

# THREE (AND A HALF) ENVIRONMENTAL FACTORS IN THE DEVELOPMENT OF STATISTICAL SAMPLING IN AUDITING

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The theory of probability, as well as some procedures that are certainly the antecedents of modern sampling methods, dates back to at least the eighteenth century.<sup>1</sup> However, according to one observer, “[the theory’s] applications to the practical drawing of samples was delayed until the twentieth.” (Stephen 1948, 21) Those applications occurred in fits and starts and were found in a variety of experimental settings – e.g., agriculture, economics, public opinion research, etc. - with most of the major early development completed by the mid-1920’s.<sup>2</sup> However, it would seem that auditing was absent from the laboratory; and even for some time after that.

Cranstoun (1948), Neter (1949) and Kinney (1986) all trace the first application of statistical concepts to auditing to the same article (Carman 1933). Vance (1960) pushed the date back even later, to the post-war ‘40’s. This paper will contend, however, that appearances may have been deceiving; that in fact, there is evidence of some more or less systematic sampling in practice prior to 1933, some of it virtually rising to the standards of statistical sampling.<sup>3</sup>

But more than “when” is the larger question of “why”? What prompted auditors to use of the tool, regardless of when they started?

It is the thesis of this paper that the profession needed at least three different “nudges” to incorporate the procedures into standard practice. The three factors are (1) professional credibility, (2) legal exposure, and (3) governmental regulation, in this case the SEC. A fourth influence - war emergency proscriptions against production interruptions in key materials industries during World War II – doesn’t quite reach the level of the other three and could be considered a subset of the regulatory factor. It’s documentation is also considerably more circumspect. So, for this paper, its role is diminished by one-half. By the 1950’s, all of these forces were in place and sampling’s legitimacy appears to have been recognized among auditors and was on course toward becoming “generally accepted.”<sup>4</sup>

## CAVEAT

The risks of historical research are obvious but a specific hazard of this particular inquiry must be acknowledged in advance. In a market economy, specialized knowledge can bring economic advantage – e.g., some of the more accomplished practitioners might not have chosen to share information on their new skills with others, at least until those skills became common knowledge from other sources. This has the potential to compromise research that is time-line sensitive. And of course there is always the risk that one may see what is not there, or not see nearly enough - i.e., the author’s

taxonomy may not, in fact, capture all of the forces which pushed the profession to examine and then adopt the techniques of an emerging field. However, the first risk is mitigated somewhat by the parallel growth of professionalism in accountancy, with its attendant notions of fraternal responsibility to the commonweal. The author leaves it to the reader to judge if the three (and a half)-factor thesis overcomes the second risk.

#### AUDITING AND RISK MANAGEMENT

Absent a one hundred percent confirmation procedure, the verification process in auditing ultimately involves two related risks: professional credibility and legal exposure. Thus it is not surprising that responsibility for attesting to specific balance sheet items, or to a client's system of internal control in general, was the subject of considerable debate for many years. For some, the risk appears to have been beyond imagination: ". . . [the complete responsibility for inventories] would involve. . . the ability properly to determine quantities in cases where such determination requires a technical skill beyond mere mathematical requirements." (Couchman 1929, 32) Following that line of thought, apparently some practitioners opted to simply eliminate the risk entirely - and presumably the scope and size of their practice - by insisting on verifying virtually every entry, every summary, every item of inventory (see Moyer 1951). Others, while acknowledging their own limitations, reached for a middle ground of reliance on outside expertise "...the auditor would not be expected to pass on depletion reserves, except to assure himself that the estimate of ore or oil on hand had been furnished by some competent person or source." (Buist 1922, 187). But this was rejected out of hand by those who thought such dependence was professionally irresponsible: "The certificate of a 'responsible official' is only too often accepted for time saved. To an auditor there should be no such person as a 'responsible individual'". (Waller 1935, 334) For those in this camp, the necessary and logical extension of anything less than complete verification was to call for qualifying the certificate (see McNair 1932). Still others invoked the wiggle room of "professional judgement". (See, for example, Wellington 1928, and Douglas 1932.) Institutionally this was the approach preferred by the profession - i.e., the American Institute of Accountants endorsed judgement in its early commentary on the "Verification of Financial Statements" (1929).<sup>5</sup> Statistical sampling, of course, would eventually become an important adjunct in the exercise of that judgement.

