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# 3

## On the Economics of Product Differentiation in Auditing\*

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### I. Introduction

Corporate financial statement audits have traditionally been viewed as homogeneous across auditors. For example, the Commission on Auditors' Responsibilities ("Cohen Commission") in its Report [1978, p. 111] stated that:

When a product or service offered by different suppliers differs significantly to the user, or *appears* to differ significantly, it is easier for one of its producers to maintain a higher, noncompetitive price. Public accounting firms go to considerable length to develop superior services for their clients, *but there is little effective product differentiation from the viewpoint of the present buyer of the service* (emphasis added), that is, management of the corporation.

In support of this view, it is usual to assert that the identity of the firm which performs an audit is irrelevant since every examination must conform to generally accepted auditing standards (GAAS) and all firm partners must be fully professionally qualified. Thus users of financial statements have no reason (nor basis) to distinguish among auditing firms.

At the same time, however, it has also been recognized that a company which may have a perfectly satisfactory relationship with a local accounting firm will often change auditors to a well-known national firm when that company first sells securities to the public. It is usually alleged that such "displacement" occurs as a result of pressure from underwriters (see, for example, *Wall Street Journal*, July 18, 1983, "Small CPA Concern Sues an Underwriter Over Loss of Client") or because of other unwarranted "biases." For example, Arnett and Danos [1979] use the term "perceptual barriers to viability" to describe these "biases." Under the assumption that the services of auditing firms are homogeneous, it follows that professional accounting

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bodies, such as the AICPA or CICA, should strive to eliminate “biases,” perhaps by “educating” managers, underwriters, and other financial statement users. However, if we drop the homogeneity assumption, then auditor displacement at the time of an initial public offering of securities (to the extent such displacement actually occurs) may simply be evidence of rational economic behavior.

### ***1.1 The Product Differentiation Hypothesis***

Recently, several researchers [Simunic, 1980; De Angelo, 1981(a) and 1981(b); Dopuch and Simunic, 1980 and 1982] have suggested that audit services, like most products, are likely to be differentiated.

De Angelo [1981(a)] argues for the existence of audit quality differentiation, in the sense of systematic differences in auditor independence, essentially as follows. First, she assumes that the production of audit services for a specific client over time is subject to a learning curve. Given this condition, if, whenever a client changes auditors, there is competitive bidding among potential suppliers, then the first year’s audit fee will be less than the avoidable cost in that year. This is referred to as “low balling.” In other words, the auditor is “forced” (through the competitive bidding process) to invest in the client by passing through into his initial fee bid the discounted future cost savings due to learning. The investment will be recovered (along with at least a normal return) through fees in subsequent years which exceed avoidable costs, and these “excess fees” constitute client-specific quasi-rents.

With respect to auditor independence, the important feature of this argument is that the quasi-rents can be lost (and the auditor earn less than a normal return) should a client *unexpectedly* change auditors. Thus, other things being equal, the existence of client-specific quasi-rents gives a client more bargaining power vis-a-vis the incumbent auditor, potentially impairing that auditor’s independence. However, De Angelo argues, other things are *not* equal in that an incumbent auditor who is tempted to “cheat” in order to please one client must also consider the possible loss of his *other* clients, should his malfeasance subsequently be discovered. Hence a large audit firm with many audits and earning large aggregate client-specific quasi-rents faces a higher potential opportunity loss from “cheating” to retain a client than would a small audit firm with few clients. The aggregate quasi-rents are said to constitute a “collateral bond” against auditor “cheating.” As a result, auditor independence will be positively correlated with audit firm size.

Note that De Angelo’s argument is essentially mechanistic, being driven by an assumed audit learning curve and competition in the bidding process. Many objections can be raised against the reasonableness of this scenario, including the fact that the existence of a significant learning curve in auditing has not been empirically demonstrated.<sup>1</sup> In addition, De Angelo ignores the *demand* for differentiated audit services, except in the narrow sense that a client is not willing to pay the cost of an independent audit to an auditor who, in fact, is not perceived as supplying such audits (i.e., a “cheater”).

