where mere reasonableness tests using external data would have presumably signalled the irregularity. However, let's consider a less obvious case, that of Heinz; refer to Exhibit 1. This case involved misstatements that were immaterial on an annual basis and "just material" on a quarterly basis. Many would immediately acknowledge the low probability that exists of any CPA identifying the irregularity. However, the purpose of Exhibit 1 is to suggest the obvious limitations of commonly applied substantive testing techniques in uncovering this type of irregularity, in which collusion with third parties provided detailed documentation of transactions which appeared, on face value, to be totally legitimate. The presumed "hard evidence" techniques like confirmation procedures and the sampling and inspection of detailed documentation are entirely ineffective in providing any clue of an audit problem. In contrast, various analytical review procedures do have the capability of providing signals of a problem.
THE H.J. HEINZ CASE ... WITH THE ADVANTAGE OF HINDSIGHT ...

SYNOPSIS

By colluding with at least 6 suppliers, legal fees, advertising, and market research expenses were manipulated from 1971 to 1979. Bogus invoices were prepared upon request. If services were not subsequently rendered, prior cash payments were returned to Heinz. Sales cutoff was also manipulated by adjusting internal documentation. Over 325 employees were aware of the impropriety, perpetrated in large part for the purpose of maximizing managers' bonus-incentive awards.

THE DILEMMA

The Wall Street Journal reported
"... it is unclear how the improper accounting practices escaped the notice of Peat Marwick, Heinz's auditors for the entire period of the improprieties"
(November 23, 1979)

WHICH SUBSTANTIVE TESTS COULD NOT DISCOVER THESE IMPROPRIETIES?

- Confirmations to vendors
- Normal cutoff tests
- Tests directed at overstatement of revenues and income and understatement of expenses
- Inquiry and observation procedures
- Those tests emphasizing large account balances, such as inventory
- Year to year comparisons from 1972 through 1979

WHAT ANALYTICAL REVIEW PROCEDURES, OUTLINED IN SAS#23, MIGHT HAVE DETECTED THE IMPROPRIETIES?

- Ratio analysis, comparing the percentage relationship of marketing, advertising, and legal expenses to sales across divisions, as well as comparing such divisional ratios to industry statistics
- In 1971 and possibly 1972, a comparison of multi-year historical patterns, pre-1971
- In the course of formulating structural models, the five-year business plans may have been reviewed by the CPA, offering the chance of detecting one strong clue of the problem: the account "Pre-billed Advertising Invoice" for services it paid for but did not receive, on Ore-Ida's 1974, 1975, and 1976 reports
- Comparison to budget at the end of the first two months of each quarter could indicate much more variance on a monthly basis than a quarterly basis
- A comparison of the division's pattern of payment practices across vendors
- The business background required for analytical review procedures would increase the CPA's awareness of the smoothing incentives and division's autonomy in reporting, thereby encouraging two-sided check of balances in miscellaneous accounts which have a weaker audit trail, i.e. purchases of services, which typically lack shipping and receiving documentation, and the use of data external to a single division when performing analytical review
Consider other recent litigation, involving issues which may have been uncovered had an analytical review approach to the audit been emphasized. Geon Industries involved an overstatement of earnings from 5% to 24% from 1971 to 1974, created through the failure to eliminate some intracompany profits from financial statements ("Arthur Andersen," 1981). Had the expected mix of intercompany and external sales been checked, based on long-term historical patterns, and had the reasonableness of total sales been assessed relative to market data, the inadequate elimination entries might have been detected. American Reserve Unit concealed its insolvency by understating its reserves for claims and claim administration expenses and by delaying its payments of claims and administrative expenses ("American Reserve," 1981). Reserves are a particularly difficult account area to audit because they tend to reflect management judgments. However, if the CPA understands the basis for such estimates and accepts the basis as reasonable, then a structural model can be formulated that measures the criteria for the estimation process and forms an objective estimate to which management's judgment can be compared. Additionally, historical trends reflecting the relationship of reserves to various aspects of operations may have proven helpful in evaluating the balance in reserves. Similarly, the erroneous amounts and manipulated payment patterns for claims and administrative expenses might well have been signalled by examining historical structural models and their implications. Mercantile Bank & Trust involved the creation of shell companies to "buy" bad loans (Drinkhall, 1981). The question arises as to how Mercantile Bank & Trust compared in its "bad loan" performance to similar operations; if the company were performing exceptionally well in that regard, apparently due to the selling of loans, further work on the buyer of these would have been recommended in an analytical review testing approach. In Data Access Systems, Inc., collateralized borrowings
(lease financings) were recorded as sales, and "certain irregular transactions and payments" involving related parties were incorrectly classified as cost of sales, assets or charges to paid-in capital ("Data Access," 1982, p. 14). Again, an historical trend analysis of each of the misstated accounts, as well as a comparison to market data, may have identified the unusual charges and classifications. Even Fund of Funds Ltd., although the critical issue is confidentiality, concerns an area of dispute that could effectively utilize analytical review. The gross overvaluation of natural resource assets purchased (Gigot, 1982) might have been detected through market comparisons, including comparisons to industry competitors.

