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Auditing practice, research, and education : a productive collaboration

Timothy B. Bell

Arnold M. Bell

American Institute of Certified Public Accountants (AICPA)

American Accounting Association. Auditing Section

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Auditing Practice, Research, and Education

A PRODUCTIVE COLLABORATION

Edited by

Timothy B. Bell & Arnold M. Wright

AICPA

American
Institute of
Certified
Public
Accountants

*Published by
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KPMG Peat Marwick LLP

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Boston College

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CIP

Dedicated to John J. Willingham

During his distinguished career as an auditing researcher, educator, and practitioner, John J. Willingham has made major contributions to the discipline of auditing through his efforts to foster research collaboration between the academic and practicing communities. In recognition of the significant impact these efforts have made on the advancement of auditing knowledge, the members of the American Accounting Association Auditing Section Research Monograph Subcommittee dedicate this monograph to John J. Willingham.

Preface

Several circumstances led the Executive Committee of the Auditing Section of the American Accounting Association (AAA) to commission this monograph. Calls had been made with increasing frequency for the academic accounting community to set forth more clearly the value and role of research. By the early 1990s two very active decades of auditing research had come to a close. During this period, auditing researchers relied heavily on the participation and support of those in public practice. Many persons, however, felt that there was insufficient communication to those in practice of the contributions of this research. In addition, the emerging economic climate fostered a general recognition of the need to better account for the practice resources that were being consumed by the academic community at rapidly increasing rates.

The 1991-92 Auditing Section Executive Committee (ASEC), under chair Ted Mock, approved the monograph project. Successor ASECs, under chairs Bill Messier and Robert Knechel, supported the monograph project as an important way to document the value of a rich heritage of research collaboration between members of the auditing practice and academic communities.

Several audiences are envisioned for the monograph. We believe that if practicing auditors read it, they will obtain a better understanding of the role of research in helping to shape contemporary auditing practice and education. Further, the work contains a rich anthology of significant developments, providing a sense of whence we have come and where we are likely to be heading as a profession. We also believe that auditing educators and scholars will find the monograph informative and worthwhile, since it documents the auditing research that emerged early in the 1900s and has flourished over the past twenty years. In addition, the monograph highlights the value of joint academic-practitioner pursuit of solutions to challenging auditing problems. Finally, we believe that the monograph will provide both undergraduate and graduate auditing students with a more complete understanding of the genesis of current auditing practices and an enhanced appreciation of the vital role that research played in their development.

As chair and chair-elect of the Auditing Section, we would like to acknowledge the many individuals who contributed to this monograph. First, the authors of each of the chapters freely gave of their time, experiences, and insights and, in so doing, have provided an invaluable contribution to auditing knowledge. Second, as AAA Auditing Section research director, Tim Bell has been a champion of this monograph before many audiences. He has devoted countless hours toward its inception, production, and dissemination, and publication is largely due to his efforts. Third, the consulting editors, Robert H. Ashton and Robert K. Elliott, made invaluable enhancements to the monograph. John Baldwin's editorial assistance also should be recognized. Fourth, the partners of KPMG Peat Marwick LLP and the trustees of the KPMG Peat Marwick Foundation have been among the most generous collaborators with members of the academic community on important auditing issues. The firm's financial support made this monograph possible. Finally, we express our gratitude to Dan M. Guy and the American Institute of Certified Public Accountants, which, in the collaborative spirit of this work, joined members and supporters of the Auditing Section to produce the monograph.

IRA SOLOMON

Chair, Auditing Section

American Accounting Association

ARNOLD M. WRIGHT

Chair-elect, Auditing Section

American Accounting Association

June 1995

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Introduction

OVERVIEW

One does not discover new lands without consenting to lose sight of the shore for a very long time.—Andre Gide (1869–1951), French novelist.

As other fields, auditing must be responsive to demands and changes in the environment in which it exists. Further, standard setters, academics, and practitioners must look to the future in considering the expectations and needs of those relying on the public accounting profession. As will be described, research conducted by those in practice and academe, and by practitioner and academic collaborators, plays a vital function in efforts to meet the challenges faced by the auditing profession.

The primary objective of this monograph is to examine the role and influence auditing research has had on practice and education.¹ A secondary objective is to identify obstacles that constrain the research production process and to suggest measures to enhance that process in ways that will benefit all public accounting profession stakeholders.

CHALLENGES TO THE PROFESSION MOTIVATING AUDITING RESEARCH

The concurrent rise of interest in auditing research and the turbulence faced by the public accountancy profession in the late 1960s and 1970s are intertwined. Litigation coming out of such now infamous cases as

¹ Auditing research has also provided significant contributions to the development of *theory* in both auditing and other disciplines. For instance, Mautz and Sharaf (1961) provide a theoretical framework for the audit process. Scott (1973) and Felix (1980) formulate a decision theory structure. Auditing researchers also have made important contributions to several other fields such as psychology (e.g., findings indicating that auditors, as trained professionals, are subject to less pronounced biases and heuristics, greater consistency, and better self-insight than average individuals), statistics (e.g., the development and refinement of several sampling methods such as monetary unit sampling), and cognitive science (e.g., work on expert systems and cognitive modeling). These contributions to theory are outside the focus of this monograph and are summarized in other works (e.g., Abdel-khalik and Solomon, 1988).

Continental Vending and *National Student Marketing* shocked the public as well as members of the profession itself and started an erosion of public confidence. “Where are the auditors?” was the outcry that rallied both the U.S. Senate and House of Representatives (Metcalf and Moss) to conduct investigations of the profession.

The Watergate hearings of the mid-1970s disclosed illegal corporate campaign contributions, which, even though the amounts were immaterial to the corporate financial position, again produced an outcry from a sensitive public. The discovery of corporate “kickbacks” to foreign government officials and agents caused renewed concern. These concerns led to the Foreign Corrupt Practices Act, which focused auditors’ attention not only on the illegal corporate payments but also on internal control.

The profession had been increasing its focus on internal control since the late 1960s because of new concerns about the massive computerization of industry. The passage of the Foreign Corrupt Practices Act reinforced the need to place greater attention on internal control in the audit methods employed within the profession.

The genesis of public concern about restrictive trade practices in the public accounting profession can be traced to the consumerism movement championed by persons such as Ralph Nader. In 1966, the Department of Justice began challenging the perceived restrictive competitive practices of CPA firms and the profession’s code of ethics; by 1972, the Justice Department had threatened litigation to directly challenge the profession’s competitive bidding prohibition. The American Institute of CPAs’ agreement to remove the restrictions averted litigation. The year 1977 witnessed the U.S. Supreme Court upholding the rights of two Arizona lawyers to advertise, despite their violating a professional rule against it: an ominous warning to CPAs.² Likewise, in 1977, the Justice Department focused on advertising, solicitation, and employment restrictions in the AICPA code of ethics, and, in 1979, the AICPA repealed these rules. The 1,760-page report of Senator Metcalf’s subcommittee, *The Accounting Establishment*, recommended more competition as a remedy to the profession’s perceived ills, thus creating continuing pressure on CPA firms.

In the same time frame, the profession witnessed the replacement of its accounting standard-setting body, the emergence of several international standard-setting bodies, and challenges to its performance of management advisory services (MAS) and Securities and Exchange

² *John R. Bates and Van O’Steen v. State Bar of Arizona*, 433 U.S. 350, 87 S. Ct 2691, 1977.

Commission (SEC) mandated reviews of targeted firms' practices (Accounting Series Releases [ASRs] No. 153: Securities and Exchange Commission 1974, "Reliance Upon Management's Opinions: Findings, Opinion and Order Accepting Waiver and Consent and Imposing Remedial Sanctions in the Matter of Touche Ross & Co." ASR 153, and No. 173: Securities and Exchange Commission 1975, "Professional Conduct: Opinion and Order in a Proceeding Pursuant to Rule 2(e) of the Commission's Rule of Practice in the Matter of Peat, Marwick, Mitchell & Co." ASR 173.) in response to alleged audit failures. Also, it became abundantly clear from the *Continental Vending* case of the early 1970s that adherence to existing professional standards was not a sufficient defense in litigation. This issue alone raised significant concerns within the ranks of the profession.

On the other hand, business entities started acquiring other entities in great numbers in the 1960s—the age of the conglomerate. Some of these same entities started massive international expansion. Accounting problems (e.g., purchase versus poolings), issues, and new principles were the order of the day. Consistently, most of the research being performed within the profession through the late 1960s and the early 1970s was accounting-related.

Thus, the auditing profession faced several significant challenges:

- Litigation
- Threats to public confidence
- Congressional hearings
- Changes in competitive bidding practices
- Changes in advertising, solicitation, and employment restrictions
- Computerization of industry and new concerns about internal control
- Illegal corporate campaign contributions
- Corporate payments to foreign officials and agents
- Increased emphasis on internal controls from the Foreign Corrupt Practices Act
- Changes in standard-setting bodies, with increased focus on internationalization of the profession
- Challenges to performance of MAS by CPAs
- SEC-mandated reviews of certain CPA firms

With all of these challenges, it is easy to see why auditing firms had to change. Under the new rules, every day was "open season" on competitors, and competitive bidding kept fees in the range of the low-cost producer or the low bidder. The audit, in some people's

opinion, had become a commodity. The motivation clearly was to produce the lowest-cost, effective audit.

One of the changes was adoption of new audit approaches and methods. Until the late 1960s and early 1970s, the “balance sheet audit” had been the basic audit approach. In a sense, the reexamination of basic audit approaches started the recent explosion of audit research. Entire approaches became “risk-based.” The profession adopted new concepts relating to internal control and started using computer audit techniques. Sampling concepts were revisited, and a new method of using statistical sampling specifically for accounting populations—dollar-unit sampling—was developed.

The development of new sampling techniques, risk-based audit approaches, and computer-assisted audit techniques clearly showed that the profession had started to focus on auditing. Each of the large public accounting firms began performing research internally and with academic researchers.

The other major impetus to academic research was the establishment of the Research Opportunities in Auditing program by Peat, Marwick, Mitchell & Co. in the early 1970s. This program provided academic researchers with funds, data, and support to investigate issues that were particularly important to the profession.

THE COLLABORATIVE PROCESS OF RESEARCH, PRACTICE, AND EDUCATION

Figure 1 depicts collaborative efforts among auditing research, practice, and education. As portrayed in the figure, this interaction is complex and dynamic, as will be illustrated throughout the monograph. Auditing practice encompasses auditing standards as well as the approaches and techniques used by individual public accounting firms. The collaborative process refers to the joint and interdependent efforts of those in practice, standard setting, and academe to address the challenges and needs of the public accounting profession. According to *Webster's Third New International Dictionary*, 1986. Merriam-Webster, Inc., Springfield, MA, p. 1930, research is defined as:

- A systematic investigation aimed at the discovery of new knowledge.
- The revision of accepted conclusions or theories in light of new facts.
- The practical applications of such new or revised conclusions.

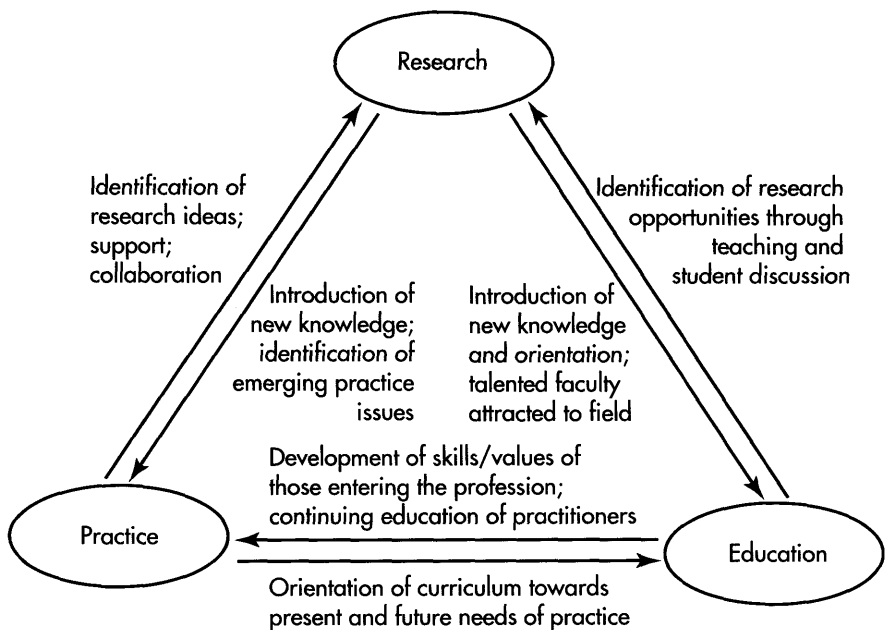


Figure 1 Auditing Research, Practice, and Education Collaboration

The first two functions are often termed “pure” or “basic” research, while the third is referred to as “applied” research. As noted, auditing research is conducted by practitioners and academics, both separately and in collaboration.

Figure 1 indicates that auditing research has influenced and has been influenced by practice. Practitioners identify research ideas and issues in need of investigation. As will be discussed in subsequent chapters, this research has in turn played an instrumental role in moving the audit approach from a procedural orientation to a risk-based approach and has promoted the development of decision tools, innovative sampling, and other quantitative techniques. Research has also influenced auditing standards in a number of areas. Again, it is important to emphasize the collaborative effort that has occurred between academic researchers and practitioners. This collaboration has had an interactive effect on both practice and research. For example, a number of research conferences have been supported by auditing firms and attended by both academics and practitioners, such as the University of Kansas Auditing Symposium, the University of Illinois Symposium on Auditing Research, and the University of Southern California Audit Judgment Symposium. The free exchange of ideas at these conferences has spurred

research on important, timely issues while also providing findings and insights that have influenced practice. Additionally, the involvement of practitioners in sponsored and joint research projects has enhanced the relevance and quality of the end product.

Auditing research also has significantly influenced—and been influenced by—education. Auditing research has had a profound effect on education in terms of faculty and pedagogy. It has attracted the interest of a great number of talented scholars to the area, many of whom now teach auditing. Involvement in research enhances faculty awareness and knowledge of significant issues and developments in the field. The enhanced awareness and knowledge improve the nature and quality of auditing courses by providing pedagogical tools that result from research (e.g., cases, computer simulation exercises) and by their impact on the orientation of courses (e.g., topics examined, nature of coverage). Changes in auditing education ultimately affect the analytical and conceptual skills of students entering the profession, with direct and long-term effects on practice.

A rich interaction is evident when one considers the associations among auditing standards, research, and education. As noted, research has influenced and been influenced by auditing standards. Changes in auditing standards in turn affect auditing education, since instruction and course orientation reflect current practice as represented by standards. Finally, in teaching concepts and issues, areas for further research are identified by unanswered practice problems and inconsistencies.

In considering the collaborative process, it is important to recognize two inherent features of research, especially basic research: its intermediate/long-run focus and the process of trial and error. Research entails a systematic investigation requiring careful planning, data accumulation, and analysis. Thus, research cannot be expected, except on occasion, to address particular, on-the-job practice problems that require immediate resolution. Rather, research is particularly valuable in considering broad issues. Additionally, research is often a learning process with its own successes and failures.

If you take away trial, you get rid of failure, but of success too.—Pindar (518 BC–438 BC), Greek lyric poet.

Research is characterized by trial and error; it produces findings that at times may not be of immediate discernible practical value. An example outside of the auditing field that illustrates this view is the development of superconductivity. Superconductivity, the property of metals and other substances to lose all electrical resistance at very low temperatures, was first discovered accidentally by Heike Kamerlingh-

Onnes of the University of Leiden in 1907, using liquefied helium at 1 degree Kelvin (about -458 degrees Fahrenheit). This discovery had little apparent significance and value until about 1986, when physicists J. George Bednorz and K. Alex Muller of IBM's Zurich Research Laboratories discovered a "high-temperature" superconductor, a mixture of lanthanum-barium copper oxides that became superconductive at 35 degrees Kelvin. For this discovery, Bednorz and Muller received the Nobel Prize. Current advances through continued experimentation have led to substances that become superconductive at over 130 degrees Kelvin, which, in turn, have led to applications such as powerful magnets used in particle accelerators and in fusion reactor experiments. Further research is expected to lead to room-temperature superconductors, which would make practical magnetically levitated trains and large-scale power storage.

THE MONOGRAPH

Objectives

As noted, the primary objective of this monograph is to examine the role and influence of research on practice and education. Research has taken place in the profession for the past fifty years. However, the rate of growth in the level of research has dramatically accelerated over the past two decades, especially in academia. At the beginning of this period only a handful of scholars were engaged in auditing research, while today auditing is clearly one of the primary fields of study in accounting, as evidenced by the dramatically increased number of published articles, working papers, and ongoing projects.

Auditing research has benefited greatly from a symbiotic relationship between academics and practitioners. Much of this research has been directed towards important issues of concern to the profession. In turn, auditing researchers have relied heavily on the support of those in practice for identification of pressing issues (e.g., at symposia), participation of personnel, access to data, and funding. The interaction with practicing auditors often ensures that the research addresses important issues and reflects significant factors bearing on the topics examined. Finally, both members of the academic and practitioner communities have mutually benefited from joint research efforts.

Given the significant resources devoted to auditing research, it is important to consider the following question: What has been the "value added"—the contributions—from auditing research? These contribu-

tions are not just theoretical advances as evidenced by publications in academic journals; they also involve the influence of research on practice (e.g., decision tools) and in the classroom (e.g., cases for analysis and discussion). Therefore, this monograph will take a broad perspective in considering the contributions of auditing research to practice and education.

A second objective of the monograph is to identify obstacles that impair the effectiveness or efficiency of research efforts and to suggest future directions to reduce them, thereby improving the research process. Because research is costly, it is vital that research efforts be conducted efficiently and result in findings applicable to important issues.

Approach and Organization

We adopt a historical perspective, commencing with the early 1900s and focus on selected audit topics in which research has played a significant role in influencing practice and education. This approach focuses attention on important developments, or milestones, in research, practice, or education. It offers several advantages:

1. The influence of auditing research and the collaborative process are illustrated in concrete terms. Attempting to develop an exhaustive list of contributions would have been a daunting task that could not have been completed on a timely basis. Further, since the focus here is to examine the relationship among research, practice, and education, a historical perspective serves to highlight the nature of this interaction. For instance, the significant role of encouragement and funding support from practice for research is examined (e.g., the *Research Opportunities in Auditing* program at KPMG Peat Marwick).
2. Our approach provides documentation of historical developments over a very dynamic period of time for the auditing profession. Such an account is not currently available and likely would be considerably less accurate if attempted at a later date. Participants of this era have drafted these recollections and perspectives as a means of sharing history. Such an overview is expected to be of value to practitioners and academics, present and future, as they consider where the profession has been and where it is going. In short, we can learn from history.
3. The historical perspective is expected to suggest measures and directions which might enhance the productivity of future research.

It is important to emphasize that the milestones identified may have had either short- or long-term influence or both. For instance, some research findings can be traced directly to a clear, near-term impact on practice, as on a particular auditing standard. On the other hand, other findings may have longer-term, continuing effects on education or practice that cannot be as readily documented or evaluated. Additionally, when we ask about the influence of research on practice or education, it is difficult to identify a direct causal relationship, i.e., *that* research study led to *this* specific change. This difficulty arises because it is often not easy to sort out how the problem was identified; what happened next; how the issue has been addressed; or the influence of various events on practice, the classroom, and regulation or institutional processes.

One reason that such identification is impractical is that the idea for research often is sparked by a practitioner citing a problem or by auditing standards, while a practice solution might be suggested by active discussion at a research conference or in an article that appears in a journal. Students' perplexed looks as educators try to teach nebulous aspects of the audit process also can lead to research studies which later may lead to improvements in practice or standards. The goals of this monograph are to illustrate the inroads made by collaboration, to share a historical perspective on how and why certain events occurred, and to encourage similar synergy in solving today's and tomorrow's challenges.

In Risk Orientation, the role of auditing research in the evolution of the audit approach from a procedural to a risk-driven orientation is examined. This chapter is followed by a consideration of the wealth of research on auditor decision-making and its influence on auditing practice, including the development of decision tools. Important historical developments in research and practice relating to sampling are discussed in Audit Sampling, while Analytical Procedures traces the expanding role of analytical procedures and the attendant influence of auditing research. Communications with Users focuses on collaborative efforts impacting the scope of CPA communications with users. The final chapter discusses obstacles that hinder effective research collaboration and identifies a number of promising directions for enhancing the research process.

Scope and Acknowledgments

The monograph is focused on the influence of research on financial-statement auditing. Specifically excluded are other types of attestation,

such as compliance and operational auditing. Despite the importance of research related to other types of attestations, this limitation in scope was necessary to make the project manageable. The historical developments, volume of research, and span of issues for the financial-statement audit alone are extremely large, although consideration of the role of research relating to other auditing areas is certainly of great importance.

The monograph, as already discussed, is not exhaustive in identifying all important historical milestones or research contributions. Expanding the scope by incorporating additional milestones would merely strengthen the inferences drawn in the monograph regarding “lessons learned” from the collaborative research process.

Finally, because of greater familiarity with these events by contributors, the historical overview relates to developments that occurred for the most part in the United States. However, references to developments outside of the United States are noted on occasion.

We wish to acknowledge the hard work of the chapter authors and consulting editors. This monograph was accomplished through the efforts of a panel of recognized and respected practitioners and scholars. Representation from practice and academe was sought to ensure a broad perspective regarding the role and influence of auditing research. Chapter authors were identified by the Research Committee of the Auditing Section of the American Accounting Association. Consulting editors oversaw completion of the monograph, and ensured its completeness and consistency. Thus, the monograph entailed a major effort requiring the expertise and valuable time of many talented individuals.

The monograph was commissioned by the Auditing Section of the American Accounting Association. Financial support for the monograph was provided by KPMG Peat Marwick, without which the project could not have been undertaken. We gratefully acknowledge this support.

We also gratefully acknowledge the valuable comments and suggestions from colleagues and practitioners on earlier versions of the monograph. This input was received from several individuals, as well as from participants at the University of Southern California Audit Judgment Symposium and the University of Illinois Symposium on Auditing Research. Their valuable insights had a major impact on the monograph.

Risk Orientation

Barry E. Cushing, *University of Utah (chapter lead author)*; **Lynford E. Graham, Jr.**, *Rutgers University*; **Zoe-Vonna Palmrose**, *University of Southern California*; **Robert S. Roussey**, *University of Southern California*; **Ira Solomon**, *University of Illinois*

OVERVIEW

The purposes of this chapter are to describe the transformation of auditing in the United States over the past century toward the currently prevailing risk-based approach,¹ and to identify and document both the indirect and direct impacts of auditing research on this transformation.

A risk-based approach to auditing is defined herein nominally as a *systematic* approach in which the nature, timing, and extent of testing are determined by assessing and evaluating the risk that financial-statement assertions are materially misstated. As treated herein, auditing research is a broad array of activities carried out by academic scholars, practitioners, or academic/practitioner teams to advance knowledge of theory, concepts, and practices germane to auditing.

We acknowledge and greatly appreciate the comments of Stephen Aldersley, Rodney J. Anderson, Robert Ashton, Andrew Bailey, Tim Bell, Ivan Bull, William Cooper, Robert K. Elliott, William L. Felix, Peter Gillett, Kathryn Kadous, Robert Mautz, William Messier, Frank Nekrasz, John Neter, Frederick L. Neumann, Jack C. Robertson, Howard Stettler, Ken Stringer, Art Wyatt, and Richard Ziegler on earlier drafts of this chapter.

¹ As such approaches have evolved, explicit recognition is generally given to the risk that the information system which produces assertions can increase or decrease the risk of material misstatement. More comprehensive risk-based approaches would involve expansion of risk assessment and evaluation practices to other aspects of audits or audit practice, including selection of new audit clients on the basis of various assessed risks (e.g., the prospective auditee's level of financial distress) and setting or adjusting audit fees on the basis of assessed risk.

Background We begin the chapter by providing two types of background information:

1. A brief review of the early development of auditing in the U.S.
2. A survey of key developments in auditing thought, as reflected in various published works.

This background will provide the foundation for our subsequent discussion of risk in auditing and the attendant risk orientation.

Two streams of research are seen as important contributors to the emergence and general acceptance of a risk orientation: (1) research on audit sampling and (2) behavioral research.² The latter research stream is most closely tied to concerns about nonsampling risk, while the former stream is most closely aligned with sampling risk. Selected studies from both of these literature streams and their implications for audit risk are discussed in subsequent sections of this chapter.

Early Auditing Research In this section, we focus on audit sampling research published between 1933 and 1969. We also discuss Mautz and Sharaf's (1961) auditing theory monograph.

Auditing Research in the 1970s In this section, we discuss studies reported during the 1970s, organized by research stream, behavioral and sampling.

Auditing Research in the 1980s and Beyond In this section, we focus on studies reported during the 1980s and beyond, with the organizing structure being key audit topics such as materiality and audit risk, management fraud, etc.

We present concluding remarks in the final section.

To repeat, our purpose throughout the chapter is to describe the contributions of illustrative research studies to audit thought and practice relating to a risk orientation. We shall emphasize forces which stimulated evolutionary change in both the character of audits in the U.S. and in the audit process. Selective testing will be seen to play a key role, resulting in an emphasis in both practice and research on sampling and, in particular, on statistical sampling. Then, an overriding analytical structure for the audit will be shown to emerge, with risk assessment and evaluation having defining roles. As the history draws to a close, the emphasis on statistical sampling in both research and practice dissipates, and audit and business risk assessment, evaluation, and control become the orientation of the auditor.

² In our view, auditing research both informs and is informed by audit practice and regulation of practice via standard setting.

BACKGROUND

In this section we first describe the development of auditing in the U.S., beginning with its early roots in the British auditing tradition. Emphasis is on the uniquely American forces around the turn of the century and the attendant institutions that set the stage for the appearance of concepts and issues such as selective examinations, the appropriate extent of testing, tailored audit procedures, internal control, both sampling and non-sampling risk, and the need for more consistency across engagements.

Second, we discuss aspects of auditing literature (i.e., selected books, authoritative pronouncements, and texts) that contributed to and were informed by these concepts and issues. Key themes include the importance of auditor judgment and decision making, the emergence of inherent and control risk assessments, and the development of pervasive analytical approaches to auditing. In our view, the activities, events, and literature discussed in this section led to the extremely productive period of audit research that began in the 1970s.

The Early Development of Auditing in America

According to Chatfield (1977), the first American audits were heavily influenced by the British tradition, in which audits were intended to verify the honesty of persons charged with fiscal responsibility. Stewardship examinations, mainly involving verification of book-keeping detail, were imported by British Chartered Accountants who visited the U.S. in the late nineteenth century to audit American properties of their British clients. American auditors soon found, however, that British-statute stewardship examinations did not fit the U.S. context.

In the early twentieth century, American bankers began to ask commercial loan applicants to submit signed balance sheets. Further, signed balance sheets were more favorably received when they were accompanied by an auditor's certification. Before long, these balance-sheet audits became a major part of the work of American auditors. Balance-sheet audits incorporated the concept of selective examination, under which not all transactions were examined; and certain accounts, especially current assets and liabilities, were given greater scrutiny.

In his classic auditing book, for example, Montgomery (1912, p. 82) observed the following:

Where there is a satisfactory system of internal check, the auditor is not expected, and shall not attempt, to make a detailed audit.

This practice, which arose largely because it became prohibitively costly to audit ever-growing American businesses on an exhaustive basis (Chatfield 1977, p. 128), in turn raised concerns about how the auditor should determine the extent of testing in general and in specific cases. Further, it was not a huge step from the consideration of these concerns to those about establishing, more generally, an appropriate balance of audit costs and benefits (i.e., avoiding inefficiency due to overauditing and avoiding ineffectiveness by underauditing). The concept of selective examination and these companion issues are, of course, fundamental to audit planning and remain, in many respects, contentious within the profession today.

Later, concerns began to arise with respect to consistency across audit engagements. In particular, practitioners and scholars recognized that a key deficiency of early U.S. audit approaches (either based on prescribed procedures or on unstructured judgment) was that the audit procedures applied on each engagement might vary in their ability to detect material financial-statement misstatements. From the perspective of individual external auditors, auditing firms, the external auditing profession, and society at large, there was clearly an advantage in imposing an overriding analytical structure to create more consistent assurance levels across audits. Further, this analytical structure would be applied in all auditee circumstances. Thus, while the procedures to be performed might vary with the circumstances of each engagement, the *process of determining* which procedures would be performed, on which assertions they would be based, and to what extent they would be performed, would not vary. Again, the intention was to enhance audit consistency across engagements.

The emergence of the concept of selective examination and companion issues, in setting the stage for an analytical approach to audit planning, also provided a rationale for academic research on risk assessment and statistical sampling. In addition, because auditors inevitably make a judgmental trade-off between audit costs and benefits (regardless of whether pure judgmental or mixed judgmental/quantitative approaches are used), research on judgment formulation and decision making, decision aids, and related topics was inevitably stimulated.

Concern about risk most directly related to the extent-of-testing issue also contributed to a recognition of, and heightened sensitivity to, other sources of risk. That is, attention became focused within the profession on fundamental issues such as the effectiveness of basic audit procedures, as well as related considerations that are today viewed as components of non-sampling risk (Vance and Neter, 1956) and are

categorized under the heading of quality control.³ In addition, as audits of financial statements for distribution to stockholders and investors became more prominent, with the attendant realization that the procedures performed as part of such audits would have to vary with auditee circumstances (see discussion below), there was increased recognition that audit procedures ultimately are selected by an auditor exercising professional judgment. This recognition provided a further impetus for behavioral research on auditor judgment formulation and decision making.

The Evolution of Auditing Literature/Pronouncements

The first widely recognized American book on auditing was Montgomery's *Auditing Theory and Practice*, published in 1912.⁴ Montgomery exemplified the interaction between practice and academia: He was a founding partner of the firm of Lybrand, Ross Bros., and Montgomery (now Coopers & Lybrand) in 1898, and also served as an Auditing Lecturer at the University of Pennsylvania and New York University and as an Accounting Instructor at Columbia University. Montgomery's academic orientation is apparent in his frequent references to auditing theory and to the science of auditing. For example:

In auditing, as in no other branch of accountancy, theory has a well-defined place, and the professional auditor who is unacquainted with all the developments of the science as improved and published by other members of his profession will find himself as far behind the times as the physician would be who stopped purchasing medical books and reading medical periodicals.⁵

Montgomery's book made a distinction between two kinds of audits: (1) the detailed audit, which prevailed in the formative days of auditing in America and for which the objectives were the detection or prevention of fraud and errors; and (2) the audit designed to ascertain the actual

³ Nonsampling risk refers to all risks other than those directly associated with the *extent* of testing, including the risk that inappropriate sampling techniques and other procedures (e.g., analytical procedures) may be applied.

⁴ The first (1912) edition of Montgomery's book is described here, while later editions are discussed in the subsection on audit texts. Montgomery's 1912 edition was preceded in 1905 by an American edition of the English reference book, *Dicksee's Auditing*, which Montgomery prepared. One of the motivations for writing his book was Montgomery's feeling that American practice was inadequately reflected by the American version of *Dicksee's Auditing*. Another book that predated Montgomery's book has been recently identified—H.J. Mettenheimer's *Auditor's Guide of 1869* (see McMickle and Jensen, 1988).

⁵ Montgomery, R.H. *Auditing Theory and Practice* (1912), p. 25.

financial condition and earnings of an enterprise for its partners, stockholders, executives, bankers, or investors. According to Montgomery, the latter represented a “vastly broader and more important class of work” which relegated the objectives of detailed audits “to a subordinate position without in any way depreciating their importance.”⁶

Montgomery explained that the purpose of his book was “to set forth the principles underlying the theory and practice of auditing and to outline the working program which must be followed in whole or in part in every audit.”⁷ Indeed, a significant portion of the book consisted of listings of accounts, accompanied by auditing procedures to be followed for each account, both for the audit intended to benefit stockholders (pages 87–206) and the detailed audit (pages 241–316). Much of the remainder of the book (pages 348–501) dealt with variations in these procedures applicable to different types of organizations such as financial institutions, public utilities, and municipalities. While the book generally presented these procedures in no apparent order, it did explain how the auditor should adjust the procedures employed to fit the various circumstances encountered.

Although early American auditing books recognized the potential advantages of a selective examination and suggested that selective examination was most appropriate when the auditee’s control system was strong, the association between extent of testing and control strength remained weak in practice during the first quarter of the twentieth century:

The literature was far ahead of actual practice. The auditor continued to expand his use of the technique of testing, but his decision as to the extent of testing was not directly tied to an appraisal of internal controls (Brown, 1962, p. 700).

By the 1920s, the general public in the U.S. was purchasing corporate securities. Consequently, audits of financial statements for distribution to stockholders and investors became an important part of the work of American auditors. It was recognized, however, that the objectives of this type of audit were different from the objectives of audits of balance sheets prepared to obtain bank credit. In 1929, the American Institute of Accountants (AIA) issued a revised version of its audit guide, the *Verification of Financial Statements*. While this guide still emphasized the balance-sheet audit for companies seeking bank credit, it also discussed the audit of income statement accounts. In

⁶ Ibid, p. 9.

⁷ Ibid, p. 1.

addition, the 1929 bulletin was the first AIA pronouncement to acknowledge the importance of reliance on the system of internal check in determining the extent of audit verification.

The Securities Exchange Act of 1934 called for annual submission of audited financial statements to the newly-created Securities and Exchange Commission (SEC). This requirement focused even greater attention on the audit of corporate financial statements to be provided to stockholders and investors. While the SEC was authorized to prescribe the form and content of the financial statements submitted, it mainly deferred to the AIA in these matters. The SEC's influence was reflected in the AIA's 1936 revision of its bulletin on audit procedure, entitled *Examination of Financial Statements by Independent Public Accountants*. This guide eliminated references to the balance-sheet audit and accorded relatively equal status to the income statement and balance sheet. Also, this document represented the first attempt to link auditing theory to recent developments in accounting theory by referring to the going-concern concept, consistency, and cost-basis valuation.

The *McKesson & Robbins* fraud of 1938–1939, which involved the deliberate falsification of inventory and accounts receivable records, had a substantial influence on subsequent auditing developments. According to Chatfield (1977, p. 137), this case forced a long-overdue appraisal of audit priorities, resulting in a final (albeit not immediate) break with the balance-sheet audit and the older British tradition of auditing the accounts rather than the business. In May 1939, the AIA's Special Committee on Auditing Procedure issued a report entitled *Extension of Auditing Procedures*. This report recommended that physical observation of inventory counts and direct confirmation of receivables be generally accepted audit procedures to the degree that, if either of these tests were omitted, an exception would be noted in the audit opinion. Shortly after publication of this report, the AIA's Special Committee was continued as a standing committee, the Committee on Auditing Procedure (CAP), and *Extension* was issued as Statement on Auditing Procedure (SAP) No. 1.⁸

The impact of the *McKesson & Robbins* case was felt for many years. Chatfield, for example, has contended that the *McKesson & Robbins* case indirectly resulted in a review of internal controls

⁸ The CAP issued a total of 54 SAPs between 1939 and 1972, at which time it was renamed the Auditing Standards Executive Committee (later the Auditing Standards Board). Further, the SAPs were codified in Statements on Auditing Standards (SAS) No. 1.

becoming the normal starting point for an audit, with the extent of testing employed largely depending on the results of that review.⁹ It has been consistently argued that expansion of the auditor's concept of internal control from the early notion of "internal check" to the current view which encompasses the entire firm and its operations, including management controls, is at least in part attributable to the *McKesson & Robbins* case.

Selected Authoritative Pronouncements

The first authoritative pronouncement on auditing in America was the "Memorandum on Balance-Sheet Audits" prepared in 1917 by the AIA at the request of the Federal Trade Commission. This pronouncement was issued by the Federal Reserve Board in 1918 under the title *Approved Methods for the Preparation of Balance-Sheet Statements*. It outlined a balance-sheet audit program for a merchandising or manufacturing firm and included specific instructions for examining particular accounts. The concept that an audit consisted of a set of well-defined procedures, adjusted to fit the circumstances of the audit client, was recognized in this first authoritative pronouncement as well as in subsequent AIA pronouncements in 1929 and 1936. For example, the 1936 bulletin consisted of forty-one pages, including twenty-two pages listing specific audit procedures to be followed for each major balance-sheet and income-statement account, and four pages discussing modifications of these procedures based on the size of the company.

In February of 1941, the SEC issued Accounting Series Release (ASR) No. 21 amending its Regulation S-X to require auditor's reports to state whether an audit was performed "in accordance with generally accepted auditing standards." Immediately thereafter, the CAP issued SAP No. 5, specifying wording changes in the auditor's report necessary to comply with ASR 21, and SAP No. 6, providing additional explanation. The significance of this development lay in the distinction between auditing standards and auditing procedures. According to SAP No. 6 (1941, p. 46):

A distinction was drawn by the Commission in its discussions with the [CAP] between auditing standards and auditing procedures. Auditing standards may be regarded as the underlying principles of auditing which control the nature and extent of the evidence to be

⁹ Several years prior to the *McKesson & Robbins* case, however, Smith (1933) discussed the important role of internal controls in determining the extent to which audit tests should be limited.

obtained by means of auditing procedures. . . . The term “generally accepted auditing standards applicable in the circumstances”¹⁰ does not imply a representation that in the particular case all procedures were followed which would be followed in the majority of cases.

This distinction effectively institutionalized the concept that an audit should not merely be a uniform set of procedures that would be customized to match client circumstances. Rather, an audit should involve the application of professional judgment to select those audit procedures considered necessary in the circumstances encountered.

Following the end of World War II, the CAP issued a special report entitled *Tentative Statement of Auditing Standards—Their Generally Accepted Significance and Scope*. In its Historical Preface this statement describes its purpose (1947, p. 7):

While it is not practicable, because of the wide variance of conditions encountered, to issue anything like an “all-purpose” program of auditing procedures, it is possible to formulate a pronouncement with regard to the auditing standards requiring observance by the accountant in his judgment exercise as to procedures selected and the extent of the application of such procedures through selective testing.

This statement set forth for the first time nine of the current ten generally accepted auditing standards, classified into the now-familiar categories of general standards, standards of field work, and standards of reporting. At its annual meeting of September, 1948, the AIA approved and adopted a resolution stipulating that the phrase “generally accepted auditing standards” in audit reports would be deemed to refer to these nine standards. The text of this resolution, together with a summary of the nine standards, appeared in SAP No. 24, issued in October 1948, and delineates changes in the wording of the auditor’s report that were made necessary by the new standards.

In 1954, the *Tentative Statement* was supplanted by the booklet *Generally Accepted Auditing Standards—Their Significance and Scope*, issued as a special report of the CAP. In 1963, the CAP issued SAP No. 33, entitled *Auditing Standards and Procedures*, which consolidated the 1954 report, a 1949 report on internal control, the codification of SAPs Nos. 1–24 (issued in 1951), and SAPs Nos. 25–32. For the first time, generally accepted auditing standards were effectively integrated with the authoritative auditing literature. Despite the fact that the distinction between auditing standards and auditing procedures had been in the authoritative literature for fifteen years, however, the CAP continued to

¹⁰ This phrase had been prescribed for insertion in audit reports by SAP No. 5.

issue Statements on Auditing Procedure for another nine years, until the publication of Statements on Auditing Standards (SAS) No. 1 in 1972. Nevertheless, given the actual de-emphasis in the authoritative auditing pronouncements on prescribing procedures, the foundation had been created for subsequent pronouncements that would provide the framework for the modern audit risk orientation.

Selected Audit Texts

Auditing textbooks experienced a transformation similar to that of authoritative pronouncements. As time passed, less emphasis was placed on cataloging auditing procedures, and greater emphasis was placed on a more analytical approach, including a risk orientation. The concept that “risk” is involved in the selection of auditing procedures appears in textbooks as early as 1957. The eighth edition of *Montgomery’s Auditing* (Lenhart and Defliese, 1957, p. 50) states that “in his estimation of the permissible effect of relative risk on his audit procedures, the auditor will consider the plan and effectiveness of the company’s system of internal accounting control and internal check.” As early as the third edition of Stettler’s *Auditing Principles* (1970), auditing procedures for each account were listed by audit objective rather than in a sequential or haphazard order. By the 1980s, U.S. auditing texts began to delineate common audit objectives that could be tailored for each account or transaction; for example, clerical accuracy, existence or occurrence, completeness, rights and obligations, valuation or allocation, statement presentation, and disclosure (Kell and Ziegler, 1983, p. 433). A Canadian text, (Anderson, 1977), apparently pioneered this approach.

Audit texts during the 1970s and 1980s also reflect an increasing emphasis on analytical, as opposed to detail-test, procedures. For example, as early as 1970, Stettler (p. 227) recommended that ratio analysis be employed to ascertain the reasonableness of inventory account balances. Beginning with the ninth edition of *Montgomery’s Auditing* (1975), most texts organized chapters dealing with auditing procedures by transaction cycles rather than by balance-sheet and income-statement accounts. Gradually, the material on auditing procedures has become a smaller portion of the standard auditing textbook. It has given way to material on reporting, ethics, legal liability, evidence, and, reflecting environmental changes and an increasingly analytical orientation, topics such as audit planning, internal control assessment, risk and materiality, EDP auditing, and statistical sampling. Finally, modern texts may be viewed as using risk orientation as a

unifying principle: After introducing the audit-risk model, chapters on audit test procedures proceed by delineating the risks within each transaction cycle, the related internal controls, the procedures for testing these controls, the audit objectives for substantive tests, and the substantive audit procedures that will achieve these objectives contingent on the results of the assessment of internal control.