In a second paper, De Angelo [1981(b)] broadens her notion of audit quality into “the market assessed joint probability that a given auditor will *both* (a)

discover a breach in the client's accounting system and (b) report the breach'' [p. 186]. Differences in quality supplied are still motivated by differences in auditor collateral bonds; that is, audit quality is correlated with audit firm size. In addition, De Angelo conjectures that the demand for differences in audit quality arises from differences in agency costs across clients. Several of the linkages (particularly the connection between the size of the collateral bond and the probability of *discovering* a breach) in that paper are very vague. However, some of the arguments (discussed later) are consistent with the present work.

At about the same time, Dopuch and Simunic [1980; 1982] proposed a demand based model of product differentiation wherein audit services possessed two characteristics valued by a company's top management: a contribution to organization control and credibility with external financial statement users. They argue that credibility is simply associated with an auditor's reputation or brand name. The demand for credibility is assumed to arise when there is an asymmetry of information between top management and investors about the honesty of top management. In this situation, a costly audit by a credible auditor can either signal management's honesty to investors or reduce agency costs by restricting top management's ability to conceal, through misrepresentation in the financial statements, the consequence of actions taken which were in the best interests of top management ("self-serving behavior") but not shareholders. Dopuch and Simunic argue further that top managements' utility functions and opportunity sets for "self-serving behavior" likely vary across companies. Hence, "the market is not likely to be characterized by a single value of credibility demanded and supplied" [1982, p. 413]. Note that an important element of any market characterized by information asymmetry is the question of observability. Thus, Dopuch and Simunic argue further that auditor credibility must be associated with an observable characteristic, such as the name of the auditor, rather than the undisclosed details of the audit examination.

These arguments are silent as to the specific rank ordering(s) of auditors on a credibility dimension and the theory is sufficiently general to allow different orderings of audit firms in different circumstances. For example, auditors may possess different local, regional, or client industry-specific reputations. However, from the observed dominance of the Big Eight firms in the market for audits of publicly held companies, Dopuch and Simunic *infer* that audits of such companies by Big Eight firms are more credible than audits by smaller firms.

## ***1.2 Previous Tests for Product Differentiation***

Several researchers have attempted to empirically test this "product differentiation hypothesis," generally in the simplified two-class form wherein audits by Big Eight firms are hypothesized to be of higher quality than audits by non-Big Eight firms.

Nichols and Smith [1983] examined the stock market reaction to auditor changes between auditor classes during the years 1973-79 by 51 companies whose common shares were listed on either the New York or American Stock Exchanges. In a series of tests, they found that while abnormal returns were in the directions predicted by the product differentiation hypothesis (i.e., negative residuals were associated with Big Eight to non-Big Eight changes while

positive residuals were associated with non-Big Eight to Big Eight changes), the mean differences were not statistically significant. They concluded that the magnitude of any market revaluation of the firm arising from a change in auditor class may not be detectable using conventional methods, particularly for large, listed companies.

Shockley and Holt [1983] used multidimensional scaling to examine how a sample of bank chief financial officers rated the Big Eight CPA firms. The basic issue tested was whether or not purchasers of audit services could systematically differentiate among the Big Eight firms (i.e., whether there was product differentiation *within* the Big Eight). Shockley and Holt found that bankers tended to differentiate among these audit firms largely on the basis of market shares within the banking industry. They therefore suggested that industry expertise may be a source of audit quality differentiation.

Healy and Lys [1983] used the product differentiation hypothesis to explain the acquisition by Big Eight firms of smaller audit firms. They conjectured that auditor mergers may be the least costly method for the clients of the acquired firm to change the quality of their auditing. However, not all clients of the acquired firm are likely to demand a change in audit quality at the time of the merger. Hence, any systematic differences between those clients which stay with the acquiring Big Eight firm and those which revert to a smaller auditor would represent factors associated with the demand for audit quality. Their test consisted of an examination of switching vs. non-switching clients of J.K. Lasser & Co., following its merger into Touche Ross, and the clients of S.D. Leidesdorf & Co., following that firm's acquisition by Ernst & Whinney. The results were weakly consistent with the product differentiation hypothesis in that switching vs. non-switching clients differed on certain plausible dimensions, including size and leverage. However, other plausible explanatory variables, including changes in client capital structure, were found to be insignificantly different between the two groups.