#### STATISTICAL SAMPLING - A BRIEF HISTORY<sup>6</sup>

As was noted above, the purposive collection of data existed from the onset of recorded history. But Stephen argued that there is no evidence of attempts at any *systematic* collection which would satisfy the norm of *reliability* - i.e., accuracy, "representativeness", and probability - before this century. However, from that point on, the development of systematic, reliable methods of sampling progressed steadily. For example, Stephen found the first evidence of random sampling as we would recognize it today in a sampling of a list of bonds and their interest rates in 1906, where the final digits in a table in the NAUTICAL ALMANAC were used to make the random selection. The first appearance of sampling in textbooks was a brief chapter in Bowley's ELEMENTARY MANUAL OF STATISTICS, published in 1909. The first random number table appeared in

1927. Sampling error was factored in to survey projects at the Federal Emergency Relief Administration and Works Projects Administration in the 1930's. The manpower shortages of the war year's in the 1940's conflicted with increased data needs and limited theoretical advancement but necessitated further refinements – e.g., in stratified sampling - and extended applications to new populations. See, for example, King and Jessen (1945) or Webb, et. al. (1943).<sup>7</sup> Note: Although incidental to his own subject matter, Stephen also found external events important to the acceptance of sampling in practice – the theme of this paper – as the articles cited from the Great Depression and World War II illustrate.

While other examples could be listed, it is clear from the above precis that sampling as a sub-discipline of statistics was in broad use and well established by the close of Stephen's survey in 1948. The questions left for this paper is when sampling was brought into the auditor's inventory and why.

#### STATISTICAL SAMPLING AND AUDITING

As introduced earlier, it is the thesis of this paper that circumstances and events drove the profession to consider sampling, and that it began earlier than previously thought. Each of these factors will be discussed below, in turn. However, a word of caution in advance. At various points in time, in various degrees, any one factor may not have been wholly independent of another (or others) and perhaps in ways that are not evident from a review of the literature. For example, while the first evidence of sampling in auditing predates any known court cases in this country, auditors in the U.S. could well have been aware of earlier litigation in the U.K. and the likelihood of some migration "across the pond." Similarly, regulatory agencies such as the S.E.C. have always been influenced by case law. Then there is the very nature of the practice of auditing where "generally accepted" standards percolate up from individual practitioners, each working under their own perceived influences and pressures which may or may not impact all at the same time nor in the same way. Still, the separation of factors is a useful artifice to examine and isolate each factor's differential contribution to the development of sampling in auditing.

#### PROFESSIONAL CREDIBILITY

Here at the close of the 20th century, in the U.S. at least, the professional credibility and legal exposure factors are probably inseparable, the first feeding off the second. However, the correlation does not appear to have been all that strong initially. As will be discussed below, the first significant court case does not appear until 1931. Yet there are numerous examples of the emergence of sampling prior to that, some even meeting the criteria of statistical sampling.

*Non-statistical measures*— i.e., subjective and judgmental, with little or no evidence of applying probability theory – can be found quite early on. For example, a Richard Witty, writing in the December, 1905 issue of the INCORPORATED ACCOUNTANTS JOURNAL "advocated the selection *in a haphazard manner* of items to be subjected to a thorough check." (Smith 1957, 452 *Emphasis added.*) Later on, one F. Thulin indirectly referenced something akin to sampling, in THE JOURNAL OF ACCOUNTANCY in 1918, with

the statement: “The auditor does not, as has been previously noted, send out *statements except here and there*, to the depositors listed in the individual deposits.” (Thulin 1918, 201 *Emphasis added*)