EARLY AUDITING RESEARCH

In this section, we focus on two early forays into auditing research: (1) Stringer's program of research on statistical auditing and audit risk and (2) Mautz and Sharaf's (1961) classic contribution to auditing theory. In addition, because many of Stringer's contributions stemmed from his collaborative venture with a member of the academic community, we take the opportunity to highlight the research contributions of teams of academics and practitioners and to discuss the importance of collaboration. While other early collaborations could be included here, Stringer's efforts are especially worthy of note because they were the genesis of the later emphasis on materiality and audit risk. Mautz and Sharaf's efforts are included here not only because of the magnitude of their contribution, but also because of the role their monograph played in highlighting auditing as a legitimate field for scientific inquiry.

The first body of auditing research was focused on the use of statistical sampling in auditing. As discussed earlier, the concept of the selective examination became a cornerstone of the American audit approach during the early part of the twentieth century. Thus, it was probably inevitable that sampling techniques and, in particular, statistical sampling, would be applied to audits of American companies. The first paper we identified on this subject was written by Carman (1933), who was affiliated with the firm of J.S. Forbes & Co., Los Angeles. Carman's paper targeted and explained the use of discovery sampling in fraud detection. The first paper advocating the use of statistical sampling in determining the extent of testing on standard audit engagements was written by Prytherch (1942) of Leslie Banks & Co. As a precursor to subsequent developments, Prytherch related statistical notions to the auditing concepts of risk and materiality:

The cost of the audit must always be balanced against the risk that major errors or fraud may not be detected . . . the auditor is primarily concerned with reviewing supporting data in order to judge the reasonableness of the accounts and to detect errors or fraud that could materially affect the financial statements. (1942, p. 525).

One way of making an assumption as to the number of false items [to test for] in a group is to decide how much in dollar amount would be a material error. (1942, p. 527).

The paper by Prytherch was one of eight on the subject that appeared in the *Journal of Accountancy* and the *New York Certified Public Accountant* during the 1940s. Another of these papers (Neter, 1949), expressed the idea that the auditor should consider selecting the tolerable level of sampling risk on the basis of the quality of the internal control system:

It may well be, however, that the auditor is willing to assume a little more risk of accepting the records as satisfactory, when indeed they are not, because previous audits indicated that good internal control exists. . . . This would seem to suggest that the auditor could vary his tolerable risks and hence his sampling plans according to his knowledge of the state of internal control (1949, p. 396).

While Neter's paper also raised the issue of how the auditor should establish a "satisfactory error concept" (extent of tolerable error), he did not follow up on the earlier suggestion by Prytherch that it should be based on the dollar amount that would represent a material error.

The 1950s saw an explosion of publications on statistical sampling in auditing, consisting of thirty-one articles (including fifteen in *The Accounting Review* and nine in the *Journal of Accountancy*) and three books (Vance, 1950; Vance and Neter, 1956; and Trueblood and Cyert, 1957). Of these forty-three publications, at least twenty-two were authored or co-authored by academics. In many cases, publications on this subject resulted from collaboration between academics and practitioners employed by one of the (then) Big Eight accounting firms. The first of these collaborative efforts was between Trueblood, Monteverde, and Davidson of Touche, Ross, Bailey, and Smart, and Cyert and Cooper of Carnegie Tech (see Trueblood and Cyert, 1954, 1957; Trueblood and Monteverde, 1954; Trueblood and Cooper, 1955; Monteverde, 1955; Cyert, Hinckley and Monteverde, 1960; and Cyert and Davidson, 1962). This effort was followed by the teaming of Hill and Roth of Price Waterhouse with Arkin of the City University of New York (Arkin, 1957, 1958, 1963; Hill, 1958; Hill, Roth and Arkin, 1962), and of Stringer of Haskins & Sells with Stephan of Princeton University (Stephan, 1960; Stringer, 1961). Also worthy of note is the collaboration which began in the late 1960s between Anderson (then a partner in the Canadian firm of Clarkson-Gordon (now, Ernst & Young, Canada) and Teitlebaum, a member of the academic community. This partnership is important because it led to vital statistical sampling innovations (see

Leslie, Teitlebaum and Anderson, 1979 and Audit Sampling of this monograph) and valuable insights with respect to the audit-risk model.

The collaboration between Stringer and Stephan, described in detail by Tucker (1989), provides a salient example of the importance of such joint efforts. While we focus here on the Stringer and Stephan collaboration, it is noteworthy that much of the research described in the remainder of this chapter, as well as in later chapters of this monograph, represents in some way the joint efforts of academics and practitioners. Stringer was recruited from the Cincinnati practice office of Haskins & Sells to the firm's Executive Office in 1957 by Gellein, the firm's research director.¹¹ Stringer's assignment was to examine current developments in auditing, especially with respect to the application of statistical sampling, for possible inclusion in the firm's audit programs and practice manuals.¹² During the 1958–1960 period, Stringer, with assistance from Stephan, developed the Haskins & Sells Audit Sampling Plan which was adopted by the firm in 1962 after extensive study and field testing, (Tucker, 1994). Among the innovative features of this plan were the following (Stringer, 1963):

1. Explicit linkage of the statistical concept of reliability with the concept of audit risk and of the statistical concept of precision with the auditing concept of materiality.
2. Establishment of the concept of an overall level of audit risk that would be acceptable as a matter of firm policy.
3. Development of a preliminary audit risk model, under which overall audit risk is calculated as the product of internal control risk and sampling risk.
4. Development of procedures for quantitatively linking the evaluation of internal control to the measurement of internal control risk and for determining the extent of reliance on internal control in planning substantive tests.
5. Implementation of the sampling procedure now known as "probability proportional to size" sampling, referred to by the firm as cumulative monetary amount (CMA) sampling, and more widely known as dollar unit sampling.

¹¹ Though not a central player in this story, Gellein himself exemplifies the research links between accounting practice and academia. A former Ph.D. student at the University of Texas, Gellein had been a professor at the University of Denver when hired by Haskins & Sells in 1953 to direct the firm's research efforts.

¹² As part of his assignment, Stringer also conducted an early behavioral experiment in which the consistency of auditors' sample size judgments was investigated (Stringer, 1959).

Tucker (1989) goes on to describe Stringer's role in the development of auditing standards related to statistical sampling between 1961 and 1972. In 1961, Stringer became a member of the AICPA's Committee on Statistical Sampling (CSS) and served as its chairman from 1962 to 1965. In 1964, the CSS issued a report, of which Stringer was the principal author, entitled "Relationship of Statistical Sampling to Generally Accepted Auditing Standards." This report, which was published in the *Journal of Accountancy* in July 1964, incorporated three key features of the H&S plan.

1. With respect to statistical precision and reliability, it suggested that "one of the ways in which these measurements can be usefully adapted to the auditor's purposes is by relating precision to materiality and reliability to the reasonableness of the basis for his opinion" (1964, p. 56).
2. It described a risk model in conceptual terms (without the H&S formula) as follows:

The ultimate risk against which the auditor and those who rely on his opinion require reasonable protection is a combination of two separate risks. The first of these is that material errors will occur in the accounting process by which the financial statements are developed. The second is that any material errors that occur will not be detected in the auditor's examination. . . . The auditor relies on internal control to reduce the first risk, and on his tests of details and his other auditing procedures to reduce the second (1964, p. 57).

3. The report explained in conceptual terms (again, without the H&S quantitative technique) how the auditor could vary the extent of testing, based on an evaluation of internal control, by "specifying reliability levels that vary inversely with the subjective reliance assigned to internal control" (1964, p. 57).

In 1967, Stringer was appointed to the AICPA's Committee on Auditing Procedure (CAP). Later, as chairman of a CAP subcommittee on internal control, Stringer was the principal author of SAP No. 54, *The Auditor's Study and Evaluation of Internal Control*, which was issued in November of 1972. Stringer attempted to incorporate the 1964 CSS report, together with additional guidance on the application of statistical sampling in auditing, into the main body of SAP No. 54. However, this attempt met with resistance from the CAP. The result was a compromise under which the 1964 report was reproduced as Appendix A of the Statement, and the additional guidance was included as Appendix B, "Precision and Reliability for Statistical Sampling in Auditing."

Appendix B is noteworthy in at least two respects:

1. It contained the first authoritative publication of an audit risk model in the form of an equation.
2. In an illustration accompanying the equation, it suggested that the auditor might set a combined reliability level (complement of overall audit risk) of 95 percent (SAP No. 54, Appendix B, ¶ 35, p. 276).

Several aspects of SAP No. 54 itself were noteworthy from the standpoint of the development of the modern risk orientation in auditing. First, the Statement suggested a “conceptually logical approach to the auditor’s evaluation of accounting control,” which consisted of four steps, as follows:

1. Consider the types of errors and irregularities that could occur;
2. Determine the accounting control procedures that should prevent or detect such errors and irregularities;
3. Determine whether the necessary procedures are prescribed and are being followed satisfactorily; and
4. Evaluate any weaknesses—types of potential errors and irregularities not covered by existing control procedures—to determine their effect on (1) the nature, timing, or extent of auditing procedures to be applied and (2) suggestions to be made to the client (SAP No. 54, ¶65, p. 252).

Second, SAP 54 suggested that, in applying this four-step approach, the auditor should not rely on generalized questionnaires, checklists, or similar material. Rather the auditor should adapt or expand such generalized material as appropriate in particular situations (¶66).

Third, the Statement suggested that it was not appropriate to carry out the four-step procedure by balance-sheet account, because “controls and weaknesses affecting different classes of transactions are not offsetting in their effect” on individual accounts; hence, “the auditor ordinarily would confine his evaluation to broad classes of transactions” (¶67).

Since the publication of SAP No. 54, a number of the larger accounting firms have developed firmwide audit guidance reflecting its prescriptions that accounting controls be evaluated by transaction cycle, that specialized questionnaires or related materials be applied to each cycle, and that the four-step approach be used as a framework for the evaluation process (Cushing and Loebbecke, 1986, pp. 36–39).

In summary, Stringer's contributions between 1957 and 1972, originating at least in part from his early research with Professor Stephan, may be viewed as the genesis of the modern risk orientation in auditing. In recognition of the significance of his contributions, the Auditing Section of the American Accounting Association awarded Stringer the first Distinguished Service in Auditing Award in 1981. Again, while these contributions are of obvious import and thus deserve considerable attention, we should also draw attention to the nature and structure of the process through which they arose: A member of the practicing community established contact with a member of the academic community; this team then conducted research, the research results directly affected the audit practice of one large auditing firm, and eventually, practice profession-wide was changed via the influence of the research team's results on authoritative pronouncements.

Although this type of collaboration continues today, other forms of collaboration, with even greater division of labor, have evolved. That is, auditing firms make resources (e.g., financial resources and access to data) available to members of the academic community, who have been trained in sophisticated research techniques, and then engage them to conduct an investigation. While KPMG Peat Marwick's *Research Opportunities in Auditing* program (discussed later in more detail) is perhaps the best known formal program of this type, other informal (and sometimes transitory) collaborations are common.

While research on the application of statistical sampling in auditing played a central role in the development of many modern auditing concepts and methods, no discussion of early auditing research would be complete without mention of the Mautz and Sharaf monograph, *The Philosophy of Auditing*. Published in 1961 by the American Accounting Association, this monograph was written by a faculty member (Mautz) and a Ph.D. student (Sharaf) at the University of Illinois.

Mautz and Sharaf began by asserting that there existed a body of theory in auditing, consisting of basic assumptions and integrated ideas, and that better understanding of this theory could be useful in the development and practice of the art of auditing (1961, p. 1). While this auditing theory had not yet been explicated, Mautz and Sharaf contended that it was inherent in the American view of an audit as a selective examination, which implied that practicing auditors must emphasize not only the steps in the audit procedures (the "how"), but also the reasons for using the various procedures selected (the "why") (p. 3). Among the key contributions of *The Philosophy of Auditing* were:

- Development of the notion that an audit be carried out using the scientific method (Risk Orientation)
- Explication of a set of auditing postulates (Audit Judgment)
- Careful examination of the nature of auditing evidence, emphasizing the application of logical methods to the process of evidence evaluation (Analytical Procedure)
- Thoughtful discussion of the auditing concepts of due audit care, fair presentation, independence, and ethical conduct (in last four chapters)

In an overall sense, however, the monograph's primary contribution lay in its view of auditing as a discipline that could be approached from a theoretical perspective. By raising the prospect that a comprehensive theory of auditing could be developed, Mautz and Sharaf inspired many accounting academics to take a more serious look at auditing as a subject of scholarly interest. Moreover, they also directed the attention of researchers who did take such a look to specific auditing topics. One can find in the monograph, for example, motivations for behavioral topics relating to the role of probability in audit evidence evaluation (p. 72), the impact of time on auditor judgment (p. 78), and the nature of audit expertise (p. 91). Interestingly, one can even find a rudimentary model of auditor judgment in this rich and forward-looking publication.

In concluding this discussion of early auditing research, it will be useful to consider the status of the auditing discipline in the early 1970s.

By the time SAP No. 54 was issued in 1972, it was widely recognized that:

- Auditing involved selective examination of accounting records.
- The selection involved a tradeoff of costs and benefits.
- This tradeoff could be approached using a framework based on the concepts of audit risk and materiality.
- Evaluation of the internal control system and determination of the extent of reliance on internal control play a key role in audit design.
- Statistical sampling could play a significant, though partial, role in the design and implementation of an audit plan.
- Professional judgment was a crucial factor in the application of these various concepts and techniques in particular settings.
- The consistency of audit procedures and the resultant audit assurance varied from engagement to engagement.

A natural response was to initiate research to examine how these and other factors ought to be taken into account in planning and carrying

out individual audits and in controlling “costs” at the level of a firm or profession. In addition, SAP No. 54 itself introduced the possibility that the audit risk model could provide a framework for integrating these factors into an overall audit approach. In concert, these conditions made auditing a subject of great interest for scholarly inquiry.

We have shown that a number of environmental conditions created serious practical audit problems and concerns, including the following:

- The emergence of litigation as a significant threat (e.g., *Continental Vending* and *National Student Marketing* cases)
- Significant changes in the competitive environment
- Proliferation of mergers, acquisitions, and conglomerate businesses, which highlighted potential risks associated with selective testing based on client size and location

These conditions raised questions about the efficacy of the traditional balance-sheet audit approach and the effectiveness of various audit procedures. In addition, they encouraged large firms to place greater emphasis during audits on the review of internal control. The uncertainties raised by these conditions seemed to make practicing auditors receptive to scholarly research as a potentially effective way of addressing their problems and concerns.

In short, by the early 1970s conditions were ripe for a surge of interest in scholarly research in auditing. It did not take long for this research to materialize.

AUDITING RESEARCH IN THE 1970s

Introduction

The surge in scholarly auditing research during the 1970s may be attributed to the aforementioned environmental conditions, and such activity was supported by research symposia which began at the same time.¹³ In May of 1972, for example, the first University of Kansas

¹³ It is arguable that other forces played an indirect role in stimulating the demand for auditing research during the 1970s. For example, the Supreme Court in 1977 effectively struck down bans against informative advertising by members of professions. This ruling was followed in the late 1970s by Department of Justice inquiries into advertising, solicitation, and employment restrictions, which were repealed by the end of the decade. Of course, the direct effect of these initiatives was to increase competition in the audit field. The attendant increased demand for improvements in audit efficiency and effectiveness was likely a significant stimulus to the demand for audit research.

Symposium on Auditing Problems was held in Lawrence, Kansas. Professor Stettler, an auditing textbook author and statistical-sampling researcher (Stettler, 1954, 1966), organized the symposium.¹⁴ His approach was to invite a roughly equal mix of academics and practitioners and to involve both groups in writing papers for presentation. The symposium was quite successful and has been held every two years since 1972. The Kansas symposium was followed by the first University of Illinois Symposium on Auditing Research in October of 1974, which also has been held every two years since its inception.

By bringing audit practitioners and researchers together on a regular basis, in a setting in which auditing research and current auditing problems were thoughtfully examined, these symposia provided a substantial impetus to auditing research, and perhaps to the use of research results in audit practice as well. In addition, they served as a marketplace for audit ideas: New ideas were offered and scrutinized, and the ideas that survive (perhaps with modification) are provided some degree of acceptance. These surviving ideas then were subjected to even greater scrutiny (e.g., by the journal review process or by field testing). The annual University of Southern California Audit Judgment Symposium, begun in 1983, continues this rich tradition.¹⁵

By 1970, virtually all analyses of audit risk that had appeared in the literature had been linked to sampling risk. Although, as noted earlier, nonsampling risk had been mentioned by Vance and Neter (1956, pp. 171–172) among others, it had not received much formal attention by 1970. However, Altman (1968) and especially Altman and McGough (1974) suggested how one source of nonsampling risk (auditee failure) could be addressed by the auditor. The latter paper is particularly interesting in that it was co-authored by an academic/practitioner team. In that paper, the co-authors described how Altman's methods (using financial-statement information, especially financial ratios, for corporate failure prediction) could assist auditors in making going-concern evaluations. Altman has continued his research on bankruptcy prediction (see Altman, 1993), and has also consulted with Arthur Andersen & Co. on financial distress indicators. At present, most or all national accounting firms use Altman's published methods, or a variation of them, in their auditing practice.

¹⁴ In a private communication, Ken Stringer indicated that his interest in statistical sampling was stimulated, in part, by Stettler (1954).

¹⁵ The University of Waterloo (Canada) has held a symposium on auditing research every other year since 1987. In addition, the University of Chicago and other institutions have held symposia devoted to auditing research.

Another series of papers, appearing at about the same time, continued the broadening of audit research by examining nonsampling risks associated with the use of audit confirmations of account balances (Davis, Neter, and Palmer, 1967; Sauls, 1970, 1972; Warren, 1974, 1975). The gist of these papers was that nonresponse and improper response to audit confirmations were significant problems that auditors should consider. As a result of this research, audit practice has changed by (1) placing *less* emphasis on the use of negative confirmations, and (2) placing *greater* emphasis on the analysis of subsequent collections of receivables.

Still another series of studies (Cushing, 1974; Bodnar, 1975) was reported in which internal control systems were analyzed using reliability-modeling techniques common in the field of engineering. These studies provided an approach to quantifying the concept of control reliability, but their greatest importance is that they paved the way for the development of audit expert systems and decision aids.

In 1973, Arthur Andersen & Co. responded to the changing environment by comprehensively re-examining its audit approach. This multiyear inquiry culminated in a new audit approach, Transaction Flow Auditing (Arthur Andersen & Co., 1976), which has since been refined on numerous occasions. Key components of Transaction Flow Auditing include:

1. General Risk Analysis—focusing attention on “areas” which pose the greatest risk of material misstatement.
2. Transaction Flow Review—analysis of accounting procedures and internal controls by transaction cycle.
3. Specific Risk Analysis—evaluation of controls and misstatement risks at the transaction and account levels using control objectives identified for each cycle function and specifically designed tests.
4. Linking of control and substantive testing phases, so that the former affects the nature, timing, and extent of the latter.

Salient features of the process by which this audit approach re-engineering was accomplished included identification of specific control objectives for each function of a transaction cycle by major industries and government operations, worldwide field testing within Andersen, and feedback from the academic community during an Arthur Andersen & Co. Audit Symposium. It is interesting to note that a separate publication of the internal control aspects of the audit approach, designed for general distribution, went through more than ten printings and over 100,000 copies were distributed (Arthur Andersen & Co., 1978).

Two further milestones during the early 1970s are germane to discussions in this section. The first was a monograph published in 1973 by the Committee on Basic Auditing Concepts of the American Accounting Association. That monograph, *A Statement of Basic Auditing Concepts*, contained a wealth of discussion of risk-related matters and the role that research could play with respect to them, as well as thought-provoking discussions of the audit investigative process (pp. 18–41). The rudiments of a risk orientation clearly are evident, for example, in the monograph discussions of warranted assertions (pp. 19–20), the distinction between professional opinions and positive knowledge (pp. 20–21), and the concept of degree of credibility (pp. 25–26).

The second milestone was the publication of the first experimental research study on audit judgment (Ashton, 1974). In motivating his research, Ashton pointed out that, while the professional literature of auditing made frequent reference to the importance of professional judgment in the independent auditor's work, no systematic research on audit judgment had been reported (p. 143). Ashton's research examined the consistency of practicing auditors' judgments about the strength of an internal control subsystem in a hypothetical audit case. Judgment consistency, which is related to the aforementioned concern about controlling audit intensity, was measured in two ways: consensus across subjects, and stability of each subject's judgments over time.

While the results indicated "a fairly high level of consistency (both consensus and stability)" (p. 153), Ashton found significant inconsistencies in the judgments of some auditors. He did not directly relate his findings to audit risk. However, as noted earlier, Ashton's initial behavioral research, as well as most of the hundreds of behavioral studies that followed, have been concerned with the nonsampling risk that, because of shortcomings in the judgment formulation or decision making of auditors, audit effectiveness or efficiency may be compromised.

Although the impact of this research on audit practice, education, and professional standards is reviewed in detail in a subsequent chapter, we briefly discuss in the ensuing subsection select streams of behavioral research reported during the 1970s and explain how they may be related to audit risk. Further, we discuss research reported during the 1970s focused on sampling risk and the audit risk model.

Behavioral Research

In this subsection we discuss select examples of behavioral audit research reported during the 1970s and highlight how this research

contributed to development of an audit risk orientation. A natural starting point for this discussion is the stream of research that started with the Ashton (1974) paper. As noted earlier, Ashton focused on *how* and *how well* auditors assess the reliability of internal control subsystems. Of course, the complement of control system reliability is control risk. The link to risk generally, and particularly the audit risk model, therefore, is quite easily made by considering the experimental task in the Ashton study. If one were to define this research stream in terms of the experimental task (assess reliability or its complement, risk assessment) and in terms of the stage of the audit process at which subjects were placed (i.e., the stage at which the accounting information system is evaluated), one would find that it is the deepest of all of the behavioral audit research streams (Solomon and Shields, 1994). Thus, the link to audit risk is straightforward, irrespective of whether one is focused on the Ashton study or on one of the more recent additions to the literature, in which the focus was the impact of patterns of control features and other forms of audit evidence on risk assessments (Brown and Solomon, 1990).

In a more subtle way, however, the Ashton stream of research, as well as most behavioral studies, is tied to audit risk. We may specifically view the audit risk as arising from two sources:

1. Examining only a sample of relevant data (sampling risk)
2. All other sources of audit risk (nonsampling risk)

Included in the residual nonsampling risk category would be errors in judgment and decision making, such as those that arise because of insufficient accounting or auditing knowledge, erroneous application of accounting or auditing knowledge, limitations of human memory and cognitive abilities, or environmental forces (e.g., time or budgetary pressure). Since most behavioral audit research is concerned with the possibility that audit effectiveness or efficiency may be compromised because of shortcomings in the judgment formulation or decision making of auditors due to such factors, behavioral audit research is indirectly linked to a risk orientation. We note that such a link exists regardless of the task performed by the experimental subjects (e.g., choosing audit procedures or generating potential explanations for unexpected fluctuations when performing analytical procedures).

To illustrate the impact of behavioral research conducted during the 1970s, one need only look to the high-profile study undertaken by Peat Marwick Mitchell & Co. (PMM) late in the decade to obtain evidence of the effects of (1) changes in internal accounting controls,

and (2) differences in audit guidance, on auditors' decisions about the extent of audit tests. This study, which was co-authored by Mock and Turner, an academic/practitioner team, was published by the AICPA in 1981 as Auditing Research Monograph 3. The results indicated that, as expected, auditors respond systematically to improved compliance-test results by reducing the extent of substantive tests. A great deal of variability among auditors was observed, however, both in the specific sample sizes recommended and in the rationale given for those sample sizes. These results suggested to the authors that the auditor's study and evaluation of internal accounting control was much more complex than previously believed, increasing the possibilities of excessive audit costs through over-auditing, and audit failure due to unwarranted reliance on controls.

The Mock and Turner study also provided evidence and insights into how the auditor's study and evaluation of internal accounting control systems might be improved. PMM concluded that improved tools were needed for documentation and evaluation of controls and initiated a follow-up study to design and implement such a tool (Mock and Willingham, 1983). The result was System Evaluation Approach, Documentation of Controls (SEADOC), a technique using a series of worksheets and flowcharts to document an internal accounting control system. SEADOC also aids the auditor in evaluating a system by identifying key control points, or locations, in the data gathering and processing activities where information is created, changed, or transferred. SEADOC was successfully field tested within PMM and subsequently implemented on a firm-wide basis.¹⁶

Before concluding our discussion of behavioral audit research during its formative decade, it is appropriate to comment on the criterion most commonly employed by behavioral researchers to evaluate auditors' judgments and decisions. That evaluation criterion is *consensus*, the extent to which different auditors make the same

¹⁶ Related PMM internal research led to other practice innovations, for example, development of a series of audit program matrices (one for each transaction cycle) to be used in selecting substantive audit procedures (Elliott, 1983, pp. 9–12). These matrices associate audit objectives, or financial-statement assertions (ownership, existence, valuation, accuracy, disclosure), or both with all possible audit procedures. Entries within the cells of each matrix indicate the effectiveness of the procedure in providing evidence to assess the corresponding assertion. Financial-statement objectives are subdivided into overstatement and understatement objectives, since many auditing procedures test for one or the other, but not both. The matrices were designed to help the auditor determine, in light of the internal control factors to be relied upon (derived using SEADOC), the most efficient set of procedures that will satisfy the audit objectives.

judgments and decisions when faced with the same circumstances. For example, in a study focused primarily on sampling, Aly and Duboff (1971) reported large differences in the size of judgmental samples suggested by approximately 150 practicing auditors who responded to a mail survey. Consistently, in the aforementioned Mock and Turner study, one of the evaluation foci was variability among the sample sizes which different auditors suggested when faced with the same set of facts. While behavioral audit researchers have relied extensively on this evaluation criterion—in part, because other criteria are difficult to operationalize in the audit context—it is also true that consensus fits the audit context quite well.¹⁷ That is, consensus is closely tied to one of the motivations for conducting audit research—the concern about controlling variability across audit engagements.

The link from the consensus criterion to audit consistency concerns may be made clearer by reference to another prominent behavioral study from the 1970s (Joyce, 1976). In this dissertation study, Joyce investigated the relationship between the amount and nature of audit work judged to be necessary and judgments about the reliability of control systems with specified features. The results revealed considerable variability (more than in the Ashton 1974 study) in such judgments. While the full implications of Joyce's results (1976, p. 54) are somewhat ambiguous, they did seem to fuel the demand for additional inquiries of this type and for behavioral auditing research in general.

Research on Sampling Risk and the Audit Risk Model

The tradition of collaboration between audit practitioners and academics on audit sampling issues continued in the early 1970s, as Professor Kaplan of Carnegie-Mellon University was engaged by PMM to research audit sampling issues. At about this time, a paper entitled “Relating Statistical Sampling to Audit Objectives” appeared in the *Journal of Accountancy* (Elliott and Rogers, 1972). In this important paper, by building on the audit risk model of SAP No. 54, Elliott and Rogers expanded the concept that overall audit risk is based on a combination of reliance on (1) internal control, (2) other audit procedures (e.g., analytical review), and (3) substantive tests based on audit samples. A key contribution of this paper was recognition that with respect to (3), auditors are principally concerned about the risk that a

¹⁷ For example, an “accuracy” criterion is difficult to employ in the audit context because there rarely exists an unambiguous correct “answer” by which accuracy can be judged (Solomon and Shields, 1994).

material error might not be reflected in a sample (using the Elliott and Rogers approach, and in statistical terms, beta risk or the risk of a Type II error).¹⁸ Elliott and Rogers, therefore, suggested that audit sampling be conducted so that the risk of incorrectly accepting a materially misstated financial-statement assertion can be specified and controlled.

Another important aspect of the Elliott and Rogers paper was the fact that it focused attention on audit applications of statistical sampling in substantive tests of details (testing of client account balances, or variables sampling). Most previous papers on the subject had highlighted attribute sampling applications used by auditors to estimate error rates in transaction processing systems for compliance testing purposes. Subsequent to Elliott and Rogers, Kaplan wrote two papers on variables sampling in auditing (1973a, 1973b). For PMM, however, the most significant result of its research on statistical sampling, aided by the firm's consultation with Kaplan, was the establishment of its "statistical audit specialist" (SAS) program. Under this program, some of the firm's best audit professionals received intensive training in the selection and application of statistical sampling methods in audit settings.

Following SAP No. 54 and Elliott and Rogers, Kinney wrote two papers (1975a, 1975b) explaining how auditors might implement a decision-theoretic approach to the auditing process. Kinney's approach included the incorporation and adjustment of prior beliefs based on the results of audit testing, and explicit consideration of the tradeoff between audit sampling costs and the losses from either rejecting a correct account balance or accepting a materially incorrect account balance. While Kinney's first paper focused on substantive tests of details, the second paper built upon the first by providing an integrated model of the audit process, encompassing internal control review, tests of compliance, tests of details, analytical review, and the final opinion decision.

These papers have had little, if any, direct impact on audit practice. However, they are significant in at least two ways. First, they provide a framework for identifying important factors in the design of an audit. Although audit practitioners may not try to measure these factors for use in a model, they have become aware that they should consider these factors in audit planning.

¹⁸ Beck and Solomon (1985) demonstrated that the association between inferential errors (Type I and II) and audit consequences (i.e., compromising audit effectiveness and audit efficiency) depends critically on the hypothesis formulation. For example, if the SAP No. 54 approach were to be used (see Roberts, 1978), a Type I error would be associated with audit effectiveness and a Type II error would be associated with audit efficiency.

Second, there had been discussion among audit practitioners about developing a quantitative (i.e., decision-theoretic) approach to audit evidence evaluation. Kinney's work made the implications of such an approach more noteworthy. Henceforth, auditors would be required to specify (1) prior probability distributions (e.g., for the likelihood of material error) and (2) loss (cost) functions for Type I and Type II errors.

Although academic scholars continued to pursue research in this area subsequent to the appearance of Kinney's papers, the interest level among U.S. auditing practitioners in this area seemed to decline.

Following the issuance of SAP No. 54 in 1972, the AICPA's Committee on Statistical Sampling undertook a project with Professor Roberts, who taught statistics at the University of Illinois, to produce a reference book for auditors who wanted to use statistical sampling. However, concerns soon arose over the lack of empirical evidence on the relative effectiveness of various statistical methods in sampling accounting populations with unusual characteristics, including extreme skewness and low error rates. To obtain such evidence, the AICPA provided financial support, allowing expansion of a project that had already been initiated by Loebbecke of Touche Ross & Co. and John Neter, a Professor of Statistics at the University of Minnesota.

This simulation-based research involved repeated sampling from a set of actual accounting populations in which hypothetical errors were seeded, with variations in error rates and sample selection methods. The results were published by the AICPA as Auditing Research Monograph 2, *Behavior of Major Statistical Estimators in Sampling Accounting Populations* (Neter and Loebbecke, 1975). Drawing on the findings of this research, Roberts completed the book, *Statistical Auditing* (1978), also published by the AICPA, which continues to serve as a valuable reference today.

The Neter and Loebbecke monograph is a major research contribution. This monograph greatly expanded knowledge about which statistical techniques were most effective in various situations. It also enhanced knowledge about how the extent of testing and stratification affect the reliability of statistical sampling results. The Roberts book extended these results and provided further guidance on choosing the statistical procedures appropriate to the circumstances, on timing the procedures, on considering the special characteristics of the system being examined, and on the impact of the skill and care of the auditor on the audit (Roberts, 1978, p. 4). The findings of the Neter and Loebbecke research continue to provide a foundation for the control of risks associated with the use of statistical sampling in audit practice.

After originating the audit risk model in the late 1950s and early

1960s, Stringer of H&S provided a substantial extension of this model in the early 1970s by developing a method of measuring the risk associated with the use of analytical review procedures in substantive tests. This method, reported in Stringer (1975), involved the use of Statistical Technique for Analytical Review (STAR), a regression analysis program for estimating the ending balance in a balance-sheet or income-statement account. The reliance assigned to analytical review (labeled *A* by Stringer) was related to the reliability level established for the regression model—a key factor in determining the precision limits of the regression estimate. The auditor would investigate actual account balances falling outside these limits. Incorporating *A* into the audit risk model yielded the following formula for combined reliability (*R*), the complement of overall audit risk:

$$R = 1 - (1 - C) \times (1 - A) \times (1 - D)$$

where *C* represents the reliance assigned to internal control, and *D* is the reliance assigned to detailed tests. Except for differences in notation, this formula was carried over to the Appendix of SAS No. 39 (AICPA, 1981) and, except for the addition of a term for “inherent risk,” to the current codification of the SASs, in which ultimate risk is called “allowable audit risk” (see discussion of SAS No. 47 below). Hence, Stringer’s research leading to the development and implementation of STAR not only influenced audit practice in his own firm, but ultimately influenced professional auditing standards as well.

H&S introduced the STAR program into its audit practice in 1971, and used it successfully for many years thereafter. Some details of the program were revealed to an academic audience through Stringer’s paper, presented at the 1975 University of Chicago Symposium on Accounting Research, and subsequently at an annual series of AuditSCOPE conferences for professors, which Deloitte, Haskins & Sells (DH&S) (now Deloitte and Touche) sponsored beginning in 1978. According to Kinney (1981), the firm’s later AuditSCOPE conferences indicated that DH&S had modified its application of the STAR program to address issues raised by academics during the 1975 and 1978 presentations. This observation provides further evidence that the interaction between auditing practitioners and academics has influenced the professional practice of auditing. Kinney’s 1981 article also is noteworthy because it led to a more detailed understanding of the DH&S procedures.

By 1976, auditing research had made some significant impacts on both auditing practice and auditing standards. However, the auditing profession was undergoing rapid changes as a result of increased rules

and regulations, audit litigation, and prospective expansion in the scope of the auditor's responsibilities. Motivated by these trends, Peat, Marwick, Mitchell & Co. concluded that auditors needed significantly different tools, techniques, and skills; that more auditing research was needed to support their development; and that the academic community possessed the skills needed to carry out much of this research (PMM & Co., 1976, pp. vii–viii). In response to these challenges and to stimulate additional interest and involvement in auditing research among academicians, PMM launched its Research Opportunities in Auditing (ROA) program with the publication of a monograph by that name.¹⁹ The firm pledged to support such research by providing over \$1 million of research funding, plus access to empirical data within the firm.²⁰ The monograph itself consisted of a description of numerous problems and opportunities that provided potential topics for auditing research and a list of over fifty prospective research projects.

The ROA program represented a large vote of confidence in the academic research community by one of the world's leading accounting firms. This confidence is reflected in the following statements from the preface to the monograph (1976, p. viii):

We believe that more academic researchers should consider the attractiveness of auditing research. The auditing profession in the United States includes many firms with the desire and ability to put useful research results into practice. Moreover, the effect of improvement and innovation in auditing can have a significant impact on our society because auditing is a vital component of the process by which resources are allocated.

Indeed, it is encouraging to see increased interest in audit research over the last several years, as manifested by a number of audit research conferences, and the rapid growth in the quantity and sophistication of published research.

The ROA program clearly provided a substantial impetus to auditing research. Many scholars with little prior interest in auditing were attracted to auditing research. Membership in the Auditing Section of the American Accounting Association (which had been established in 1976) grew by 150 percent, from 441 members in July of 1977 to 1,106 members in May of 1980. The volume of auditing research also

¹⁹ Rich Lea, then a partner in PMM, but formerly a member of the academic community, was one of the architects of the program and one of the authors of the monograph.

²⁰ By the time the ROA program was discontinued in 1993, the firm had spent or committed over \$3.9 million on auditing research, according to the 1993 annual report of the KPMG Peat Marwick Foundation.

increased rapidly, leading to the establishment of the first auditing research journal by the Auditing Section in 1981. Further, the ROA program encouraged academicians to identify and carry out research projects with practical implications. This orientation is reflected in the title of the Auditing Section's journal, *Auditing: A Journal of Practice and Theory*, and in the journal's policy of having both an academic and a practitioner review each submitted paper.

An interesting feature of the ROA monograph is PMM's description of the audit process (1976, pp. 18–28). It begins with a brief specification of overall audit objectives, and then describes an audit engagement as consisting of four phases: (1) initial planning; (2) field work planning; (3) verification; and (4) final review, reporting, and summarization. According to PMM, the key element of initial planning is the identification of critical audit areas in the course of developing an overview of the client in its economic environment (p. 25). It includes a preliminary analytical review of the client's year-to-date figures, for the purpose of locating any unusual or unexpected relationships that may require special attention during the audit. In the second phase, field work planning, the monograph suggests that the auditor develop an audit program that satisfies the overall objectives, but is tailored to the characteristics of the client and to the concerns identified during the initial planning phase. This audit program translates the overall objectives into subobjectives, which might be structured either on a "transaction cycle" basis or on an "account-by-account" basis. These subobjectives then become the basis for selecting the nature, timing, and extent of detailed auditing procedures.

In this description, the modern risk orientation of the audit process is apparent. Gone is the concept underlying the AIA's 1936 pronouncement, *Examination of Financial Statements by Independent Public Accountants*, that an audit consists of a set of well-defined procedures for each balance-sheet and income-statement account. In its place is a view of the audit as a complex decision process in which detailed procedures are identified, following not one, but two planning steps. PMM's description of the audit process reflected a transition, taking place within all of the large accounting firms, from the concept of the balance-sheet audit to the concept of the risk-based audit. Under Stringer's influence, Deloitte, Haskins & Sells, in the early 1960s, was probably the first firm to make this transition.

In the 1970s, in addition to PMM,²¹ both Touche Ross & Co. and Arthur Andersen & Co. adopted consistent approaches. Touche Ross

²¹ Various features of PMM's audit approach are described in Elliott (1983).

developed its new risk-based audit approach, the Touche Ross Audit Process (TRAP), following the appointment of Jim Loebbecke as National Director of Auditing in 1973. As discussed earlier, between 1973 and 1977, Arthur Andersen & Co., under the direction of Bob Roussey, also developed and implemented a risk-based audit approach, called Transaction Flow Auditing. Ernst & Whinney (Grobstein and Craig, 1984), Coopers and Lybrand (C & L, 1983 and Graham, 1985), and Price Waterhouse (Walker and Pierce, 1988) subsequently implemented similar audit approaches.

In summary, the risk-based audit approach had been widely adopted in audit practice by the end of the 1970s, and would soon be codified into auditing standards by SAS Nos. 39 and 47 in 1981 and 1983. Although the degree to which these developments were led by auditing research, as opposed to environmental and other forces, is certainly debatable, what seems incontrovertible is that the nature of these developments was influenced greatly, if not determined, by audit research. The use of statistical sampling methods in auditing practice, with research and researchers playing a major role, raised the companion issues of (1) measuring and controlling sampling risk, and (2) identifying and controlling nonsampling risks.

To address these issues, practicing auditors tapped into expertise resident in the academic community. Stephan's work with Stringer between 1958 and 1960 was instrumental in the development of the audit risk model. Research streams initiated by Davis, Neter, and Palmer (1967), Altman (1968), Ashton (1974), and Neter and Loebbecke (1975) have helped the auditing profession identify and control significant nonsampling risks. The Mautz and Sharaf conception of auditing as a science with an underlying theoretical structure began a process of change in the way academics viewed auditing. By 1980, viewing auditing as a nexus of complex judgments and decisions was common not only in academia but in practice as well.

AUDITING RESEARCH IN THE 1980s AND BEYOND

In discussing auditing research in the 1980s and beyond, our approach changes. Rather than provide an assessment of the impact of auditing research subdivided by research foci (behavioral versus statistical sampling), we now describe select research impacts of a more specific nature, organized around key audit topics. Accordingly, the bulk of the discussion in this section is presented in six subsections:

1. Management Fraud
2. Sampling
3. Materiality and Audit Risk
4. Control Risk
5. Audit Approaches, Procedures, and Error Detection
6. Business Risk

The section is concluded by a brief discussion of prominent research themes of the early 1990s and their implications for continued evolution of the audit risk orientation.

Management Fraud

In the late 1970s, PMM undertook a study of methods of detecting and deterring management fraud. This study included two research projects funded under the firm's ROA program. PMM also commissioned a group of papers on the issue by experts from a variety of related disciplines and sponsored a symposium, held during June of 1978, to discuss these papers. A book containing the results of the firm's research, together with the symposium papers, was published in 1980 (Elliott and Willingham, 1980). Also included in this book were papers on two ROA projects in which the focus was fraud (Albrecht, et al. 1980; Sorensen and Sorensen, 1980). Both of these papers advocated a "red-flag" approach to fraud detection by auditors.

The red-flag approach, involving a checklist of potential fraud indicators, was certainly not new. As Sorensen and Sorensen pointed out (1980, pp. 197–198), it had been used during the early 1970s by at least one large accounting firm. In addition, acceptance of the red-flag approach was expanded by the latter half of the 1970s with the appearance of SAS No. 6 (§ 11) and SAS No. 16, (§ 9 and § 10). The Albrecht study, however, contributed to acceptance of this approach because:

- The authors validated their initial list of red flags against seventy-two past cases of management fraud, including several of the most prominent cases of audit failure (Albrecht and Romney, 1980).²²
- The authors' validated fraud-risk-evaluation questionnaire was published in the *Journal of Accountancy* (Romney, Albrecht and Cherrington, 1980).

²² These cases included *Ultramares*, *McKesson & Robbins*, *Continental Vending*, *BarChris*, *Westec*, *Yale Express*, *National Student Marketing*, *Penn Central*, *Four Seasons*, *Stirling Homex*, *Equity Funding*, and *Hochfelder*.

- The study itself was widely publicized, including coverage in *U.S. News & World Report* and articles in several professional publications.²³

At least partly due to the impact of this study, use of a checklist of potential fraud indicators has become a more prevalent part of the risk-assessment process in practice and is currently prescribed in auditing standards (SAS No. 53 ¶ 10).