Analytical review procedures provide a new perspective to the auditor not effectively captured by other auditing techniques; this relative advantage of analytical review procedures should be explicitly considered in judging how to allocate audit time. Should the overall reasonableness of reported numbers be established, particularly through the use of "hard" analytical review techniques that integrate externally-generated data, a basis exists for decreasing other substantive tests and for having greater assurance that the accounting numbers produced internally are not bogus numbers.

The Precision of Evidence Provided: Field Experience

When the phrase is used, "should the overall reasonableness of reported numbers be established," the common question raised is whether analytical review procedures can possibly "establish" anything worthy of reliance, i.e., isn't within 25% about as well as such techniques can perform? Exhibit 2 reports on some field experience with regression analysis. The standard error ranges from 2% to 7% of the balance being predicted, which, at a 95% confidence level, provides a precision measure ranging from 4% to 14%. The models reported are parsimonious models, frequently integrating nonaccounting data,
### Field Experience with Regression Analysis

<table>
<thead>
<tr>
<th>Type of Client</th>
<th>Nature of Explanatory Variables</th>
<th>Audit Objective</th>
<th>Average Value of Variable Being Explained (Number of Observations in Model)</th>
<th>Model Precision @ 95% Confidence [Standard Error x 1.96]</th>
<th>( R^2 )</th>
<th>Average Size of Residual (Absolute Value)</th>
<th>Point Estimates’ Achieved Precision @ 95% Confidence (Simultaneous)</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retailer</td>
<td>6 Accounting</td>
<td>To select stores to visit during an audit</td>
<td>9,960 (40 stores)</td>
<td>1,051</td>
<td>.996</td>
<td>401</td>
<td>(407)</td>
<td>(1803)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 Verifiable Physical Characteristic of stores</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Credit Union</td>
<td>1 Accounting</td>
<td>Substantive test of reported share balances</td>
<td>12,409 (72 months)</td>
<td>531</td>
<td>.439</td>
<td>334</td>
<td>(808)</td>
<td>(881)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Detailed testing of explanatory variable was performed)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>1 Forecast</td>
<td>[Note: No control over price fluctuations was in the model]</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>2 Economic Indicators</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ski Lodge</td>
<td>2 Operating Statistics</td>
<td>Substantive test of revenue</td>
<td>198,955 (80 weeks)</td>
<td>28,103</td>
<td>.986</td>
<td>31,540</td>
<td>(1,420)</td>
<td>(60,679)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 Marketing Statistical</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Utility</td>
<td>2 Accounting</td>
<td>Substantive test of revenue</td>
<td>22,317 (36 months)</td>
<td>1,002</td>
<td>.998</td>
<td>1,078</td>
<td>(2,477)</td>
<td>(3,280)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 Production Statistical</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>1 Environmental statistical</td>
<td></td>
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<tr>
<td></td>
<td>2 Economic Indicators</td>
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</tbody>
</table>

* I wish to thank Price Waterhouse & Co. for permitting me to report on some of the firm's field experience with the regression tool.
and using from 36 to 80 observations in the estimation process. Such experience supports the ability of analytical review procedures that utilize a structural model approach — often with only a small number of variables — to provide reasonably tight precision and, most assuredly, to thereby provide a basis for decreasing the extent of other substantive test procedures. The ability of the audit teams at Price Waterhouse & Co. to specify relationships with high explanatory power — note the adjusted $R^2$ values — and tight precision suggests that the structural modeling approach is workable in the field and presents few problems in implementation. Modeling tends to formalize a thought process that is already familiar to auditors. Of relevance is that the models reported in Exhibit 2 were verified as complying with all the underlying statistical assumptions of the least-squares estimation process and that some outliers which were identified led to material adjustments which had not been located by detailed testing procedures.