Yet in that same issue as the article by Witty (1905), we find evidence of primitive versions of both simple random and cluster sampling; a W. Strachan expressed “a preference for an extensive test of one month’s transactions as opposed to a less thorough perusal of all transactions recorded during the period.” (1905, 452) By 1925, a Felix Hebert combined the two into a multi-level procedure: “I have found that a very good method is to take some of the larger [insurance] agencies and to check thoroughly all of their writings for some given month, but taking the reports of each agency for a different month, endeavoring as far as possible to have a check of some one agency for each month of the period covered by the audit.” (Hebert 1925, 84) This became a process known as *test-checking*, a bridge between non-statistical sampling methods and statistical sampling – i.e, the technique assumed some unspecified level of “proportionality” between errors found in samples and what could therefore be inferred for the population as a whole.<sup>8</sup> It remained for Carman, cited earlier by Kinney and others as the first to relate statistical concepts to auditing, to introduce notions of non-normal distributions, a particular concern in fraud discovery: “If the distribution were not uniform – as is likely to be the case in practice – the probability of finding one or more false items in the [sample] is practically the same regardless of the number of valid items in each of the individual parcels.” (Carman 1933, 363)<sup>9</sup>

Sampling, then – primarily as test-checking – was clearly in use prior to liability considerations, before the establishment of regulatory or other administrative agencies, and certainly before World War II. Why? Evidently, the increasing size and scope of businesses meant that auditors either had to leave work (and fees) on the table or find ways to manage the increased risk accruing to the larger and more complex engagements, while continuing to address the expectations of the market as to the reliability of their attestations – in other words, their professional credibility.

## LEGAL EXPOSURE

Courts in the U.K. appear to have taken up the issue of sampling both earlier and more directly than their American counterparts. In a decision in 1895, a British court allowed less than a one hundred percent examination of accounts when it ruled that an auditor could: “...select a few cases at *haphazard*, see that they are right and *assume* the others like them are correct also. (Robel 1944, 45, *Emphasis added*.)

Case law in the U.S. followed a more circuitous route, emerging out of litigation involving an auditor’s responsibility to third parties. In these cases, auditors were sued by third parties claiming losses suffered due to relying on audited financial statements. The plaintiffs charged negligence, specifically the auditors’ failure to sufficiently verify assets, etc. as represented on the financial statements. Since the early lawsuits were brought by creditors and other external to the client firm itself, auditors initially found safe harbor on grounds that there was no contractual relationship between the plaintiffs and defendants and thus no duty owed to them (known as the *privity* rule in contract law).<sup>10</sup> With that argument controlling, the courts could ignore addressing the quality of

the evidence which led to the auditor's opinion, an avenue that would have opened the door for discussion of validation tools (such as sampling.)

That all changed with the case of *Ultramares Corporation v. Touche et. al.* in 1931. In this case, the lower court once again followed precedent in absolving the auditors of liability under the doctrine of *privity*. However, the appeals court, while sustaining the original decision, then provided an opportunity for relief under another venue – gross negligence constituting “constructive” fraud, defined in this case as: “[T]he pretense of knowledge when knowledge there is none.” (Ultramares, 441) That lack of knowledge rose to the level of gross negligence when: “[A]n opinion, especially an opinion by an expert, may be found to be fraudulent if the grounds supporting it are so flimsy as to lead to the conclusion that there was no genuine belief back of it.” (Ultramares, 447) To this day, Ultramares is cited in the apprenticeship literature in re the legal responsibility of auditors.<sup>11</sup>

However, pertinent to this thesis, the court in Ultramares also provided the means for auditors to establish support for their “belief” via sampling: “Verification by *test* and *sample* was very likely a sufficient audit as to accounts regularly entered upon the books in the usual course of business.” (Ultramares, 449) While the case was ultimately settled out of court, the rulings in the case did set precedent.<sup>12</sup> It seems unlikely then, indeed implausible, that the dictum of the court endorsing sampling would have been ignored by the auditing profession.<sup>13</sup>

#### GOVERNMENTAL REGULATION – THE SECURITIES AND EXCHANGE COMMISSION (SEC)

Created by the Securities Acts of 1933 and 1934, the Commission was barely up and running before circumstances allowed it to weigh in on the issue of sampling in the audit process. The specific event was the McKesson Robbins fraud that occurred in the mid-1930's but only fully came to light in 1938.