Sampling

In June of 1981, the Auditing Standards Board issued SAS No. 39, on *Audit Sampling*. This statement brought the audit risk model (previously contained in the appendices to SAP No. 54) into the main body of the authoritative pronouncements. The discussion of the model was framed in terms of risk rather than its complement (reliability), introducing the term *ultimate risk* to refer to the complement of what SAP No. 54 had called the *combined reliability level*. SAS No. 39 further distinguished between sampling risk and nonsampling risk, and identified the two types of sampling risk:

1. Risk of incorrect acceptance, related to the *effectiveness* of an audit.
2. Risk of incorrect rejection, related to the *efficiency* of an audit.

An appendix to SAS No. 39 expressed the formula for the audit risk model in terms of risk measures rather than the more cumbersome reliance measures employed in Appendix B of SAP No. 54. The new appendix also added analytical review risk to the model. Hence, SAS No. 39 effectively codified many of the research contributions of Stringer (1961, 1963, 1975), Elliott and Rogers (1972), and others who had addressed these topics during the 1960s and 1970s.

The results of a research project by Kinney and Uecker had a direct impact on the content of SAS No. 39. As reported in Kinney and Uecker (1982, p. 68), a proposed draft of the statement had suggested use of a subjectively created “upper error limit,” which then would be compared to the planning stage tolerable error rate to determine the acceptability of sample results. Kinney and Uecker’s experimental results, however, indicated that this method could lead to excessive risk of incorrect acceptance of a materially incorrect account balance, while that would not be the case for an alternative method (i.e., the risk assessment method). Using this method, the auditor assesses the risk of

²³ See the bibliography of Albrecht and Romney (1980) for a partial list.

material misstatement given the sample result and the planning criteria. On the basis of these findings, the Statistical Sampling Subcommittee decided to revise the proposed SAS to feature the risk-assessment method.

Materiality and Audit Risk

When using quantitative methods to measure sampling risks, auditors must “allocate” materiality to individual accounts. Clearly, when multiple accounts are involved, some subset of overall materiality would have to be used to control risks appropriately at the level of the financial statements. In their 1972 article, Elliott and Rogers proposed such a method, involving an equating of overall materiality to the square root of the sum of the squares of the materiality levels used for individual balances (1972, p. 53). The rationale underlying this method is from classical sampling. It is based on the relationship that exists between the standard deviation of a set of values and the standard deviations of mutually exclusive subsets that comprise the set (assuming that the subsets are statistically independent). Elliott and Rogers noted (fn. 9, p. 53) that an optimal solution to this “materiality allocation” problem existed, based on the variability and the relative audit costs of the accounts to be audited, but did not attempt to determine such a solution.

In one of the first ROA projects, a team of researchers led by Cushing derived an optimal materiality allocation algorithm, field tested it on four PMM clients, and reported potential moderate-to-large savings in audit costs (Cushing, Searfoss, and Randall, 1979). By the early 1980s, PMM was using a materiality measure for planning purposes called “gauge” (Elliott, 1983, p. 4), which was a variation of the original Elliott and Rogers concept. Concurrent with Elliott’s membership on the Auditing Standards Board (ASB), the notion of determining a maximum allowable monetary error for an account balance or class of transactions (tolerable error) based on some kind of allocation of overall materiality was incorporated into SAS No. 39 (§ 18). SAS No. 47, *Audit Risk and Materiality in Conducting an Audit*, was issued two years later, while Elliott was still an ASB member. This pronouncement devoted several paragraphs to explaining risk and materiality considerations at the financial-statement level (§ 9–16) and at the individual account-balance or class-of-transactions level (§ 17–26), with a brief discussion of the relationship between materiality assessments at the two levels (§ 18).

Three further points about SAS No. 47 are in order:

1. Some of the SAS No. 47 ideas relating to evaluation of audit findings were first discussed at the second Illinois Symposium on Auditing Research held in 1976 (Leslie, 1977).²⁴
2. A simplified approach to specifying tolerable error was described in a *Journal of Accountancy* article which Elliott co-authored (Zuber, Elliott, Kinney, and Leisenring, 1983).
3. Perhaps most important, SAS No. 47 added the concept of inherent risk to the audit risk model specified in the authoritative pronouncements.

Houghton and Fogarty (1991) describe a research project carried out by Deloitte Haskins & Sells to determine the characteristics of auditor-detected errors, and whether areas in which errors occur could be identified during the audit-planning process. These authors examined 480 audit engagements in the U.S., United Kingdom, and South Africa. They reported that nonsystematically processed transactions (journal entries) have a significantly higher likelihood of error than systematically processed transactions. They also found that a significant portion (73 percent) of the errors examined occurred in areas of higher inherent risk and either were or could have been identified during the audit planning process, based on prior knowledge of the client. Based on these findings, the firm implemented a significant modification of its audit approach to incorporate inherent risk analysis into its audit risk model.

Two papers published in 1983 cautioned auditors about potential misuse of the risk model in practice. In the first paper, Kinney (1983) explained how audit risks might increase if the risk model were improperly used to conditionally revise an audit plan or to evaluate audit results. In the second paper, Cushing and Loebbecke (1983) discussed several ways in which the audit risk model could provide misleading results in certain circumstances and then provided a number of recommendations for avoiding these potential problems when applying the model. These papers had substantial impact on the methods used in practice to implement the audit risk model, as promulgated in SAS No. 39 and No. 47.

In 1984, the *CPA Journal* published a series of articles on audit risk and materiality which were based on an internal Coopers & Lybrand monograph. In these *CPA Journal* articles, Graham (1985) provided the general practice community with insight into how SAS No. 47 might

²⁴ Leslie (1977) attributed these ideas to the then forthcoming book, *The External Audit* (Anderson, 1977).

be implemented. These articles have served as a framework for research on audit risk (Srivastava and Shafer, 1992; Haskins and Dirsmith, forthcoming) and are especially important because of the cautions they contain with respect to literal use of the audit risk model.

Most firm policy materials now follow these authors' advice and shy away from literal use of the model in evaluating audit results. In addition, to mitigate the strict independence assumptions inherent in the quantitative version of the model (as explained by Cushing and Loebbecke), in most firms, the model is supposed to be used with qualitative inputs. Leslie (1984) and his colleagues have, however, suggested a rather different approach, arguing that many of the shortcomings of the audit risk model would be overcome if the model were incorporated into a partial Bayesian framework. Such a framework was described in Leslie, Teitlebaum, and Anderson (1979) and later in the Canadian Institute of Chartered Accountants' (CICA) *Extent of Audit Testing* study (CICA, 1980) and in Leslie (1985).

Control Risk

Bailey et al. (1985) described how a computer-aided decision-support system based on artificial intelligence concepts could be used by auditors in analyzing and evaluating internal control systems. The paper reported several advantages of the proposed approach relative to traditional control evaluation methods. The authors offered their technical manual and software to interested readers. At least one firm, Price Waterhouse, has relied on these ideas in developing software for analyzing and evaluating internal control systems. The significance of the paper, however, is that it is an early application of expert-systems technology to an important auditing problem: the evaluation of control risk. Several other audit applications of expert systems, most developed by academics, were soon reported in the literature (Messier and Hansen, 1987; Messier, 1994). The potential advantages of expert systems as a practical audit tool were apparent, and a number of risk assessment and risk response aids have since been implemented in practice, including Risk Advisor by Coopers & Lybrand (Graham, Damens, and Van Ness, 1991) and ADAPT by Grant Thornton (Gillett, 1992).

SAS No. 55, *Consideration of the Internal Control Structure in a Financial Statement Audit*, issued during the late 1980s, specified that when assessing control risk, the auditor must obtain a sufficient understanding of the client's internal control structure, including: (1) the control environment, (2) the accounting system, and (3) control

procedures. One of SAS No. 55's key contributions relates to the importance of the auditor's understanding of the control environment. Numerous factors were included in the description of the control environment, notably:

- Management's philosophy and operating style
- The entity's organization structure
- The functioning of the board of directors and the audit committee
- Management's control methods for monitoring and following up on performance

SAS No. 53, *The Auditor's Responsibility to Detect and Report Errors and Irregularities* also was issued during the late 1980s. This SAS directed auditors to consider the potential for errors and irregularities at the financial-statement level, as well as at the level of account balances or transaction classes.

Kreutzfeldt of Arthur Andersen & Co., together with Wallace, provided a partial validation of key aspects of the exposure draft of SAS No. 55 (Kreutzfeldt and Wallace, 1990).²⁵ These authors pointed out that an underlying assumption of the proposed pronouncement was that the control risk factors identified in the exposure draft have a relationship to the occurrence of errors. Their study analyzed financial-statement errors leading to proposed adjusting journal entries on 260 audit engagements, randomly selected from the client base of Arthur Andersen & Co.'s thirteen largest U.S. offices. The authors concluded that the proposed control-structure attributes can provide information useful for improving estimates of appropriate levels of detection risk, both on an overall basis and at the account level.

The Kreutzfeldt and Wallace findings not only provide support for one of the most critical assumptions underlying SAS Nos. 53 and 55, but also provide limited empirical validation of the risk orientation that is the foundation of contemporary auditing standards and practices. While some aspects of SAS No. 55 have been subject to serious criticism (Morton and Felix, 1991), there have been no major challenges to this pronouncement's contribution to the risk orientation of contemporary auditing standards. Further, in concert with SAS No. 47, SAS Nos. 53 and 55 provide a powerful conceptual framework and practical operationalization of the modern audit risk orientation. Indeed, reflecting an apparent consensus shortly after the issuance of SAS Nos. 53 and 55,

²⁵ The Kreutzfeldt-Wallace study was presented at the University of Waterloo Audit Symposium in November of 1987, though its publication with the other symposium papers was delayed until 1990.

Alderman and Tabor (1989) characterized modern audits as “risk driven.”

As represented by Ashton and Ashton (1988), research on control risk assessments continued to be an important focus of the academic community during the 1980s. In this study, the authors recognized that an important feature of audit decision-making tasks previously had not been given sufficient consideration—namely, that evidence is collected and evaluated in a sequential, rather than simultaneous, fashion. Moreover, if auditors were to use certain simplifying judgmental rules of thumb, evidence order may affect such audit judgments and decisions, although such an effect would not be appropriate. Ashton and Ashton reported evidence consistent with audit usage of such simplifying cognitive mechanisms (i.e., the auditors’ judgments were affected by evidence order).

The Ashton and Ashton study may be viewed as a continuation of the line of research on simplifying judgmental rules of thumb (“judgment heuristics”), popular in the early 1980s.²⁶ This line of research gained favor, in part, because, use of such heuristics could lead to departures from “optimal” judgments and decisions. In addition, to the extent that different auditors adopt different rules of thumb or use them to different degrees, greater decision-making variability and, in turn, less consistent audit intensity may result.

Audit Approaches, Procedures and Error Detection

In 1981, Cushing and Loebbecke analyzed the audit approaches of twelve large accounting firms. This research led these authors to identify a key attribute of a firm’s audit approach, the *audit structure*:

We define a structured audit methodology as a systematic approach to auditing characterized by a prescribed, logical sequence of procedures, decisions, and documentation steps, and by a comprehensive and integrated set of audit policies and tools designed to assist the auditor in conducting the audit (Cushing and Loebbecke, 1986, p. 32).

In the study, fourteen elements were delineated which could be used to measure the degree of structure of a firm’s audit approach. Variations among these elements of structure across the twelve subject firms also

²⁶ Two of the more widely cited papers in which auditor usage of judgmental heuristics was investigated are Joyce and Biddle (1981a and b). See Solomon and Shields (1994) for other papers in which auditor usage of judgmental heuristics was investigated.

were reported. A draft of their research results was widely circulated among auditing academics and practitioners in 1983, and it stimulated a debate on the issue of audit structure at the 1984 Touche Ross/University of Kansas Audit Symposium (Mullarkey, 1984; Sullivan, 1984). The final version of the Cushing and Loebbecke research was published in 1986 by the American Accounting Association as *Studies in Accounting Research* #26.²⁷

The Cushing and Loebbecke study was important for several reasons. The first reason is that, from the perspective of this chapter, documentation in the monograph clearly showed that auditing practice had changed radically from the view of an audit as a relatively inflexible set of procedures, as reflected in the AIA's 1936 pronouncement, *Examination of Financial Statements by Independent Public Accountants*. In a flowchart of the audit process derived from then-current auditing standards, Cushing and Loebbecke (1986, pp. 7–12) showed that those standards depicted the audit process as a complex decision process. Under this process, the audit program was designed, and later modified as necessary, to control audit risk effectively. This characterization also was reflected in their description of the audit approaches of the participating firms (chapters 3 and 4).

Another contribution of the Cushing and Loebbecke study is the identification of differences in audit structure which provided “a new framework for studying many types of audit judgments” (see *Research Opportunities in Auditing: The Second Decade*, Abdel-khalik and Solomon, 1988, p. 9). In recent years, researchers have used the audit structure construct to attempt to explain a variety of phenomena, including audit judgments ranging across all stages of the audit process, as shown in Table 1. These phenomena include risk assessments made at the preliminary planning stage of the audit (Huss and Jacobs, 1991), while assessing inherent risk (Dirsmith and Haskins, 1991), and during the audit reporting stage (Mutchler and Williams, 1990).

Unfortunately, there is little documented evidence of the impact of this research on practice or on trends in CPA firm structure, though some informed speculation is possible. It seems likely that auditing applications of recent advances in information technology, such as expert systems and other decision aids, has tended to increase the degree of structure of all firm audit approaches. Nevertheless, while some firms appear to be moving toward a more structured audit approach, at least one major firm (Deloitte and Touche) in recent

²⁷ The authors of this monograph received the 1987 Wildman Award for the significance of its contribution to the professional practice of accounting.

TABLE 1 Analysis of Audit Structure Research Classified by Audit Process Step

<i>Audit Process Step</i>	<i>Research Topic and Citation(s)</i>
Preliminary audit planning	<ul style="list-style-type: none"> • Client acceptance and continuance decisions (Huss and Jacobs, 1991). • Auditors' planning problem representations (Christ 1993).
Risk assessment	<ul style="list-style-type: none"> • Inherent risk assessment (Dirsmith and Haskins, 1991).
Audit program planning	<ul style="list-style-type: none"> • Auditor sample size decisions (Bamber and Snowball, 1988; Kachelmeier and Messier, 1990).
Performance and evaluation of tests	<ul style="list-style-type: none"> • Auditor use of computer-assisted audit techniques (Lovata, 1989). • The effectiveness and efficiency of auditor task performance (McDaniel, 1990). • The disposition of audit-detected errors (Iceman and Hillison, 1991). • Auditor preferences for decision aids (Abdolmohammadi, 1991).
Reporting decisions	<ul style="list-style-type: none"> • Materiality judgments relating to consistency exceptions (Morris and Nichols, 1988). • The timing of issuance of the financial statements (Williams and Dirsmith, 1988; Newton and Ashton, 1989; Cushing, 1989; Bamber, Bamber, and Schoderbek, 1993). • Going-concern opinion decisions (Mutchler and Williams, 1990).
Other/general	<ul style="list-style-type: none"> • Accounting firm preferences for auditing standards (Kinney, 1986). • Auditor perceptions of role conflict and role ambiguity (Bamber, Snowball, and Tubbs, 1989). • The characteristics of audit markets (Kaplan, Menon, and Williams, 1990). • The assessment of audit quality by audit committees (Knapp, 1991). • Organizational-professional commitment (Schroeder, Reinstein, and Schwartz, 1992)

years has suspended use of some of the more highly structured aspects of its audit process.

In a 1982 paper entitled "Audit Detection of Financial Statement Errors" (Hylas and Ashton, 1982), Hylas of PMM and Ashton of Duke University reported the results of an empirical study of 281 errors requiring financial-statement adjustments on 152 PMM audits. The errors were found to be concentrated in relatively few areas and were fairly predictable by industry. In summarizing the results of the study, the authors stated that a "large portion of financial statement errors are initially signaled by less rigorous audit procedures such as analytical review and discussions with the client" (p. 764). In a subsequent research study, St. Pierre and Anderson (1984) investigated factors associated with lawsuits against public accountants. Their finding, that auditors' litigation risk is higher for new clients and certain industries, highlights the importance of developing an understanding of the client's business. While it is difficult to discern a direct impact of these studies, it seems likely that their findings have contributed to, or at least supported, a significant trend which has since become evident: placing greater emphasis on understanding the client's business, and substantially increasing the extent to which analytical procedures are performed and changing how the resulting evidence is used. KPMG Peat Marwick's recent reorganization to emphasize industry expertise may be viewed as a recent manifestation of this trend.

SAS No. 55 mandated an audit-process change that is important because it relates directly to our risk orientation subject matter and because extant research has elucidated a pitfall in potential ways of satisfying the requirement. In particular, SAS No. 55 instructs the auditor to extend risk analysis down to the level of specific assertions within an account balance or class of transactions. However, SAS No. 55 offers little guidance on how to aggregate assertion-level risk assessments to obtain overall risk at the account-balance level. Although firms have developed their own techniques (some well in advance of SAS No. 55), Lea, Adams, and Boykin (1992) identified conditional independence among assertion-level risk assessments as a requirement for coherent aggregation of assertion risks. Further, these authors showed that aggregation of assertion-level risk assessments by transaction stream achieves this conditional independence, while it is not achieved when the aggregation is by account balance. Their paper also includes several other suggestions on how assertion-level risk assessments may be integrated within the audit planning process.

Business Risk

As early as 1983, the risk orientation had become sufficiently entrenched that practicing auditors thought and wrote about aspects of their practice not directly related to the audit process in risk terms. One of the best-known examples is the concept of business risk which Brumfield, Elliott, and Jacobson (1983) defined as “the probability that an auditor will suffer a loss or injury to his professional practice” (p. 60). While concern about business risk matters may previously have influenced audit practice, the coining of the “business risk” term and appearance of the aforementioned article in the *Journal of Accountancy* seem to have signaled a heightened concern about such matters. Changes in market conditions (e.g., increased competition) had altered the cost-benefit calculus for audit services, thereby exacerbating business risk concerns.

Researchers, often using economic analysis, began to investigate these changing market conditions. For example, Simunic (1980), in contrast to claims by government regulators that the largest audit firms monopolized the market, suggested that price competition prevailed throughout the market for audits of publicly-held companies. Business risk considerations played a major role in Simunic’s modeling of the pricing of audit services. Consistently, DeAngelo (1981a) argued that audit firm size is a surrogate for audit quality (i.e., *ceteris paribus*, larger firms deliver higher quality) and thus, provided additional perspective on the supply side of the market for audit services. Empirical evidence, including Palmrose (1986) and Francis and Simon (1987), supported her arguments.

Another contentious issue involved the pricing of audit services, in particular, “low-balling.” DeAngelo (1981b), again using an economic framework, provided an appealing explanation for the observed phenomenon and subsequent studies provided consistent empirical evidence. For example, Simon and Francis (1988) reported evidence both of price cutting and price recovery in the context of auditor change.

Business risk is prominently affected by litigation. Indeed, some practitioners use the term *litigation risk*, to describe auditors’ loss exposure (Sullivan, 1992). Factors associated with litigation were documented in research during the late 1970s and during the 1980s, including Schultz and Gustavson (1978), St. Pierre and Anderson (1984), and Palmrose (1987).²⁸ Size (larger clients), industry, financial

²⁸ This line of research continued into the 1990s, as evidenced by Stice (1991), Carcello and Palmrose (1994), and Lys and Watts (1994).

distress, financial failure, and irregularities are among those factors which have been associated, in these studies, with a greater likelihood of auditor litigation. Given the increase in alleged audit failures during the latter part of the decade, especially in the savings and loan industry, business risk concerns certainly did not dissipate during the 1980s. On the contrary, as evidenced by the increased attention given to client retention and acceptance decisions by both researchers (Huss and Jacobs, 1991) and practitioners, concerns about business risk arguably reached new heights as the 1990s approached.

The 1990s

In the early 1990s, investigation into a variety of significant research issues relating to audit risk began. Of course, it would be premature to assess the impact on audit practice and standards. Nevertheless, it is instructive to consider selected research endeavors of the 1990s. One issue, initially raised by Leslie (1984), and still unresolved, involves determining whether it would be beneficial to modify the simple joint-probability risk model from SAS No. 47 to incorporate expectations and prior experience (i.e., a Bayesian framework), as many audit researchers have suggested (Kinney, 1989; Aldersley, 1989; Smieliauskas, 1989; Sennetti, 1990). Another issue, pursued initially by Shibano (1990), is whether the audit risk model, as depicted in extant authoritative pronouncements, provides adequate guidance to auditors who may be concerned about management fraud. Shibano's approach is to separate audit risk into nonstrategic (relating to unintentional misstatements) and strategic (relating to intentional misstatements) components. This approach results in an enhancement of the audit risk model, yielding a richer understanding of audit risks and a strategic audit testing theory more useful for designing audits for irregularities.

The use of belief functions to analyze the decision process underlying audit risk assessment has been described in detail by Srivastava and Shafer (1992) and extended to audits for irregularities by Srivastava et al. 1993. In this research, models of audit risk are developed at the statement, account and audit objective levels utilizing levels of belief (based on an absence of opposing evidence) rather than mathematical probabilities. These authors note, however, that many practical issues must be addressed through further research before their approach would be feasible. Future research results produced by those who choose to extend these initial inquiries could have broad implications for practice and standards.

Behavioral research on auditor judgment in the assessment of audit

risks continues to be pursued, as exemplified by the Brown and Solomon (1990, 1991) studies. Moreover, recognizing the trend toward greater use of analytical procedures, behavioral audit researchers during the 1990s have increasingly turned their attention to such procedures. Studies elucidating the complex auditor cognition involved in performing such procedures (Koonce, 1993) have begun to be reported, as have studies addressing the role of auditors' knowledge in the specification of plausible hypotheses for unexpected analytical procedure fluctuations.

A related stream of research has produced intriguing, albeit preliminary, evidence that even expert auditors naturally focus their hypothesis evaluation efforts on explaining or supporting the hypothesis under consideration instead of "playing devil's advocate"—determining whether other hypotheses could account for the fluctuation (Heiman, 1990; Koonce, 1992). Fundamental questions also are being raised and investigated concerning the nature of auditor expertise with respect to risk assessment and other audit tasks and the role that experience plays in such expertise formation (Bonner and Lewis, 1990). Finally, business risk concerns reached the level at which the accountancy profession began a push for liability reform. This legal reform movement has created a sharp demand for research (Elliott, 1993; Kinney, 1993).

While substantive implications may eventually be drawn from studies such as those just mentioned, in most cases it is too early to tell what their impact will be. Additional scrutiny certainly will be given to those studies reporting the most important results. In the interim, auditing scholars, practitioners, and scholar/practitioner teams will continue to raise and conduct research on new issues relating to the assessment and evaluation of both audit and business risk.

CONCLUDING REMARKS

In this chapter, we have documented a transformation of the predominant auditing approach in the U.S. over the past century from: (1) an emphasis on verification of bookkeeping detail in the late nineteenth century, to (2) a balance-sheet audit approach in roughly the first half of this century, to (3) the risk-based approach which dominates current auditing standards and practice. We also have attempted to elucidate both the indirect and direct impacts of auditing research on this transformation. It is important to note, however, that the auditing research cited in this chapter has not been performed by academics

acting alone. Rather, a significant portion of the research has been carried out by practitioners, sometimes collaborating with members of the academic community.

The continuous interaction between auditing scholars and practitioners, which has been a theme of this chapter, extends back at least to Montgomery, a founding partner of what is today Coopers & Lybrand, an auditing scholar at several universities, and an educator who authored a leading auditing text. More recently, this interaction has taken several forms, including:

- Joint participation in auditing research symposia
- Research programs, such as Research Opportunities in Auditing
- Sponsored research directed at specific audit practice problems
- Consulting engagements
- Joint involvement in the Auditing Section of the American Accounting Association, and in the editing of its research journal, *Auditing: A Journal of Practice & Theory*
- Academic participation on the Auditing Standards Board
- Frequent movement of auditing practitioners into academic positions, and vice versa.

These forms of academic/practitioner interaction are now a firmly established feature of the auditing environment in the U.S. and Canada. This observation suggests that auditing research and researchers will continue to exert significant influence on auditing practice and standards.

In closing, we wish to revisit the observation made in the introductory section of this chapter. As our story has revealed, selective testing played a key initial role in stimulating evolutionary change in both the character of audits in the U.S. and in the audit process. Selective testing, in turn, resulted in consideration of sampling and also, in concert with a desire to formalize the audit process and exercise better control over important audit outcomes, an emphasis on statistical sampling in both practice and research. Later, an overriding analytical structure for the audit emerged, with risk assessment and evaluation playing a major part. But the emphasis in both research and practice on statistical sampling has now dissipated. In its place are the audit and business risk assessment, analytical evaluation, and controls perspectives—the modern audit risk orientation.

Audit Judgment

E. Michael Bamber, *University of Georgia*; **Peter R. Gillett**, *University of Kansas* (chapter lead author); **Theodore J. Mock**, *University of Southern California*; **Ken T. Trotman**, *University of New South Wales*

OVERVIEW

Risk Orientation described the development of the risk-based approach of current audit practice. As noted, auditor judgment plays a very important part in that story. In fact, audit judgment is pervasive throughout the audit risk perspective, from decisions involving audit sampling to all aspects of nonsampling risk. This chapter will sketch the history of audit judgment research¹ in an attempt to illustrate the impact of this line of research on audit practice. In particular, we present in some detail two collaborative audit research studies. The first deals with the evaluation of internal control and related audit program planning; the second with a decision-support system for audit program tailoring. Inevitably, this chapter presents only an outline of audit judgment research and does not attempt to be complete in depth or in breadth of coverage.

The professional and academic auditing literature has recognized for a number of decades the importance and pervasiveness of judgment in auditing. The characteristics of auditing that are common to other professions such as medicine, law, and psychology are the possession of a body of knowledge and a sense of responsibility to society with regard to the use of this knowledge (Windal and Corley, 1980). This knowledge permits the professional to make judgments beyond the scope of the nonprofessional. AICPA (1955) states that “judgment is the most important factor in the making of an audit,” and Mautz (1959) states that “judgment must inevitably play a major role in auditing.” More recent AICPA Statements on Auditing Standards (SAS) have

¹ The term we use in this chapter is *judgment research*. The term is meant to include behavioral auditing research, research into audit decision making, and research into audit decision support. The terms *judgment* and *decision making* are used interchangeably in this chapter.

discussed the need for auditors' judgments in many areas. Auditing firms explicitly endorse these statements with many references in their audit manuals to the importance of the exercise of professional judgment at the various stages of the audit.

Table 1 lists typical judgment activities and the types of judgments to which these activities lead. Research has been conducted on most of these activities, some of which is summarized within this chapter.

Much of the research we consider in this chapter concentrates on how and how well auditors perform audit judgments. Some of the questions addressed include:

- What is the level of consensus on auditor judgments?
- Are auditor judgments consistent over time?
- What is the level of auditors' self-insight?
- To what extent are auditors subject to the same biases as other judges, and what heuristics do they use?
- Are auditors overconfident or well calibrated?
- Are auditors conservative in making judgments?
- What information (i.e., cues) do auditors rely on in making judgments?
- What is the relationship between experience and expertise?
- How does the auditor's knowledge develop with experience?
- How can audit judgments be improved?
- What are the roles of group judgment, workpaper review, and decision aids in improving the effectiveness and efficiency of audit judgment and decision making (cf. Solomon and Shields, 1994)?

Ultimately, the quality of the eventual audit opinion must depend on the quality of a myriad of decisions taken in the course of planning and performing the audit. The nonsampling risk of reaching an incorrect or inappropriate opinion referred to in Risk Orientation is affected, more significantly than by any other factor, by the success or failure of the exercise by the auditor of professional judgment in a variety of situations.

BACKGROUND

What audit procedures should be performed? In what areas should audit effort be focused, and on what issues? What should be the nature, timing, and extent of audit procedures? How should the evidence obtained from a variety of sources be aggregated? What

TABLE 1 Judgment Within the Audit Process

<i>Judgment Activities</i>	<i>Resulting Judgments</i>
Establishing materiality	<ul style="list-style-type: none">• Accounting materiality• Audit materiality• Acceptable business risk
Identifying important audit objectives and assertions	<ul style="list-style-type: none">• Important audit areas• Important transaction streams and balances• Important financial statement assertions
Assessing the inherent risk environment	<ul style="list-style-type: none">• Implications of the client environment for identification of potential audit concerns, focuses of audit attention, and control structure• Inherent risk assessment for financial statement assertions
Evaluating internal controls	<ul style="list-style-type: none">• Potential for improved audit efficiency or effectiveness based on assessing control risk as less than maximum• Key controls for testing• Control risk for financial statement assertions• Weaknesses in controls (reportable conditions)
Developing an audit strategy	<ul style="list-style-type: none">• Reliance on tests of controls• Potential for different audit approaches (e.g., suitability of various analytical procedures as substantive evidence, circumstances favoring statistical or nonstatistical audit sampling, or other forms of tests of details)• Emphasis on balances or on transaction streams
Generating the audit program	<ul style="list-style-type: none">• Identification of strategic assertions• Selection of an appropriate combination of specific audit procedures and determination of scope and timing of application

Continued.

TABLE 1 Judgment Within the Audit Process—cont'd

<i>Judgment Activities</i>	<i>Resulting Judgments</i>
Selecting and evaluating analytical review procedures	<ul style="list-style-type: none">• Particular procedures to be applied, data to be used, relevant formulae, and calculations• Development of expectations• Identification of significant fluctuations• Formulation and corroboration of explanations of fluctuations
Evaluating the results of audit testing	<ul style="list-style-type: none">• Conclusions on the results of specific audit procedures in relation to their objectives and to the results obtained
Considering the materiality of unadjusted audit differences	<ul style="list-style-type: none">• Consideration of the nature and amount of unadjusted audit differences individually and in aggregate in relation to their potential impact on users of the financial statements• Decision whether to press for adjustment by the audit client or to accept the differences as immaterial
Determining the going-concern basis	<ul style="list-style-type: none">• Whether the client can reasonably be expected to continue in operation for the forthcoming twelve months
Applying generally accepted auditing standards and accounting principles	<ul style="list-style-type: none">• Identification of relevant accounting and auditing standards• Determination whether such standards have been appropriately applied in the light of client circumstances• Identification of appropriate courses of action in cases where standards have not been correctly applied
Applying the Code of Professional Conduct	<ul style="list-style-type: none">• Determination whether auditor behavior is acceptable within the dictates of professional requirements and ethical principles
Selecting an appropriate audit opinion	<ul style="list-style-type: none">• Whether the financial statements fairly present results for the period

audit conclusions may be drawn? What audit opinion should be rendered?

These questions, and many others like them, indicate that the very notion of an audit is inextricably linked with the exercise of judgment. As Risk Orientation has described, the audit approaches used by firms may be characterized as more or less structured; and at least for the more structured approaches, quantitative models have been proposed to address some of the potential judgment issues.

For example, Audit Sampling describes the development of approaches to the determination of sample sizes by the application of statistical techniques. The superiority of Bayesian over classical methods has been fervently argued (Johnstone, 1994), and the merits of *influence diagrams* as a decision tool have been extolled. Srivastava, Shenoy, and Shafer (1990) have argued for a *belief-function* approach (cf. note 4 below). Some advocate an overtly subjective approach to audit judgment. Even when normative models are favored, human elements are necessarily involved in the practical application of a firm's audit approach and the extent to which normative models accurately describe actual auditor behavior is an empirical issue. At stake is the extent of nonsampling risk to which the auditor is exposed.

Historically, the manner in which the auditor made these various judgments was not a subject widely discussed. It was considered simply a matter of "professional judgment," gained by years of training and experience. There was some sentiment that "in the best of all possible auditing worlds, every auditor, given the same set of facts, would select the same auditing procedures and apply them to the same extent" (Hicks, 1974, p. 40).² However, the profession also recognized that there was a plethora of alternative approaches to conducting an acceptable audit. In its call for research into the audit process, Peat, Marwick, Mitchell & Company (1976) explicitly recognized the existence of serious gaps in the understanding of the audit process, which compounded the difficulty in evaluating these alternatives:

The criteria now used for selecting particular procedures to meet specified audit objectives are highly subjective. . . . There is no systematic way to determine whether the chosen procedures are superior to others (singularly or in combination) that could have been used.

² This sentiment was clearly dispelled in the experimental study of Mock and Turner (1981), where 200 experienced auditors, given an identical set of facts, exhibited significant variability in their judgments and decisions.

In the last twenty years, a significant amount of systematic research has appeared that has aided policy makers and accounting firms in their deliberations on the formulation of audit policies and procedures. This literature is usually described as audit judgment/decision-making research or human information processing research in auditing. The aim of this research has been to describe actual behavior, assess judgment performance, establish the factors that determine judgment performance,³ and test theories of the cognitive processes that produce the judgments and decisions. These studies also provide the information necessary for suggesting and testing steps (e.g., decision aids) for facilitating judgment, since it is necessary to understand a decision process before attempting to improve it (Libby, 1981; Libby and Luft, 1993).

Prior to the early 1970s, there was little scientific audit judgment research. However, this changed with a substantial number of publications appearing from 1974 onwards. During the 1970s, several forces operated to make audit judgment an issue. First, through mergers and acquisitions, the leading accounting firms were growing along with their clients, and they began to examine the effectiveness and efficiency of their auditing methods and policies. By inference, recognition of nontrivial differences between practices implied that gains in audit efficiency, if not in effectiveness, were possible. Mautz (1975, p. 95) comments that “variations in the nature, extent, and timing of audit tests for equivalent situations may not fall within a reasonable range even for a single firm, much less for the entire profession.” Second, a series of cases (*Equity Funding*, *U.S. Financial*, *National Student Marketing*, and *Fund of Funds* were some of the most visible) where auditors failed to uncover massive fraud or warn of imminent financial failure led to the claim that there was a gap between what society expected and what the audit delivered (Causey 1982). This raised obvious questions about the effectiveness of the audit function and, by implication, of audit judgment.

Besides the above demand factors, a number of supply factors have been influential. First, accounting researchers became aware of the use

³ A line of research that is not discussed to any extent in this chapter deals with normative or optimal models of audit decision and judgment. Early examples of this type of research developed decision theory and Bayesian models (Kinney 1975a, 1975b). More recent examples include the theory of belief functions and multistage Bayesian models (Srivastiva, Shenoy, and Shafer, 1990; Krishnamoorthy, Mock, and Washington, 1993). Note, however, that most audit judgment research assumes or specifies some type of benchmark by which to assess the judgments or the judgment process such as accuracy, consensus, or variability.

of the *Brunswik lens model* as a method of descriptively modeling the process through which auditors and users of accounting reports make judgments. Ashton (1974) was the first to adopt this model in auditing and provided a framework that allowed audit researchers to investigate various audit judgment issues. Second, a follow-up study by Joyce (1976) found conflicting results for the extent of testing compared to the internal control judgments considered by Ashton.

These differences in results across tasks, together with the very rich discussion and future research sections in both Ashton and Joyce papers, led to many Ph.D. topics and research proposals aimed at addressing these issues. Third, the first audit research conferences were held at the University of Kansas and the University of Illinois during this time. Finally, the publication of *Research Opportunities in Auditing* by PMM in 1976, together with the ROA Program, which provided funding for audit research, had a considerable impetus on research output.⁴

The critical feature of this research starting with Ashton (1974) was that it introduced scientific method to the study of audit judgment. Conclusions based on anecdote and casual observation are limited at the best of times.⁵ In auditing, an individual auditor's typical exposure to only a few clients and the limited communication within and across firms (at least until peer reviews became standard) particularly restricts the available range of experiences.

Ashton (1983, p. 3) identifies three features of audit judgment research that have contributed to both its scientific quality and its practical usefulness:

1. The use of decision-making paradigms (such as the *Brunswik lens model*) which, as noted above, facilitate the systematic study of the

⁴ This research impetus was strengthened by the publication of several books/monographs on the research paradigms (Ashton, 1982; Ashton, 1983; Libby, 1981) and some major review articles (Libby and Lewis, 1977, 1982; Joyce and Libby, 1982; Birnberg and Shields, 1984; Felix and Kinney, 1987; Wright, 1988; Solomon, 1987; Ashton et al., 1988; Bonner and Pennington, 1991; Libby and Luft, 1993). The three audit judgment chapters by Libby, Messier, and Solomon, and Shields in the latest Ashton and Ashton (1995) book continue this impetus.

⁵ Dawes (1988, p. 102) gives the following example of the dangers of conventional wisdom based on experience rather than scientific study: "My colleagues who claim to know that no child abusers stop on their own do in fact have experience with abusers. The problem is, of course, that these therapists' experience is limited to those not stopped on their own, and since their experience is in treatment settings, these abusers cannot by definition stop without therapy. What happens as a result is that the very nature of my colleagues' experience precludes contact with the subset of people whose extent is at issue: child abusers who stop on their own."

components of audit judgment and the integration of the results from various studies into a coherent body of findings.

2. The use of controlled experimental settings, critical for removing the many confounding factors that make audit judgment so complex. The controlled experimental setting permits anecdote to be put to the test.
3. The extension and replication of prior research.

Ashton (1983, p. 4) concludes that

the consistency of research findings obtained across different substantive decision tasks, different auditors, different researchers, and different degrees of realism should increase substantively the confidence that both researchers and practitioners have in the relevance of the research for audit practice and policy-making.

Arguably, the accounting academic has a comparative advantage in conducting research with the three features identified by Ashton (1983). As an objective outsider, the academic should be less constrained in conducting controlled experiments and more questioning of conventional wisdom. He or she also has the opportunity, with the support of accounting firms, and being less constrained by firm affiliation, to tap a larger subject pool.

Consequently, in this chapter we focus on the contribution of this scientific inquiry to understanding audit judgment itself and the implications of the research for audit practice and education. We do not provide a comprehensive review of audit judgment research; many related topics that have been the focus of considerable judgment research are covered in other chapters of this monograph. For comprehensive reviews of the audit judgment literature, there are a number of excellent books and review articles that have been identified earlier.

EARLY AUDIT JUDGMENT RESEARCH

The early studies (1970s and 1980s) examining audit judgment focused on evaluating the quality of audit judgment. Without externally observable criteria for evaluating judgment accuracy, researchers used a variety of complementary measures to evaluate the quality of audit judgment. The most widely used measure, as Risk Orientation notes, was *consensus*, the extent of agreement between auditors. Other characteristics examined included the consistency in the auditor's judgments

over time, the auditor's confidence in his or her judgments, and the auditor's self-insight in terms of the perceived emphasis given to various information inputs versus the actual weight placed on the inputs. These studies also examined auditor cue usage. Most of these studies extended Ashton (1974).

Ashton (1974) examined auditors' internal control judgments over payroll. The auditor-subjects responded to a series of cases, consisting of different responses to the same six internal control questions (e.g., "The tasks of timekeeping and payment are adequately segregated from the task of payroll preparation") by rating the strength of internal control in each case. Consistent with the conventional wisdom, auditors placed greatest significance on the segregation-of-duties cues. Ashton also found the extent of consensus (average correlation) between auditor judgments on the strength of the internal control systems was relatively high ($= 0.70$), compared to the consensus found in studies of other types of expert judges, for example, stockbrokers and radiologists (Slovic, Fleissner, and Bauman, 1972; Hoffman, Slovic, and Rorer, 1968). His findings were also inconsistent with some earlier auditing studies (for example, Aly and Duboff 1971, Corless 1972).

Joyce (1976) extended Ashton's study by examining the hours planned for substantive testing. Joyce also used a series of cases to manipulate internal control characteristics, but he examined the accounts receivable area rather than the payroll area. Joyce found a lack of consistency across auditors' program planning judgments (mean consensus of 0.37) and that auditors had considerably lower self-insight than did Ashton's subjects (0.53 versus 0.89, out of a maximum of 1.0). Joyce suggests that while auditors may agree on the evaluation of internal control, they may disagree on "how to incorporate that evaluation in a judgment of what audit work to plan and perform" (Joyce 1976, p. 53).

The Ashton (1974) and Joyce (1976) studies have been replicated and extended by subsequent research. Trotman and Wood (1991) identify seventeen studies that examine consensus in internal control judgments. Overall, the results show higher mean consensus than typically reported in non-auditing studies. However, there is considerable variation in consensus between studies. Interestingly, Trotman and Wood do not find any evidence that these differences can be explained by moderator variables, including auditor experience, type of internal control system, and length of internal control questionnaire.

More generally, Solomon and Shields (1994) review twenty-eight studies that model auditor judgments. They conclude that, with only a few exceptions, the results of the auditing studies are consistent with

non-auditing studies. The primary result is that, at best, auditors only exhibit moderate levels of consensus.⁶ These results are consistent with Mautz's (1975) earlier concern over the lack of consistency that may exist in audit practice. The results suggest that there is scope for improvement in audit judgment and, thereby, audit practice.

The SEADOC Saga

In the 1970s, the subject of internal accounting controls received significant attention within the profession. Important events during this period included the passage of the Foreign Corrupt Practices Act. Unfortunately, when practitioners looked to academic researchers for knowledge that might help with issues such as internal accounting control evaluation, they quickly discovered that little was available.

In 1977, Peat Marwick began two parallel research efforts aimed at enhancing audit research. The first effort was the well-known *Research Opportunities in Auditing* program. The chief element of this program was the yearly research grant competition that selected and funded approximately ten academic research projects. A less well-known effort was Peat Marwick's in-house research program, in which academics were selected to spend one or more years within the firm, conducting research on an agenda of research issues generated by the firm. The first of these in-house efforts resulted in the research that ultimately led to System Evaluation Approach, Documentation of Controls (SEADOC). This research project is summarized below, along with some of the important implementation efforts that led to the ultimate use of SEADOC within KPMG.⁷

SEADOC, a system for documenting internal accounting controls and a decision aid for evaluating accounting control systems, was in essence an extension of SEA (System Evaluation Approach), Peat Marwick's method of documenting internal controls. SEA relied heavily on the flowcharting of accounting systems. The extension process that led to SEADOC involved both a basic research phase and a field test phase.