Palmrose [1984] investigated the association between agency cost variables and the use of different classes of auditors. She hypothesized that the higher the expected level of agency costs arising from a certain ownership-management structure in a company, the higher the level of audit quality which will be demanded. The test consisted of a series of logistic regressions of auditor choice (Big Eight vs. non-Big Eight) on a set of potential explanatory variables which measured expected agency costs (i.e., client size, degree of separation between ownership and management, leverage, and the existence of management compensation plans tied to accounting numbers). The sample consisted of a cross-section of 276 companies classified by industry. The results were inconclusive and somewhat anomalous in that client size was the only consistently significant explanatory variable (i.e., the clients of the Big Eight firms tended to be larger). In addition, leverage was the only other variable which was sometimes significant, but in the wrong direction. That is, the clients of Big Eight firms tended to have lower leverage (lower expected agency costs), which was contrary to the hypothesis.

One direct implication of product differentiation in auditing is that there should be related systematic differences in audit prices. As pointed out by Simunic [1980], the market for audits is a hedonic market wherein differentiated products are not observable directly, but rather are revealed by differ-

ences in prices associated with differences in observed product characteristics. Thus, if Big Eight firms deliver a higher quality of service than non-Big Eight firms then, other things held constant, audit prices should likewise vary between the two groups.

The existing evidence on this point is mixed. Simunic [1980] found that prices charged by the Big Eight firms in the United States were, on average, not significantly different and perhaps somewhat lower than non-Big Eight firm prices, across all sizes of clients. Note that his sample consisted of a cross section of 397 audits of companies ranging in size from \$500,000 in assets (and sales) to about \$10 billion in assets (and sales). Using a pooled cross section of 136 Australian companies, Francis [1984], on the other hand, found that prices charged by Big Eight firms *were* significantly higher than prices charged by non-Big Eight firms. This is consistent with the results reported by Taffler and Ramalinggam [1982] using data from the United Kingdom. However, in addition to the institutional differences between countries, the companies in Francis' sample were significantly smaller (by about a factor of 10) than those in Simunic's U.S. sample. In a subsequent paper, Francis and Stokes [1985] report that the positive difference between Big Eight and non-Big Eight firm prices seems to be largely confined to the very smallest companies in their sample (mean assets of \$1.8 million Australian dollars). This leads the authors to speculate that scale economies to Big Eight firms and consequent lower production costs may "swamp" the price effects of product differentiation, except for audits of very small companies where "scale economies are less likely to exist" [p. 12].

The conflicting nature of this evidence may, at least partially, be due to the difficulties of inferring audit *prices* from audit *fee* data. An audit fee, which alone is directly observable, can be thought of as the product of price times audit quantity purchased by the client company. Hence in a cross section (and time series) of fees, sources of extraneous differences in audit quantities must be carefully controlled before inferences about prices can be made. While there is now considerable evidence about the *major* determinants of audit fees [e.g., Simunic, 1980; Palmrose, 1983; Maher, Broman, Colson and Tiessen, 1985], the specifications of existing models are no doubt imperfect and omitted variables may bias regression coefficients. In addition, many audit fee determinants are correlated with company size, the relation between fees and size is nonlinear, and, because of the dominance of the Big Eight firms in the audits of large companies, it is very difficult to obtain a sample of audits wherein the clients of Big Eight and non-Big Eight firms are well matched on a size dimension. Hence, a failure to properly control the nonlinear client size effect on fees can easily lead to a biased coefficient on an auditor identity variable. Add to these econometric difficulties the possible confounding effects of scale economies to large auditors, and it is not surprising that no clear evidence on product differentiation has yet emerged using audit fee data.

In summary, the empirical tests of the product differentiation hypothesis have, to date, been suggestive but inconclusive. But, this is not surprising given the early stage of the research on this topic, as well as the economics of auditing in general.

### **1.3 Plan of this Paper**

The economic foundations for the product differentiation hypothesis in auditing are only roughly and incompletely sketched out in the existing literature. Our objective in this paper is to develop these foundations, which serve as a basis for a theory of auditor choice by top management of a company. Note that the auditor choice decision is non-trivial only under the hypothesis that auditor services are somehow differentiated. The assumption of homogeneous audit services implies that the assignment of auditors to clients is random or simply a function of auditor cost conditions. For example, if only the largest auditing firms are fully able to exploit available economies of scale due to input indivisibilities, then there is no meaningful auditor choice and these largest firms will eventually (in a world of transaction costs) “sweep” the market for audits.