In this well-known case, management created a fictitious subsidiary with equally phony receivables and inventories. The result was to overstate the firm's total assets by almost one-fourth, some \$19 million. The outside auditors did not physically confirm the assets and issued clean opinions. (While this oversight may seem odd, given that the Ultramares case should have fresh in their minds, there were still no official auditing standards requiring confirmation of assets.)

When the fraud was discovered the news stunned regulators (and investors.) The SEC investigated and found the firm lacking in the requisite “vigilance, inquisitiveness, and analysis of the evidence available” to give an informed opinion. But again, as with Ultramares, the Commission specifically accepted sampling when it cited the McKesson-Robbins case in Accounting Series Release 19, although in a somewhat backhanded manner: “[These conclusions] should not lead to a general condemnation of recognized procedures for examination of financial statements by means of *tests and samples*.” (1940, 13, *Emphasis added*.)<sup>14</sup>

#### WAR EMERGENCY FACTOR

A special instance of the regulatory factor, this is last of the four chronologically and, admittedly, largely void of direct evidence. But the circumstances surrounding the

conduct of the war were compelling for continued expansion and development of the use of statistical sampling in auditing.

World War II presented auditors with a special problem. The *Ultramares v. Touche and McKesson-Robbins* cases were less than a decade old; both clients and audit firms themselves were understaffed (young men were away at the war and the profession had not yet welcomed women into its ranks to any significant degree); and any interruption of production in most industries, especially in the war materials sector, was proscribed by law – e.g., no strikes by organized labor. Yet audits were still required. And just how were auditors to satisfy their own (let alone investor's, creditor's and the court's!) standards of verification? Evidence is sketchy at best but there is a hint in what amounted to open letter to the profession from the SEC, in which the Commission acknowledges the dilemma:

Under the present circumstances, however, it may in particular cases be impossible to take a satisfactory physical inventory without interruption of the production and delivery of war materials.....However, it is clearly in the public interest that a positive and effective substantiation of the inventory amounts be made as circumstances permit. The auditor by devising supplemental procedures based on the circumstances of the particular case and by extending the scope of normal procedures which do not require cessation of production should endeavor wherever possible so to satisfy himself as to the substantial fairness of the inventory amounts, while indicating the omission of the normal procedure of observation or test checking, need not contain an exception to the substantial fairness of the presentation of inventories.<sup>15</sup>

It is not evident from this message just what level or degree of comfort or relief the SEC intended. Read one way, the Commission is clearly expressing sympathy for the restrictions auditor's faced; but a second read might be that the Commission is reminding the profession to continue to meet its responsibilities nonetheless. And auditors were encouraged to be creative in fulfilling those responsibilities – e.g., “supplemental procedures”, such as, perhaps, sampling? (There is no evidence that the profession's legal exposure was suspended during the war, which in itself would have pushed auditors to substantiate, in this case, inventories with whatever means were at their disposal.) Moreover, there was the continued recognition of sampling in the profession's literature, which could only have added to its appeal under the conditions.<sup>16</sup>

## CONCLUSION

This paper has attempted to identify several factors influencing the incorporation of statistical sampling into the audit process. Obviously, only an historical fact itself is uncontestable. Interpretation of a fact, an event, is subject to debate. (Sometimes even the choice of words used to describe the “fact” has led to lively debates among scholars.) What has been described here is the author's interpretation of a chronological record of literature, including judicial decisions, directly or indirectly touching on the intersection of statistical sampling and auditing. Sometimes the evidence was fairly straight forward; other times it was indirect, even circumstantial. Still, collectively, in the

aggregate, it was felt to be persuasive.