⁶ There have also been several studies (Crosby, 1981; Solomon et al., 1982; Shields, Solomon, and Waller, 1987) that have examined auditors' ability to make probabilistic judgments. These studies also find low levels of consensus and, in addition, judgments that are affected by the method used to elicit the probability distributions.

⁷ Details of the original research are reported in Mock and Turner (1981). A detailed historical development of SEADOC is contained in Mock and Willingham (1983, pp. 91-99).

The Basic Research Phase The basic research began in 1977, with a research plan designed to address the following questions:

1. To what extent and in what manner do experienced auditors respond to different evidence of the effectiveness of internal controls?
2. What factors do auditors consider in making and in justifying their audit planning judgments?
3. Are auditors' decisions influenced by different types of decision aids, guidance, and approaches?
4. Are auditors' decisions influenced by heuristics, training, experience, or other behavioral differences?

A three-phased research approach was employed to address these issues and others that arose during the course of the research. Phases I and II consisted of a series of five related field experiments, where experienced auditors completed a study and evaluation of a case designed to replicate the data normally available in Peat Marwick workpapers. The primary decision task for the auditors was to provide sample-size recommendations and a related rationale memo. Phase III was a protocol study that utilized process-tracing techniques, again using experienced auditors solving the same realistic audit case. Mock and Turner (1981) provide details on each of these phases.

The general results of the basic research phases showed that the study and evaluation of internal controls is much more complex than was previously believed. For example, the results showed:

Significant variability and lack of consensus in recommendations among auditors, the majority of which was not explainable in terms of the manipulated variables (differences in control risk assessments, differences in decision guidance that was provided, and additional manager review) or in terms of measured independent variables (experience, training, anchoring, cognitive-width, etc.);

Significant variability between auditors in their interpretations of the nature and relevance of the audit procedures, of the internal accounting controls, and of other audit factors;

Significant variability in auditors' decision processes in terms of information search, alternatives considered, criteria applied, and heuristics utilized; and

Lack of comprehensiveness and clarity in the auditors' retrospective documentation of the rationale for their recommendations.

Findings of this nature imply an enhanced possibility of excessive audit costs through overauditing, as well as unwarranted reliance on

controls, which might lead to a high risk of audit failure through underauditing. The findings also provide empirical evidence and insights into means of improving the study and evaluation of systems of internal accounting controls—in short, the basis for the design and implementation phases of the research. Over a period of approximately two years, the knowledge gained from the basic research phase plus additional research led to the design of SEADOC, which differed significantly from earlier approaches used at Peat Marwick to study internal accounting control within an audit. These differences in their approach to internal control evaluation are detailed in Mock and Willingham (1983).

The Field Tests The field tests were undertaken to satisfy the following objectives:

1. Obtain additional data on the overall efficiency and effectiveness of SEADOC
2. Gain assurance about the applicability of SEADOC to different types of entities and to entities operating in different regions including overseas locations
3. Gain assurance of the applicability of SEADOC to computerized systems
4. Debug SEADOC documentation, procedures, and techniques
5. Determine the most effective way to bridge SEADOC results to other audit procedures
6. Gather information on the type of training needed to fully implement SEADOC

The Field-Test Population. Twenty-two engagement teams participated in the field tests. The engagement teams were from sixteen different offices, including Paris, The Hague, Frankfurt, and London. In addition to several manufacturing companies, the clients included representatives of the savings and loan, banking, education, printing, retailing, freight forwarding, and oil and gas industries.

The clients ranged in size from \$700,000 to \$864,000,000 in total assets and from \$300,000 to \$1.4 billion in total revenues. Total audit hours of the field test engagements ranged from 175 to 4,000. Total audit hours of seven of the twenty-two engagements were 500 or fewer, whereas eight of the twenty-two were 1,000 or more.

The areas chosen by the engagement teams for field test work covered all of the traditional “cycles”—revenue, purchases, inventory, and payroll. Three engagement teams applied SEADOC to the entire company.

The fields tests led to the expectation that the implementation of SEADOC would realize a 17-percent reduction in audit hours for new clients. Perhaps more important, the new documentation proved to be more effective than the old, and it produced more consistent documentation from client to client and auditor to auditor. It is always difficult to realize both increased efficiency and increased effectiveness with any innovation, but the Peat Marwick experience with SEADOC has shown it is possible.

Further, the initial research produced not only SEADOC, but also two sampling decision aids, both based on mathematical models. One is used to determine compliance test sample sizes after controls are documented and analyzed. The other is used to determine substantive-test sample sizes after controls have been tested. These decision aids, together with SEADOC, were designed to respond to the original research findings on variability in auditors' sample-size decisions.

One additional result of the in-house research that led to SEADOC was an attempt to update the various Peat Marwick audit training courses. Part of this process included consulting a number of academics concerning materials and content of their courses. This led to the inclusion of materials related to the role of heuristics and biases in audit judgment, the use of structured decision approaches, and so forth.⁸

Impact on Other Firms. The SEADOC methodology has had an impact in the auditing profession outside Peat Marwick. For example, in 1989, Grant Thornton introduced a revised methodology for the documentation and assessment of certain aspects of the internal control structure in response to SAS No. 55. The Information and Control Understanding System (INFOCUS) documents boundary events and processes within the accounting system, focusing on control points where information is captured or changes form. The INFOCUS software provides for a combination of narrative and flowchart documentation, supported by a decision base of processing cycles, events, boundaries, control points, and control procedures of various types. While the original system was developed primarily as a documentation tool, work is currently under way in conjunction with Jim Peters of Carnegie Mellon University to introduce a level of artificial intelligence to the decision aid.

⁸ In the mid-1980s, the primary case study used in Mock and Turner—the Olde Oak Case—was developed as an educational audit case and used extensively in audit classes at USC. It was ultimately submitted and published in the Harvard University Case Studies Series.

AUDIT JUDGMENT PROCESS RESEARCH

Another body of audit judgment research has attempted, following the lead in psychology, to understand more about the process by which audit judgment occurs. Although early audit judgment research did not investigate the processes leading to judgments, studies using process-tracing methodologies (e.g., Biggs and Mock, 1983) provided evidence that information search and decision process could be important determinants of auditor judgment. Earlier research in psychology had identified information processing constraints, such as information overload, as important factors in performance.

An attempt to synthesize an account of the psychological processes by which auditors bring experience to bear in reaching judgments was made by Gibbins (1984), in which he concluded that the professional accountant “probably does not consciously analyze situations as much as s/he would like, probably does not look ahead and anticipate problems as much as s/he would like, and probably is more defensive and justification-oriented than s/he would like to be.”

Faced with limited information-processing abilities to deal with complex tasks, decision makers have two broad coping strategies. The first is the selective use of information. Typically, attributes of available evidence are not given sufficient attention. For example, auditors may focus on characteristics of the evidence that are representative of the population characteristic of interest (e.g., deviation rates), while ignoring other relevant characteristics (e.g., sample sizes).

The second strategy is to simplify the task. This can take many forms, including the use of rules of thumb to eliminate alternatives from consideration. Another method is the use of an anchoring and adjustment strategy based, for example, on last year’s working papers. Another common approach to simplifying the task is to ignore or discount the effects of uncertainty.

Heuristics and Biases

The early studies in this area are commonly referred to as heuristics and biases research. “Heuristics” refers to the particular mental shortcuts and “biases” to the particular problems that can arise from such heuristics. Auditing research has focused on representativeness and anchoring and adjustment.

Representativeness involves judging the likelihood of an event by the degree to which its characteristics are representative of (i.e., similar to) the characteristics of the population of interest. Uecker and Kinney

(1977) is one of the earliest studies in this area. They had auditors examine three pairs of sample results, invoking different sample sizes and error rates. Auditors selected the sample providing the stronger evidence that the population deviation rate was not greater than 5 percent. By design, the stronger evidence was the sample with the *larger* deviation rate, but larger (more reliable) sample size. Use of the representativeness heuristic, however, would lead to selection of the (less reliable) sample with the *smaller* deviation rate, since this characteristic is representative of the population characteristic of interest.

The auditors performed better than subjects in similar psychology studies with 70 percent of auditor judgments being correct. However, 54 percent of subjects made at least one judgment consistent with the representativeness heuristic. Subsequent research (Joyce and Biddle, 1981b; Bamber, 1983; Rebele, Heinz, and Briden, 1988) has examined auditors' sensitivity to the reliability of the source of the evidence. This research overall—in contrast to nonauditing studies—finds that auditors are relatively sensitive to the reliability of information sources.

A commonly used judgment shortcut is anchoring and adjustment. This occurs when a judgment is made by anchoring on a value and adjusting to allow for the circumstances in the present case (Hogarth, 1987, p. 55). The problem with this strategy is that the outcome is highly dependent on the information available or the way the information is presented. Adjustment from this anchor is typically insufficient.

The relevant auditing studies report mixed results. For example, Joyce and Biddle (1981a) find that auditors insufficiently adjusted from an irrelevant anchor. On the other hand, Butler (1986) reports that, while students anchored on information provided by the researcher, auditors established their own anchor.

Recent research has employed Hogarth and Einhorn's (1992) belief-adjustment model, which assumes that belief adjustment follows an anchoring and adjustment process. The model is particularly relevant to auditing because it recognizes the sequential nature in which information may be received. Using this model as a framework, several studies (Ashton and Ashton, 1988; Tubbs, Messier, and Knechel, 1990; Asare, 1992) have found that auditors place more weight on evidence received most recently. That is, the researchers observed a recency effect when auditors revise their beliefs based on sequences of positive and negative evidence. This is a common finding in psychology (Hogarth and Einhorn, 1992).

Such an effect has major implications for audit practice, since this suggests that the order in which auditors receive and evaluate evidence

may have a substantial impact on decision making. That is, two auditors may receive exactly the same evidence but in varying order and subsequently arrive at different conclusions, thus potentially reducing audit effectiveness or efficiency. However, environmental factors and audit task may moderate recency effects (Messier and Tubbs, 1994; Trotman and Wright, 1994; Kennedy, 1993).

Biases may occur not only in processing information but also in the search for information. Several studies (for example, Kida 1984) have investigated the evidence-search strategies used by auditors. Auditors often explicitly or implicitly formulate hypotheses to explain certain factors (for example, a change in key ratios during preliminary analytical review) and then search for evidence to test the hypothesis. Kida (1984) examined whether the hypothesis-testing strategies employed by auditors affect their search for data. Kida noted that audit tasks require auditors to sift through a number of pieces of information, some of which can provide confirming evidence and some, disconfirming. The overwhelming conclusion from the psychology literature is that individuals preferentially collect evidence that tends to confirm rather than disconfirm their hypothesis. Kida suggested that if confirmatory strategies are employed by auditors, the final decisions will depend to some extent on the initial framing of the hypothesis.

Although Kida found limited support for the existence of confirmatory strategies, the effect was less powerful than found in many psychological studies. Subsequent research (Smith and Kida, 1991) provided very little confirmation of the presence of confirmatory strategies in the information search and recall process of auditors. The results of these studies suggest that the pervasive, overriding concern by auditors for negative outcomes (that is, conservatism) may have nullified or precluded the use of confirmatory strategies (Smith and Kida, 1991).⁹

Confidence and Accuracy

In an increasingly litigious environment, auditors' levels of confidence and calibration have important practical implications. In addition, it may be argued that the belief that audit adds value to society is predicated on the assumption of high-quality auditor judgment. At this

⁹ A range of other studies has examined hypothesis generation by auditors in analytical review situations (Libby, 1985; Biggs, Mock, and Watkins, 1988; Libby and Frederick, 1990; Bonner and Lewis, 1990; Heiman, 1990; Bedard and Biggs, 1991). The results of these studies are outlined in *Analytical Procedures*.

stage there has been a limited amount of research in this area. Tomassini et al. (1982) examine the calibration of auditors' prior probability distributions regarding financial-statement account balances. Their results showed significantly less overconfidence than in the psychology literature and a tendency toward underconfidence. Solomon et al. (1982) had auditors respond to general knowledge questions and found substantial overconfidence. They suggested that as auditors were found to be underconfident on the audit task and overconfident in the general knowledge task, it appeared that there was something unique in the auditing context that resulted in auditors not being overconfident.

Moeckel and Plumlee (1989) measured auditor confidence in situations that necessitated complicated inferences. Auditors were asked to review a set of hypothetical workpapers, then respond to a recognition test and rate their confidence in their memories. The study found that auditors are at least as confident in their incomplete and inaccurate memories as they are in their accurate memories. The authors note that the general tendency toward misplaced confidence could lead to poor judgments when the accumulation of evidence is finalized and the auditor undertakes the formulation of an opinion on an account balance, accounting cycle, or the financial statements as a whole.

These findings provide an intriguing mixture of results. Auditors use various heuristics and are susceptible to some biases found in psychological studies to be widespread. Nevertheless, experienced auditors performing familiar tasks have generally been far less susceptible to these biases. In particular, auditors appear to be less subject to biases that involve evidence insensitivity. Arguably, auditors' sensitivity to evidence reflects the nature of auditing and represents a consequence of auditing expertise. In addition, there is little support for auditors using a confirmatory bias.

Achieving a greater understanding of auditors' judgment processes is hindered, however, by the limited amount of audit research and the limited theoretical framework provided by psychology. Kleindorfer, Kunreuther, and Schoemaker (1993, p. 100) note that psychology has "only begun to scratch the surface as to when and why individuals use particular heuristics and exhibit certain biases."

Expertise and Knowledge Research

Over the last decade, a dramatic enhancement of our understanding of the role of knowledge and memory as determinants of audit judgment

performance has taken place. In particular, studies have examined knowledge differences between auditors with different levels of experience and expertise and, more recently, how knowledge differences relate to differences in auditor performance (Libby, 1994; Libby and Luft, 1993; Bonner and Pennington, 1991). These studies can provide some of the information necessary to answer a variety of practical questions, including the following:

- Where in an audit can more experienced auditors most usefully be employed?
- How can university education, continuing education, firm training, and experience be combined to maximize learning?
- When will different kinds of learning aids and decision aids be most beneficial?
- In which cases will generalists' or specialists' performance be superior?
- Which entry-level auditors will be most successful? (cf. Libby 1994)

Most of the past research in this field has been part of a model-building process. We have learned about knowledge storage and retrieval by auditors of different experience levels and, to a lesser degree, how these knowledge differences affect performance. However, because this research is still at an early stage, any attempt to answer the above practical questions would be premature. In short, this area of research is seen as important for its long-term practical implications for expert systems, training, and staff allocation, but direct practical implications await further research.

DECISION SUPPORT RESEARCH IN AUDITING

Given some of the deficiencies in judgments noted above, there have arisen strong arguments for intervention into audit processes, to provide decision support. Various researchers in business (Hogarth, 1987), decision sciences (Kleindorfer, Kunreuther, and Schoemaker, 1993), and auditing (Ashton and Willingham, 1988) recognize the potential opportunities for decision-support aids. In general, there are three ways in which judgment may be improved: (1) feedback from the individual's own experiences, (2) training based on others' experiences and research, and (3) decision aids. It is generally accepted in psychology that because of problems with feedback,

individuals have difficulty learning from their own experiences (Hogarth, 1987; Dawes, 1988).¹⁰

Nonetheless, some accounting and auditing research shows that outcome feedback can improve performance on repetitive tasks (e.g., auditor performance evaluations, prediction of failure, internal control evaluation) which have reasonably high task predictability (Harrell, 1977; Hirst and Luckett, 1992; Hirst et al., 1994). An alternative to learning from experience is training. Training involves learning from the experience of others and generally from the firm's institutionalized knowledge. Some tentative efforts at understanding the nature of auditor training have begun (Bonner and Walker, 1994). Here we focus on the third method of improving judgment, namely, the use of decision-support aids.

Decision-support aids entail structuring judgment to some degree. They have been examined at two levels in auditing. The first level is the structure of the accounting firm's audit methodology. Cushing and Loebbecke (1986) document variations in fourteen elements of structure across twelve of the largest accounting firms. There have been many studies that have examined the effects, including the effects on audit judgment, of the differences between firms' audit structure. These are reviewed in Risk Orientation.

Two results are relevant here. First, differences in audit structure are associated with differences in a variety of judgments (e.g., materiality judgments—Morris and Nichols, 1988; sample-size judgments—Bamber and Snowball, 1988; inherent-risk assessments—Dirsmith and Haskins, 1991) so that the form of decision support does appear to make a difference. Bamber and Snowball (1988) and Bamber, Snowball, and Tubbs (1989) found that the degree of structure affects auditors' perceptions of their work environment and how auditors approach a sample-size judgment task. They do not, however, find a consistent relationship between the degree of firm structure and consensus, suggesting that firms have viable alternatives in structuring their audit process. This finding further suggests that accounting firms need to carefully consider potential changes to their audit practice, as there can be important consequences to such decisions.

¹⁰ Kleindorfer, Kunreuther, and Schoemaker (1993, pp. 111–114) identify both external and internal sources of difficulty. External obstacles include: (1) missing feedback as, for example, rejected alternatives are rarely followed up; (2) confounded feedback, since actions taken after the decision usually affect the outcome; and (3) noisy feedback, since chance also influences the outcome. Internal blocks include: (1) ego defenses that involve the rationalizing away of negative outcomes and (2) cognitive biases, especially the “knew it all along” or hindsight bias.

Second, there is some controversy over whether increased structure replaces audit judgment. This concern was raised years earlier over statistical sampling. Elliott and Rogers's (1972, p. 65) response is also relevant to a consideration of the effects of audit structure:

This sampling plan (or any other) does not replace or reduce the need for audit judgment. If anything, more judgment is required because many judgments must now be clearly articulated, and this will nearly always result in their being more carefully considered.

In fact, Kachelmeier and Messier (1990) suggest that decision aids of this type can lead to *decreased* consensus, because of the increased number of judgments. The view expressed by many academics and practitioners is that structured approaches supplement rather than replace audit judgment.¹¹ It is sometimes argued that structured approaches clarify what judgments are needed, the possible choices, and the implications of each choice—but they leave the auditor responsible for reaching appropriate decisions.

The second level of decision-support analysis involves the match between the individual auditor and a specific decision aid. Several studies have examined the judgment effects of specific auditing decision aids. These decision aids typically restructure the task, decomposing a global judgment into several component judgments. Ashton and Willingham (1988) question whether the resulting larger number of requisite judgments may (1) require greater cognitive effort, leading to a preference for unaided judgment; and (2) compound outcome variability, rather than increase consensus. The limited experimental research on these issues is surprising, given their auditing significance and the mixed results of early research.

Jiambalvo and Waller (1984) and Daniel (1988) examined applications of the audit risk models in SAS No. 39 and SAS No. 47, respectively. Use of these risk models was associated with inappropriate results (i.e., probabilities > 1) and less consistency between responses (compared with the auditors' global risk judgments). Jiambalvo and Waller suggested that further research was necessary before their results could be attributed to inadequacies in auditors' risk assessments versus the risk model itself. They conclude, however, that this decision aid's decomposition does not necessarily improve judgment outcomes.

¹¹ Perhaps a more insightful way of looking at this issue, rather than in terms of structure versus judgment, is suggested by Carpenter and Dirsmith (1993). They argue that the conflict is between the field auditor's professional independence and the national office's desire for bureaucratic control.

Kachelmeier and Messier (1990) report similar results, using a different audit task. They examined auditors' use of the sample size formula in the AICPA (1983) *Accounting and Auditing Guide, Audit Sampling*, as an aid in sample-size determination. Auditors provided with the decision aid exhibited greater variability in their sample sizes than did auditors in an intuitive judgment group. In addition, a comparison of the auditors who used the decision aid to calculate sample sizes with a third group of auditors who provided the component judgments (from which the researchers calculated the implied sample sizes) suggested that auditors in the former group attempted to circumvent the aid by working backwards from their desired sample sizes.

Based on previous research on control reliance, Libby and Libby (1989) developed a decision-aid formula for combining component judgments (i.e., process susceptibility to error, control reliance, and compliance test strength) to determine the appropriate extent of reliance on the client's accounting controls. In contrast to the previous three studies, Libby and Libby report that their decision aid was associated with greater judgment consensus and that these judgments, on average, were more like the responses of a group of experts. Libby and Libby attribute the difference between their results and those of the previous studies to the fact that theirs was the only study that actually trained subjects to use the decision aid.

McDaniel (1990) also finds positive results associated with the use of a structured decision aid. Auditors implemented a partial audit program for testing the details of inventory. Half of the auditors received an unstructured program that simply contained the relevant audit objectives, while the other half received a structured program that specified, among other things, a systematic selection method. However, McDaniel also manipulated time pressure, finding that the benefits associated with the structured approach disappeared with increased time pressure.

This research on audit decision aids provides several conclusions:

1. The mixed results on the effects of audit decision aids are not surprising given the lack of theory to guide their development and implementation. Audit judgment is complex and not subject to simple descriptions or prescriptions.¹²

¹² Auditing research is not alone in finding mixed results associated with decision aids. The decision-science literature suggests that effectiveness and efficiency benefits from the use of decision aids remain unproven (Sharda et al., 1988). Moreover, based on a review of experimental studies, Kottmann and Davis (1991) suggest that given the choice, users of decision aids tend to prefer unsophisticated methods, including unaided judgment, over formal methods.

2. Given the state of knowledge, there are going to be some “hits and misses.” Consequently, careful testing of decision aids is essential before implementation and training; supervision and review will also be necessary during their use. Libby and Libby’s (1989) study suggests decision-aid implementation is equally as important to its success as the initial design.
3. The effect of a decision aid on audit judgment may vary with other environmental factors. For example, Ashton (1990) found that in the absence of a decision aid, the provision of a monetary incentive or feedback about performance or the requirement to justify choices all resulted in improved performance. In the presence of a decision aid, however, the same incentive, feedback, and justification requirements resulted in lower performance.
4. Further research in this area is crucial to the long-term success of decision-aid implementation. Ashton and Willingham (1988, p. 18) conclude their evaluation of audit decision aids as follows:

Moreover, since many audit decision aids are built upon human judgment and require judgment inputs for their operation, research that improves our understanding of auditors’ knowledge, expertise, and decision-making skills will be even more important in the future than it is today.

Despite their potential limitations, decision aids have advantages that audit practitioners have been keen to obtain. Increasingly complex and sophisticated decision aids have been implemented. One recent example in the area of audit planning is ADAPT.

Audit Program Generation (ADAPT)

In 1983, Grant Thornton (then practicing in the U.S. as Alexander Grant) developed a revised approach to audit sampling that operationalized the Audit Risk Model of SAS No. 39 and SAS No. 47. The new approach, introduced by partner Stephen Yates, implemented a structured methodology for planning the aggregation of audit assurance from different sources. Key components of the plan included:

1. A measure of planning materiality (Touchstone) similar in form to gauge (Elliott, 1983).
2. Explicit assessments of inherent risk and control risk, based on environmental assessment and compliance sampling of internal controls.
3. Estimation of detection risk related to other substantive procedures such as analytical review.

4. Explicit implementation of the audit risk model.

The actual sampling approaches were based on sequential sampling for compliance samples and monetary unit sampling (MUS) for substantive samples, influenced by Kaplan (1975); Roberts (1978); Leslie, Teitlebaum, and Anderson (1979); and AICPA (1983) *Accounting and Auditing Guide, Audit Sampling*. Modifications of the calculations took account of the interaction between balance-sheet and transaction-stream assurance. However, the plan in practice was significant more for its implications for the integration of audit assurance from different sources than for the specific generation of sample sizes. A software implementation was introduced in 1984. In 1985 and 1986, use of the Grant Thornton Sampling Plan was extended to other member firms of Grant Thornton International (Grant Thornton, 1986).

In 1987, Grant Thornton firms worldwide began discussion of the development of a harmonized audit approach. Regarding the planning of audit assurance, interest was concentrated on:

1. An assertion-based focus for audit assurance (Leslie, Aldersley, Cockburn, and Reiter, 1986).
2. Extension of the audit risk model to provide for explicit separate consideration of detection risk relating to analytical procedures, tests of details other than sampling, and procedures directed at related assertions.
3. Explicit consideration of the network of relationships between assertions.

The Audit Manual Working Party (chaired at the time by U.K. firm partner Peter Gillett) considered in detail a paper on structuring the assessment of audit evidence presented at the 1988 USC Audit Judgment Symposium by Boritz and Wensley (1988). In this paper, relevance and reliability of audit procedures were modeled separately and the resulting assurance propagated across a network of assertions. These ideas bore fruit in the revised audit approach published by the firm (Grant Thornton, 1990). The U.K. firm also undertook the development of ADAPT, an expert-system decision-support aid for the generation of audit programs based on this approach (Gillett, 1993). Sample sizes are generated as required for the procedures selected, based on the existing methodology of the firm.

The objective of ADAPT is to improve the efficiency, effectiveness, and consistency of audits by assisting the auditor at the planning stage in tailoring audit programs. ADAPT operates in accordance with three goals, which it seeks to achieve in the following order:

1. Ensure that sufficient audit evidence is planned.
2. Ensure that excessive audit evidence is not planned.
3. Produce an optimal audit approach.

The principal design philosophies incorporated in ADAPT are the following:

1. The user retains ultimate control of the process.
2. The software is capable both of generating programs and of assessing the effectiveness of programs determined by the auditor.
3. Audit program generation is based on two techniques: heuristic rules and a mathematical model.

Audit program generation is thus based on a combination of auditor knowledge and experience, knowledge represented and stored within ADAPT, heuristic rules, and a mathematical model of the propagation of audit assurance—all in combination with a sophisticated control strategy for the selection of procedures.

The developers of the software used measures of diversity to discount assurance derived from nonindependent procedures, resulting in a form of “sub-additivity,” described in a paper also presented at the USC Audit Judgment Symposium (Spires, 1989). Although the system as implemented is based on extensions of the audit risk model, the software was also designed to provide for alternative formulations such as a Bayesian model (Leslie, 1984) and a belief-function representation (Srivastava, Shenoy, and Shafer, 1990). Verification and validation were carried out during 1991, and were influenced by early versions of Boritz and Wensley (1992). The system was implemented in the final quarter of 1991.

In use, ADAPT interacts with the auditor on a series of interrelated planning judgments:

1. The auditor determines which of the potential audit areas relating to the financial statements (e.g., accounts receivable) are the areas where attention is to be focused.
2. For the important audit areas, the auditor, assisted by ADAPT, selects the important balances and transaction streams (e.g., sales, cash receipts, credit notes) and financial-statement assertions.
3. For each of the important assertions, the auditor provides judgments on levels of inherent risk and control risk, based on prior audit work (e.g., tests of controls).
4. Based on the model selected (e.g., AICPA audit risk model, or a

Bayesian or belief-function alternative), ADAPT assesses pertinent levels of detection risk.

5. The auditor provides an assessment of the levels of planning materiality (Touchstone) for the various assertions, based on the use of other decision aids.
6. In conjunction with ADAPT, the auditor identifies any audit procedures that are required in the circumstances or are for some reason prohibited or inappropriate.
7. To the extent that procedures identified as required do not reduce detection risk sufficiently, ADAPT seeks to generate an optimal cost-effective audit program, taking account of interrelationships among the important assertions and the relevance of selected procedures to the various assertions.
8. Where relevant, ADAPT generates appropriate sample sizes for the procedures included in the audit program.
9. ADAPT explicitly provides for consideration by the auditor of whether the eventual program provides insufficient or excessive audit evidence.
10. The auditor is provided the opportunity to determine which, if any, of the selected audit procedures might more efficiently be performed in advance of the period end and what modifications this would require to the overall audit program.
11. ADAPT explicitly provides for the planning decisions taken to be reviewed and approved by senior audit staff (typically, managers and partners).
12. The auditor judges what will be the most convenient sequence for the execution of the selected audit procedures.
13. The auditor determines whether the standard text of the selected procedures is appropriate for client circumstances or requires modification.

Of course, many of these broad areas of audit judgment themselves involve a number of more detailed judgments. For example, the assessed level of control risk will depend on earlier planning judgments on the relative efficiency and effectiveness of assessing control risk as maximum. In turn, higher-order judgments are involved in assessing whether use of ADAPT will be cost-effective for a particular audit as opposed to reliance on more traditional decision aids. ADAPT does not deal with the performance of audits. Its application in audit planning, however, is both a clear example of the pervasive nature of audit judgment and a strong indication of its potential complexity.

In common with other decision aids, the intended status of ADAPT raises interesting questions. Like other expert systems, ADAPT aims to improve the quality of audit judgments in specific instances by making expertise available for use by less experienced staff. ADAPT is a hybrid system, containing a normative component together with ad hoc procedures based on heuristics provided by audit experts. It aims to operate within the requirements of applicable auditing standards. At the same time as improving the quality of judgments taken in individual circumstances, it also seeks to improve the overall consistency of auditor judgments within the firm with each other, with auditing standards, and with a methodology adopted by the firm. Use of such tools potentially modifies, rather than aids, audit judgment. In other words, the objective is not simply to automate existing auditor performance, but rather, to enhance it.

ADAPT operates on stand-alone microcomputers, and is designed on the assumption that audit decisions will be made by individuals rather than groups; however, the software explicitly provides for the subsequent review of audit decisions by other members of the audit team.

MULTIPERSON RESEARCH AND THE REVIEW PROCESS

There has been recognition of the importance in auditing of group decision making and the review process since the early judgment studies. For example, Joyce (1976) noted that the review process is designed to reduce judgment variance and that discrepancies between auditors may be less frequent in actual audit engagements than in the studies that considered individual judgments. Solomon (1987) described two types of multiperson processes: audit teams and audit groups. *Audit teams* refer to the audit judgments made in a hierarchical, sequential, and iterative audit review process. We refer to this as the *review process*. The term *audit groups* refers to joint (concurrent), multiperson judgment decision making intended to solve a problem or perform a task.

At the time of the Solomon (1987) review, only four judgment studies had examined the review process (Bamber, 1983; Mock and Turner, 1981; Trotman and Yetton, 1985; Trotman, 1985). Bamber used the context of the review process to examine the extent to which a superior would adjust the perceived informativeness of audit evidence collected by a subordinate team member based on the subordinate's reliability. Contrary to earlier psychological literature that suggested

insufficient adjustment, Bamber found excessive adjustment. Both Mock and Turner (1981) and Trotman and Yetton (1985) examined the effect of the review process on the variability of judgments. Mock and Turner considered sample-size judgments and found, contrary to expectations, no reduction in variance.

Trotman and Yetton considered internal control evaluations and found the use of either interacting or composite groups (statistical averages of individual judgments) resulted in a decrease in the variance of judgments. There were no significant differences between interacting and composite group judgments. Trotman (1985) considered the effect of the review process, interacting groups, and composite groups on judgments of the likely dollar error in an inventory system. All forms of group judgments were more accurate than individual judgments. While there were no differences between the review process (manager and senior), and interacting groups (two seniors), both outperformed composite groups of two seniors. Further investigation showed that the improvement in the review process was mainly due to a reduction in systematic bias as a result of better weighing of individual contributors. On the other hand, interacting groups were the most effective in reducing random error. Based on the findings of no difference between review and interacting groups, Libby and Luft (1993) suggest that accuracy gains may not be the principal target of the hierarchical nature of the review process on certain tasks. They suggest that the purposes of the use of a hierarchical process are to:

- Ensure that the firm's liability for Type 1 and Type 2 errors is reflected in judgments.
- Establish accountability relationships through performance evaluation.
- Train less experienced auditors.

Research examining the judgments of audit groups has also been relatively scarce. Most of this research has used student surrogates and cannot be generalized to the audit domain. Two notable exceptions are Schultz and Reckers (1981) and Solomon (1982). Schultz and Reckers examined choice shift among groups and their relationship with other factors. They find that the capacity (advisory versus binding) of the group decision and the nature of the communication channel (telephonic versus face-to-face) significantly affected probability estimates. Nevertheless, significant differences were not found between individuals and groups.

Solomon (1982) examined the probability assessments of indi-

vidual, three-member interacting group, and composite group probability assessment. Interacting group judgments were superior to individual differences, in both consensus and correspondence with audit values. In general, the differences between interacting and composite groups were not significant.

Since Solomon (1987) few studies have further examined the review process or audit groups (for example, Ramsay, 1994; Libby and Trotman, 1993). Ramsay extended earlier studies on the review process by distinguishing between mechanical and conceptual errors to show that managers outperformed seniors in detecting conceptual errors and that opposite was true for mechanical errors.

Libby and Trotman (1993) noted that preparers enter the judgment process prior to an initial judgment and have incentives to justify their position (Emby and Gibbins, 1988). On the other hand, reviewers enter the judgment process subsequent to formulation and documentation of an initial judgment, and therefore would be expected to be more concerned with determining whether the preparer judgment makes sense. Libby and Trotman suggest that this particular structural element results in offsetting biases, ensuring that adequate attention is given to decision-inconsistent information. In other words, while initial decision-makers in their experiment were more likely to recall evidence *consistent* with their decision than inconsistent with it, reviewers were more likely to attend to and recall evidence *inconsistent* with the initial decision, thus offsetting the original decision-makers' bias and increasing the likelihood of consideration of the implications of inconsistent information. Overall, the research on the review process and audit groups confirms that both have benefits in that they can reduce judgment variance, increase accuracy of judgments, and reduce certain biases.

SUMMARY

This chapter has examined research into audit judgment. The subject matter of some of this judgment research (e.g., materiality, opinion formulation) is examined in subsequent chapters. The primary research findings from the study of how and how well auditors perform at this fundamental auditing attribute are summarized in Table 2.¹³ There are three overriding conclusions:

¹³ For completeness, the table includes educational implications of this research effort.

TABLE 2 Audit Judgment Research: Primary Findings and Impacts

<i>Aspect of Audit Judgment Research</i>	<i>Primary Finding</i>	<i>Primary Audit Practice Impact</i>	<i>Primary Audit Education Impact</i>
Evaluation of Audit Judgment	Auditors exhibit moderate levels of consensus, self-insight, and consistency.	Potential exists for reducing judgment variance. Increases in consensus are likely to benefit audit efficiency and effectiveness.	Motivation for introducing judgment and decision-making issues into the classroom.
Audit Judgment Process	Auditors are sensitive to evidence. The unique characteristics of auditing make auditors less sensitive to common judgment biases. However, auditors are not bias-free.	Auditors should be aware of heuristics and biases. Results point to the uniqueness of auditing and caution against uncritical application of findings from other disciplines to audit practice.	Sensitizing students to biases associated with common judgment heuristics is a straightforward and common example of bringing research findings into the classroom.
Decision Supports	Decision supports do make a difference. However, the limited research suggests the effects are not always positive.	Decision aids are not a panacea. Effectiveness and efficiency gains are not automatic. Both implementation and design are important.	Explain to students the need for decision aids and potential costs and benefits associated with their use.

Continued.

TABLE 2 Audit Judgment Research: Primary Findings and Impacts—cont'd

<i>Aspect of Audit Judgment Research</i>	<i>Primary Finding</i>	<i>Primary Audit Practice Impact</i>	<i>Primary Audit Education Impact</i>
Audit Group and Review Processes	Very limited research. There are gains to both review and group processes. Research has only begun on identifying the nature of such gains.	There are differences between individual and multi-auditor judgments. Both forms of multi-auditor judgments (review process and audit groups) have benefits as they reduce judgment variance, increase accuracy, and reduce certain biases.	Reinforces exposing students to group processes. Encourages use of peer review of homework, papers, etc.
Audit Expertise and Knowledge	Expertise is more than experience. Research has just begun to identify the attributes of audit expertise and how it is achieved.	Potentially, it provides direction for the development of training programs and decision aids as well as staff allocation.	Identification of the key attributes of auditor knowledge/expertise provides classroom guidance for covering the auditor's knowledge and skill.

1. Auditors' judgments are amenable to improvement, and these improvements can result in audit efficiency and effectiveness gains.
2. Auditing's unique aspects (e.g., in-depth experience but with relatively few clients, low population error rates, audit team context, limited feedback) means that auditors cannot simply accept and apply findings from other disciplines such as psychology and decision sciences. The auditing context is a critical element of the audit process, although Solomon and Shields (1994) argue that it is the ensemble, rather than individual contextual features, that is unique.
3. Audit judgment is complex. The context-specific nature of the audit process and its many interdependencies make it difficult to untangle the attributes of auditor expertise, let alone how to package them in training programs or decision aids.

Without additional audit judgment research, attempts at improving audit efficiency and effectiveness will largely be hit-or-miss, experimental in nature, and based on an incomplete understanding of auditor judgments and the audit process.

Audit Sampling

Stephen J. Aldersley, *Ernst & Young*; **William L. Felix, Jr.**, *University of Arizona*; **William R. Kinney, Jr.**, *University of Texas*; **James K. Loebbecke**, *University of Utah* (chapter lead author)

OVERVIEW

The extent-of-testing issue, as described in Risk Orientation, developed as a direct result of auditors' adoption of selective examination of evidence populations. The consideration of extent-of-testing in turn led directly to the introduction of sampling concepts (both statistical and nonstatistical) into auditing policies and practice. The development of the use of audit sampling in practice over the last thirty years clearly illustrates productive collaborations among practitioners and academicians from both auditing and statistics. These relationships allowed researchers and policy makers to share knowledge about the field of statistical sampling and ways of applying sampling to auditing. In addition, much of the impetus for the development of policies and methods for nonstatistical sampling in auditing derived from these efforts. The result has been the successful development and communication of methods, policies (for firms and for the profession as a whole), and educational materials and practices throughout the profession, both in the United States and abroad.

This chapter describes some of especially significant people and events in this process. We begin by looking at the environment and activities in the period before the 1970s, focusing on key players and the strings of activity motivated by them. There follows a discussion of the development of two major types of statistical methods: variables sampling and monetary unit sampling. An appendix showing the publications that arose in response to the activities described in the text is provided. It notes the backgrounds of the authors, further illustrating the degree of interaction that has taken place between the professional and academic worlds.

Our overall conclusion from analyzing this history is that the process that occurred provides a healthy and productive model for the auditing profession's development.

THE EARLY YEARS OF PROFESSIONAL-ACADEMIC INTERACTION

In 1933, Lewis A. Carman published an article in the *American Accountant*, "The Efficacy of Tests." Carman, a practitioner, introduced the notion to the accounting profession that statistical sampling methods could be useful to auditors. He proposed the use of a discovery sampling technique in fraud detection. Several years later, a roundtable discussion on audit-testing techniques was held at the annual meeting of the American Institute of Accountants. The discussion leader, Robert Prytherch, reported the content of that discussion to the profession in "How Much Test Checking Is Enough?", published in the *Journal of Accountancy*. Prytherch referred to Carman's pioneering work and discussed how statistical sampling could be applied to a number of different auditing areas.

Prytherch's report was one of a number of publications appearing in the 1940s that discussed sampling in auditing; these were written by practitioners and focused on the need in auditing practice for some guidance on the extent of audit tests. W.D. Cranstoun in 1948 summarized them in a *Journal of Accountancy* article, "A New Look at Basic Auditing Techniques." In his article, Cranstoun referred to an unpublished paper on the use of statistical sampling in auditing written by a doctoral student in statistics at Columbia University, John Neter.

The 1950s saw a significant increase of activity in (and publications about) the use of statistical sampling in auditing, specifically the efforts of academics like Neter, Lawrence Vance, and Howard Stettler. Vance and Stettler were both auditing professors. Although Neter was a statistician, he possessed an undergraduate business degree and a masters degree in accounting. The most significant aspect of the 1950s, however, was the formation of alliances between academicians and practitioners in the development of statistical sampling in auditing. We have chosen to emphasize here three of these collaborative efforts, although we will also comment on the other efforts underway during this period.

The Touche Ross Effort

Robert M. Trueblood always considered himself an academic in practitioner's clothing. In the early 1950s, as partner in charge of Touche, Niven, Bailey & Smart's Pittsburgh office, he formed an association with the Carnegie Institute of Technology for the purpose of exploring how statistical methods could be used in accounting

practice. A formal study group was created and specific problems were identified, some from Touche's practice. In addition to Trueblood, Robert Monteverde and Robert Johnson were involved from the Touche side. Carnegie participants included Richard Cyert (who later became president of Carnegie Mellon University) and W.W. Cooper.

A number of significant publications came out of this cooperative effort from both sides of the team; two are of particular interest here:

- An early bibliography—interesting because of the fact that, although statistical sampling in auditing was in its infancy, it contained seventy relevant articles and papers, many unpublished (Trueblood and Monteverde, 1954).
- An *Accounting Review* article by Trueblood and Cooper (1955), in which appeared the recognition that “collaboration between disciplines is regarded as being critically important [to success in statistical sampling research].”

For Trueblood, this study had another important outcome: It led to his taking a sabbatical in 1960 as the Visiting Ford Distinguished Research Professor at Carnegie. This visit enabled him to work on two other publications reflecting his scholarly bent: *The Future of Accounting Education* and *Auditing, Management Games, and Accounting Education*.

In addition to his firm and academic activities, Trueblood was an active participant in the activities of the AICPA. In November 1956, in response to the profession's growing interest in the use of statistical sampling, the AICPA formed the Committee on Statistical Sampling. Trueblood was appointed its first chairman and remained so for two years. In that position, he was able to channel his knowledge from the Carnegie study into the profession's standards-setting process.

After the completion of the Carnegie study, Trueblood became chairman of Touche Ross. He moved to Chicago, where he was also partner in charge of that major office, and his activity in the statistical sampling arena naturally declined. He did encourage persons in the Chicago office consulting practice to stay involved, particularly Justin Davidson (who later became the dean of the Business School at Cornell University and then Ohio State University); but, as a firm, Touche participated but did not lead after the change in Trueblood's position. However, in 1970, the firm invested heavily in computer tools and decided to make a renewed thrust in the use of statistical methods as part of its increased computer utilization. Jim Loebbecke, then a manager in

the firm's development group located in Minneapolis, was given the responsibility for that effort.