**Integrating Evidence Gathered Through Structural Modeling Approaches**

As was suggested earlier in this discussion, the analytical review procedure is one aspect of the audit process, the reliance on which will depend upon its precision. However, the absence of full reliance on a single procedure in no way negates the contribution of that procedure. Figure 5 provides a general description of the decision process by which analytical review evidence, obtained by applying regression analysis as an audit tool, is integrated with other sources of evidence.

**Advantages to Further Developments in Practice**

As more sophisticated “hard-evidence” analytical review techniques are applied in practice, a more objective means of forming expectations concerning a client's audited values will become prevalent. The reported problems that
Illustration: Integrating Regression Analysis With Other Sources of Evidence

If no complications exist for the constructed model (e.g., uncontrolled internal data) no further audit work may be required and full reliance may be possible.

Is achieved precision equal to or better than desired precision?

Can achieved precision be sufficiently improved by specifying model?

Investigate significant outliers.

Reduce work or perform test as directed by regression and error analysis.

Can explanations justify reduced audit work elsewhere or can outliers be used to direct timing and location of other audit tests?

Compare desired precision to achieved precision.

Reduce work as warranted.

Can this ceiling (at a 95% level) be used to preclude the probability of errors which would otherwise be tested?

Determine complementary audit procedures—compliance and/or substantive test procedures—which can (or have) cost-effectively narrowed the gap of desired and achieved precision to zero.

The complementary procedure may be an extension of the regression models to test the results of audit inquiry procedures.

Be certain to acknowledge the reduction in overall audit risk which results from overlapping audit procedures.
can arise in more judgmental approaches, such as the effects of auditors anchoring their analytical review judgments on the current period's unaudited values (see Kinney and Uecker, 1982), will be avoided, thereby increasing the overall effectiveness of the audit process. In addition, the potential of the regression tool (as recently discussed by Barnes, 1981; Graham, 1981; Leininger and Conley, 1980; and Akresh and Wallace, 1980), as well as possible extensions of that tool (see, for example, Clark, 1981 and Albrecht and McKeown, 1977), can begin to be realized. It should be recognized that the potential is available to both external and internal auditors (Albrecht, 1980). Of course, the increased use of structural models by external and internal auditors is expected to coincide with the more effective use of alternative limited information (see Kinney, 1979; Lev, 1979; and Stringer, 1979) and ratio approaches (see Casey, 1980; Chen and Shimerda, 1981; and Kinney, 1981) to analytical review. No one analytical review procedure will be optimal in all circumstances (see Hillison, 1981 for related research); however, a more structured approach to the analytical review process will make it easier for the CPA to use objective measures when possible, isolating those areas where a judgmental approach is required, so that the CPA can devote increased attention to such areas. For example, the "client-responsive" audit, recently described by McAllister and Dirsmith (1982), requires increased attention to the effects of a client's business environment on an audit; some of these effects can be formally modelled, and others can be judgmentally analyzed in a more effective manner when the decision aid of a structured model that incorporates other known business aspects is made available to the CPA.

A recent study by Hylas and Ashton (1980) which reported that 20% of material audit adjustments booked for 152 clients of Peat, Marwick, Mitchell & Co. were found by comparisons to expectations from prior years and related
inquiry procedures and 27% were found by other analytical review techniques, supports the effective audit role assumed by the relatively "weak evidence" analytical review procedures that dominate practice today. Imagine the potential effectiveness of the "hard evidence" analytical review approaches, relatively untapped audit tools that are currently available to practitioners.

A final advantage to developing CPAs' understanding of sophisticated analytical review techniques is that such procedures can be useful in providing management advisory services, as well as review services to clients. For example, regression analysis has been applied in rate cases, particularly in the form of reliance on the capital asset pricing model (see Brigham and Crum, 1978), and the review of clients' forecasts will require the CPA's understanding of the regression technique or similar forecasting procedure, as applied by clients in generating their predictions (AICPA, 1980). The regression tool and similar modeling techniques may also assist CPAs in operating their own firms more efficiently. For example, performance evaluation of offices and partners and the assignment of professional staff members to particular engagements, as well as the selection of client portfolios, are potential modeling applications by CPA firms.
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