But can anything else be taken from this piece? Other than to document a particular phase in the professional development of auditing, which may be enough in itself, does this piece have any additional value?

Historical research should either provide new insights to the past, provide new or additional (or contravening) perspective on the present or future by drawing on that past, or at least reinforce some aspect of that present or future. This modest effort would seem to fit into the last set. What has been shown here is one more example of the conflicting tensions evident in the practice of auditing. Clearly auditing was late in bringing the power of statistical sampling to bear in meeting its responsibilities to the commonweal, a commonweal which, through licensure, grants the profession some relief from unfettered market competition. Without that protection, the market would decide whether that delay was acceptable; but with it, the profession had (has?) some incentive to move with more than the usual caution in the face of change, even if there is damage to the public good. And while this was by no means the sole contributing cause, indeed not even the principal factor, the public good did suffer as a result of this “prudence”, as evidenced by McKesson-Robbins, etc. Of course some would argue that the profession should always move with “all deliberate speed” in matters such as this. But critics would contend that that course is somewhat self-serving – i.e., auditors, rather than their clients or the public as a whole, would then determine what they do to justify the privileges granted by the community instead of the community making that judgement. This then plays into the debate of how much oversight should be placed on the profession, a debate that has been recently fueled by concerns on “earnings management” expressed by the Securities and Exchange Commission and others. If the thesis of this paper is accepted, it would be yet one more reason for continued diligent oversight to insure that the public interest is protected, that the profession is held to the highest standards of competence in the conduct of its activities.

## Notes

<sup>1</sup>Strictly speaking, the chronology, as reported by Stephan, actually can be seen as starting with the first cognitive moment in human history: “All empirical knowledge is, in a fundamental sense, derived from incomplete or imperfect observation and is, therefore, a sampling of experience.” (1948, 13)

<sup>2</sup>Again Stephen is the source for this conclusion, citing the endorsement of sampling by the International Statistical Institute in 1925. Even then, the ISI took a fairly tepid approach, conditioning its approval of any application meeting the standards of “....representativeness, mathematical statement of precision, and [a] full description of the methods employed.” (1948, 23)

<sup>3</sup>Carman’s article was apparently selected as the first evidence of the use of statistical concepts in auditing because of his discussion of probabilities and for alluding “to the distinction between sampling risk and nonsampling risk.” (Kinney 1986, i). Yet, by definition, any sampling involves notions of statistical inference and with it some intuitive understanding of probability theory, however rudimentary. Perhaps Kinney and the

other commentators simply applied a higher standard of rigor to what can be called statistical sampling than that of the author in nominating a start date.

<sup>4</sup>Support for this can be found in the publication of Vance and Neter's textbook on the subject: Vance, L. and J. Neter, 1956. (Commercial publishers do not invest in products without a viable market.) Moreover, a survey of articles in practitioner journals at the time also suggests widening use of the technique – e.g., Adams (1947), Berylson (1947), Cranstoun (1948), Mautz (1945), Neter (1949), and Vance (1949). Kinney (1986) extended the developmental period to the publication of SAS No. 47 in December 1983, although his collection of articles stops in 1975. Further, he characterized SAP No. 54 (1972) as the “seminal” work and the pronouncements that followed “refinements.”

<sup>5</sup>Even Couchman, cited earlier as having reservations, left auditors some squirming room, although his characterization of professional judgement bordered on the occult: “The auditor must satisfy *himself by such methods as form a part of his skilled procedure* that the accounts so shown on the records. . . .” (1929, 27 *Emphasis added.*)

<sup>6</sup>This section also draws extensively on the work of Stephen (1948). It should be noted that Stephens was careful not to characterize his study as a “comprehensive picture,” pointing to the “[d]ifficulties [which] beset anyone who attempts to trace the developing uses of sampling because they are scattered throughout many branches of science and technology and are described, if at all, in subordinate portions of reports and articles whose titles provide no hint of what they may contain on the subject of sampling.” (1948, 12). Even so limited, however, it more than adequately serves the necessary background for this paper.