Loebbecke obtained his degree at the University of California at Berkeley, where he studied auditing under Lawrence Vance. He was fascinated by statistics in school and continued to study that subject after graduation. This high level of interest led to his using statistical sampling in a number of audit engagements in the San Francisco office throughout the 1960s. In giving Loebbecke his assignment, Trueblood advised him to obtain consulting assistance. He recommended a statistician on the faculty at the University of Minnesota who Trueblood knew had a strong interest in the use of statistics in auditing—John Neter. Loebbecke and Neter worked together for several years. In 1975, they jointly authored *The Behavior of Major Statistical Estimators in Sampling Accounting Populations: An Empirical Study*, a seminal contribution to our understanding of the performance of statistical estimators in accounting.

In addition to working with Neter, Loebbecke joined the AICPA Statistical Sampling Committee, of which he was a member from 1973 through 1977 and chairman for the last two of those years. During his tenure on the Statistical Sampling Committee, Loebbecke worked with the “next generation” of professionals with interest in statistical sampling from the other large firms. These included Bob Elliott from Peat Marwick, Jack Broderick from Arthur Young, and Bob Roussey from Arthur Andersen. These relationships provided for information sharing among the members representing their firms, and the group served as a sounding board for new ideas. Concepts were brought forward, discussed, and modified for the benefit of the profession.

The Committee's major task at that time was to update its educational materials. Previously, a set of self-study training modules had been developed, which the Committee felt contained some technical problems and required improvement. It contracted with Donald Roberts, a statistician and associate professor in the business school at the University of Illinois, who then wrote a comprehensive book entitled *Statistical Auditing* (AICPA, 1978), for which the Committee served as consulting editors. Both the practitioners and the academics on the committee (Bill Felix and Bill Kinney) benefited substantially from their interactions within the Committee and with Roberts on this book.

Loebbecke was so pleased with the opportunity to do formal research and work with academicians on this and other projects that he decided to leave Touche Ross in 1980 to accept a position as a professor at a research university.

The Deloitte Effort¹

One of Bob Trueblood's fellow members on the original Statistical Sampling Committee was Oscar Gellein. Gellein had an academic background and was hired by Haskins & Sells to head up the firm's research activities. In the late 1950s, he enlisted the full-time help of a manager from the Cincinnati office, Ken Stringer, whose assignment was to make a comprehensive study of the firm's audit methods. Stringer was particularly interested in questions concerning the extent of audit testing. One source of that interest was an article by Howard Stettler, "Statistical Interpretation of Test Checks," that appeared in the *Journal of Accountancy* for January 1954.

Stringer had had no formal training in statistical methods. He responded by reading extensively on the subject. As a result of his efforts, Stringer concluded that the application of contemporary methods would not really satisfy the auditor's needs. Acceptance-type approaches were not sufficient: They didn't provide information on the significance of the results. He also suspected that methods based on normal distribution theory might not be valid when applied to accounting populations with low error rates.

Finding himself without a solution from the literature, Stringer sought outside assistance. After considering a number of possibilities, he formed an alliance in 1958 with Frederick Stephan, a professor of statistics at Princeton University and former president of the American Statistical Association.² Stringer chose Stephan not only because of his technical credentials, but also because the latter's cooperative attitude made this partnership between business and academia feasible. Stringer and Stephan embarked upon a project in which each would teach the other about his discipline, with the hope that the result would be the development of a statistical plan specifically tailored to auditors. The approach would have to be statistically sound, useful in an auditing context, and acceptable to auditors in terms of understandability and ease of use.

Stringer and Stephan ultimately developed their own approach, called cumulative monetary amount sampling (CMA). CMA was successfully implemented in Deloitte's audit practice. The firm be-

¹ We gratefully acknowledge two working papers that were the source for much of the material in this section, both by James J. Tucker of Widener University: "Initial Efforts of Kenneth W. Stringer to Develop a Statistical Sampling Plan" and "Changing Technology and Public Accounting: Early Efforts to Investigate the Use of Statistical Sampling." These papers were based on a series of interviews that Tucker held with Kenneth Stringer, as well as upon access to Stringer's personal files.

² John Neter also became President of the American Statistical Association, in 1986.

gan using it in the early 1960s and continues to do so to the present day.

Some of the basic ideas behind CMA were disseminated by Stringer and Stephan, not only in articles they wrote, but through Stringer's active role in the AICPA standard-setting process. Stringer was on the Statistical Sampling Committee from 1962 through 1965, serving as its chairman from 1963. He was also active in the predecessor committee to the Auditing Standards Board and other committees. Over a period of many years, he was able to share his knowledge and thoughts about sampling, serving as a source to others both within and without the standard-setting process. Similarly, he was an active participant in the American Accounting Association.

Clarkson Gordon

Clarkson Gordon (CG) in Canada developed and implemented dollar-unit sampling (DUS) on an extensive basis in their practice in the late 1960s and early 1970s. This development and implementation took place through close collaboration between Rod Anderson, CG's first National Director of Auditing; Don Leslie of CG; and Albert Teitlebaum, an academic statistician.

In 1965, Rod Anderson became CG's first National Director of Auditing with two items on his priority list: computer auditing and statistical sampling. Computer auditing came first, and both an initial methodology and training programs were completed in 1967. In late 1967 or early 1968, CG moved full scale on the statistical sampling project. At about this time Don Leslie rejoined the firm and was assigned to the sampling project. Just before this period, while working on a CICA project that included Deloitte's Giles Meikle and PW's Dave Higgenbotham, Rod Anderson met and discussed sampling approaches with Ken Stringer and Frederick Stephan. An outcome of these discussions was CG's adoption of an upper-precision-limit approach to statistical sampling, rather than another alternative Anderson was considering.

As the CG statistical sampling project was getting underway, another member of the firm recommended that Rod Anderson and Don Leslie talk to a statistician at McGill University, Albert Teitlebaum. These three formed the team that led CG's development of DUS. The team agreed that the Deloitte approach Rod Anderson had learned made sense. However, since Deloitte did not publish the details of their approach, the CG team had to work out for itself the methods and rationale for DUS that appeared in the 1973 CICA article.

It is interesting that Rod Anderson attributed the differences in publishing the results to a “Hamiltonian” versus a “Jeffersonian” view of the world: “The H&S firm seemed to have taken the Hamiltonian view that it was unnecessary to tell the mob anything except that this is what you do.” In contrast Don Leslie and Rod Anderson took the Jeffersonian position that people will audit better if they know the whys and wherefores. Rod Anderson observed that some conversations with Giles Meikle were very helpful in the development of DUS.

In the process of developing DUS, the CG team considered a number of alternatives, including different approaches to selection and computing the UEL and sequential sampling. The results of their developmental efforts are reported in their book, *Dollar Unit Sampling* (1979). Considerable effort was expended to make the method easy to explain and to teach. Terms like *precision gap*, *precision gap widening*, and *taintings*, were coined with a view toward making training and use of the method by auditors easy and understandable.

The development effort by the CG team led to numerous papers and presentations. These activities were extremely helpful to the academic community and resulted in a substantial research literature on DUS and related methods. The subsequent adoption of DUS methods by the entire auditing profession was certainly substantially aided not only by CG’s activity in this area, but by its policy of openness.

Other Alliances

Of course, the other large accounting firms were considering, or developing statistical sampling methods during the same period that the work at Touche Ross, Deloitte, and Clarkson Gordon was taking place. For example, Price Waterhouse undertook a major effort to implement attribute sampling in their practice in the early 1960s. They formed an alliance with Herbert Arkin, a statistics professor from Baruch College, to assist them in this effort. In the 1970s, Walter Pugh and then Abe Akresh of Price Waterhouse collaborated with Frank Luh of Lehigh University to develop and implement computer software for the use of statistical methods in Price Waterhouse’s audit practice.

Arthur Andersen had in place some basic sampling aids in the 1960s. Of special note was a 1968 firm monograph, *Sampling in Auditing*, by Art Wyatt, an accounting academic who wrote an important early auditing text, left academe to work at Arthur Andersen, and later became a member of the Financial Accounting Standards Board. In the early 1970s, Arthur Andersen decided to expand the number and quality of sampling aids available to their audit teams. During the mid-1970s,

they developed substantial guidance for using variables-sampling methods, then created and implemented a monetary unit sampling plan. A major focus of this effort was to operationalize statistical concepts in terms that auditors can understand and use in practice. Computer practice aids and training were also developed.

Both of these innovations were accomplished by collaboration between one of Arthur Andersen's partners with a strong interest in sampling, Bob Roussey, and an academic, Bill Felix. As we note in a later section, these two, with the additional assistance of Dick Grimlund, collaborated in the development and implementation of a version of the "moment-bound" modification to monetary unit sampling for Arthur Andersen's use in the early 1980s. This later collaboration resulted in the creation of practice aids and computer software available to other firms. In addition, academic articles were written, including Grimlund and Felix (1987) and Felix, Grimlund, Koster, and Roussey (1990).

Bill Felix, along with other academics such as Bill Kinney and Bart Ward, were part of a "new generation" of accounting academics who went through substantially revised accounting Ph.D. programs in the late 1960s and early 1970s. Along with a new emphasis on "source discipline" knowledge, these revised Ph.D. programs required extensive training in both theoretical and practical statistics. A number of these academics participated in the development of a newly acquired academic respectability for auditing research in general and sampling research in particular.

Other firms, such as Arthur Young (with Neil Hitzig) and Peat Marwick with (Bob Elliott), assigned responsibility for statistical sampling to firm members who had significant academic training in statistical methods. These individuals and the practitioners mentioned above were comfortable with the academic community and established regular lines of communication with the academics. In part for this reason, sampling topics became a regular part of the auditing symposia that began to flourish in the mid-1970s. The resulting interactions were of substantial benefit to both the practitioners and the academics.

VARIABLES SAMPLING

We now shift our perspective of the impact of research in the area of statistical sampling away from people and toward the primary methods themselves. We will first consider variables sampling, followed by monetary unit sampling.

Error magnitude and risk concepts are implicit in all three generally accepted auditing standards of fieldwork, especially the third standard. They are explicit in three exceptionally important interpretations of generally accepted auditing standards: Statement on Auditing Procedure (SAP) No. 54, *The Auditor's Study and Evaluation of Internal Control* (1972), Statement on Auditing Standards (SAS) No. 39, *Audit Sampling* (1981), and SAS No. 47, *Audit Risk and Materiality* (1983).

Variables (also, “classical” or central-limit-theorem based) sampling considers both the frequency and amount of errors (magnitude) and allows expression of confidence or certainty (risk) about its conclusions. It is thus appealing to auditors. The use of variables sampling in auditing was explored in the early investigations of sampling, but more aggressive consideration occurred in the late 1960s and early 1970s. These methods were implemented rather broadly in the 1970s and 1980s, but their use has declined in the 1990s. Much of their current use is for accounting estimation problems, such as the conversion of an inventory to LIFO.

Scholarly consideration of variables sampling in auditing began with Prytherch's (1942) article and his discussion of audit materiality and the qualitative and quantitative aspects of error. The paper is remarkable in that it raises numerous issues, including the need to:

- Stratify populations
- Sample the top-valued stratum 100 percent and still do some sampling in lower strata
- Consider the effectiveness of internal control in deciding on the extent of tests
- Determine where the possibilities of major error or fraud are
- Consider an altered approach when understatement error is the primary risk

Finally, Prytherch discusses the need to *quantify* materiality and make cost-benefit considerations in audit sampling. Thus, Prytherch foreshadowed many of the concepts in current professional standards. Shortly after Prytherch, the early writings of Cranstoun, Neter, and Vance discussed sequential analysis as an important area for auditing. Thus, these authors together show the basis for the “audit risk model” approach and that sequential analysis in auditing was contemplated by at least the middle of the century.

As illustrated in the preceding section, the decade of the 1960s can be characterized by continued exploration of the special sampling

problems faced by auditors. While Stringer (with van Heerden in the Netherlands) invented variations of DUS, others were involved with the adaptation of traditional survey sampling techniques to the special environment of auditing. Hill, Roth, and Arkin (1962) is representative of this genre. Their work discusses the application of such classical survey sampling techniques as stratified sampling and cluster sampling, as well as difference estimators and discovery sampling.

In the first University of Kansas auditing symposium in 1972, Stringer discussed the first quantitative professional standard, SAP No. 54. This discussion predated publication of the final version of the standard by about six months. A comparison of Stringer (1972) to the actual standard shows how the relatively specific language about risk in a preliminary draft became less specific before approval of the final version. The paper also contains the first references to “inherent risk” and substantive audit sampling as they now appear in SAS No. 47.

Elliott and Rogers (1972) incorporated a quantitative internal control evaluation system, along with other audit procedures, in the determination of the required sample size for tests of details using classical sampling methods. Their paper carefully distinguishes the risk of incorrect acceptance from incorrect rejection and focuses attention on hypothesis testing. It is also the first presentation of a means of allocating materiality among accounts. Elliott and Rogers is noteworthy for its redirection of classical sampling from an estimation of total audited dollar value approach to a hypothesis testing of error approach. That is, instead of a confidence interval on total audited value and a comparison with total book value, it subtracts total book value from audited value, then tests the hypothesis that total error exceeds a “material” amount for the account. This latter reformation led to considerable savings of cognitive effort on the part of the reader and led to greater intuition on the part of the auditor. Also, its focus on the distribution of sampling error under simple null and alternative hypotheses was instructive, in that the reader could clearly see the relationship between the risks of Type I and Type II errors and sample size.

A group of papers published after SAP No. 54 document some of the dangers only alluded to in prior work. Two papers published shortly after SAP No. 54 point out peculiarities of accounting populations and the need to exercise care in borrowing statistical techniques from other areas and applying them to audit problems (Stringer’s fundamental concern). Kaplan (1973) provides evidence on the paradoxical danger of applying auxiliary information (ratio and difference) estimators to accounting populations that are too “clean” or almost error-free.

Goodfellow, Loebbecke, and Neter (1974) present a basic discussion of the strengths and weaknesses of the various competing sample selection and evaluation methods in use at the time.

The year 1975 brought forth perhaps the most influential audit sampling paper of the decade. Neter and Loebbecke (1975) used four account balance populations based on real-world audit results to simulate several types of accounts. To these populations they applied several popular estimators, including the major classical estimators and a specific form of the MUS estimator with which they were familiar. They found that no single estimator works best on all populations. They also found that traditional classical estimators do not function well when the sample size is small and when the distribution of error is far from normal. These results greatly stimulated interest in MUS methods as well as in further refinement of classical methods. Examples of the latter are: Burdick and Reneau (1978), Baker and Copeland (1979), Beck (1980), Frost and Tamura (1982, 1986), Roberts (1986), and Biddle, Bruton, and Siegle (1990). Examples of MUS research include Reneau (1978), Leitch et al. (1982), Dworin and Grimlund (1984), Manzeffricke and Smieliauskas (1984), Tsui et. al. (1985) and Grimlund and Felix (1987).

Since 1986, very little published work has involved audit sampling using classical methods. Instead, most scholars with an interest in statistics have turned their attention to other aspects of auditing, including risk assessment, analytical procedures, evidence integration, game theory, and audit litigation. The decline in sampling research may be due to a combination of factors, including a decline in use of statistical estimation in auditing practice and considerable focus of research support on other issues.

MONETARY UNIT SAMPLING

As discussed in terms of Stringer's concerns and the Neter-Loebbecke study, a significant source of problems in the use of classical sampling techniques is the highly skewed distributions of errors that usually exist in accounting populations. The right skewed accounting error distributions required large sample sizes and would in some cases make the estimates unreliable. These problems motivated a number of practitioners and academics (in various combinations) to explore other sampling approaches. Their efforts have made a major contribution to both the methods currently available for use in practice and the theory supporting them. The various sample selection and evaluation methods

called monetary unit sampling (MUS) are especially important. They are designed to be effective when looking for overstatement errors and very few errors are expected.

Of the various terms used to describe MUS methods, probability proportional to size (PPS) sampling as used in the field of statistics best describes the way in which MUS-type samples are selected. Differences in the various methods include both selection techniques and the ways of evaluating results. For example, random PPS, systematic or interval dollar-unit selection, and cell sampling are all in use.

The earliest development of MUS methods in the U.S. was by Stringer and Stephan. Because their method was the first used on a widespread basis, especially in the U.S., the term *Stringer Bound* is often used, somewhat loosely, to describe the basic attributes-theory-based bounds. Interestingly, the period between the initial development and implementation in Deloitte of their method (circa 1960) and the eventual publication (1973) of the details of a related method, was quite long. As a result, the impact of Stringer and Stephan's research, although clear, may not have been as great as it could have been. Deloitte has yet to publish a detailed description and rationale for CMA.

Rodney Anderson and Albert Teitlebaum reported the development of dollar-unit sampling in 1973 (Anderson and Teitlebaum, 1973). Their article was the first detailed disclosure (in English) of a heuristic underlying MUS bound on errors in an accounting population. Because the development of the method was disclosed in the professional literature and debated in a number of auditing and statistical forums, Anderson and Teitlebaum (and later Donald Leslie) are widely recognized for their contributions. All three actively participated in debates about these methods and thereby added significantly to the impact of their development efforts on research and practice.

The upper error bound for MUS is relatively simple to compute. Using attributes theory, the appropriate Poisson mean for zero error is priced at an assumed maximum of \$1.00. Any errors found in the sample are ordered from the largest to the smallest fraction of error to book value (this fraction is called a *tainting*) and then weighted using the incremental Poisson means for the number of errors found. The Poisson distribution is used to approximate the hypergeometric distribution in this process, in order to simplify the needed tables.

A variety of slightly differing weighting methods were developed. These methods differ, for example, in whether the taintings are weighted individually or averaged, or in how any understatement errors in the sample are incorporated in the upper bound on overstatement

errors. Alternative methods to estimate needed sample sizes were also developed and debated in the literature.

Evaluations of the various forms of the MUS heuristic quickly focused on the methods' conservatism (see Goodfellow, Loebbecke and Neter, 1974). As increasing numbers of errors are found in a sample, the basic MUS methods tend to reject good populations too often. Some modifications of these basic methods, such as the "cell bound" approach described by Leslie, Teitlebaum, and Anderson (1979), reduce the extent of this problem but do not eliminate it. Loebbecke and Neter (1975) discuss the resulting issues for selecting appropriate methods and suggest that MUS methods are but one of several that auditors should consider when estimating amounts of balances or errors.

In 1977, Professors Fienberg, Neter, and Leitch (1977) developed a multinomial distribution-based method for evaluating a PPS sample. Their method was intended to approximate closely a theoretically correct approach for MUS and to be substantially less conservative than the various MUS approaches when errors are found in increasing numbers in a sample. The multinomial method was used as a backup method by a few firms, but never acquired much popularity because of the difficulty even large mainframe computers had in computing the error bound. The problem became worse as the number of errors increased.

Because of some theoretical questions and the computational difficulty with the multinomial bound, academics proposed other approaches including:

- The Moment Bound—Dworin and Grimlund (1984)
- The Multinomial-Dirichlet Bound—Tsui, Matsumura, and Tsui (1985)
- The Beta-Normal Bound—Manzefricke and Smieliauskas (1984)

These methods are all easy to compute (on data processors) competitors of the multinomial bound. Their introduction resulted in research articles comparing their performance in the face of varying distributions of amounts and errors in accounting populations (Grimlund and Felix, 1987; Manzefricke and Smieliauskas, 1984). As might be expected, their performances varied, and no one approach clearly dominated.

As a result of that research, Arthur Andersen took an interest in the Moment Bound method and, with the assistance of two academics (Felix and Grimlund), undertook the necessary research to carefully evaluate the method for use in practice (see Felix, Grimlund, Koster and

Roussey, 1990). The results of this research were positive and led to the development of a version of the method and an accompanying sample-size determination routine. This was adopted and continues in use today.

SUMMARY

Great changes have occurred in auditing during the last sixty years. As indicated elsewhere in this monograph, auditors have moved towards a risk-based approach to audits. In the early stage of that movement, this approach was, in part, carried out by measuring the risk associated with the conclusions drawn in specific, individual tests by statistical sampling. This method led to a great deal of research and cooperation throughout the profession.

Today, the analysis of risk has led auditors to “re-engineer” the audit. A recurring theme is to recognize and respond to a broader set of risks. This new focus, along with increasing competition, seems to have led to a reduction in the number of tests of details performed during an audit, with an increased emphasis on examination of individually significant transactions and the use of analytical procedures. We believe the important thing about the research effort described in this chapter is its significance as a successful *collaborative* research effort and as a model for more such efforts by the profession in the future.

Appendix

Statistical Sampling Chronological Bibliography

The following is a bibliography of publications relating to the use of statistical sampling in auditing. The publications are presented in chronological order in the left-hand column. The four right-hand columns indicate whether the authors or source of the publication are academic research (A), practitioner research (P), academic education (E), or professional standard setting (S).

In the academic research column, an A means that the academic is associated with accounting and auditing, and an S means the academic is associated with statistics.

Publication	A	P	E	S
Carman, Lewis A., "The Efficacy of Tests," <i>American Accountant</i> , v18, (December 1933), 360–366.		X		
Prytherch, Robert H., "How Much Test Checking Is Enough?" <i>Journal of Accountancy</i> , v74(6), (December 1942), 525–530.		X		
Cranstoun, W.D., "A New Look at Basic Auditing Techniques," <i>The Journal of Accountancy</i> , (October 1948), 274–283.		X		
Neter, John, "An Investigation of the Usefulness of Statistical Sampling Methods in Auditing," <i>Journal of Accountancy</i> , v87(5), (May 1949), 390–398.	S			
Vance, Lawrence L., <i>Scientific Method for Auditing</i> (Berkeley, CA: University of California Press, 1950).	A			
Vance, L.L., "How Much Test Checking Is Enough?" <i>The Accounting Review</i> , (January 1951), 22–30.	A			

<i>Publication</i>	<i>A</i>	<i>P</i>	<i>E</i>	<i>S</i>
Neter, John, "Sampling Tables: An Important Statistical Tool for Auditors," <i>The Accounting Review</i> , (October 1952), v27(4), 475-483.	S			
Trueblood, Robert M., "The Use of Statistics in Accounting Control," <i>N.A.C.A. Bulletin</i> , (July 1953), 1561-71.		X		
Stettler, Howard F., "Statistical Interpretation of Test Checks," <i>Journal of Accountancy</i> , v97(1), (January 1954), 49-57.	A			
Trueblood, Robert M., and Robert J. Monteverde, "A Bibliography on the Application of Statistical Methods to Accounting and Auditing," <i>The Accounting Review</i> , v29(2), (April 1954), 251-254.		X		
Trueblood, Robert M., and W.W. Cooper, "Research and Practice in Statistical Applications to Accounting, Auditing, and Management Control," <i>The Accounting Review</i> , v30(2), (April 1955), 221-229.	A	X		
Monteverde, Robert J., "Some Notes of Reservation on the Use of Sampling Tables in Auditing," <i>The Accounting Review</i> , v30(4), (October 1955), 582-591.		X		
Vance, Lawrence L., and John Neter, <i>Statistical Sampling for Auditors and Accountants</i> (New York: John Wiley & Sons, 1956).	A/S			
Arkin, Herbert, "Statistical Sampling in Auditing," <i>The New York Certified Public Accountant</i> , v27(7), (July 1957), 454-469.	S			
Trueblood, Robert M., and Richard M. Cyert, <i>Sampling Techniques in Accounting</i> (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1957).	S	X		
Arkin, Herbert, "A Statistician Looks at Accounting," <i>Journal of Accountancy</i> , v105(4), (April 1958), 66-67.	S			

Continued.

<i>Publication</i>	<i>A</i>	<i>P</i>	<i>E</i>	<i>S</i>
Hill, Henry P., "An Accountant Looks at Statistics," <i>Journal of Accountancy</i> , v105(4), (April 1958), 58–61.		X		
Stephan, Frederick F., "Faulty Advice About Statistical Sampling—Some Comments on 'A Simplified Statistical Technique for Use in Verifying Accounts Receivable'," <i>The Accounting Review</i> , v35(1), (January 1960), 29–32.	S			
Cyert, Richard M., G.M. Hinckley, and Robert J. Monteverde, "Statistical Sampling in the Audit of the Air Force Motor Vehicle Inventory," <i>The Accounting Review</i> , v35(4), (October 1960), 667–673.	S	X		
van Heerden, A., "Steekproeven als Middel van Accountantscontrole" (Statistical Sampling as a Means of Auditing), <i>Maandblad voor Accountancy en Bedrijfshuishoudkunde</i> , nr. 11, (1961), 453.	S			
Stringer, Kenneth W., "Some Basic Concepts of Statistical Sampling in Auditing," <i>Journal of Accountancy</i> , v112(5), (November 1961), 63–69.		X		
Brown, R.G., and L.L. Vance, " <i>Sampling Tables for Estimating Error Rates of Proportions</i> ," (Berkeley, CA: University of California Press, 1961).	A			
AICPA Subcommittee on Statistical Sampling, Statement on the Use of Statistical Sampling, <i>Journal of Accountancy</i> , (February 1962), 60–62.				X
Hill, Henry P., Joseph L. Roth, and Herbert Arkin, <i>Sampling in Auditing</i> (New York: The Ronald Press Company, 1962).	S	X		
Cyert, R.M., and H.J. Davidson, <i>Statistical Sampling for Accounting Information</i> (Englewood Cliffs, NJ: Prentice-Hall, 1962).	S	X		

Publication	A	P	E	S
AICPA, Statement on Auditing Procedures No. 33, <i>Auditing Standards and Procedures (a codification)</i> , (1963).				X
Arkin, Herbert, <i>Handbook of Sampling for Auditing and Accounting</i> (New York: McGraw-Hill 1963).	S			
Stringer, Kenneth W., "Practical Aspects of Statistical Sampling in Auditing," <i>Proceedings of the Business and Economic Statistics Section</i> (American Statistical Association, 1963), 405–411.		X		
ICPA, Committee on Statistical Sampling, "Relationship of Statistical Sampling to Generally Accepted Auditing Standards," <i>Journal of Accountancy</i> , v118(1), (July 1964), 56–58.				X
Settler, Howard F., "Some Observations on Statistical Sampling in Auditing," <i>Journal of Accountancy</i> , v121(4), (April 1966), 55–60.	A			
AICPA, Statement on Auditing Procedure No. 36, <i>Revision of Extensions of Auditing Procedures Relating to Inventories</i> , (1966).				X
Davidson, H.J., John Neter, and A.S. Petran, "Estimating the Liability for Unredeemed Stamps," <i>Journal of Accounting Research</i> , v5, (1967), 186–207.	S	X		
AICPA, <i>An Auditor's Approach to Statistical Sampling: Vol. 1—An Introduction to Statistical Concepts and Estimation of Dollar Values</i> , (1967).			X	X
Institute of Internal Auditors, <i>Sampling Manual for Auditors and Supplement to Sampling Manual for Auditors</i> , (Orlando, FL: IIA, 1967 and 1971).				X
AICPA, <i>An Auditor's Approach to Statistical Sampling: Vol. 3—Stratified Random Sampling</i> , (1968).			X	X

Continued.

<i>Publication</i>	<i>A</i>	<i>P</i>	<i>E</i>	<i>S</i>
Vanasse, Robert W., <i>Statistical Sampling for Auditing and Accounting Decisions: A Simulation</i> , (New York: McGraw-Hill, 1968).	A		X	
Haskins & Sells, <i>Audit Sampling. A Programmed Instruction Course</i> (1970).		X	X	
Burstein, Herman, <i>Attribute Sampling</i> , (New York: McGraw-Hill, 1971).	S			
Meikle, G.R., "Example of a Sampling Plan," <i>Statistical Sampling in an Audit Context: An Audit Technique Study</i> (Toronto: CICA, 1972).		X		X
Elliott, Robert K., and John R. Rogers, "Relating Statistical Sampling to Audit Objectives," <i>Journal of Accountancy</i> , v134(1), (July 1972), 46-55.		X		
Stringer, K.W., "Toward Standards for Statistical Sampling," <i>Auditing Looks Ahead</i> , (Touche Ross/University of Kansas Symposium on Auditing Problems, 1972), 43-49.		X		
Internal Revenue Service, "Revenue Procedure 72-36," <i>Internal Revenue Bulletin</i> (No. 1972-29, July 17, 1972).				X
AICPA, Statement on Auditing Procedure No. 54, <i>The Auditor's Study and Evaluation of Internal Control</i> , (1972).				X
AICPA, <i>An Auditor's Approach to Statistical Sampling: Vol. 5—Ratio and Difference Estimation</i> , (1972).			X	X
Anderson, R.J., and A.D. Teitlebaum, "Dollar-Unit Sampling: A Solution to the Audit Sampling Dilemma," <i>CA Magazine</i> , (April 1973).	S	X		
Teitlebaum, A.D., "Dollar-Unit Sampling in Auditing," <i>Proceedings of the National Meeting of the American Statistical Association</i> (1973).	S			

<i>Publication</i>	<i>A</i>	<i>P</i>	<i>E</i>	<i>S</i>
Kaplan, Robert S., "Statistical Sampling in Auditing with Auxiliary Information Estimators," <i>Journal of Accounting Research</i> , v11(2), (Autumn 1973b), 238–258.	A			
Burstein, Herman, <i>Sample-Size Tables for Quality Control and Auditing</i> , (Westport, CT: Regrave Information Resources Corporation, 1973).	S			
Goodfellow, J.L., J.K. Loebbecke, and J. Neter, "Perspectives on CAV Sampling Plans," <i>CA Magazine, Part I</i> (October 1974), 23–30, and <i>Part II</i> (November 1974), 47–53.	S	X		
AICPA, <i>An Auditor's Approach to Statistical Sampling: Vol. 2—Sampling for Attributes: Estimation and Discovery</i> [revision], (1974).			X	X
AICPA, <i>An Auditor's Approach to Statistical Sampling: Vol. 6—Field Manual for Statistical Sampling</i> , (1974).			X	X
McRae, Thomas W., <i>Statistical Sampling for Audit and Control</i> , (London: Wiley, 1974).		X		
Neter, John, and James K. Loebbecke, <i>Behavior of Major Statistical Estimators in Sampling Accounting Populations: An Empirical Study</i> , Auditing Research Monograph 2 (New York, AICPA, 1975).	S	X		X
Kaplan, R., "Sample Size Computations for Dollar Unit Sampling," <i>Journal of Accounting Research</i> , v13 Suppl., (1975), 238–258.	A			
Loebbecke, James K., and John Neter, "Considerations in Choosing Statistical Sampling Procedures in Auditing," <i>Journal of Accounting Research</i> , v13 Suppl., (1975), 44–50.	S	X		
Kinney, William R., Jr., "A Decision Theory Approach to the Sampling Problem in Auditing," <i>Journal of Accounting Research</i> , v13(1), (Spring 1975a), 117–132.	A			

Continued.

<i>Publication</i>	<i>A</i>	<i>P</i>	<i>E</i>	<i>S</i>
Newman, Maurice S., <i>Financial Accounting Estimates through Statistical Sampling by Computer</i> , (New York: Wiley, 1976).		X		
Smith, T.M.F., <i>Statistical Sampling for Accountants</i> , (London: Haymarket Publishing, 1976).		X		
Felix, W.L., and R.A. Grimlund, "A Sampling Model for Audit Tests of Composite Accounts," <i>Journal of Accounting Research</i> , v15, (1977), 23–41.	A			
Fienberg, S., John Neter, and R. A. Leitch, "Estimating the Total Overstatement Error in Accounting Populations," <i>Journal of the American Statistical Association</i> , v72, (1977), 295–302.	S/A			
Burdick, R.K., and J.H. Reneau, "The Impact of Different Error Distributions on the Performance of Selected Sampling Estimators in Accounting Populations," <i>Proceedings of Business and Economic Statistics Section</i> , (Washington, D.C.: American Statistical Association, 1978), 779–781.	A			
Reneau, J.H., "CAV Bounds in Dollar Unit Sampling: Some Simulation Results," <i>The Accounting Review</i> , v53, (1978), 669–680.	A			
Roberts, Donald M., <i>Statistical Auditing</i> , (New York: AICPA, 1978).	S			X
Leslie, Donald A., Albert D. Teitlebaum, and Rodney J. Anderson, <i>Dollar-Unit Sampling: A Practical Guide for Auditors</i> (Toronto: Copp Clark Pitman, 1979).	S	X		
Kinney, William R., Jr., "Integrating Audit Tests: Regression Analysis and Partitioned Dollar-Unit Sampling," <i>Journal of Accounting Research</i> , v17(2), (1979), 456–475.	A			

<i>Publication</i>	<i>A</i>	<i>P</i>	<i>E</i>	<i>S</i>
Leslie, Donald A., "Auditing in a Multilocation Environment," <i>Proceedings of the Annual Meeting of the American Statistical Association</i> (1979).		X		
Aldersley, S.J., and A.D. Teitlebaum, "Rigorous DUS-Cell Evaluation," <i>Proceedings of the Annual Meeting of the American Statistical Association</i> (1979).	S	X		
Baker, R.L., and R.M. Copeland, "Evaluation of the Stratified Regression Estimator for Auditing Accounting Populations," <i>Journal of Accounting Research</i> , v17 (1979), 606-617.	A			
Ernst & Whinney, <i>Audit Sampling</i> , (Cleveland: Ernst & Whinney, 1979).		X		
Beck, P.J., "A Critical Analysis of the Regression Estimator in Audit Sampling," <i>Journal of Accounting Research</i> , v18 (1980), 16-37.	A			
AICPA, Auditing Standards Board, <i>Statement on Auditing Standards No. 39</i> , (New York: AICPA, 1981).				X
Arens, A.A., and J.K. Loebbecke, <i>Applications of Statistical Sampling to Auditing</i> , (Englewood Cliffs, NJ: Prentice-Hall, 1981).	A		X	
Bailey, A.D., <i>Statistical Auditing: Review, Concepts, and Problems</i> , (New York: Harcourt, Brace, Jovanovich, 1981).	A		X	
Guy, D.M., <i>An Introduction to Statistical Sampling in Auditing</i> , (New York: Wiley, 1981).	A		X	
Frost, P.A., and H. Tamura, "Jackknifed Ratio Estimation in Statistical Auditing," <i>Journal of Accounting Research</i> , v20, (1982), 103-120.	A			
Leitch, R.A., J. Neter, R. Plante, and P. Sinha, "Modified Multinomial Bounds for Larger Numbers of Errors in Audits," <i>The Accounting Review</i> , v57, (1982), 384-400.	S/A			

Continued.

<i>Publication</i>	<i>A</i>	<i>P</i>	<i>E</i>	<i>S</i>
Arkin, Herbert, <i>Sampling Methods for the Auditor: An Advanced Treatment</i> , (New York: McGraw-Hill, 1982).	S			
AICPA, Statistical Sampling Subcommittee, <i>Audit Sampling</i> (New York: AICPA, 1983).				X
AICPA, Statement on Auditing Standards No. 47, <i>Audit Risk and Materiality</i> , (1983).				X
Leslie, Donald A., "An Analysis of the Audit Framework Focusing on Inherent Risk and the Role of Statistical Sampling in Compliance Testing," <i>Auditing Symposium VII: Proceedings of the 1984 Touche Ross/University of Kansas Symposium on Auditing Problems</i> , Howard F. Stettler and N. Allen Ford, eds. (Lawrence, Kansas: School of Business, University of Kansas, 1984), 89–125.		X		
Dorwin, L., and R.A. Grimlund, "Dollar Unit Sampling for Accounts Receivable and Inventory," <i>The Accounting Review</i> , v59, (1984), 218–241.	A			
Manzefricke, M., and W. Smieliauskas, "A Simulation Study of the Performance of Parametric Dollar Unit Sampling Statistical Procedures," <i>Journal of Accounting Research</i> , (Autumn 1984), 588–604.	A			
Neter, John, H.S. Kim, and L.E. Graham, "On Combining Stringer Bounds for Independent Monetary Unit Samples from Several Populations," <i>Auditing: A Journal of Practice and Theory</i> , (Fall 1984), 74–88.	S	X		
Aldersley, S.J., and D.A. Leslie, "Models for Multilocation Audits," <i>Symposium on Auditing Research VI</i> (Urbana-Champaign: University of Illinois, Department of Accountancy, 1984), 99–128.		X		
Wilburn, A.J., <i>Practical Statistical Sampling for Auditors</i> , (New York: M. Dekker, 1984).		X		
Tsui, K., E.M. Matsumura, and K. Tsui, "Multinomial-Dirichlet Bounds for Dollar-	S/A			

<i>Publication</i>	<i>A</i>	<i>P</i>	<i>E</i>	<i>S</i>
Unit Sampling in Auditing,” <i>The Accounting Review</i> , (January 1985), 76–96.				
Neter, John, and J. Godfrey, “Robust Bayesian Bounds for Monetary-Unit Sampling in Auditing,” <i>Journal of the Royal Statistical Society</i> , Ser. C, 34, (1985), 157–168.	S/A			
Duke, G.L., <i>Behavior of Test Statistics in the Auditing Environment: An Empirical Study</i> (Sarasota, FL: American Accounting Association, 1985).	A			
Burgstahler, D., W.L. Felix, Jr., and R.S. Roussey, “An Incorrect Rejection Problem in Monetary Unit Sampling,” <i>1986 Illinois Audit Symposium</i> (Champaign-Urbana: University of Illinois, 1986).	A	X		
Frost, P.A., and H. Tamura, “Accuracy of Auxiliary Information Interval Estimation on Statistical Auditing,” <i>Journal of Accounting Research</i> , v24 (1986), 57–75.	A			
Roberts, D.M., “Stratified Sampling Using a Stochastic Model,” <i>Journal of Accounting Research</i> , v24 (1986), 111–126.	S			
Grimlund, R., and W.L. Felix, Jr., “Simulation Evidence and Analysis of Alternative Methods of Evaluating Dollar Unit Samples,” <i>The Accounting Review</i> , (July 1987), 455–479.	A			
Biddle, G.C., C.M. Burton, and A.F. Siegel, “Computer-Intensive Method in Auditing: Bootstrap Difference and Ratio Estimation,” <i>Auditing: A Journal of Practice and Theory</i> , v9 (Fall 1990), 92–114.	A			
Felix, W.L., Jr., R.A. Grimlund, F.J. Koster, and R.S. Roussey, “Arthur Andersen’s New Monetary Unit Sampling Approach,” <i>Auditing: A Journal of Practice and Theory</i> , (Fall 1990), 1–16.	A	X		
Steele, Anthony, <i>Audit Risk and Audit Evidence: The Bayesian Approach to Statistical Auditing</i> , (London; San Diego: Academic, 1992).	A			
AICPA, <i>Audit Sampling (Audit Procedure Study)</i> , New York: AICPA, (1994).				X

Analytical Procedures

Stanley F. Biggs, *University of Connecticut*; **W. Robert Knechel**, *University of Florida*; **Norman R. Walker**, *Price Waterhouse*; **Wanda A. Wallace**, *College of William and Mary* (chapter lead author); **John J. Willingham**, *University of Texas at Austin*

OVERVIEW

The profession has a long history of interaction and collaboration between practitioners and academic researchers in the field of analytical procedures. This interaction has provided important advances for the practice of auditing. A good example of this process can be seen in the research related to the development of the statistical analytical procedures package STAR, developed by Deloitte, Haskins, and Sells. STAR was developed by an academician in statistics, along with practitioner Kenneth Stringer, as a tool intended to integrate regression analysis and sampling. The result, a regression-based analytical review package, immediately caught the attention of a number of academicians, who wrote papers that in turn sparked considerable discussion among other academicians and practitioners.

As an example of this interaction, at the 1978 Illinois Auditing Research Conference, Kinney and Salamon, then at the University of Iowa, presented research involving a simulation analysis of a model similar to STAR. A practitioner with Peat Marwick, Bob Elliott, and an academician, Wanda Wallace, then at University of Rochester, provided extensive comments about the prospects for effective use of regression modeling in analytical procedures. This discussion resulted in a large-scale project conducted by Wallace and a practitioner, Abraham Akresh of Price Waterhouse. The results of this project provided a number of important insights into the applicability of regression models in the practice of analytical procedures (discussed later in this chapter).

The authors appreciate firm histories that have been compiled and shared for Coopers and Lybrand and Touche Ross. We also appreciate the sharing of recollections by Jack Krogstad, Research Director for the Treadway Commission and now at Creighton University.

Today nearly all firms are aware of the usefulness of regression analysis in analytical procedures, and they apply such tools in their audit process and in management advisory services. While not all of the research done in analytical procedures has involved an extensive amount of practitioner-academic collaboration, a great deal of it has equally important implications for practice. This chapter chronicles such research, beginning with a brief overview of some of the critical events and issues that shaped the research in analytical procedures.

THE PARADOX OF ANALYTICAL PROCEDURES

Performing analytical procedures to obtain audit evidence has long been a common practice. Firms' technical procedures manuals reportedly included this topic in the 1930s, as a formalization of already existing practices (Stringer and Stewart, 1985). Analytical procedures, whether under the guise of reasonableness tests or analytical review (both terms that have been used in the past) are pervasive in the audit process. Academic research has raised a number of concerns related to the effectiveness of analytical procedures, however, some of which remain unresolved.

Early research raised questions about the ability of analytical procedures to generate estimates sufficiently precise to allow accurate conclusions about an account balance, in light of materiality levels for an engagement. Later research identified a number of potential problems related to the decision process actually used by auditors during the performance of analytical procedures. One such problem was auditors' ability to formulate expectations that were effective in detecting unusual fluctuations within account balances and to generate correct hypotheses or explanations for such observed fluctuations. The *paradox* of analytical procedures arises because, in spite of this research evidence, archival investigations indicate that analytical procedures provide an initial indication of the existence of a great many of the errors detected by an auditor during an engagement. Furthermore, conventional wisdom among practitioners perpetuates the belief that analytical procedures are effective and efficient sources of audit evidence and that their use should be expanded.

In other words, research has both corroborated the usefulness of analytical procedures and has pointed the way toward enhancing their application. Practice has been innovative in embracing certain technologies and in exploring means of controlling various risks identified by judgment research. Over time, the use of analytical procedures has

TABLE 1 Analytical Procedures' Evolution

Early Years: *Fluctuation analysis, ratio analysis and reasonableness tests* dominate analytical procedures' application; the Salad Oil King and Equity Funding cases demonstrate the importance of designing analytical procedures within the context of an industry and suggest their feasibility and potential power.

Aftermath: *Understanding of the auditee* is recognized as critical to effective auditing.

Structure Sought: A means of *organizing one's understanding of auditee's operations* is developed through formalizing expectations used in performing analytical procedures.

Technology's Improvement Facilitates Modeling: *Precision can be quantified* and greater reliance placed on more objective and sophisticated, statistically based modeling approaches.

Application of Tools: Involves both analysis and judgment, leading to attention to decision making; *judgment pervades even statistical applications*, suggesting a need to consider how biases and cognitive processes influence analytical procedures.

Growing Interest in Analytical Procedures: Economic pressures, the growing complexity of business, the prevalence of estimates throughout the financial statements and the expectations-gap implications for fraud detection lead to *increased interest* in analytical procedures.

Standard-Setters Act: Error detection capabilities of analytical procedures combined with technological innovations that facilitate field use of statistical methods and expert-system-based decision tools lead to *mandated integration of analytical procedures* in the planning and review phase of the audit process, with use of substantive tests encouraged.

Ongoing Research: Efforts continue to *enhance effectiveness and efficiency* of analytical procedures through education, research, and field application experiences.

increased, both as a function of economic pressures and as a result of collaborative research efforts that have demonstrated its feasibility, power, effectiveness, and efficiency. These and other developments are described in the pages of this chapter, the "story line" of which is outlined in Table 1.

The purpose of this chapter is to trace the refinements in the use

of analytical procedures, as well as the research activity that has led to greater insights into the benefits and pitfalls of using analytical procedures. Early work in this field, involving a number of joint projects between academics and practitioners, led to the adoption of many current policies, practices, and standards that influence practice. More recent research has had a less extensive influence on practice to date, but has raised a number of critical issues to be addressed in order to enhance the level of rigor and precision in applying analytical procedures. These issues will continue to grow in importance as auditors reduce other forms of costly testing and increase their reliance on analytical procedures—a discernible trend in practice and standard setting. Indeed, analytical procedures may be the best tool for (and perhaps the only tool capable of) identifying certain types of frauds (St. Pierre and Anderson, 1982 and 1984) and for auditing the increasing number of estimates found in financial statements.

The remainder of this chapter is organized along both chronological and thematic lines. Initially, the interaction of firm initiatives, standard setting, and various important feasibility studies executed in the late 1970s and early 1980s are discussed. An important theme of this section is the demand-driven nature of the work by many academics in consultation with practitioners. In other words, problems that arose in practice led to a reaction by academic researchers, leading to findings of relevance and importance to both practice and the standard-setting community. Drawing upon SAS No. 56, we organize our discussion of research in the 1980s and beyond along the major steps in the decision process entailed in executing analytical procedures. Institutional developments are discussed, alongside the interaction of standards, research, and practice. We recount educational effects and discuss future directions for research.

PHASE ONE, THE EARLY YEARS: EMPHASIS ON FEASIBILITY

The idea of “reasonableness tests” has appeared in the auditing literature through most of its history. Although rarely acknowledged in books or professional literature, the early practical experimentation with analytical evidence laid the foundation for much of the development that followed. In the late 1940s, the 1950s, and the 1960s, attention was directed mainly at developing means of *integrating* various statistical tools into the process of analytical review as it was known at that time.

The perceived possibilities of analytical procedures were a primary motivation for practitioners' interests. They saw analytical procedures as potential contributors to the planning, execution, and final review phases of the audit. In addition, the cost of such procedures was expected to be lower than other available auditing tools. Many believed that troubled companies could be identified and litigation risk reduced through analytical procedures. However, they also saw the limitations of analytical procedures, particularly the very real danger of misuse, leading to underauditing and greater litigation risk. Research was needed to improve the effectiveness of analytical procedures, in order both to enhance the strengths and potential of the tool and to minimize its weaknesses. Practitioners and academics together directed attention to this area.

AICPA Agenda Development

The first formal treatment of analytical evidence in professional standards dates from the mid 1970s. In 1976 and 1977, the Auditing Standards Committee (ASC) placed analytical review on its agenda, leading eventually to the release of SAS No. 23 on analytical review. The impetus for the study was a perceived need for standards to reflect common practice. Among the key participants were John Willingham, a former academic who had joined Peat Marwick, and practitioner Jim Leisenring. (Both professionals have been active in the academic and standard-setting communities throughout their careers in practice.)

Researcher/Practitioner Joint Efforts on Regression Analysis

A number of independent efforts were also getting started in the mid 1970s. Prior to 1977, Professor Leo Bernstein of the City University of New York regularly consulted with Coopers and Lybrand on analytical procedures and financial statement analysis. Statistics professor John Neter and accounting professor Robert Kaplan independently pursued research associated with modeling, leading to a 1978 consortium of five public accounting firms—Touche Ross, Peat Marwick, Clarkson and Gordon, Price Waterhouse, and Deloitte, Haskins and Sells. The consortium was committed to supporting these researchers in a project to explore the application of regression analysis in the field. Data were made available for client applications. The conclusion drawn at that time, given the technology then existing, was that a regression approach would be cost-prohibitive for client applications.

In 1980, collaboration between C.A. Kulikowski, a Rutgers University Medical School Professor, and Coopers and Lybrand explored the feasibility of applying expert systems to analytical procedures in auditing, but determined that the technology for effective widespread delivery was not yet available. Further, The Peat Marwick Research Opportunities in Auditing (ROA) program supported research on expert systems that revealed the need for advances in microcomputer technology to develop practical decision aids that would include analytical procedures.

Statistical Evolution: Dialogue of Practitioners and Academicians at University Conferences

Around this same time (mid to late 1970s), some major initiatives in statistics evolved, including the following:

- STAR
- Dollar-Unit Sampling (DUS) (Leslie, Teitlebaum, and Anderson, 1979)—bearing out the advantage of generating estimates of error incidence in dollars
- The joint work by Touche Ross through Jim Loebbecke, then a partner, and John Neter (1975) to create a population that mirrored typical auditing populations (facilitating simulation tests of audit effectiveness of analytical procedures)
- Increased simulation evidence—reflecting the Loebbecke and Neter findings—on regression analysis (e.g., seeding errors in statistically generated distributions of errors to determine whether a modeling approach detects errors (and if not, what the rate of nondetection is) and false error signals

STAR's particular importance was that it related analytics directly to the overall risk of the engagement through regression analysis. The 1978 University of Illinois Auditing Research Conference included a paper by Kinney and Salamon, who conducted a simulation analysis designed to explore how well regression analysis similar to STAR would identify seeded errors. Discussants Elliott and Wallace (1978, published 1979) noted that while the detection capabilities in a simple regression simulation setting were promising and even demonstrable analytically, a number of key issues required further attention. These included the relative performance of more sophisticated multiple regression models, the methods of addressing statistical concerns to determine their effectiveness, and the means of quantifying the costs attendant to field application.

The discussion at the University of Illinois Conference was instrumental in sparking a call from Price Waterhouse (by Abraham Akresh in particular) to several academicians. Wanda Wallace performed a parallel study of traditional analytical procedures and regression analysis, applied at an auditing client by using General Electric time-sharing software. The audit team collected information requested by the researcher, who then formulated models based on discussions with the team and the client. The audit team concurrently collected evidence using traditional procedures. The results obtained from the traditional audit approach were then compared to those generated from the modeling approach. Significant findings included the following:

- Regression analysis identified all the issues detected using traditional analytical procedures.
- Regression analysis identified some risk areas *not* detected through traditional analytical procedures.
- The review time of audit managers and partners was reduced when modeling was applied, compared to the time required for traditional analytical procedure working papers.
- Precision was well within materiality thresholds.
- The quantification of dollar amount by which expectations differed from recorded amounts with associated precision, was valued by the audit teams in reaching conclusions.

This study also identified key statistical problems common in empirical work and the resiliency of models to various statistical approaches to addressing autocorrelation, multicollinearity, heteroscedasticity, nonnormality, and model shift concerns. Key strengths attributed to the more sophisticated analytical procedure applications were:

- The potential for use of externally generated data in the modeling process, as well as the advantage, in discussions with clients, of being explicit about which factors had been controlled through the modeling process.
- An ability to test the explanations offered by clients through reanalysis of an adjusted model.
- From this practice experience arose a research publication (Akresh and Wallace, 1982), which helped establish the feasibility of regression analysis as an effective analytical procedure.

SAS No. 47 and National Office Initiatives

As the research into the feasibility of regression modeling was progressing, policy changes arose, producing SAS No. 47, which more

explicitly recognized audit risk and materiality and their potential association with various quantifiable tools for collecting evidence. For example, analytical procedures were acknowledged as a useful approach for evaluating detection risk. By using quantitative tools such as regression analysis, statistical error measures could be more easily combined with statistical sampling results using the SAS No. 47 framework. Practitioners and researchers saw the link, as evidenced by specific projects they had undertaken.

In particular, STAR incorporated the use of regression estimates in sampling approaches. Price Waterhouse increased its investment in software and training associated with regression applications (Wallace, 1985). Indeed, software was being designed as decision support “fronts” to various statistical sampling approaches to ease access and application in the field. The public accounting firms formed statistical auditing groups and pooled their expertise to create such software. Specific examples of such efforts include the following:

- A hierarchical model for financial statement analysis of ratios and financial relationships, developed in 1981 by Coopers and Lybrand through internal research with some reliance on published academic research. This model later became a microcomputer-based computational program called Coopers & Lybrand Effective Analytical Review. It included: simple time-series procedures to identify annual and quarterly aberrations; a “Z-Score” and liquidity measurement for identifying troubled companies; common-size financial statements; and a “building block” approach for describing and analyzing ratio results, including interrelationships among ratios.
- The Touche Ross Audit Process (TRAP), developed between 1971 and 1980. This was a conceptual risk-based approach that included the review of controls in an EDP environment and the use of statistical sampling in auditing. Professor Miklos Vasarhelyi, with University of Southern California and later Columbia University, helped develop software applications for classroom use. The TRAP software included the use of “A-Score” and “Gambler’s Ruin” methodologies. Regression analysis was studied and it was concluded that it would be primarily useful in determining locations to visit in multilocation audits (i.e., cross-sectional analysis). Ongoing development efforts focused on supporting various industry applications.
- Software created during this same time frame by Price Waterhouse for the application of regression analysis (design specifications by

Wallace, building off literature such as Kinney and Bailey, 1976; Kinney, 1979; Wallace, 1979; and Kinney and Salamon, 1982; and peer reviewed by Bill Felix and others). Later, Wallace (with programmer Frank Luh) converted and enhanced this mainframe software for personal computers. Beta testing of software versions by auditing practitioners and feedback from engagement teams led to periodic enhancement of such audit tools.

The tone of this time has been described as being one of controlling the ever-increasing costs of auditing, with terms coined such as “re-engineering the audit process” and “obtaining added value.” Indeed, this can be characterized as a beginning of an era that persists today, in which firms continually strive to audit “smarter”—an era stimulated by regulatory and competitive pressures.

PHASE TWO: EMPHASIS ON TECHNIQUES

As the feasibility of using analytical procedures became clearer, researcher and practitioner attention gradually shifted to the proper approach to performing such procedures and improved techniques that could be used by auditors. This shift in focus eventually led to a change in standards through adoption of SAS No. 56.

Ingredients for Change: Judgment Research and Technology

Since the 1980s, research has placed increasing emphasis on understanding auditor judgment in analytical procedures and on the application of new technology in analytical procedures. Kinney and Uecker (1982) and Libby (1985) were two of the first studies to investigate auditor judgment in the context of analytical procedures. By identifying problems occurring in the application of auditor judgment while performing analytical procedures, potential areas of improvements in the practice of analytical procedures were highlighted.

Historically, the Mock and Turner (1981) study on internal control, published by the AICPA, was very important, because it showed that senior accountants make errors, reviewers make errors, and that a lack of consensus prevailed. “Halo effects”—whereby auditors automatically attribute good things to those evaluated positively in the past (effective staff members and solid clients)—were likewise a concern. While these findings were known internally within public accounting

firms before the late 1970s, the decision to share such systematic evidence in the public domain was an impetus to consider how the judgment of auditors might be improved (Libby, 1981). One “solution” explored was a machine/model blend that could enhance both consensus among auditors and consistency in decision making over time.

Hence, new technologies were increasingly explored as technological progress made computers far more capable of performing complex algorithms efficiently. The phenomena observed over time were the development of:

- More structured audit processes (Cushing and Loebbecke, 1986).
- Gauge as a tool for materiality and risk assessment (developed by Peat Marwick).
- Expert-system decision tools to assess bank loans, fraud, and internal auditing operations (Abdolmohammadi, 1987; Sen and Wallace, 1991; Tim Bell and John Willingham at Peat Marwick, and Lynford Graham at Coopers and Lybrand, among others, were involved in such efforts).
- Increased attention to audit tool effectiveness.

The two factors of technological progress and the emergence of judgment research set the stage for increased interest in research on analytical procedures in the early 1980s and demonstrate the linkage of technical research on analytical procedures with judgment-related research on these procedures. When one considers how the need to improve auditors’ judgments leads to greater interest in analytical procedures, the goal is to examine both the key judgments in applying analytical procedures and the key threats to such judgments. For example, judgment variability can signify an inconsistent application of an appropriate analytical procedure and may indicate an advantage in adopting more sophisticated forms of analytical procedures with a more guided application process.

We turn now to the key areas of this research that have implications for various phases of applying analytical procedures. A convenient way to organize this research is to use the model of analytical procedures that is implied in SAS No. 56. This statement suggests three fundamental steps in the application of analytical procedures, namely (1) development of expectations, (2) identification of unusual departures from expectations, and (3) investigation of these departures from expectations.

Next we list these three steps and add a fourth consideration (field performance of analytical procedures) as a basis for organizing the literature.

1. **Development of analytical expectations:** What have we learned about the types of prediction models that we use for analytical procedures?
2. **Identification of unusual departures from expected outcomes:** What have we learned about identifying when an outcome is unexpected and requires further investigation?
3. **Investigation of unusual departures from expected outcomes:** What have we learned about auditors' ability to delve into unexpected fluctuations and generate the correct explanation for the discrepancies?
4. **Field performance of analytical procedures:** What have we learned about how analytical procedures are actually used in practice and how effective they are?

The specific wording in this SAS evolved from research findings and associated deliberations in the standard-setting process, as discussed later and in Risk Orientation.

Development of Analytical Expectations

One of the first areas of analytical procedures research involved investigations into the development of analytical expectations. The earliest work involved the development of statistical models for use in developing account expectations. Later, research addressed issues of how auditors judgmentally develop analytical expectations.

Basic Modeling Approaches

Extensive research has been directed at determining the proper expectation models to use when performing analytical procedures. Nonstatistical modeling of expectations has been explored in Kinney (1979 and 1987), Knechel (1986 and 1988) and Loebbecke and Steinbart (1987). The basic goal of this research was to apply decision-theoretic approaches to simulated contexts, to test the effectiveness of various methods of developing expectations for specific accounts and ratios. This work included consideration of how various transactions and associated errors and irregularities would be expected to influence certain ratios and accounts (e.g., how would recording of fictitious sales be expected to influence particular relationships?). These papers also examined the context in which analytical procedures should be applied. Among other findings, this research demonstrates that the use of monthly data in modeling greatly increased overall effectiveness in detecting potentially material misstatements (Knechel, 1988). Field

applications reported by Scott and Wallace (1993), which regularly use monthly data, suggest another interplay of theory, research, and practice.

Statistical models of financial performance and operations were explored by Kinney (1978), Kinney and Salamon (1978/79), Wallace (1978/79), Elliott (1978/79), Dugan, Gentry and Shriver (1984), Knechel (1988), and Scott and Wallace (1993), among others. These papers examined simulation results that formulated expectations, compared these to reported results, identified differences, and evaluated the effectiveness of simple and multiple regression models in detecting errors. Alternative autoregressive integrated moving average (ARIMA) and seasonal trend analysis tools have been shown to be effective in governmental and business sectors for forecasting and analysis. These tools are sensitive to patterns over time in single series of data sets or among groups of variables. The more disaggregated the data are, the more precise the estimates and the more reliable the analytical procedures. Issues such as the influence of measurement error and various statistical problems common in regression applications have also been addressed, leading to guidance in applying quantitative tools. Empirical evidence in actual applications of statistical models and results obtained are shared, facilitating further development.

Key Streams of Research in Statistical Models with Audit Applications

One can identify concurrent lines of inquiry that evolved in the literature and served as momentum to other research. Akresh and Wallace (1982) shared their regression findings at the University of Illinois Conference, with lively discussion of implications. The subjects debated—the cost-benefit tradeoffs in training professionals, developing user-friendly software, obtaining externally generated data for model building, and retaining the confidentiality of model components—were addressed both for feasibility concerns and possibilities for innovation. The development of expectations would clearly require an understanding of the tool and the underlying data sets in order to be effectively applied in the audit process. Comparisons were made to earlier simultaneous equation ideas described by Bob Kaplan and academic work on ARIMA and time-series models (Albrecht and McKeown, 1977). John Neter likewise shared some regression application results.

The discussion emphasized how the use of sophisticated models was consistent with an increased focus on auditors' understanding of

client operations as a critical component of the audit process (the concept of “auditing smart”). The design of expectation models requires an understanding of what makes an entity “tick”: What are the causal links that lead to different expectations, and what data sets exist both internally and externally that can generate useful “comparables” for identifying unusual developments?

The Validity of Ratio Analysis

Research along a related line included simulation and analytical studies of the behavior of ratios (Casey, 1980), time-series models, and ways in which distributions might be truncated or treated to address potential statistical problems. Notable are Lev and Sunder’s (1979) work on the ill effects of ratios as independent variables in modeling, Hopwood and McKeown’s (1981) work on time series, and Frecka and Hopwood’s (1983) work on ratio distributions. Ample debate between academicians and practitioners concerning the use of limited information in analytical review occurred in such forums as the University of Chicago’s *Journal of Accounting Research* conference in 1979 (Kinney, 1979; Lev, 1979; and Stringer, 1979; an example of later related work is Loebbecke and Steinbart, 1987). These studies imply that formulation of expectations might better consider numerators and denominators separately, rather than using ratios, and that the use of broader, more sophisticated information sets (i.e., rather than merely the prior year’s adjustment experiences) were very beneficial. A substantial body of existing research showed that statistically based models tend to be more effective than simple ratio models. In addition to research papers, several books appeared that focused on analytical procedures, such as the collaborative work of Blocher and Willingham (1985) that discusses ratios and modeling at some length, and the discussion of STAR by Stringer and Stewart (1985).

Influence of Unaudited Values on Auditor Expectations

With auditors’ analytical expectations, one question that arises is the extent to which they are prone to consider management’s unaudited assertions as a “starting point” in the audit process. One of the earliest studies of auditor judgment in analytical procedures was conducted by Kinney and Uecker (1982). Their purpose was to determine whether auditors are inappropriately influenced by unaudited account values when they develop expectations for use in analytical procedures. They

conducted an experiment in which they had auditors develop expectations for gross profit based on a set of financial information containing the current year's unaudited values and the two prior years' audited values. Kinney and Uecker hypothesized that auditors who received high unaudited values would generate significantly higher expectations than the auditors who received low unaudited values. The results supported their hypothesis, indicating that auditors' expectations were influenced by the client's unaudited value.

Other researchers were concerned that Kinney and Uecker's results could have arisen from factors other than an inappropriate influence of the client's unaudited values. Biggs and Wild (1985) were concerned that the bias may have come from the fact that auditors only had two years of audited information to use in forming expectations. In a replication of the Kinney and Uecker study, Biggs and Wild increased the amount of audited information available to auditors. Their results showed that the increased data moderated the effect of the unaudited value but did not eliminate it. Heintz and White (1989) were concerned that the auditors in both the Kinney and Uecker and Biggs and Wild studies may not have recognized that the unaudited amounts were actually unaudited. They labeled the unaudited values as nine-month data to denote it more clearly as unaudited. Their results indicated that auditors' expectations were still influenced by the unaudited account values.

The line of research begun by the Kinney and Uecker study is extremely important. If auditors' expectations are influenced by the client's unaudited value, then the independence of evidence is compromised and audit risk may be increased. Wild and Biggs (1990) developed a theoretical model that addressed audit risk effects in this situation. Their model demonstrated that if a material misstatement is present and the client's unaudited value influences the auditor's expectations, then audit judgments will be biased in the direction of increased risk of not detecting that misstatement. As Kinney and Uecker point out, this bias is particularly dangerous given the availability of unaudited values during analytical procedures.

One Example of Research Influencing Standard Setting

As a result of these four research studies, the Auditing Standards Board in writing SAS No. 56, included specific wording about the auditor's responsibility to develop *independent expectations* and to use *reliable data* when developing such expectations (§16). For example, SAS No. 56 (Au 329) states, "Analytical procedures involve compari-

sons of recorded amounts, or ratios developed from recorded amounts, to expectations *developed by the auditor.*” [emphasis added]

While the expectations developed by the auditor could be “influenced” by the recorded unaudited book value, similar wording included in the Canadian standards, CICA’s Auditing Recommendations (Section 5300.32), further emphasize the auditor’s independent knowledge:

Analytical procedures include comparisons of recorded amounts to expectations *developed by the auditor.* The auditor develops such expectations by considering relationships that are expected to exist based on the auditor’s *knowledge* of the business and industry in which the entity operates. [emphasis added]

Both the Canadian and the U.S. standards stress that the auditor conducts analytical procedures by comparing recorded amounts to expectations developed by the auditor based on reliable data. The important point about this research, implicitly recognized by the standard-setting bodies, is that auditors, to avoid observed bias, should develop expectations without knowledge of the unaudited account values and by using reliable data in their development. Independent expectations can be used as criteria for evaluating unaudited values, without biasing the judgment in the direction of increased risk of not detecting a material error.

Identification of Unusual Departures from Expected Outcomes

In the early 1980s, a University of North Carolina Conference included a paper by Kinney and associated Holstrum discussion about the DHS STAR approach and how the audit consequences—referred to as Type I and Type II errors—were being evaluated to assess the effectiveness of tests. Incorrect acceptance of the account book value (compromising audit effectiveness) is cited as Type II, while incorrect rejection of the account book value (compromising audit efficiency) is referred to as Type I error. (Note that this assumes a hypothesis that the account book value is fairly presented.) Robert Knechel states that this exchange prompted his interest and subsequent research (1988) in the use of simulation to evaluate the performance of regression analysis as an auditing tool.

One of the challenges in applying analytical procedures is to define effectively what constitutes an unusual departure from an expected outcome. Indeed, it may be that change is expected and hence the lack

of change itself is the unusual departure (Wallace, 1983). Several studies have explored the specification of decision rules for making this judgment. Kinney and Salamon (1982) discuss the approach reflected in the STAR tool used by DHS. They found that STAR was effective in controlling Type II errors and resulted in few Type I errors. Akresh and Wallace (1982) found that regression analysis using an outlier and aggregate standard error approach was an effective decision aid. Knechel (1988) compared decision rules' performance at detection capabilities in a simulation setting. Statistical decision rules have been demonstrated to be effective, but the evidence concerning nonstatistical decision rules is mixed; Knechel (1988) found they are effective, but Loebbecke and Steinbart (1987) found they are not.

Field Performance of Analytical Procedures, Including Investigation of Unusual Departures

Descriptive Research of Auditor Analytical Procedures Judgment and Findings of Asymmetric Use of Analytical Procedures

Until very recently, little was known about how analytical procedures were actually performed. Survey research indicated that analytical procedures are performed primarily on a judgmental basis (Esposito, 1980; Biggs and Wild, 1984; Biggs, Mock, and Watkins, 1989; Tabor and Willis, 1985). The reason why judgmental analytical procedures are so popular in practice relative to statistical approaches has never been fully answered. Part of the explanation is likely connected to the relatively recent advent of friendly software and technological accessibility; other limitations are related to the educational process and the slow integration of applications-based statistical courses.

The uses of analytical procedures in practice have been explored by Wallace (1982), Blocher, Esposito and Willingham (1983), and Coakley and Loebbecke (1985). Biggs, Mock, and Watkins (1989) conducted a study with the principal purpose of developing an initial understanding of how auditors actually perform analytical procedures. The primary research findings were based on detailed evidence of how two managers and two seniors performed analytical procedures and made adjustments to a standard audit program, using a comprehensive and relatively realistic case (over 100 pages) on a large retailer of electrical appliances. To obtain detailed descriptive evidence of the auditors' decision process, the researchers had the auditors think aloud as they performed the case (this is referred to as *protocol analysis*). The

auditors were observed to use analytical procedures to identify situations that required increases in the standard audit program, but they did not use analytical procedures to reduce the program. This result occurred even though there were a number of accounts in which the unaudited values did not show unusual fluctuations and were within normal expectations. Asymmetric use of analytical procedures (i.e., increasing but not decreasing the audit program) may be a threat to expected audit efficiency.

Two other researchers prepared follow-up studies. Bedard (1990) undertook a study of audit program changes across several years for a number of audits and found that analytical procedures were not used to reduce audit programs. Cohen and Kida (1989) conducted a large-scale experiment which corroborated the Biggs, Mock, and Watkins finding that analytical procedures are used to increase but not decrease audit programs.

These three studies provide a persuasive triangulation of results. Whether in a detailed study of a few auditors, an experiment involving a large number of auditors, or in a study of actual audit programs from the archives of auditing firms, it appears that analytical procedures have only one use in the time frame examined, namely to identify problems and increase audit tests to confirm the existence of those problems. This is a valid use of analytical procedures. For auditors to obtain the full benefit of analytical procedures, however, they also need to look for opportunities to reduce audit programs. Note that this triangulation is a vivid example of the interplay between active experimental research and the scrutiny of past practice in the determination of audit effectiveness and efficiency.

Another finding of Biggs, Mock, and Watkins is relevant to the asymmetric use of analytical procedures issue, although this is unconfirmed by other research. One part of the research had auditors perform both statistical (regression analysis) and judgmental analytical procedures. Interestingly, auditors were willing to use the results of the statistical analytical procedures to both reduce and increase the audit program. However, when performing judgmental analytical procedures, they only increased the audit program and did not make any reductions. The implications of this finding await additional research. However, it may be that auditors do not have confidence in their own judgment or the use of simple techniques, for example, this-year-to-last-year comparisons with limited diagnosticity. Alternatively, auditors may have more confidence in relying on what seems to be a more sophisticated and objective (and thereby more defensible) technique: regression analysis.

Analytical Procedures for Predicting Going-Concern Problems

Another milestone relating to academic research was the “Altman model” based on a Ph.D. dissertation that described how a discriminant model (a multivariate technique that models a two-way classification such as “bankrupt” and “not bankrupt”) could be used to anticipate bankruptcy risk (Altman and McGough, 1974). The Z-score was adapted to an A-score by Arthur Andersen, which adopted the tool in its client evaluation process (also see Kida, 1980; Zavgren, 1983; Zmijewski, 1984; and later related research such as Hopwood et al., 1988). Coopers and Lybrand likewise developed a microcomputer tool to aid in the comparisons of the Z scores of target companies and their industry peers through relationships developed from industry financial data. This research was incorporated in that firm’s Risk Advisor. Touche Ross included such an approach in their TRAP software, as already described.

Of interest in demonstrating the evolution from ratios to multivariate models is the work by Beaver (1966), which provided early evidence that ratios could be of use in predicting failure. This work was part of the foundation upon which Altman’s model was constructed. Yet research into what ratios can tell us about the likelihood of bankruptcy continues (Davis and Peles, 1993, describes equilibrium values for firms’ liquidity ratios).

An Example of the Challenge of Research by Practice

When the Z-score was widely publicized, the Price Waterhouse national office initiated a project to evaluate its usefulness as a client evaluation tool. The firm found that the methodology had a substantial number of Type I errors, namely flagging a going-concern problem where none existed. Although this may be a low-cost error for investment decisions, it is arguably a high-cost problem for audit efficiency. Hence the advisability of incorporating the Z-score as a routine evaluation tool was challenged by practice. These sorts of findings propelled further inquiry into more effective distress indicators. For example, Wallace (1989) considered the relevance of regression models using market-based information in signalling clients’ distress.

Analytical Procedures for Signaling the Existence of Fraud

As discriminant analysis became easily accessible in software, attention was directed to the goal of not merely anticipating going-concern risks, but also exploring warning systems associated with fraud

detection (Wallace, 1983). The red-flag literature often involved analytical procedures directed at ratio analysis and consideration of trends and the context of companies within both the industry and the economy (Albrecht and Romney, 1986; Loebbecke, Eining, and Willingham, 1989). Pincus (1989) considered problems with a checklist approach to a decision aid directed at the red-flag literature, again displaying a synergy in recommended decision tools and judgment-related research.

The fraud model in Risk Advisor represents a blend of expert-system technology and the results of research performed by Loebbecke et al. Additional consideration of the fraud question was spawned by the Treadway Commission, as described later. Note that researchers constantly learn from one another. The Pincus study questioned whether users of checklists considered items jointly or only independently, leading in part to Loebbecke et al.'s consideration of *sets* of indicators.

Analytical Procedures' Detection of Errors

Another line of inquiry was initiated in the work of Hylas, a KPMG practitioner, and Ashton, an academician (1982), which studied errors identified in the auditing process, to discern their nature and how they were uncovered. One of the key findings was the frequency with which analytical review initially directed the auditors' attention to errors. While the analytical procedures might have had to be coupled with detailed tests to quantify the precise proposed adjusting journal entry, the former clearly directed the latter, rather than vice versa. In addition, various inquiry procedures were cited as powerful tools for an auditor.

This study led to heightened interest and subsequent progress in the creation of better analytical tools and standards. Their findings were later replicated by Wright and Ashton (1989). The common caveats acknowledged in this empirical research include the following:

1. There is a built-in bias toward ascribing credit for initial detection to analytical procedures because of the traditional sequencing of audit procedures (whereby analytical procedures precede and often direct tests of detail).
2. Limitations exist in evaluating overall effectiveness, since the extent of undetected errors is uncertain.

Descriptive research on error analysis has led to more recent work on the structure of knowledge of financial-statement errors by auditors and how this is associated with experience (Frederick, Heiman-Hoffman, and Libby, 1994).

Analytics may well be the only procedure available for the audit

of estimates, implying that they operate in such a setting as substantive tests rather than review tools. Indeed, evidence of this belief is emerging through error-analysis research being extended into specific industries. Bell and Knechel (1994) report that in the property and casualty insurance industry, analytical procedures are extremely effective at identifying errors, with the most significant differences being in the loss reserves.

Brainstorming Among Research Teams Including Academicians and Practitioners

Arthur Andersen, intrigued by the early error analysis of KPMG (Hylas and Ashton, 1982), as well as by the potential of analytical procedures and technology, formed a research team of academicians and practitioners. The Kreutzfeldt (an Arthur Andersen Principal at the time) and Wallace (an academician) article (1986) describes the resulting effort, as do related publications by Wallace and Kreutzfeldt (1991 and 1995) and by Kreutzfeldt and Wallace (1990). Roberts and Wedemeyer (1988) were provided access to the database in this work to consider discriminant models' applications. The findings of this joint effort influenced the construction of a "workbench" and a database focus by Arthur Andersen.

Ed Blocher of the University of North Carolina worked extensively with Grant Thornton in developing field applications of analytical procedures, reflecting his and others' research. An entire stream of research on error analysis (Coakley and Loebbecke, 1985; DeFond and Jambalvo, 1991; Hamm et al., 1985 and 1987; Icerman and Hillison, 1991; Johnson et al., 1981; Ramage et al., 1979; Willingham and Wright, 1985; Wright and Ashton, 1989; Wright and Wright, 1992) has likewise emerged. This research has been summarized in a meta-analysis summary paper by Kinney and Martin (1994). Interestingly, this latter piece is directed, in part, to demonstrating the value-added aspect of the auditing process.

INSTITUTIONAL DEVELOPMENTS: A SEGUE TO PHASE THREE

Treadway Commission

By the latter part of the 1980s, the Treadway Commission (Committee on Fraudulent Financial Reporting) began to explore apparent causes of fraud and the means of deterring or detecting it when it occurred. From conversations with Jack Krogstad, Research Director

of the Commission, all the commissioners shared an interest in the academic literature, its lessons, and its usefulness in setting policy; the commission's first major step was to perform a literature review. As a result, a number of lines of research interested the commission, including analytical procedures. Those active with the Auditing Standards Board, as well as committees and task forces of the AICPA, report that an initial step in approaching most agenda items was to have staff members review existing literature and distribute discussions of key findings to the decision makers for deliberation.

A Coglitore and Berryman study (1988), as well as Wallace articles (1983 and 1984), led to consideration of the importance of analytical procedures and their potential strength in identifying problem areas. Bart Ward, Bill Kinney, Wanda Wallace, Zoe-Vonna Palmrose, and many others interacted with the commission to share, interpret, and respond to inquiries that led to the final set of proposals and recommendations.

SAS No. 56

One specific recollection of those involved is that the analytical procedures project that led to SAS No. 56 had begun some time before the expectations gap, but as attention was drawn to the potential power of analytical procedures in detecting potential fraud, that standard was folded into the "expectation-gap standards." Two AICPA task forces, one directed toward analytical procedures and the second focusing on fraud were an added impetus to the development of SAS No. 56. Kinney and Felix (1980) express many of the ideas later appearing in the SAS, suggesting again the interrelationship of literature and standard setting.

The development of other attestation services, particularly reviews, that require analytical procedures as the key tool for collecting related evidence speaks to the perceived importance and power of such procedures from the vantage point of standard setters. As SSARs and SASs have incorporated analytical procedures, various decision tools are included in the standards and associated guidance that pinpoint key areas of inquiry and types of comparisons to be performed. A clear distinction is drawn between substantive testing use of analytical procedures and planning uses of analytical procedures. SAS No. 56 in particular requires the application of analytical procedures both in the planning and the final review stage of the audit process. The review stage of analytical procedures can be viewed as the "last chance" to correct errors in the financial statements.

Much of the work of performing postmortems on alleged audit failures has been directed toward assessing what steps in the review process might prevent similar mistakes on future engagements (St. Pierre and Anderson, 1982 and 1984). It is reported that Coopers and Lybrand undertook a similar study, based on SEC Enforcement Releases and private data, and reached similar conclusions with respect to the power of analytical techniques (Coglitore and Berryman, 1988). A number of areas have thus evolved in which reasonableness checks that use both internally and externally generated information are recommended. SSARSs require the use of analytical procedures as the primary review process for review engagements.

Committee of Sponsoring Organizations (COSO)

When the Committee of Sponsoring Organizations (COSO)—an institutional cooperative effort involving the AAA, AICPA, Financial Executives Institute (FEI), Institute of Management Accountants, and Institute of Internal Auditors—issued their conclusions on the key components of internal control structure, a critical dimension was *monitoring*. Analytical procedures can be viewed as key monitoring tools. In fact, Kreutzfeldt and Wallace (1986 and 1990) report that “significantly lower errors are identified in well-controlled settings (defined as those in which management routinely applies analytical procedures as a management tool).”

Note that the COSO research team for Coopers and Lybrand included participation by Alan Winters, then at the University of South Carolina. The Advisory Committee of the FEI’s Research Foundation in the early phase of the project involved Bob Sacks, Loebbecke, and Wallace. Andy Bailey and Al Arens were formally involved with the COSO group on behalf of the AAA. The COSO framework, evolved from active participation of the research and practice communities, is being integrated into SAS No. 55 with explicit mention of the components, including monitoring. The prognosis is that a key tool for monitoring is the application of analytical procedures by management teams.

PHASE THREE: EMPHASIS ON JUDGMENT ISSUES

With institutional developments formalizing a key role for analytical procedures, research has focused on auditors’ ability to use these tools effectively. We can revisit the SAS No. 56 three-stage model to organize our discussion.

Stages 1 and 2: Development of Analytical Expectations and Identification of Unusual Departures

Pattern Recognition and Hypothesis Generation During Analytical Procedures

The recognition of patterns as a means of identifying unusual departures is the subject matter of one line of judgment research in analytical procedures. A study by Bedard and Biggs (1991a) developed descriptive evidence of auditors' diagnostic reasoning in analytical procedures. The researchers were particularly interested in determining the extent to which auditors used combinations of financial ratios to identify potential financial misstatements. They developed a case based on an actual practice situation, in which a misallocation of overhead caused a pattern of financial discrepancies. To discover the error using analytical procedures, it was necessary for the auditors to (1) identify the pattern of discrepancies (i.e., reasoning from single accounts would not lead to the correct error), and (2) infer the cause (misstatement) that produced the pattern.

The results indicated that less than one-third of the auditor subjects were able to correctly identify the error seeded in the case. There were two primary reasons why auditors failed to identify the seeded error:

1. Some auditors evaluated the financial discrepancies one account at a time rather than evaluating combinations of financial discrepancies; without using a pattern of critical cues, they could not solve the problem.
2. Even if they managed to recognize the pattern of critical cues, a number of auditors were unable to generate a correct hypothesis about the underlying cause of the discrepancies.

Bedard and Biggs (1991b) conducted a follow-up study to see if these results would hold for a larger sample of auditors. The results overall were similar to the original study. Manufacturing/inventory experience did improve auditor performance, however, and when management provided the correct explanation, the auditors recognized it as being correct. When management provided a misleading explanation, performance declined.

Yet it is possible that auditors who do not generate the correct hypothesis, may still perform audit tests that can identify the seeded error. Bedard, Biggs, and DiPietro (1993) have investigated this issue in a further follow-up study. They found that audit programs were effective in detecting the seeded error primarily when the auditor had proposed the correct hypothesis. In contrast, a recent study by Asare and

Wright (1994) indicated that auditors were able to establish relatively effective audit program procedures even when their error hypothesis was inaccurate.

There are several implications for practice based on this line of research. First, the research indicates that auditors could improve hypothesis generation by examining *patterns* of discrepancies. Many of the auditors in the Bedard and Biggs study wrongly attempted to perform analytical procedures by reasoning about single discrepancies. However, double-entry accounting and the systematic allocation of costs naturally results in patterns of effects. By considering corresponding effects (i.e., the credit that corresponds to a given debit), the auditor can more accurately identify possible errors. Auditor training should include practice at recognizing patterns. Expert systems and multivariate models are tools that can lead the auditor to concurrently consider *sets* of variables, whereas the traditional checklist has too often led to a one-at-a-time analysis.

A second implication for practice involves the failure to evaluate fully the hypotheses generated. Many of the auditors who selected an incorrect hypothesis could have easily disconfirmed the hypothesis if they had evaluated whether the hypothesis accounted for all of the discrepancies. Kinney (1987) expressed concern for this problem, which he called “truncated analytical procedures.” By truncating the evaluation process, the auditor accepts an inadequate hypothesis and expends unnecessary audit resources testing it with procedures that are generally more costly than analytical procedures. Auditors should fully evaluate the hypotheses they generate prior to testing. This evaluation process involves the simple step of thinking through the debits and credits that would be present if the error hypothesis were true. There may be a need for working-paper evaluation of “what if” implications of an explanation proposed by either management or the auditor. The reasons for practitioners’ call for educators to enhance their students’ reasoning and communication skills dovetail with findings from judgment and archival research.

Frederick, Heiman-Hoffman, and Libby (1994) found that experienced auditors had better-developed category structures, which enabled them to sort errors by either audit objectives or transaction cycle. On the other hand, students who had previously been taught audit objectives and transaction cycles in the classroom were not able to sort errors by either of these categories. These results suggest that experience substantially affects auditors’ ability to access previously learned knowledge and to understand the underlying causes of errors. An important direction for future research is the search for ways to

change university instruction to provide substitutes for actual audit experience and thus allow better performance for newly hired auditors.

Stage 3: Investigation of Unusual Departures from Expected Outcomes

After unusual departures have been identified, they have to be investigated. The research associated with pattern recognition and hypothesis generation clearly overlaps this investigative process. Evaluation of alternative hypotheses and the possible interference of already-generated hypotheses can influence the effectiveness of the investigation process.

The Interference of an Already-Generated Hypothesis

Once hypotheses have been generated, auditors must investigate to determine which is accurate. The search for confirming and disconfirming evidence related to a hypothesis can be influenced by an already-generated hypothesis. An important line of research shows interference effects in analytical procedures (Libby, 1985; Libby and Frederick, 1990; Heiman, 1990; Bedard and Biggs, 1991b; Bedard, Biggs, and DiPietro, 1993). Interference is a fairly pervasive cognitive problem involving a memory retrieval limitation, in which items already retrieved *interfere with* or prevent retrieval of other items in memory. Most people have experienced an interference effect. For example, people sometimes have trouble recalling the name of a movie star because someone has just mentioned another, similar name. Considerable evidence exists indicating the presence of interference effects on decision making by a variety of professionals, including investors (Moser, 1989) and physicians (Patel and Groen, 1986).

Libby (1985) conducted a study in which auditors had to generate hypotheses about potential errors underlying unexpected discrepancies in several financial ratios. The primary purpose was to determine the effect of experience on auditors' hypothesis generation. Libby proposed that the hypotheses generated by auditors who had recently experienced particular types of errors would be affected by that experience. He also proposed that hypotheses would reflect auditors' perceptions about the most frequent errors. Libby's results indicated that hypotheses generated were influenced by the recency of auditors' experience with errors and their perceptions about the frequency of occurrence.