<sup>7</sup>It appears that most of the early sampling was survey research, most of that conducted by mail. Stephan found examples in collecting data for agricultural forecasting, dating back to the middle 1800's. However, reliability was almost totally absent: “..many of the reports were simply based on the respondent's judgement about the conditions in his locality and the list of respondents was built up by farmers, agricultural agents, members of the staff of agricultural colleges, etc. who were willing to serve without pay.....” (1948, 16) Field investigators in the federal government's Labor Bureau, which was established in 1884, were equally casual: [collecting data] “.....‘in *representative markets*’ [by] sending agents into *various* districts with a list of employers *from which they could choose* what they *believed* to be a *representative group*.....” (1948, 17 *Emphasis added.*)

<sup>8</sup>The failure to explicitly include the calculus of probability in test-checking led to considerable variation in the selection of sample size. Indeed, the criteria for selection seems to have been left to some combination of intuition and experience ranging from “....not less than 10 percent and perhaps as much as 20 percent of the loan accounts should be covered in the....confirmation procedure” (Verification of Notes Receivable in a Small-Loan Business 1940, 73-4) to “...anywhere from fifteen to fifty percent” (Testimony of Expert Witnesses at S.E.C. Hearings 1939, 215) or somewhere in between “....20% to 33-1/3% of the items....” (Wellington 1939, 83).

<sup>9</sup>While raising the level of rigor in audit sampling, Carmen could only return to profes-

sional judgement when facing the possibility of Alpha (Type I) and Beta (Type II) errors under normal conditions: “There remains one interesting question. An auditor might well ask, ‘having made a 30% test with negative results, what is the probability that the untested items are likewise all legitimate?’ The questions can be answered only where there is general probability based on experience.” (1933, 366) If the object were fraud discovery, he found no remedy whatsoever: “There is, however, no..... experience figure for defalcations – they depend too much on special conditions and individuals.” (Ibid)

<sup>10</sup>Landell v. Lybrand, 1919.

<sup>11</sup>See, for example, Robertson, J. and T. Louwers 1999, 757.

<sup>12</sup>See, for example, Rush Factors, Inc. v. Levin, 1968.

<sup>13</sup>Note that this judgement was rendered in 1931, two years *before* the publication of the article by Carman. It is not clear (a) whether the judge is alerting auditors to one way of satisfying his new demands or merely sanctioning an already existent practice and, (b) whether or not Carman’s article is in response to the Ultrameres decision. (The latter seems unlikely since Carman makes no reference to the case in his article plus, even though the review process was mercifully shorter seventy years ago – especially editorial review – the manuscript was probably under development prior to 1933, if not 1932.)

<sup>14</sup>Securities and Exchange Commission, 1942, 190-1.

<sup>15</sup>Not only had Carman’s article been one of the profession’s journal by then, but others were adding their thoughts even as the war went on. See, for example, Prytherch (1942), Miller (1942), and Hebert (1946). Note: The AIA actually beat the SEC to the punch by a few months by issuing SAP1 in 1939 (Special Committee on Auditing Procedure, 1939). This statement required the confirmation of inventories and receivables. Was this a “professional credibility” issue, in response to the reaction of the investment community, or in anticipation of the SEC’s ASR? There was probably a little of both influences, but which predominated, if either, is irrelevant to this paper since the AIA statement makes no reference as to *how* to conduct the confirmation. In fact, the AIA was still a long way from 1975, which Kinney correctly identifies as the first official sanction of statistical sampling by the AICPA.

## References

- Adams, J. 1947. Sampling theory applied to the test audit. *The New York Certified Public Accountant*. (October): 645-52.
- American Institute of Accountants. 1929. Verification of financial statements. *The Journal of Accountancy* (May):321-54.
- Berylson, K. 1947. Sampling and internal control on non-detailed monthly audits. *The New York Certified Public Accountant* (October): 660-63.
- Buist, G. 1922. Purposes and limitations of a balance sheet audit. *The Journal of Accountancy* (September): 182-89.
- Carman, L. 1933. The efficacy of tests: test-checking subjected to mathematical analysis. *The American Accountant* (December): 360-66.