Libby's study motivated follow-up research investigating the interference effect. For example, Libby and Frederick (1990) found that auditors who inherit a hypothesis (i.e., become aware of a hypothesis

suggested by another source) representing a typical financial-statement error have difficulty generating additional hypotheses from the same transaction cycle. The researchers attribute this result to output interference. Several other studies have obtained consistent results, convincingly documenting an interference effect (Heiman, 1990; Bedard and Biggs, 1991b).

The importance of an interference effect in analytical procedures arises if management provides a misleading explanation, which then prevents the auditor from generating the correct hypothesis. Bedard, Biggs, and DiPietro (1993), for example, found that auditors' analytical procedures and audit program decisions were interfered with by misleading management representations.

Anderson et al. (1992) investigated the interference effect of non-error hypotheses (e.g., an unusual financial result caused by changed economic conditions) on error hypotheses (e.g., an unusual financial result caused by an error). They found that auditors who generate error *after* non-error hypotheses produce fewer error hypotheses than those who generate error hypotheses *before* non-error hypotheses. This suggests that non-error hypotheses interfere with auditors' ability to generate a complete set of plausible hypotheses. Asare and Wright (1994) found similar results. Koonce (1992) describes those conditions in which auditors may be prone to compromising audit effectiveness by accepting a potentially incorrect non-error cause.

One hypothesis that the auditor may generate involves the perceived credibility of management, as inquiries are made into why certain unusual patterns have emerged after analytical procedures are applied to various assertions. Research by Anderson, Koonce, and Marchant (1994) reports that explanations from client managers possessing high competence are judged to be more reliable. This result holds even when the competency-associated perceptions are formed in varying sequence.

Clearly, interference is a factor that auditors should consider during analytical procedures. This is particularly so when auditors seek management explanations of unexpected discrepancies. Kinney and Haynes (1990) argue that the wording in SAS No. 56 encourages auditors to seek out explanations from management before developing their own explanations. Such an effect could exacerbate interference effects in analytical procedures and result in a reduction of audit efficiency, if not effectiveness. Auditors may be able to avoid interference effects by generating error hypotheses before considering non-error causes, as well as by generating their own hypotheses before asking management for an explanation about significant discrepancies found during analytical procedures.

Beyond recommending such sequential processes, the research findings point to a possible advantage of models that explicitly test the adequacy of non-error explanations for unusual patterns and then quantify the unexplained portion of such fluctuations. These models can effectively force extended generation of hypotheses, at least until such time as objective evidence is obtained that an adequate explanation is at hand. Such synergy among judgment, statistical, analytical, and archival research with practice choices epitomizes the evolution of analytical procedures.

CURRENT STATE: INTERACTION OF STANDARDS, RESEARCH AND PRACTICE

The attention to analytical procedures—now as a required procedure both at the planning and review phases of the audit as well as a potential substantive test throughout the audit process—has increasingly been recognized as potentially powerful, efficient, necessary, and capable of being enhanced through various decision-support tools (Walker and Pierce, 1988). Indeed, one could easily argue that it was the error-analysis research that built credibility for analytical procedures as a promising evidence collection tool. Later, the body of literature that acknowledged the ability to discern patterns in ratios (Kinney and Salamon); the performance of various combinations of ARIMA (Wallace, 1984); X-11 (Dugan et al., 1984–85); and regression techniques (Kinney, 1978; Lev 1980; Kinney and Salamon, 1982; Wallace, 1984); the Type I and Type II experience of regression analysis (Knechel, 1988); and the practicality of the tool (Scott and Wallace, 1993 and 1994a; Gillett, 1993) spawned further research, practice applications, and standard-setting guidance.

The judgment research began to focus on analytical procedures in terms of how the process occurred, what might influence the formation of expectations, and how confirming and disconfirming evidence interacts with the hypothesis formulation, evaluation, and testing process (Church, 1990). Earlier discussions provided some detailed examples of the interplay between research and practice in this body of literature.

Decision-support systems continue to be developed that use regression analysis, forecasts, and market performance to generate risk indicators in an audit setting. Evaluation of seventy-seven frauds by KPMG spanning twenty years corroborated the impression that experience in fraud is difficult for a single individual to collect due to its rare incidence. This suggested that a decision tool which pooled

experience could enhance audit effectiveness. Indeed, increased activities of the Quality Control Inquiry Committee of the AICPA are expected to suggest sets of warning signs that could be incorporated into analytical procedures.

An interesting development that influenced such interaction of standards, research, and practice was the internationalizing of the public accounting firms' policies, given the active involvement of university professors in a number of CPA firms abroad. For example, in 1990, an internal Coopers and Lybrand committee reviewed research from firms in the United Kingdom, the United States, Canada, and the Netherlands in moving toward international practices. Within this group was a Dutch representative who was an active professor at a local university with teaching and research interests, in addition to his partnership responsibilities with the firm. Also, there were Houghton and Fogarty, whose work examined the United States, United Kingdom, and South African audits. Peter Gillett was a practitioner involved in advanced technology in the United Kingdom as a partner of a public accounting firm and is now pursuing a Ph.D. at the University of Kansas (and is involved in this monograph project). Such examples of exchange between the practice and academic communities signify a healthy interrelationship that continues to enhance the evolution of analytical procedures and other dimensions of the audit process.

A balance of research, theory and practice issues is increasingly evident in pedagogical materials (Wallace, 1991 and 1995). They describe the standard-setting process, demonstrate field applications, and share research insights on theory and practice.

Inferences

In general, one may characterize the chronology and findings as follows:

- Analytical procedures can be used to identify unusual fluctuations.
- Decision rules help to maximize effectiveness and efficiency, as well as to avoid heuristics and biases that could have unintended effects.
- Behavioral judgment can be improved through training auditors to consider patterns and to carefully consider alternative hypotheses and disconfirming evidence.
- Testing of explanations is an important facet of analytical procedures' effectiveness.

As technology becomes friendlier, increasing the accessibility of comparative data, statistically-based decision support systems to

formulate independent expectations are likely to become more commonplace. This means that there is an important need for future cooperative efforts among practitioners, academicians, and standard-setters. The experience of auditors in the field with decision-support systems, differentially structured decision processes, and highly varied client contexts—which pose a variety of implementation issues—deserves systematic study and incorporation into the classroom and into standards.

THE CLASSROOM

The focus of this chronology, presenting the interaction of academics, practice, and standard-setting, has been on research as it identifies, solves, and suggests other problems concerning the accounting and auditing profession. What about the classroom? Not surprisingly, shortly after the patterns in ratios were evaluated in the research journals, a monograph with diskettes for classroom use was published by the AAA (Kinney and Salamon). The article on the misperceptions related to analytical procedures, reflecting much of the field experience gained at that point by Wallace (1983) in concert with Price Waterhouse, was widely used in classrooms and included as mandatory reading by those preparing for the Canadian CA examination.

Textbooks have increased attention not only on statistics, but have also incorporated both going-concern modeling research and regression analysis as analytical procedures. Of particular interest are collaborative efforts, such as Jack Robertson's consultation on the statistical sampling materials in *Montgomery's Auditing*, ninth edition, a resource first published in 1912 and associated with Coopers and Lybrand. The tenth edition, co-authored by educator Henry R. Jaenicke, was the first published in both classroom and professional versions. Similar literature directed toward the promise of analytical procedures appeared over time, including Graham (1981), resulting, in part, from his activity as chair of the AICPA's Quantitative Methods Task Force from 1979 to 1981.

Case materials, including "Dermaceutics" (a collaborative effort of the Auditing Section of the AAA and Coopers and Lybrand) focus on analytical procedures as applied to peer-group information and in the context of economic and industry conditions. Many courses use litigation settings and study enforcement releases of the SEC as sources of "hindsight" analysis, to determine whether irregularities have been effectively detected on a more timely basis had certain barometers been monitored as analytical procedures by management or by the auditors.

In addition, cases are frequently used in the classroom that relate to decision biases and pattern recognition, to sensitize students to the existence of the former and the skills entailed in the latter.

Educators report that the general results of the auditor “expertise” literature, as well as the emerging results on industry patterns in error analyses, have been used as one means of motivating student projects on industry analysis. Moreover, educators report they frequently require reading on research relating to commonly occurring auditing errors, including Kreutzfeldt and Wallace (1986) and Coakley and Loebbecke (1985), in undergraduate and graduate classrooms. Note that Nelson (1993) implies that the performance of novice auditors may be improved by increasing their knowledge of basic accounting principles and error frequencies. Similarly, the Kinney and Uecker (1982) research is used to make students aware of the inappropriate use of unaudited values in analytical procedures settings. Wallace (1991 and 1995) includes the Bedard and Biggs (1991a) case in her auditing text materials to help make students aware of the importance of pattern recognition in analytical procedures.

Past Successes

Educational successes of the past include the Union Pacific role-play/audit simulation training process, shared with the Auditing Section of the AAA and with various universities. Such pedagogical approaches involve making the student apply analytical procedures, pursue inquiry procedures with crafty and hostile managers, sort out “planted” explanations from reality, and identify a number of seeded errors and significant problems. The evidence on the role of experience has led many firms to give higher priority to the actual planning and performance of analytical procedures.

Training that uses various technology and decision-support tools is increasingly evident in both classroom and firms. Workshops by KPMG shared their fraud software. The Trueblood seminars have shared Deloitte and Touche resources, including cooperative efforts with MEAD to access NEXIS for systematic analytical comparisons. Coopers and Lybrand has shared its expert systems in demonstrations of Expert-TAX (Shpilberg and Graham, 1986-87), as well as Risk Advisor (1989) and Risk Advisor Property and Casualty (1992). These efforts involve academicians who take the tools to the classroom to ensure more familiarity by students of technology, statistics, and innovations in the audit process—all important attributes of analytical procedure applications.

FUTURE RESEARCH NEEDS

While some initial work has been performed on source credibility (Bamber, 1983), dealing with explanations of unusual fluctuations and aggregation challenges of auditing, these appear to be particularly fruitful areas for further research. The Treadway Commission recommended that internal auditing departments be formed as a key component in deterring and detecting fraud. Moreover, the AICPA has recognized the use of internal auditors by external auditors as an important element to consider in evaluating the control structure, audit risk, and implied detection risk for audit planning and execution. Increased globalization and technological development of companies have led to substantial sophistication in internal auditing operations and innovation. Many believe that, with the FDICIA and related regulation, the *internal* auditing group will become a key resource to top management in apprising them of the adequacy of control (Wallace and White, 1994).

Already, internal auditing is applying regression analysis software developed by Price Waterhouse as a risk-assessment tool and as a means of performing key internal auditing projects. For example, regression models have been applied to identify which locations to visit, where mismanagement is most likely to arise, and what balances are out of line relative to expectations formed from historical, other units', or competitors' operations. Questions arise whether specific quality control steps are needed to permit joint use of statistical models for auditing purposes or whether separable estimations need to be formulated by external and internal auditing.

The auditing of estimates is an increasingly challenging area that lends itself to various decision-support tools and analytical procedures (Wallace, 1993). This area is an added opportunity for joint exploration of postretirement estimation models, environmental liability exposure, warranty liability, frequent-flier responsibilities, and the like. Representations by management and attorneys require corroboration, and one means of checking the reasonableness of explanations is to model the factors and see whether they explain unexpected fluctuations. It may be that certain traits of information or problems lend themselves better to alternative decision-support systems and analytical tools. Although initial evidence is available, further work should be pursued.

Fraud detection is elusive, and the power of analytical procedures to detect illegal acts is also at issue. Yet limited-assurance engagements and internal control/compliance engagements (potentially expanded through regulation such as FDICIA and the revision of the *Yellow Book*)

raise a number of questions on the effectiveness of analytical procedures in the absence of the other aspects of the audit process present in the full attestation of financial statements. At the time of this writing, an Analytical Procedures Task Force of the AICPA has recommended additional implementation guidance for SAS No. 56, as well as explicit inclusion of analytical procedures within the material misstatement framework as outlined in SAS No. 53. The task force has observed that SAS No. 56 currently links to SAS No. 47 in paragraphs .06 to .08, with direct references in paragraph .20. Yet it has recommended an Auditing Procedures Study on analytical procedures, which would include education and communication to tie into SAS No. 47 and (among other topics) to “parlay abstract concepts in SAS No. 56 and relate to real life including a link to academic research” (Scott and Wallace, 1994b). Issues for further direction include how precision of the expectation is driven by whether the analytical procedure is a primary or secondary test and how the use of analytical procedures may vary depending on the size of the company (ASB, 1994, pp. 160–161).

The question of how the sequencing of audit tests interacts with the effectiveness of analytical procedures and measures was also raised. In the early research, the influence of analytical procedures on the audit process seemed to be one of directing auditors to do more work, rather than motivating them to reduce work. While the application of more sophisticated and objective techniques seemed to help balance this tendency, which prevailed with simple flux analysis, a need appears to exist for more systematic evidence of effectiveness and the substitutability of analytical procedures for certain other evidence-collecting tools. Patterns in exceptions need to be evaluated, much as they do in tests of controls; and management integrity may need evaluation as auditors assess the quality of the input information, the interrelationships being analyzed, their reliance on management representations, and problems emerging repeatedly in alleged audit failures.

Work with Risk Advisor led to the findings that risk assessment tends to be client-centered, because the auditor’s knowledge is organized in this manner, and that negative wording in statements designed to elicit client knowledge improves recall and integration of facts. This suggests that the framing of questions in a positive or neutral manner is not as effective as negative wording in helping an auditor to recall facts supporting a statement indicating a client problem (Bedard and Graham, 1994). This interface of judgment research and knowledge application can lead to enhanced tools for evaluating evidence from the application of analytical procedures. Future inquiry should explore the investigation process, including the selection of tests, evaluation of

TABLE 2 Practice Recommendations

<i>Research Finding</i>	<i>Implication</i>
Auditors can be biased by unaudited book values; interference can arise from management explanations.	Auditors should develop their own expectations before reviewing unaudited book values and their own explanations before consulting management.
Disaggregated data leads to more precise and reliable expectations when modeling.	Auditors generally should collect monthly information for time-series modeling and by-store or by-location data for cross-sectional evaluations.
Models can quantify precision levels that lie within planning materiality thresholds.	Use modeling as a risk-assessment tool to quantify unexplained fluctuations and to test the sufficiency of explanations in describing unusual transactions and balances.
Empirically, error patterns that permit experienced auditors to identify underlying cause emerge across accounts, industries, and company categories.	Develop instructional tools that impart error-category structures gained by experienced auditors to facilitate understanding by newly hired auditors of the underlying cause of errors.
Auditors use analytical procedures to identify situations that require increases in the standard audit program, but frequently do not use analytical procedures to reduce the audit program.	Look for opportunities to reduce audit programs when analytical procedures suggest transactions and balances are reasonably within expectations.
Sets of ratios, financial relationships, and qualitative attributes can be combined to estimate the likelihood of bankruptcy, fraud, or both.	Altman Z-Score, Andersen's A-Score, logic analyses from numerous academic studies, and fraud-warning systems can signal signs of troubled companies and should be considered as screening tools in client risk assessments.

evidence, and reliance on standard tests in conjunction with analytical procedures.

Tools used in decision making when a number of qualitative objectives are sought may have usefulness in the analytical procedures area. These might include data envelopment analysis, which has been applied in a number of studies in the governmental and not-for-profit areas. Similarly, internal auditing departments have experimented with tools for risk assessment that use paired comparisons and various engineering-based analytical approaches to direct resource allocations. These tools merit research to determine whether their application within analytical procedures would enhance audit effectiveness or efficiency.

SUMMARY

This chapter has described the development of research, practice, and standards associated with analytical procedures. Their interaction has involved perceived needs, problems, cost-saving opportunities—and unanswered questions. The research has decisively responded to certain questions, such as the feasibility of achieving precision levels commensurate with desired materiality thresholds through the application of quantitative tools such as regression analysis on monthly information available in the typical audit setting.

The research has likewise raised questions. For example, how can the auditor be deterred from overreliance on unaudited management assertions? Research has considered how expectations can be developed, discrepancies identified, patterns discerned, differences investigated, and practice applications enhanced. Judgment and archival research have interacted, with practice developments and new promulgations from standard-setters moving forward the scope and extent of analytical procedures throughout the audit process. Questions persist that are most likely to find answers through the continued cooperation of the academic, practice, and standard-setting communities. Table 2 presents recommendations for practitioners, relating to past interactions among research, practice, and standard-setting communities in the field of analytical procedures.

Communications with Users

D. R. Carmichael, *City University of New York*; **William F. Messier, Jr.**, *University of Florida*; **Jane F. Mutchler**, *Pennsylvania State University*; **Kurt Pany**, *Arizona State University* (chapter lead author); **John B. Sullivan**, *Deloitte and Touche*

OVERVIEW

Since the 1960s, the scope of CPA communications with users has increased from providing one basic product—audit reports on annual historical financial statements—to providing a wide variety of attestation products. These products currently include additional reports on annual historical financial statements and attest reports on other information, such as forecasts, internal control, client compliance with laws, and even advertising claims. Intertwined with this development is a rich body of research that in some cases has preceded changes in auditor communications and in others has provided performance feedback on various aspects of policies already in place.

The purpose of this chapter is to describe interrelationships between auditing research and changes in CPA communications with users. We have divided our discussion into three distinct time periods: 1917 to 1974, 1974 to 1980, and 1980 to date.¹ For each of these periods, we discuss changes in the professional standards, followed by a discussion of research during the period. We then focus in detail on one area—auditor reporting on uncertainties—to illustrate the role and influence of research.² The last section of the chapter attempts to provide a road map of changes that lie ahead for standards related to auditor communication with users. Although the chapter presents

¹ The time period divisions were chosen to facilitate exposition. The end points roughly correspond to major milestones, such as the issuance of SAS No. 2 (AICPA 1974) and the issuance of professional standards and guidelines related to reporting on internal control (AICPA 1980a) and financial forecasts (AICPA 1980b).

² Another example of auditor communication not discussed in this chapter is standards setting and research related to consistency reporting. For information related to consistency reporting, see Solomon and Rich (1993).

examples of research related to policy making and changes occurring in the attest function, it is not intended to serve as a complete literature review nor is it intended to discuss all changes that occurred in the professional standards related to auditor communication.³

HISTORICAL BACKGROUND: 1917–1974

Professional Standards

Until 1917, no authoritative accounting or auditing standards existed in the United States.⁴ CPAs communicated the results of their work almost entirely through audit reports accompanying historical financial statements or through disclaimers resulting from “write-up” work in which they had prepared but not audited a client’s financial statements. The lack of authoritative standards led to a great degree of flexibility with respect to the scope of audit procedures and to audit reports tailored to include conclusions justified by the scope of those procedures.

In 1917, a standard report was included in the Federal Reserve Bulletin. Between 1917 and 1948, the public accounting profession modified the standard report seven times. During this period, and through the 1960s, the attest function continued to be practiced as a one-product industry. Subsequently, additional forms of CPA association have been developed, providing various levels of assurance with a wider variety of types of information. In this portion of the chapter we discuss the interactions of policy making and research on auditor communications, beginning in the 1960s, but with an emphasis on the period subsequent to 1970, when systematic research increased dramatically.

Related Research

Research conducted in the 1960s questioned whether the current audit report effectively communicated the nature of an audit, provided information on auditors’ reporting decisions, and addressed the issue of whether the scope of audit services should be expanded to include services beyond the audit of historical financial statements.

³ There is other research indirectly related to auditor communication, such as audit independence and auditor/client disagreements, not included in this chapter. Our focus is only on research directly related to communications with users.

⁴ See Carmichael and Winters (1982) for a detailed analysis of the evolution of audit reports.

The Wording of the Standard Unqualified Report

Auditing researchers in the 1960s devoted considerable attention to the adequacy of the auditor's standard unqualified report. Much of the early research on the standard audit report followed one of two divergent approaches, arguing either that the wording of the audit report (1) should be made more understandable and should alleviate user misunderstanding of the nature of audits, or (2) is irrelevant.

Auditing researchers who argued that the report should be made more understandable often supported their arguments with results of surveys of various financial statement user groups. A number of these researchers⁵ suggested that the role of the auditor is not well understood by users and that the form of the audit report is responsible for much of this lack of understanding. Research conducted during the 1960s typically asked financial statement users such questions as "How well do you understand the audit report?" or asked for interpretations of such terms as "presents fairly" and "in accordance with generally accepted auditing standards." Subsequently, the Cohen Commission (Commission on Auditor's Responsibilities, 1978) considered this research and summarized it with this statement: "Users are unaware of the limitations of the audit function and are confused about the distinction between the responsibilities of management and those of the auditor." Based on this analysis, the Cohen Commission recommended modification of the standard report.

The second research approach was to argue analytically that slight modifications of the wording of audit reports are not likely to be of much importance, since users view the standard auditor's report as a symbol and notice only departures from that symbol. Researchers during this period cited the early study by Mautz and Sharaf (1961), which suggests that the report should be reduced in length to state merely that the financial statements have been examined with due audit care and that they present fairly the balance sheet and income statement of the company. Seidler (1974) suggested that, in the most extreme interpretation, the argument that the standard report is a symbol might lead to a two-word report—"Clean Opinion." However, more research attention has been devoted to suggesting modification of the precise wording of the report than to changing it drastically to a short "seal of approval," as Seidler argued.

⁵ See, for example, Epstein (1976), Fess (1972), Rosenfield and Lorensen (1974), and Roth (1968).

Reporting Criteria

In 1972, the AICPA issued the first of its series of Auditing Research Monographs. Carmichael (1972), previously a faculty member at the University of Texas, analyzed audit reporting cases from practice to determine the criteria used to distinguish between issuance of qualified opinions, adverse opinions, and disclaimers of opinion. This publication represents the AICPA's first sponsorship and systematic consideration of the results of academic research in the setting of auditing standards.

Scope and Nature of Attest Services

During the late 1960s and early 1970s, research in the academic area of finance made increasingly clear the fact that annual historical financial statements were only one of a number of inputs used in making debt and equity investment decisions. The need for timely information led to public disclosure of interim (generally quarterly) historical financial statements. In addition, the potential advantages of credible forecasts of future operations seemed obvious. This situation led accounting researchers to consider the need for CPA association with additional types of information.

An early approach was to use a questionnaire⁶ to survey financial statement users on their need for CPA association with information. For example, the form might ask: Are you in favor of or opposed to requiring companies to have audits of their quarterly financial reports? Similarly, researchers questioned CPAs directly to determine whether auditors were able to supply auditing services in new areas (e.g., Pratt, 1973). They also presented numerous arguments about the possibility of auditor involvement in these additional areas (e.g., quarterly information, internal control, forecasts), as contrasted to providing varying levels of assurance (e.g., limited assurance based on a review).⁷

Concurrent with this early research, the American Accounting Association's Committee on Basic Auditing Concepts (ASOBAC) issued a report (AAA, 1972) that insightfully views the role of the CPA in broader terms than had generally been done in the past. The report describes the function of auditing as a means of helping users to evaluate the quality of information communicated. ASOBAC further

⁶ See, for example, Imke (1967), Pratt (1973), Shenkir and Rakes (1972), and Opinion Research Corporation (1974).

⁷ See, for example, Wilkinson and Doney (1965), Bevis (1962), Johnson (1974), and Nurnberg (1971).

suggests that the audit function adds value to information, by serving as a control over information quality and by increasing information credibility. It goes on to say that this increased credibility allows the user to “be more confident in using the information for its intended purposes than he would be if the audit function had not been performed” (p. 29).

The report then emphasizes the concept of degrees of credibility and acknowledges the possibility that different types of services may offer differing degrees of credibility. It states that “ideally, an investigator should not express his belief concerning a proposition without expressing the degree of credibility attached to the proposition being judged” (p. 41). ASOBAC suggests that in the future the audit report may include varying degrees of credibility or assurance.

Consistent with the ideas presented in ASOBAC, Carmichael (1970) provided a well-reasoned discussion of the possibility of producing a publicly available “opinion” on a client’s internal control system. While surveys elicited responses as to whether users desired auditor association with internal control, Carmichael discussed the possibilities of other forms of association. In addition, in a question still debated by the profession,⁸ he asked, “Does an opinion on internal control contain information important to anyone other than management?”

Subsequently, Carmichael (1974), also consistent with ASOBAC, suggested that different types of information (e.g., interim statements, forecasts, annual financial statements) require differing levels of assurance (p. 69). His paper envisions a spectrum of possible forms of assurance ranging from a “denial of assurance when the CPA is acting in the role of an accountant in a write-up engagement to the maximum form of assurance of the traditional opinion audit” (p. 69). At this point the research issue becomes one of considering not only “what information,” but “what form of association.”

Early empirical studies⁹ asked financial statement users to give information about various forms of association with forecast information. For example, Asebrook and Carmichael (1973) asked if CPAs should report on whether a forecast’s assumptions had been selected with appropriate care and consideration.¹⁰ In general, these studies indicated that investors, when asked directly, agreed that such assurances would be desirable.

⁸ See, for example, Chief Accountant of the SEC Walter Schuetze’s (1993) arguments against such reporting. Messier and Whittington (1993) present a discussion of the pros and cons of attestation on management reports on internal control.

⁹ See, for example, Asebrook and Carmichael (1973) and Corless and Norgaard (1974).

¹⁰ Interestingly, this is a form of association with forecasts which is available today.

Winters (1975) tested the effect of a limited form of auditor association on annual financial statements. Commercial loan officers were asked to compare unaudited financial statements with and without CPA association. Most respondents believed that they would increase their reliance on financial statements in cases of CPA association. In addition, respondents indicated their preferences for several forms of CPA review of unaudited financial statements that went beyond what was then required by professional standards; respondents were generally positive toward these additional forms of association. Winter's paper was the first to address, empirically and directly, the possibility of a "review" form of association with historical financial statements.

Although this research indicates a desire for additional forms of assurance, questions existed as to the desirability of providing such services, because of possible user inability to understand the nature of the assurance being provided. Carmichael (1974) states:

Doubts about the ability of users to distinguish among different forms of assurance have slowed acceptance by auditors of the concept of levels of assurance. Many fear that users might not recognize the distinctions and would assume that the auditor was accepting the same degree of responsibility as he does for audited annual financial statements (p. 69).

Despite these concerns, the Cohen Commission (Commission on Auditors' Responsibilities, 1978), Coopers and Lybrand (1974), and Peat, Marwick, Mitchell & Co. (1976) all suggested the possibility of varying forms of CPA association with different types of information. In summary, early research of both an analytical and an empirical nature suggested the possibility of expanding the attest function.

MILESTONES: 1974–1980

Professional Standards

During the period between 1974 and 1980, the professional standards for performance of the attest function were expanded dramatically, in a manner consistent with much of the previously cited research.

Reporting Criteria for Audit Reports

Results of Carmichael's earlier cited field study, Auditing Research Monograph No. 1 (Carmichael, 1972), were used in SAS No. 2, *Reports*

on Audited Financial Statements, to provide auditors with more detailed reporting guidance on when qualified and adverse reports and disclaimers were to be issued than had been provided in the past.¹¹

Involvement with Other Information in Documents Containing Audited Financial Statements

In December of 1975, SAS No. 8 was issued, requiring auditors to read other information in documents in which their audit report was included (e.g., annual reports). It may be argued that “good practice” always required this. However, this represented a change in policy by expanding auditor responsibility to information beyond the financial statements. Communication to the user is only required when the information seems improper. Thus, SAS No. 8 expanded the information on which a CPA may be required to report and also developed a “reporting by exception” mode.

Involvement with Quarterly Information

Prior to 1976, there was, in general, no CPA association with quarterly financial information. As of 1976 the Securities and Exchange Commission (1975) required an “unaudited” note to be included in the audited annual financial statements of most large publicly held companies. SAS No. 10 developed a form of CPA association by outlining the required “limited” procedures which auditors must perform at year-end on this “unaudited” information. SAS No. 10 also made it possible for the company to engage the CPA to perform the review at the end of the quarter on a “timely” basis, with a report being issued to the board of directors upon completion of the audit. Subsequently, SAS No. 13 allowed CPAs to issue a report to the public based on a limited review. This form of association was consistent with the previously presented results of Winters (1975), and with the analytical discussions of the ASOBAC report.

Special Reports

SAS No. 14, issued in December 1976, outlines an approach of performing “agreed-upon procedures” related to specified elements, accounts, or items in a financial statement. The resulting report provides

¹¹ The second edition of the monograph points out that SAS No. 2 “is the result of consideration of the recommendations of ARM No. 1” (Carmichael 1978).

“negative assurance,”¹² a summary of findings, or both. This milestone is important in that it, in combination with SAS No. 13, clarified a form of accountant association which previously had been primarily used in the area of comfort letters for underwriters. Negative assurance, a level of assurance short of that provided in audits. Alternatively, when a summary of findings is provided, the communication shifts from providing assurance to simply reporting results.

Review and Compilation Engagements for the Financial Statements of Nonpublic Companies

Statement on Standards for Accounting and Review Services (SSARS) No. 1, issued in December 1978, clearly distinguished between review engagements in which “limited assurance” is communicated to financial statement users and compilations in which no explicit assurance is communicated to financial statement users. The combination of previous standards and SSARS No. 1 thus created three forms of association with the historical financial statements of nonpublic companies: compilation, review, and audit. In addition, as indicated above, SAS No. 14 outlined another form of association—agreed-upon procedures. These various forms of association provide the basis for the subsequent attestation standards (AICPA 1986b) issued in 1986, which provide the framework for expansion of the attest function.

Reporting on Internal Control

In July 1980, SAS No. 30 expanded the attest function in the area of reporting on internal control. SAS No. 30 replaced SAP No. 49 (1972), a standard that had presented a report on internal control which was worded to include so many warnings and limitations as to result in issuance of few such reports. SAS No. 30 allowed a more positively worded general distribution report.

Reporting on Financial Forecasts

In October 1980, the AICPA issued standards for reporting publicly on client financial forecasts (AICPA 1980b). The review form of association outlined in the standard was consistent with the empirical and analytical discussions presented in research discussed earlier.

¹² Negative assurance indicates that during the examination no matters came to the attention of the examiner to indicate problems. Effective with SAS No. 75, auditors no longer provide negative assurance on agreed-upon procedures engagements.

In summary, between 1974 and 1980 the AICPA:

- Developed further guidance on audit reports.
- Developed engagements providing various forms of assurance that CPAs might issue on information, including compilation, review, and agreed-upon procedures engagements.
- Greatly expanded the types of information with which CPAs might become associated, including not only historical information but also internal control and financial forecasts. (This expansion in some cases explicitly used the results of research and in others is consistent with conclusions suggested by earlier findings.)

Concurrent and Subsequent Research

Research on changes in professional standards was conducted to provide information on user perceptions of these new “products.” The research also considered whether financial statement user decisions differ based on the form of CPA association.

Perceptions of Information Reliability with Varying Forms of CPA Association

Libby (1979b) asked a sample of CPAs and bankers to compare different audit reports (unqualified, qualified, and disclaimers of opinion) and rate their similarity. He found that users did distinguish between types of opinions, and that their perceptions were similar to those of CPAs.¹³ Policy makers and practitioners have questioned whether it is more useful to issue a qualified opinion or a disclaimer of opinion when there has been a scope limitation or an uncertainty, since it is not clear that users are able to discriminate between these two types of audit reports. Libby’s results convincingly show that the level of assurance perceived by users is far lower when a disclaimer is issued, in contrast to a qualified opinion.

Strawser (1991) summarizes a number of studies¹⁴ that compare financial statement user reactions to information with various forms of CPA assurance. These studies generally elicit a financial statement

¹³ Pillsbury (1985) and Nair and Rittenberg (1987) extended the techniques applied by Libby and found that while perceptions of audit reports by bankers and CPAs were similar, differences existed with respect to other reports. In sum, their research raises questions whether bankers perceive that review reports provide more assurance on the reliability of an entity’s financial statements than do CPAs.

¹⁴ For example, Reckers and Pany (1979), Pany and Smith (1982), and Johnson, Pany, and White (1983).

user's beliefs about the reliability of financial information with and without CPA association. Results generally indicate that users believe financial statements are significantly more reliable when an audit engagement has been performed, as contrasted to a review or compilation or when there is no CPA involvement.

The available research indicates that financial statement users are able to distinguish between assurances provided by an audit and by a review. But only very small, statistically insignificant differences in users' perceptions exist between the various forms of association that are less than audits. Although users consider financial statements with no auditor association less reliable than statements compiled by a CPA, this difference is generally not statistically significant. The difference between compiled and reviewed statements is also small, although compilation means are slightly below review means.

Another group of studies¹⁵ cited by Strawser address CPA association with forecast information. These studies have in general revealed that CPA involvement with forecasted financial statements resulted in higher confidence, from both CPAs and bankers, that the forecasted financial statements were free of material errors. There was also greater confidence that forecasted net income would not deviate materially from actual net income.

In summary, research on user responses indicates that forms of association short of audits are considered to result in less reliable information than audits. When more than one form of association short of an audit has been tested, the results have generally been in the expected direction (i.e., greater CPA association results in greater perceptions of reliability), but these differences have been small and statistically insignificant.

Decision-Making Effects with Various Forms of CPA Association

Most decision-making contexts that have been addressed relate to the loan decision. A frequent approach is to develop a loan package for loan officer consideration. All loan officers receive that package, with the only difference being the type of CPA association with either the historical or forecasted information. These studies¹⁶ have not revealed systematic differences in loan decisions when differing types of CPA reports are provided. Characteristics of the company involved (e.g.,

¹⁵ Those studies include a series of research projects conducted by Danos, Holt, and Imhoff (1982), as well as a study by Johnson and Pany (1984).

¹⁶ See Johnson, Pany, and White (1983), Johnson and Pany (1984), and Danos, Holt, and Imhoff (1982).

management, financial condition) have been considered more important than the form of CPA association with the information presented. When these factors are considered in combination, research indicates that, while audited information is considered most reliable, the difference is not so large as to induce differences in loan decisions.

Standard Unqualified Reports

Research continued in the area of user interpretation of the message communicated in the standard report.¹⁷ In general these studies reiterated inconsistencies between the message CPAs believed they were communicating compared with the message received by financial statement users. The difference was especially large for perception of CPA responsibility for the detection of fraud, an area in which users believed that CPAs provided much greater assurance than did the CPAs themselves.

Reporting on Internal Control

As previously indicated, early research addressed the area of CPA attestation on internal control. In 1978, the Cohen Commission had recommended that auditors expand the study and evaluation of the system of internal accounting control performed as part of financial statement audits to allow them to provide a conclusion on its functioning. In 1979, the SEC proposed to require management-issued reports on internal control. It also called for auditors to attest to the assertions made by management. Wallace (1981) reports that more negative responses were received related to this proposal than for any previously proposed rule on accounting. Further, Wallace (1982a and 1982b) suggests her survey of user and preparer groups indicates that, in general, users would prefer such information, but that CPAs, directors, and controllers were opposed to it.

DEVELOPMENTS AFTER 1980

Professional Standards

Between 1980 and 1987, while significant changes occurred in auditing standards setting (especially an increased emphasis on a risk-based

¹⁷ See, for example, Barnett (1978–79), Pany and Johnson (1985), and Fess and Ziegler (1968).

audit approach), the changes in communication were limited. One exception was the issuance in March 1981 of SAS No. 34, *The Auditor's Considerations When a Question Arises About an Entity's Continued Existence*. SAS No. 34 provided guidance for auditors in assessing whether an entity was a going-concern. This standard provided more specific suggested wording for the auditor's report when there was a question about the entity's continued existence. SAS No. 34 and its successor, SAS No. 59, are discussed later in this chapter.

The passage of the attestation standards in 1986, in addition to clarifying the scope of attest engagements, clarified communication requirements related to various types of engagements. The attestation standards established for other types of information three basic types of engagements: examinations (i.e., audits); reviews; and agreed-upon procedures. SAS Nos. 35 and 49 further clarified the nature of agreed-upon procedures engagements and letters for underwriters, respectively.

The next significant changes in the auditor's communication role began in April of 1988 when the "expectation gap" standards were passed by the Auditing Standards Board (ASB). Following is a discussion of changes in these standards which had the greatest effect on CPA communications.

Revision of the Standard Audit Report

In 1988, SAS No. 58 modified the auditor's standard report (for the first time in forty years) to include statements (1) differentiating management and auditor responsibilities, (2) explicitly acknowledging that an audit provides reasonable assurance about whether the financial statements are free from material misstatements, and (3) briefly explaining the nature of an audit.

Consistent with earlier research findings, the objective of these changes was to improve user understanding of the auditor's role.

Elimination of Qualifications for Uncertainties

The expectation gap standards eliminated qualified opinions due to uncertainties, replacing them with an unqualified report with an explanatory paragraph describing the uncertainty. This change is considered in detail later in this chapter.

Reporting on Internal Control

SAS Nos. 60 and 61 were designed to improve communication between the auditor and audit committee members. SAS No. 60

replaced SAS No. 20 (issued in 1977), which required communication to management and the board of directors about material weaknesses in internal accounting control procedures uncovered by the audit. SAS No. 60 goes further and requires communication of significant deficiencies in the control environment, the accounting system, and control procedures. In addition, it demands communication of “reportable conditions” coming to the auditor’s attention that represent significant deficiencies in the design or operation of the internal control structure. SAS No. 61 requires a variety of disclosures to the audit committee relating to various audit findings and occurrences (e.g., disagreements with management, major issues discussed with management).

In addition to communications on internal control required by auditing standards, accountants have been asked to provide reports on management’s assertion about the effectiveness of an entity’s internal control structure. An impetus for such reporting occurred when Congress passed the Federal Deposit Insurance Corporation Improvement Act of 1991 (FDICIA), requiring the management of all financial institutions with assets greater than \$200 million to issue a report on the effectiveness of internal control structure. The FDICIA also requires that accountants attest to management’s report.

In 1993, the AICPA issued SSAE No. 2, *Reporting on an Entity’s Internal Control Structure Over Financial Reporting*, to provide guidance for issuing such reports. SSAE No. 2 defines an entity’s internal control structure over financial reporting as including those policies and procedures that pertain to an entity’s ability to record, process, summarize, and report financial data consistent with the assertions embodied in either annual financial statements or interim financial statements, or both.

Management may present its written assertion about internal control structure in either of two forms: as a separate report that will accompany the practitioner’s report, or in a representation letter to the practitioner.

SSAE No. 2 outlines procedures for two forms of engagements for reporting on internal control structure: an examination, or agreed-upon procedures. Criteria issued by the AICPA, regulatory agencies, and other bodies of experts that follow due process qualify as control criteria.

Research on the Expectation Gap Communication Standards

On May 11-12, 1992, the AICPA Private Companies Practice Section, the Big 6, and Grant Thornton sponsored a conference to discuss

research related to the expectation gap auditing standards. The papers were published in a book entitled *The Expectation Gap Standards: Progress, Implementation Issues, Research Opportunities* (AICPA, 1993). The Proceedings contain papers on the revised standard audit report, consistency, uncertainties, and reporting to audit committees.¹⁸

Standard Unqualified Report

A number of studies¹⁹ have compared user perceptions of the old and new audit reports to examine whether report changes have altered the message communicated. Most of that research indicates that the new form of the audit report clarifies the auditor's role and the fact that financial statements are the representations of management. Yet users continue to have a higher expectation that auditors will detect fraud than do auditors.

Reporting on Internal Control

The fact that SAS Nos. 60 and 61 result in communications that are not typically available to the public has limited the amount of research attention this area has received. Wallace (1992) analyzed more than 100 auditor reports to management and concluded that auditors have continued to provide sensitive comments to management over the years since passage of the Foreign Corrupt Practices Act, which required that management establish effective systems of internal accounting control.

Summary

The expansion of the attest function subsequent to the 1960s has resulted in a situation in which both the forms of association available and the types of information to which CPAs attest have increased greatly. A large body of research has either preceded the changes or tested the effects of changes in the professional standards.

Among the research findings that add credibility to the direction that standard setting has taken and that may have relevance to future policy decisions are the following:

¹⁸ See Jaenicke and Wright (1993), Solomon and Rich (1993), Carmichael and Pany (1993), and Rittenberg and Nair (1993).

¹⁹ See, for example, Hermanson, Duncan, and Carcello (1991), Houghton and Messier (1991), Kelly and Mohrweis (1989), Miller, Read, and Strawser (1990), and Pringle, Crum, and Swetz (1990).

1. Financial statement users are able to distinguish between types of audit reports issued, with disclaimers of opinion, especially, being regarded as providing much less assurance than either a qualified or an unqualified report.
2. Financial statement users are able to distinguish between differing assurance levels provided by a review and an audit. Although actual decisions made (e.g., deciding whether to grant a loan) have not in general differed for reviewed versus audited statements, measures of the reliability of those statements and the assurance provided by CPAs are much lower for reviewed statements.
3. Replies of financial statement users as to the reliability of financial statements with no CPA association or with a compilation form of association are generally slightly less than those for reviewed statements, though differences are generally not statistically significant.
4. Research conducted when forecast “reviews” were performed (rather than the current “examination” form of association) indicates that reviewed forecast information is considered much more reliable than forecast information issued without review.
5. Users perceive that the SAS No. 58 revision of the standard audit report has clarified the roles of management and auditors concerning financial statements. Yet users continue to have a higher expectation that auditors will detect fraud than do auditors themselves.

COMMUNICATING UNCERTAINTIES, INCLUDING GOING-CONCERN STATUS

The auditor’s role and responsibilities in communicating information on uncertainties, including the going-concern status of a client, provides an excellent example of the interrelationship of research and policy making relating to auditor communications.²⁰ The primary user communication issue is whether auditors should modify audit reports when clients have included all required disclosures related to the uncertainties.²¹ Such an

²⁰ See Carmichael and Pany (1993) for a discussion of auditor responsibility for reporting on uncertainties (including going concern), especially as it relates to the expectation gap auditing standards.

²¹ There is agreement that in the situation when an uncertainty, including going-concern status, is not properly disclosed, a “departure from generally accepted accounting principles” exists, which requires auditors to modify their report through issuance of either a qualified or an adverse opinion.

audit report modification either *provides additional information* to investors in the sense that the auditor's view of the uncertainty is made explicit or *highlights information* that is also disclosed in the financial statements.

Historical Background

SAP No. 15, issued in 1942, represents the AICPA's first formal effort to consider the effects of uncertainties, including going-concern uncertainties, on the audit report. That Statement suggests that the cumulative effect of uncertainties may be so great as to create a situation either in which an auditor's report might require an exception or in which it might not be possible to render an opinion. Subsequently, the Securities and Exchange Commission's Accounting Series Release (ASR) No. 90 (1962), and the AICPA's SAP No. 33 (1963) required that the phrase "subject to" be used to introduce a qualification of opinion when the financial statements were materially affected by uncertainties. In 1974, the Auditing Standards Executive Committee (predecessor of the Auditing Standards Board), in SAS No. 2, concluded that uncertainty about the ability of an entity to continue should be reported in the same manner as any other uncertainty (AICPA 1974).

In 1978, the Cohen Commission recommended elimination of report modifications for uncertainties, including going-concern uncertainties. The Commission concluded that a responsibility to evaluate whether an uncertainty should lead to a qualified opinion was not compatible with the auditor's role of evaluating whether uncertainties are properly presented and disclosed in conformity with GAAP.

Early Research

In general, the Cohen Commission's conclusions seem consistent with the "efficient market hypothesis" theory that suggests that securities markets quickly receive all publicly available information and reflect it in share prices. Indeed, that research finding is cited at least three times in the Commission's report (1978, pp. 6–7, 55, 119) and is relied upon throughout. As an example of an implication of the efficient market hypothesis, consider audit report modifications for uncertainties. A proponent of that theory might argue that the report modification issue may be resolved by determining whether auditors provide additional information beyond that disclosed in the notes. If not, then the report modification is unnecessary.

In addition to considering the efficient market hypothesis, the Commission cited the results of Altman and McGough (1974). Altman and McGough conclude that using financial ratios is a better indicator of a company's future prospects than noting whether the auditor has modified the audit report. The study includes the surprising result that Altman and McGough's statistical model accurately predicted failure for 82 percent of a sample of companies which subsequently failed, whereas only 44 percent of that sample had received an audit report modified for going concern.²²

The Altman and McGough paper is an extension of Altman's earlier study (Altman 1968) in which he used financial ratios to predict corporate bankruptcy. While the Cohen Commission recommendation of elimination of uncertainty modifications has never been implemented in the United States,²³ CPA firms began, and continue, to use models such as those presented by Altman.²⁴

After the Cohen Commission report, a number of research projects addressed the issue of the usefulness of uncertainty modifications. At a conference at the University of Illinois, attended by both academics and practitioners, Shank and Dillard (1979) presented results of a survey of executives and financial analysts which indicated that financial statement preparers and users view "subject to" modifications as a red flag that adds value to audited information.

Libby (1979a) used a different approach to study uncertainty report modifications. He provided each loan officer with information that included one of the following:

- An unqualified audit report without financial statement note disclosure of an existing uncertainty;
- An unqualified audit report with financial statement note disclosure of the uncertainty; or
- A qualified "subject to" audit report with financial statement note disclosure of the uncertainty.

²² Kida (1980) points out that comparing bankruptcy model prediction with audit report modification does not directly address auditor ability to identify problem companies. His results suggest that auditors in his study considered economic trade-offs such as the risk of losing a client, of being exposed to third-party lawsuits, and of loss of reputation in making a decision on whether to issue a going-concern modification.

²³ In 1980, Canada eliminated the "subject to" qualification on the grounds that full disclosure of uncertainties makes such qualifications not only unnecessary but undesirable (Boritz, 1991, 77).

²⁴ Discussions with audit practitioners indicate that mathematical models such as Altman's are being used to indicate financial distress rather than to predict bankruptcy.

The results of his analysis suggest that, while the existence of the uncertainty note disclosure had a negative effect on the bankers' loan decisions, addition of the audit report modification had no further discernible effect on the decision. There was some indication, however, that it affected the loan officers' confidence in the remainder of the financial statements.

Libby's results are largely consistent with the Cohen Commission suggestion that the report modification is redundant in that it provides no information beyond that already disclosed in the financial statements. Thus, research conducted in the late 1970s would seem to indicate that the uncertainty modification added to an audit report does not affect users' decisions. Yet when directly asked, users desire the modification as a red flag.

Professional Standards Development in 1981 and 1982

In March of 1981, SAS No. 34 was issued. SAS No. 34 accepts the premise that audit reports should be modified for going-concern uncertainties and provides operational guidance to auditors on assessing a client's likely continued existence. Thus, rather than eliminate the "subject to" qualification, the Auditing Standards Board's solution was an attempt to improve practice through providing additional guidance. SAS No. 34 states that while an audit does not include a search for evidential matter relating to an entity's continued existence, when an auditor becomes aware of information contrary to its continued existence, modification of the audit report might become necessary. It also establishes procedures to be followed when such a question arises. These procedures are consistent with information used in models such as those presented by Altman.

One year later, in March of 1982, the Auditing Standards Board, with apparent SEC concurrence, issued a proposed SAS which, if adopted, would have eliminated the "subject to" qualification (Mann 1982 11–12; AICPA 1982). The argument for elimination was based largely on the belief, previously articulated by the Cohen Commission and consistent with much of the available research, that an audit report should not be modified when the financial statements adequately present and disclose an uncertainty in conformity with GAAP.

In June of that year, before going ahead with the change, the ASB held a meeting with the public to obtain the views of financial statement users. Users who attended argued that the "subject to" report was valuable and that its elimination would be viewed as an attempt by auditors to shirk their responsibility to investors (Mann, 1982, 12). In

June 1982, based largely on views expressed at the public meeting, the Board delayed release of the proposed SAS indefinitely (Konrath 1985).

Research Following 1982

Research relating to uncertainties, including going concern, continued along two lines, namely (1) examination of the unique information provided by uncertainty reports and (2) examination of the relationship of going-concern opinions to bankruptcy.

Unique Information Provided by Uncertainty Reports

Research into the unique information provided by uncertainty reports has followed two approaches:

- Focusing on the reaction of the stock market to the issuance of an uncertainty report.
- Using survey and experimental research to assess users' and auditors' perceptions of and reactions to uncertainty reports.

Various studies analyzed whether an "abnormal" stock return reaction occurs when a "subject to" qualified opinion is issued. The overall approach, adapted from finance research on the efficient markets hypothesis discussed earlier, is one of using prior stock market returns to develop an "expected" return. That expected return is compared to the actual returns around the time of the issuance of a report modified for an uncertainty. If the reaction varies significantly from that "expected," it is referred to as "abnormal" and the report is considered to have provided "information" to the market.

The results of the use of this approach have been mixed. The earliest studies isolated no effect (Asare, 1990). Several subsequent studies, however, concluded that "subject to" qualified opinions had information content. For example, Dopuch, Holthausen, and Leftwich (1986) found a significant negative stock price reaction when the media disclosed that a "subject to" qualified opinion was to be issued. In addition, Frost (1991), replicating and extending an earlier study by Banks and Kinney (1982), found that a small sample of firms with "subject to" qualified opinions had more negative stock price reactions than those not receiving such audit reports, although the difference is not statistically significant.

A primary limitation of this approach is that knowledge of the type of audit report to be issued often becomes available concurrently with the release of the information in the financial statements. This makes it

difficult to isolate a true market reaction to the audit report. Because the company involved may be experiencing severe financial difficulties, a lack of a market reaction also may occur because investors expected such an audit report well in advance. Assessing such investor expectations is, at best, a difficult task.²⁵

Hopwood, McKeown, and Mutchler (1989) attempted to correct for problems in the market research and assess the incremental information content of opinions modified for consistency and uncertainty by assessing their ability to assist in predicting bankruptcy. They found that consistency and going-concern modifications do provide incremental information content over that provided by ratios in a bankruptcy prediction model, giving credence to users' insistence that modified audit opinions provide useful information.

Survey and experimental research on this topic either asks a respondent whether such reports are desirable or gathers responses to a "case" situation that manipulates one or more related variables. As indicated earlier, Shank and Dillard (1979) had surveyed users who found that "subject to" modifications provided a useful red flag. Campbell and Mutchler (1988) surveyed bankers and CPAs and found that their perceptions about the nature and usefulness of going-concern opinions were similar. When users are placed in simulated decision-making contexts, however, the results have been different.

In a study similar to Libby's (1979a) earlier study, Abdel-khalik, Graul, and Newton (1986) provided financial statement loan officers with financial statements that disclosed an uncertainty in the notes to the financial statements. One group of respondents was provided financial statement note information on an uncertainty, while the other group received the note description plus a report modified as to the uncertainty. The study concluded that "subject to" qualified opinions had no significant additional effect on bankers' assessments of the riskiness of clients. Thus, both the results of the study by Libby and of this one are consistent with a conclusion that, for the tested populations, uncertainty qualifications are unnecessary.

Mutchler (1984) interviewed sixteen audit partners and asked detailed questions about their perceptions of the purpose of the going-concern modification and the circumstances in which they would issue such a modification. She found a lack of consensus on the

²⁵ Consistent with this limitation, studies by Mutchler (1985) and Dopuch, Holthausen, and Leftwich (1987) have shown that going-concern modified reports can be predicted relatively accurately using publicly available information.

perceptions of the auditor's role in the presence of going-concern uncertainties, both between partners employed by different firms and even between partners within the same firm.

Relationship of Going-Concern Opinions to Bankruptcy

Research has continued along the line originally presented by Altman which compares auditor issuance of going-concern modifications with the bankruptcy prediction mathematical models. In addition, research has addressed the question of whether the issuance of a going concern modification is a self-fulfilling prophecy: Does issuance of a going concern modification result in bankruptcy?

The relationship between subsequent bankruptcy of a client and the issuance of a modified audit report received much research attention subsequent to Altman and McGough's (1974) original work. One significant limitation of such an analysis is that professional standards make clear that going-concern related report modification decisions are not equivalent to bankruptcy prediction. The law literature has no parallel to "continued existence" or a "going concern" (American Bar Association, 1987).

Boritz (1991, 28) presents the typical stages of business failure: problem incubation, severe cash shortage, rescue attempts, and finally failure. The point at which a severe cash shortage is noted might lead the auditor to conclude that a going-concern modification is necessary. Yet an analysis of management's plans may lead the auditors to believe that the company may regain financial health. In such a situation, most auditors would not consider the existence of financial stress as sufficient to result in a going-concern modification. A company also might fail due to a sudden event subsequent to the audit.

Research, however, consistently focuses on the link between bankruptcy and the going-concern opinion to assess auditor accuracy. Many researchers, in addition to Altman and McGough (1974) (Altman, 1982; Menon and Schwartz, 1986; Hopwood, McKeown, and Mutchler, 1989) have consistently found that less than 50 percent of any given set of bankrupt companies receive the going-concern opinion. Similar to the research on the information content of report modifications, these results relate to the time period in which SAS No. 34 was in effect.

As discussed earlier, the Altman and McGough (1974) paper compared the bankruptcy prediction accuracy of Altman's bankruptcy prediction model with that of auditor's going-concern opinions and found the model to be a much better predictor. In a subsequent study, Hopwood, McKeown, and Mutchler (1994) separately consider stressed

and nonstressed companies and the actual failure rate in the population of all companies.²⁶ Their results indicate that under those circumstances the auditors' going-concern opinions are comparable to statistical models as indicators of bankruptcy.

Professional Standards Development in 1986 and 1987

In 1986, the Auditing Standards Board dropped its efforts to eliminate "subject to" audit reports, despite a consensus that, contrary to audit reporting requirements, "a 'subject to' opinion is not appropriate if a contingency has been appropriately disclosed under FASB Statement No. 5" (AICPA 1986a). The Board also concluded that a project to reconsider the auditor's reporting responsibility when a going-concern question arises should be added to the agenda.

Despite the ASB's contention that properly disclosed uncertainties should not result in modification of the audit report, others have continued to argue that it serves as a red flag, considered by users to be an important function performed by auditors. Going-concern qualifications have received the most attention as necessary early warnings of impending trouble. Indeed, some have defined an audit failure as a situation in which an independent auditor issues an unqualified opinion and shortly thereafter the entity goes bankrupt or has major financial problems (Berton 1985).

Congressman John Dingell, Chairman of the Commerce Committee, stated succinctly, "the level of busted audits has been too high and too spectacular" (Berton and Ingersoll 1985). In his remarks to Congress, Congressman Wyden (1986, 1) stated:

In one financial disaster after another, including E. F. Hutton, United American Bank, Penn Square Bank, E.S.M. Government Securities, Home State Savings Bank of Ohio, American Savings and Loan of Florida, Drysdale Government Securities, Saxon Industries, and others, the disaster struck virtually on the heels of clean audit certificates issued by audit firms indicating that the companies were financially sound. The result? Hundreds of thousands of investors and creditors were out hundreds of millions of dollars.

While informed observers might fault the factual accuracy of this analysis, the popular press generally does not question assertions that

²⁶ A "stressed" company exhibited at least one of the following: (1) negative working capital in the current year, (2) a loss from operations in any of the last three years prior to bankruptcy, (3) a retained earnings deficit three years prior to bankruptcy, or (4) a net loss in any of the last three years prior to bankruptcy.

auditors are not providing the public with adequate advance warning about the deteriorating finances of companies. Thus, in the mid 1980s, auditors faced a political situation in which at least two key congressmen believed that not only were going-concern report modifications necessary, but that auditor performance in issuing them needed to be improved. In 1985, one international CPA firm advocated increasing audit requirements to include consideration of a company's financial *condition* as well as its financial *position*. The distinction between position and condition was intended specifically to address public concerns of business failures which occurred shortly after a company had received a report without a going-concern modification (Price Waterhouse, 1985, 7–10).

The net effect of the ASB's deliberations appear in SAS Nos. 58 (all uncertainties) and 59 (going-concern uncertainties). In both cases, the "subject to" qualified opinion is replaced with an explanatory paragraph following the opinion paragraph. The need for a fourth (explanatory) paragraph on uncertainties directly tracks SFAS No. 5. When a material loss is probable, but no reasonable estimate of the amount is possible, an explanatory paragraph is required. When a material loss is reasonably possible, the auditor is to consider whether to add an explanatory paragraph based on the magnitude of the amount involved and the likelihood of occurrence.

SAS No. 59 requires auditors to evaluate whether there is substantial doubt about the entity's ability to continue as a going concern for a reasonable period, generally not to exceed one year beyond the date of the financial statements being audited. The recoverability of asset amounts and the amount and classification of liabilities is no longer the deciding factor in whether to modify the report. Substantial doubt about a client's going-concern status is the critical factor.

The ASB struggled with identifying the point at which report modification for uncertainties should occur. For uncertainties, SFAS No. 5 terminology including "probable" and "reasonably possible" were used without embellishment. "Substantial doubt" was selected for going-concern modifications.

Related Research

Research conducted both prior to and subsequent to SAS Nos. 58 and 59 has relevance to the definitional issues indicated above. In addition, research is available addressing the effects of SAS Nos. 58 and 59 on the frequency of report modification and its relationship to bankruptcy.

Probable and Reasonably Possible

SAS No. 58 suggests that the auditor should add an explanatory paragraph when it is probable that a material loss will occur but management is unable to make a reasonable estimate of the amount. When a loss is reasonably possible, the auditor is to consider both the magnitude of the amount and the likelihood of occurrence.

The general nature of the definitions provided led to studies²⁷ that required respondents to make those terms operational. These studies asked CPAs to interpret the numerical meaning of the terms “reasonably possible” and “probable.” All studies have reported significant variation in replies. Average responses for “reasonably possible” are between 15 percent (Harrison and Tomassini, 1989) and 42 percent (Schultz and Reckers, 1981). Slightly less variation exists for the meaning of “probable,” which typically receives a mean of approximately 70 percent likely.

SFAS No. 5 does not suggest whether the consideration of likelihood of unfavorable outcome and estimation should be simultaneous or sequential. In sequential consideration, the auditor first estimates the magnitude of potential loss, then assesses the probability of its realization. The studies have in general found that auditors responding to cases generally *do not* follow a sequential process but instead make decisions considering materiality and likelihood simultaneously, while also considering trade-offs between the two.

SAS No. 58 explicitly includes a trade-off between probability and amount of loss. Raghunandan, Grimlund, and Schepanski (1991) found that auditors replying to cases did follow this type of decision process.

Substantial Doubt

SAS 59 uses the undefined risk level of “substantial doubt” as the triggering point for report modification. Knapp, Wallestad, and Elikai (1991) tested a variety of situations by asking CPAs to report the numerical probability at which “substantial doubt” occurs. The average reply was approximately 55 percent, and there was significant variability in the CPAs’ responses. There was also significant variability in the CPAs’ perception of the “likelihood that an auditor of a failed firm will be sued.”

²⁷ See, for example, Schultz and Reckers (1981), Jiambalvo and Wilner (1985), Harrison and Tomassini (1989), and Raghunandan, Grimlund, and Schepanski (1991).

In a related study, Asare and Messier (1993) examined three issues related to the substantial doubt criterion used in SAS 59:

1. The consistency of the threshold level used by auditors for issuing a modified report.²⁸
2. The consistency between those threshold levels and auditors' report choices.
3. The association of the auditors' threshold levels to three factors (loss of client, threat of lawsuit, rate of failure).

Using a realistic case, they asked partners and managers to provide a preliminary judgment about the entity's ability to continue as a going concern, make a report choice, and provide a threshold level for issuing a modified report. The auditors' mean threshold likelihood was 62.52 percent, but there was substantial variability. The auditors' report choices were consistent with their substantial doubt thresholds, and the threat of lawsuit was the only factor associated with the auditors' threshold levels.

The results of these studies indicate the difficulty in obtaining a consensus interpretation for concepts such as "reasonably possible," "probable," and even "substantial doubt." Even if the standards clearly define the concepts, it is unlikely that auditors would interpret a given situation in the same manner. For example, it is not clear that a perception of 60 percent likelihood by any one auditor is similar to another auditor's perception, in terms of leading to the same judgment for a given situation. In other words, a company's given state may lead one person to conclude that it has a 65 percent likelihood of failure while another person might conclude that the company has a 40 percent likelihood of failure. What if the Auditing Standards Board deemed 60 percent as meaning substantial doubt? In the case described, one auditor would legitimately issue the going-concern opinion while the other, equally legitimately, would not.

²⁸ Asare (1992) has characterized the going-concern judgment as a two-stage process. In the first stage, the auditor collects evidence E (in the form of contrary information and mitigating factors) to reach a subjective belief, $P(C-E)$, where C is the event that the firm will continue in existence. In the second stage, the auditor compares $P(C-E)$ to $P^*(C)$, where $P^*(C)$ is the threshold level for issuing an unqualified opinion. The auditor will issue a modified report if $P(C-E) < P^*(C)$, whereas the auditor will issue an unqualified report if $P(C-E) \geq P^*(C)$. Within this characterization, $P^*(C)$ represents the auditors' likelihood for what constitutes substantial doubt.

Frequency of Going-Concern Opinions and Their Relationship to Bankruptcy

Studies²⁹ are becoming available on the effects of SAS Nos. 58 and 59 on the frequency with which audit reports are modified and on the relationship between a going-concern modification and subsequent bankruptcy. These studies generally report an increase in the number of going-concern and other uncertainty modifications subsequent to issuance of the standards. But, because the period examined (generally 1989 and 1990) was a period in which the American economy was recessionary, it is uncertain whether the increase can be explained by the change in standards or in the economy. Finally, Raghunandan and Rama (1995) report that during the period subsequent to the effective date of SAS No. 59, 62 percent of bankrupt companies received a going-concern modification prior to bankruptcy. This early finding requires further analysis before any strong conclusions may be drawn. Yet the percentage is higher than that obtained in any of the earlier reported studies, which used pre-SAS No. 59 data.³⁰

Summary

The profession has modified its approach for reporting on uncertainties, including going concern, over the past decades. Among the research findings are the following:

1. While many (e.g., the Cohen Commission) have suggested elimination of uncertainties as a basis for report modification, weak support for retention of uncertainty reporting exists in that some stock market studies indicate that, in “surprise” situations in which such a report had not been expected, there is a market reaction. In addition, disclaimers of opinion relating to going-concern status seem to have a negative market response.
2. Surveys of users invariably indicate that they regard the red-flag function of the report as desirable. Yet, experiments indicate that uncertainties that are red flagged *both* through the audit report and through notes to the financial statements *do not* result in different decisions when compared to those disclosed *only* in the notes.

²⁹ Typical of these studies (and among the first) are Biggs and Guenther (1994) and Raghunandan and Rama (1995).

³⁰ Carcello and Palmrose (1994) examine the relationship between report modification and litigation. Their preliminary findings (due to small sample sizes) indicate that auditor litigation based on companies with modified audit reports had the highest dismissal rates and the lowest payments.

3. Auditors frequently do not modify an audit report for going-concern status in the year prior to a company failing. A large number of studies indicate that this occurs approximately half of the time. A recent study using post-SAS No. 59 data indicates that this percentage of nonmodified reports may be decreasing. Evaluation of this performance is clearly subjective. Some may find the overall situation acceptable; others may find it problematical, especially from a potential litigation perspective.
4. Surveys and experiments conducted of auditors find that the subjective terms used in SFAS No. 5—*remote, reasonably possible, probable*—as well as SAS No. 59’s *substantial doubt* elicit a broad range of replies. The ASB may wish to again look at whether providing more specific guidance in this area would be worthwhile.

FUTURE DIRECTIONS

While SAS No. 58 represents the first major revision of the standard auditor’s report in more than forty years, it is unlikely that the report it proposes will last that long. Forces at work within and outside the profession will, in all likelihood, cause a substantial revision to the standard report within the next ten years. In this section we discuss some of those forces and the profession’s reaction to them.

Public Oversight Board Recommendations

In March of 1993, the Public Oversight Board of the SEC Practice Section of the AICPA’s Auditing Standards Board made a number of recommendations to the ASB (AICPA 1993b 59–66). Three of the recommendations that address auditor communications are:

Recommendation IV-4: The Auditing Standards Board should revise the auditor’s standard report to make the prospective nature of certain accounting estimates clear, including a caveat that the estimated results may not be achieved. This communication should not be written as a defensive retrenchment by the auditing profession, but rather as a more realistic and reasonable explanation of the limitation of assurance that can be provided on certain accounting estimates.

Recommendation V-12: The SEC should require registrants to include in a document containing the annual financial statements: (a) a report by management on the effectiveness of the entity’s internal control system relating to financial reporting; and (b) a report by the

registrant's independent accountant on the entity's internal control system relating to financial reporting.

Recommendation V-13: The Auditing Standards Board should establish standards that require clear communication of the limits of the assurances being provided to third parties when auditors report on the adequacy of client internal control systems.

AICPA Special Committee on Financial Reporting

In November 1993, the AICPA Special Committee on Financial Reporting (AICPA, 1993c) released a report that included recommendations on the role of auditing which may potentially affect the manner of future audit communication. The report states:

Users believe audited information has value because auditors provide independent assurance of the reliability of amounts reported and accompanying disclosures. They would like auditors to provide additional qualitative commentary in their reporting. (p. 5)

Examples of commentary that were cited by users during the Committee's research activities included additional information on the following:

- Audit scope and its findings.
- Entity's accounting and reporting practices in relation to alternative accounting methods.
- Risks associated with realizing recorded assets.

Auditing Standards Board Responses

As a result of these research activities and reports, the ASB has initiated projects to consider:

- Developing a statement concerning auditing management estimates for inclusion in the standard auditor's report.
- Developing a statement concerning the auditor's responsibility for testing internal controls as a part of a financial statement audit.
- Finalizing the expectation gap exposure draft, "Examination of Management's Discussion and Analysis."

New Standard Auditor's Report

Many of the recommendations being made to the profession, and much of the discussion within the profession, suggest a need to revise the standard auditor's report. Changing the auditor's standard report to

make the prospective nature of certain accounting estimates clear, as recommended by the Public Oversight Board, would remind users that many of the audited amounts have a wide range of acceptable answers.

The most significant of the minimum changes being contemplated by the ASB is likely to be reporting on internal control. Almost every major commission that has addressed the issue of internal control has recommended that the standard audit report be revised to communicate to users the degree of responsibility an auditor is assuming with respect to internal control as a result of an audit of the financial statements. Previously, these recommendations have been rejected because such statements might detract from the opinion on the financial statements.

A description of the auditor's responsibility could lead to differential reporting for those auditors taking a "substantive" approach to auditing financial statements, as opposed to those assessing control risk at levels lower than the maximum and "relying on controls." However, discussions with representatives of the Financial Executives Institute and with other users indicate that they appear ready to accept such differential reporting. Users are increasingly prepared to recognize that internal controls are important and, as more companies tie their systems together, effective computer internal controls are critical.

Another possible change in the near future is the inclusion in the standard audit report of a section addressing matters that the auditor believes are significant, called by some an "auditor's discussion and analysis." The first step in connection with such a change may be reporting on management's discussion and analysis. However, even if a new standard for reporting on management's discussion and analysis is adopted, the development of guidance for an auditor's discussion and analysis would still be a major project. Such a project would also represent a significant departure from the role that external auditors have historically played and would place them more in the role of an internal auditor conducting a management audit, i.e., placing the external auditor in the role of the asserter. Research is needed to assess whether such a change would really be responsive to users' needs.

If standards for an auditor's discussion and analysis are not adopted, there are many steps to be taken short of a full discussion and analysis. The addition of new disclosures for risks and uncertainties as a result of the Accounting Standards Executive Committee project may cause many auditors to reconsider the need for "emphasis of a matter" paragraphs and uncertainty paragraphs. There appears to be confusion over when an uncertainty paragraph should be used and when an "emphasis of a matter" paragraph would be the more appropriate response. Many users appear to be confused (as do some auditors) as

to the difference between such paragraphs. Perhaps the time is right to eliminate the differences between these two paragraphs and call everything that appears after the opinion paragraph an “emphasis of a matter” or an auditor’s discussion and analysis.

Other Future Communication Changes

Many practitioners question whether the communication of the results of an audit of financial statements will continue to be the primary communication product for the profession in the future. They question the necessity and usefulness of the classic historical financial statements. Some envision that these challenges will lead to the replacement of the audit of the financial statements with the more direct communications and assurance services that will address the systems and information flows of the future. What these systems or information flows of the future will look like is uncertain. The profession is actively considering expansion beyond the audit of the financial statements, and such a traditional service may represent only a small part of the revenues of a major firm in the future. Researching the needs of the users of these new services will be critical.

SUMMARY

In summary, a large body of research has developed which has provided insights into auditor communication both *ex ante* and *ex post* to standard setting. The function is likely to change significantly in the future. Suggestions outlined in this chapter provide fuel for debate, not only for policy-making bodies but also for researchers interested in auditor communications.

Summary, Obstacles, and Future Directions

OVERVIEW

This chapter has two primary purposes. The first objective is to highlight some of the major outcomes (“value added”) resulting from the collaborations discussed earlier in this monograph. The second objective is to examine obstacles to collaborative efforts and to discuss ways of overcoming them. The hope is not only that there will be future collaborative research, but that such endeavors will meet ever-increasing standards for efficiency and effectiveness.

SUMMARY OF SIGNIFICANT OUTCOMES

Review of Purpose

The previous chapters have described the rich heritage of practitioner/academician collaboration in addressing auditing challenges. This collaboration is complex, resulting in a variety of influences, not all of which are self-evident. For example, research has affected the content and approach of auditing courses, which, in turn, affects the thinking and skills of those entering the auditing profession. Earlier chapters of the monograph have provided a historical overview of the numerous practitioner/academician collaborations in six broad topic areas, illustrating the nature and depth of this process. As discussed, many parties have been beneficiaries including students, standard setters, and members of both the practice and academic communities. The next few paragraphs summarize some of the major outcome(s) of these collaborations in each of the six topic areas.

Outcomes

The evolution of audit practice from a largely procedural to a risk-driven approach is the focus of Risk Orientation. This evolution was stimulated by competitive and other pressures, but research and

joint research/practice initiatives made such a shift possible. Research discussed in this chapter also has greatly influenced auditing education.

Research on audit judgment, the focus of *Audit Judgment* has led to an understanding of the strengths and weaknesses of auditors' decision making, identification of the types of decisions for which decision "tools" would be of value, and development of such tools for practice. Policy makers also have been aided in their effort to formulate standards and procedures. For instance, many of the potential problems traditionally associated with nonsampling risk have been analyzed in audit judgment studies. Among such problems is the potential for the order in which information is received to influence auditor judgment. In addition, numerous studies reviewed in *Audit Judgment* have been concerned about the potential for different auditors, facing the same facts, to reach substantially different conclusions.

The importance of research symposia, while mentioned in *Risk Orientation*, also is highlighted in *Audit Judgment*. Such symposia provide an opportunity for identification of important practice issues and concerns, the exchange of ideas between academicians and practitioners, and the dissemination of research findings.

A significant amount of research by practitioners, by academics, or by practitioner-academic teams, has been conducted on audit sampling approaches. This collaboration, described in the fourth chapter, has resulted in a number of developments, including monetary unit sampling. Auditing education also has been greatly influenced by research in this area as this research, in concert with that discussed in *Risk Orientation*, has provided a framework that often is used to introduce students to auditing.

The fifth chapter is focused on the movement toward a greater emphasis on audit analytical procedures. Practice and research collaboration has led to the development and testing of numerous quantitative approaches to analytical procedures including regression (e.g., STAR at Deloitte, Haskins, and Sells) and these collaborative efforts have influenced auditing standards. Studies of the incidence of errors have provided evidence on analytical procedures' effectiveness. Judgment issues in applying analytical procedures, as identified in recent research, are also examined in this chapter. An example is the potential negative effects that could arise if an explanation provided by a client for an unexpected material fluctuation were to inhibit the auditor from fully considering alternative causes for the fluctuation.

The effort to better meet societal needs by broadening the attest function from the traditional financial-statement audit to the current variety of services (e.g., reviews and reports on internal controls) is the

theme of Communications with Users. The focus is practitioner/academician collaboration in analyzing potential attest services, developing tools for those services judged to represent appropriate expansions, and clarifications of the role of the attesters and their reports. For instance, research on reporting the going-concern status of a client is examined. This research clarified the auditor's role and provided input to standard-setters with respect to the need for recognition of going-concern issues in the auditor's report. The findings of research conducted in the early 1970s, which were used to develop more detailed audit reporting guidance (i.e., when qualified, disclaimer and adverse reports are to be issued), also are included.

Interspersed throughout the monograph are discussions of the profound impact of practitioner/academician collaborative research on auditing education. Auditing research opportunities attracted the attention of numerous talented scholars, resulting in, among other things, an explosion in the quantity of auditing textbooks and innovative pedagogical tools (such as cases and computer simulations). Such collaboration has also contributed to the dramatic change in the nature and focus of auditing courses from a procedural to a conceptual, analytical/risk orientation. In turn, this educational shift is anticipated to have a pervasive near- and long-term effect on practice, in terms of both the portfolio of skills and the focus of those entering the profession.

This brief description of some of the practice, research, and education outcomes of practitioner/academician collaborations is intended to provide a sense of the richness of the collaborations and the significant contributions they have made. It is important to note that the outcomes identified reflect future as well as past and current contributions to the field of auditing, since some of the developments are germane to long-term issues that have yet to be resolved. For example, recent research continues to elucidate challenging practice problems that will take some time to address. Such problem definition, in itself, is an important contribution toward meeting future challenges.

OBSTACLES TO EFFECTIVE COLLABORATION

Despite the many collaborative contributions we have identified, interactions between auditing practitioners and academics could be more productive. Obstacles to effective collaboration, summarized in Table 1, are now discussed from the perspective of practice and academe. While the ensuing discussion is based, in part, on prior commentaries on this issue, the goal is to add to the dialogue

TABLE 1 Obstacles to Effective Collaboration

<i>Practice</i>
<ol style="list-style-type: none">1. Lack of awareness of research and the collaborative process2. Focus on immediate practice problems and solutions3. Significant time pressures4. Client confidentiality
<i>Academia</i>
<ol style="list-style-type: none">1. Use of technical jargon and focus on statistical analyses2. Tenure criteria: focus on theoretical, controlled research3. Little replication and implementation research4. Lag in academic recognition of current business problems5. Limited interactions with practitioners and inadequate or untimely feedback6. Insufficient coordination of research efforts to deal with large-scale issues
<i>Education</i>
<ol style="list-style-type: none">1. Limited course coverage of the collaborative process2. Little discussion of the research process and research issues/findings

commenced in publications like Abdel-khalik (1983); AAA (1980); Bricker and Previts (1990); Dopuch (1978); Flint (1988); and Lee (1989).

Practice Obstacles

A significant obstacle to collaboration is a limited awareness in practice of the nature and extent of potential benefits of interactions with academicians. The roots of such limited awareness likely lie in limited knowledge of audit research and its contributions. As noted by Sullivan (1993): "... (M)any practitioners probably would answer that audit research has had little or no impact on how they conduct audits. ... (P)ractitioners are not aware of most of the audit research findings." This lack of awareness likely will constrain the frequency with which practitioners become involved in, support, or use research and research findings. In turn, a collaboration opportunity cost is borne.

A second (perhaps related) obstacle stems from the natural focus and needs of practitioners to solve immediate, client-specific problems,

while research is best suited for dealing with longer-range, broad issues (Abdel-khalik, 1983). This time-frame and specificity incongruence may lead practitioners to conclude, falsely, that research cannot solve “real-world” problems, which, in turn, can further limit interactions between academics and practitioners. Additional obstacles are the significant time pressures faced by practitioners and the requirement that practitioners protect client confidentiality. In concert, the result is limited ability of practitioners to provide to researchers access to data, participants, and counsel. In the current competitive environment of public accountancy, practitioners face unprecedented time pressures. These pressures inevitably limit the availability of practitioners to interact with and counsel academic researchers. Further, these same time pressures, coupled with the aforementioned limited awareness of the potential importance of research and the difficulties of reading research papers (academic communication obstacles are discussed below), have resulted in very little direct exposure of practitioners to research output.

Client confidentiality concerns make the provision of data to researchers at least appear problematic, since an important objective of research is the broad dissemination of knowledge through publication. Whatever the causes, the resulting lack of accessibility is a serious impediment to the conduct of research and/or its effectiveness. For example, limited counsel from practitioners in the design of a study may mean that the research fails to address a relevant issue or omits important practice considerations. The end result is that a researcher may examine a trivial topic, focus on an artificial, simplistic context, unrepresentative of practice, or develop and test overly simplified theories of auditor behavior. In turn, practitioners’ perceptions that investments in research are not prudent may be reinforced.

One of the major goals of this monograph is to overcome these obstacles. It has been our intent, for example, to show that it is in the best interest of the profession as a whole if practitioners and members of the academic community work together to conduct quality research on important short- and long-term problems related to auditing. We have tried to reach this goal primarily by documenting the successes of prior, less-harried times when collaborative efforts produced significant insights and often solutions to challenging auditing problems. We also observe that some of the obstacles may be more form than substance. For example, there is no reason that client confidentiality must be compromised when access to client-specific data is provided to academicians. Academicians rarely will focus their analysis and report at the level of individual firms and it almost never is necessary to identify specific companies. Rather, researchers typically are interested

in data from large numbers of entities that are analyzed and reported in the aggregate.

Academic Obstacles

A number of broad obstacles to effective collaboration in academia are identified in Table 1. First, members of the academic community often employ technical jargon and relatively esoteric statistical analyses in reporting their research. While such reporting is effective in communicating with other members of the academic community, it can be tedious and difficult for practitioners to read such reports. Again, the result is that practitioners may fail to recognize the value of research and future collaborative efforts are stymied. Inevitably, the diffusion of research innovations to practice will be delayed.

Second, tenure criteria at universities focus on publication in research-oriented, academic journals, which often require tightly controlled, rigorous studies written in technical language. Such rigor, however, can predispose a researcher to focus on highly simplified settings that can limit what can be learned about practice. Third, there is little replication or implementation research currently being done in auditing. Consequently, there often is a single study or, at best, only a few studies on a particular topic. The resulting limited evidence on the strength of results under different conditions provides a natural (and appropriate) reluctance to use such results in practice. The lack of replication studies appears to be caused, at least in part, by limited prospects for publishing such research in leading academic journals.

Further, while academic research often has identified significant issues and innovations for practice, there has been very little involvement of academics in the implementation of research results. This lack of involvement also may be attributed to the academic incentive system. That is, while there are tenure, salary, and promotion incentives to focus on the development of theory, culminating in published articles in recognized journals, there are few incentives to assist with implementation.

Additional matters presenting significant obstacles in academia to effective collaboration are limited researcher awareness of current issues facing the profession, limited opportunities for interaction with practitioners, and limited coordination of efforts. Further, academic researchers largely work independently, either individually or in small groups, making coordination of effort very difficult on large-scale issues. As a result of limited communication between members of the practitioner and academic communities, there often is a lag in the time

between when practitioners and academic researchers become aware of problems. Research efforts, therefore, may fail to address important issues in a timely manner. Despite teaching and administrative demands placed on their time, members of the academic community have a responsibility to communicate with practitioners or otherwise ensure that their research is of a timely nature. Further, once communication has commenced, researchers should provide timely feedback to practitioners on the results of the research and their implications.

Auditing Education Obstacles

Two obstacles to collaboration in auditing education are noted in Table 1. Currently there is little course coverage in auditing classes of the collaborative process and its benefits (Wright, 1993). Further, auditing courses typically contain little, if any, discussion of the nature of the research process (e.g., its comparative advantage in examining intermediate and long-range issues, the nature and role of theory) and research findings. Insufficient coverage of these matters is problematic, since those entering the profession are unaware of the nature and breadth of the collaborative practice/research process nor are they aware of the auditing practice, theory, and educational contributions that have resulted.

FUTURE DIRECTIONS

Table 2 provides avenues that promise to reduce obstacles to effective and efficient collaboration. Some of these measures may be implemented by practitioners while some are to be implemented by academicians. Many (perhaps most) of the suggested measures already have been implemented by some firms or universities; it would be beneficial if they were more widespread. Monograph scope limitations, however, do not permit commentary on how these measures should be implemented (which is likely to vary by setting) nor is there discussion of cost-benefit trade-offs, though these are significant and complex issues. Nonetheless, the hope is that discussion here of potential future directions will begin an important dialogue on these issues.

Practice Innovations

An increase in the number of research symposia is likely to be a very valuable means of facilitating greater exchange of ideas, to communicate research advances, and to promote the relevance and timeliness of

TABLE 2 Future Directions

<i>Practice</i>
<ol style="list-style-type: none">1. More research symposia2. Greater firm communication of collaborative process to staff3. Increased joint research4. Enhanced communication of significant practice issues to members of the academic community5. Academic research fellows
<i>Academia</i>
<ol style="list-style-type: none">1. Improved communication of research results2. Greater course coverage of the collaborative process and research issues3. Increased acceptance of applied, replication, and implementation research for tenure and promotion4. Improved project planning and screening5. Practitioners in residence

research. Such symposia seem to have been very cost-effective means of accomplishing these goals (and others) in the past. Firms also may enhance recognition of the collaborative process by disseminating the results of such interactions in their communications to staff and in continuing education programs. Such dissemination would build “grass roots” awareness of the value of partnering with members of the academic community. We also might expect the quality of research presented to be enhanced while concurrently increasing access to practitioner-subjects and data.

Greater communication by practitioners of pressing practice issues that might become the focus of research also would be very beneficial. The *Research Opportunities in Auditing* monograph prepared by KPMG Peat Marwick is a noteworthy example of this type of communication and the monograph *Research Opportunities in Auditing: The Second Decade* provides a collaboratively produced similar example.

A final recommendation is the appointment of academic research fellows who would reside for a specified time period at the firm’s locale for the purpose of conducting research jointly with practitioners. Such arrangements can greatly leverage the skills of members of the academic community, facilitate the exchange of ideas, and enhance the value of research to the firm.

Academic Innovations

Significant efforts are needed to improve the communication of research results to those in practice. One potential vehicle is to include in each research report an executive summary clearly describing the issues addressed and the principal findings. Alternatively, organizations such as the Auditing Section of the American Accounting Association could periodically review the literature for those in practice.

Greater auditing course coverage of the collaborative process and current research endeavors would instill an appreciation by those entering the profession for such collaboration and the value of research. Dividends are likely to be paid in the increased value attributed to research by future practitioners and the concomitant greater interest in jointly pursuing research solutions to vexing practice issues.

Broader definitions as to what constitutes “research” meeting tenure and promotion expectations also would enhance prospects for future collaboration between members of the academic and practice communities. While this is a very large issue and without denigrating in any way “discovery” research, applied research and papers in which existing knowledge is communicated to other audiences are of value and there are signs that such scholarship will be given greater weight in future tenure and promotion decisions. Finally, very little research has been done with respect to implementation (e.g., applying and evaluating decision tools placed in the field), despite the fact that implementation is clearly a significant issue in practice. Corroborative implementation research is especially likely to produce significant returns.

Two final measures are improved project planning/screening and practitioners in residence. Given the competitive environment in public accountancy, members of the academic community should ensure that requests for support (data, participants, testing, funding) relate to meaningful, well-planned studies. Research “best practices” would include, at a minimum, discussion of project proposals in university workshops and “informal” discussions with members of the practicing community.

Last, greater opportunities for practitioners in residence would be beneficial in helping to ensure the greater relevance of research, to promote a higher level of collaboration, and to increase recognition of research by fellow practitioners.

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