- Couchman, C. 1929. Requirements of a balance sheet audit. *The Journal of Accountancy* (January): 20-36.
- Cranstoun, E. 1948. A new look at basic auditing techniques. *The Journal of Accountancy* (October): 274-83
- Douglas, T. 1932. Auditor's responsibility for inventories. *The Journal of Accountancy* (May): 354-62.
- Hebert, F. 1925. Audits of accounts of fire insurance companies. *The Journal of Accountancy* (August): 81-99.
- Herbert, L. 1946. Practical sampling for auditors. *The Accounting Review* (October): 386-90.
- Kenney, W. (Ed.) 1986. Fifty years of statistical auditing. NY: Garland Publishing, Inc.
- King, A. and R. Jessen. 1945. The master sample of agriculture. *Journal of the American Statistical Association* (40): 38-57.
- Landell v. Lybrand* 264 Pa 408, 107 Alt 783 (1919)
- McNair, R. 1932. Audit procedure for the present-day building-and-loan association. *The Journal of Accountancy* (May): 332-45.
- Mautz, R. 1945. Accounting and statistics. *The Accounting Review* (October): 399-410
- Miller, K. 1942. Mathematical techniques. *The Journal of Accountancy* (August): 170.
- Moyer, C. 1951. Early developments in american auditing. *The Accounting Review* (January): 3-8.
- Neter, J. 1949. An investigation of the usefulness of statistical sampling methods in auditing. *The Journal of Accountancy* (May): 390-98.
- Prytherch, R. 1942. How much test checking is enough? *The Journal of Accountancy* (December): 525-30.
- Robel, F. 1944. Auditing standards and procedures in the light of court decisions. *The Journal of Accountancy* (July): 42-58.
- Robertson, J. and T. Louwers. 1999. *Auditing* (9<sup>th</sup> ed.) Irwin/McGraw-Hill: Boston.
- Rush Factors, Inc. v. Levin*, 248 F. Supp. 85 (D.R.H. 1968).
- U.S. Securities and Exchange Commission. 1942. Omission of inventory taking in defense industries. *The Journal of Accountancy* (February): 190-1.
- U. S. Securities and Exchange Commission. 1940. *Accounting Series Release No. 19*.
- Smith, A. 1957. The accounting profession's growing interest in statistical sampling. *The New York Certified Public Accountant* (July): 451-3.
- Special Committee on Auditing Procedure, American Institute of Accountants. 1939. Extensions of auditing procedure. *The Journal of Accountancy* (June): 342-49.
- Stephen, R. 1948. History of the uses of modern sampling techniques. *Journal of the American Statistical Association* (43): 12-30.
- Strachan, W. 1905. Detail checking. *Incorporated Accountant's Journal* (December): 452-4.
- Thulin, F. 1918. Procedure in a bank audit. *The Journal of Accountancy* (September): 191-211.
- Ultramares v. Touche*, 255 N.Y. 170, 174 N.E. 441 (N.Y.Ct. App. 1931)
- Vance, L. 1949. Auditing uses of probabilities in selecting and interpreting test checks. *The Journal of Accountancy* (September): 214-17
- and J. Neter. 1956. *Statistical Sampling for Auditors and Accountants*. New York: John Wiley & Sons, Inc..
- Waller, C. 1935. Test methods in auditing. *The Incorporated Accountant's Journal* (June): 333-36.
- Webb, J., M. S. Northrup and S. Payne. 1943. Practical applications of theoretical sampling methods. *Journal of the American Statistical Association* (38): 69-77.
- Wellington, C. 1928. Accountants' responsibility for inventory verification. *The Journal of Accountancy* (September): 179-93.
- . 1939. "Mechanics" of confirmation of inventories. *The New York Certified Public Accountant* (November): 81-89.