In Section II, using Lancaster’s [1966] “characteristics” framework, we begin by analyzing the attributes of the audit service which may be valued by top management. In doing so, we consider the distinction between audit quality and quantity and their relation to audit service inputs. We then analyze the “product location” decision of auditors, and develop the argument that the credibility of an audit is communicated to external financial statement users (e.g., prospective shareholders and creditors) through an audit firm’s brand name. Thus it is the brand name which has *ex ante* value to top management when seeking to influence the decisions of users. We conclude this section with a discussion of some welfare implications of product differentiation.

In Section III, we associate auditor credibility with the power of an auditor’s tests (in a statistical sense), and analyze the sources of demand for *different* levels of credibility. We argue that an auditor’s brand name induces a Bayesian revision of users’ prior probability distributions that financial statements contain material error. In a world of rational users who can “price protect” themselves when transacting with management, cross sectional differences in the prior probability of error and the wealth effects of error will cause top managers of different companies to demand different credibility levels. We examine the role of future rents and quasi-rents in “enforcing” the delivery of a particular expected power of test, and consider the implication of our analysis for rates of litigation (“hit rates”) which can be expected to occur across audit firms whose credibility varies. Finally, we compare our analysis to that of De Angelo and present some examples to illustrate the main ideas. The paper closes with some concluding observations and comments.

## **II. Economics of Product Differentiation**

### **2.1 Basic Concepts**

Consistent with the traditional view of financial statement audits, the standard assumption in microeconomic analysis has been that the products produced by firms in a particular industry or market are homogeneous. That is, within an industry, consumers cannot distinguish the product produced by firm *i* from that produced by firm *j*. More formally, this assumption is expressed by the condition that the cross price elasticity of demand for the product of the *i*<sup>th</sup> firm in an industry with respect to the price of product of the *j*<sup>th</sup> firm in the

industry is infinite, or the products are perfect substitutes.<sup>2</sup> An implication of this assumption is that a single price must prevail within the market.

Chamberlain [1933] was the first economist to suggest that no two firms are likely to make precisely the same product, even though they operate in the same industry. He coined the term “monopolistic competition” to describe a market where there are *many* sellers, each one producing a somewhat differentiated product. If, on the other hand, there are only a few firms in the industry, the market can be described as a differentiated products oligopoly. Note that differentiated products are assumed to be *strong* substitutes, but not *perfect* substitutes for each other. That is, their cross price elasticities are finite and relatively large. If the products are very weak substitutes in demand (cross price elasticities approach zero), then the products are no longer simply differentiated, but the firms can be thought of as operating in different industries. In fact, a criticism of Chamberlain’s work has been that the notion of differentiated products is really nothing new, but simply causes us to think more deeply about which group of firms ought to be considered an industry [e.g., Stigler, 1968]!

Following Chamberlain, and the essentially concurrent work by Hotelling [1929] on spacial duopoly, there were few contributions to the economics of product differentiation until the work of Lancaster [1966; 1971] on the nature of product characteristics. In considering exactly how products may be differentiated, Lancaster proposed the notion that a commodity is not desired in and of itself, but rather for the bundle of utility bearing characteristics it contains. For example, a specific brand and model of automobile provides not only the obvious characteristic *transportation*, but also some amount of the characteristics *safety*, *social prestige*, *driving entertainment*, *pleasant appearance*, etc. Each of these characteristics commands an implicit price in a market, and the observed market price of the commodity (e.g., automobile) will be a linear combination of the measured quantities of each of the component characteristics. Since quantities of characteristics vary across products, observed prices will also vary. Hence in order to compare product prices, construct price indices over time, or test hypotheses about market behavior using price data, it is necessary to control for differences in product characteristics. A way to do this is to estimate the coefficients of a hedonic regression function where product price is the dependent variable and quantities of characteristics are the independent variables. This is essentially the theoretical rationale underlying the studies of audit fees discussed in Section 1.<sup>3</sup>

The notion of characteristics suggests that there are two basic ways in which products can be differentiated. In the simplest case, the industry’s product contains only *one* characteristic, but products of various firms differ in the amount of the characteristic each contains. This situation can be described as vertical product differentiation and it implies that products can be ordered on a single dimension, which can be labeled *product quality*. The more general case, where the product possesses many characteristics and producers differ in the amount of each characteristic their product contains, can be called horizontal product differentiation. Note that in this case, the description of each firm’s product is a  $k$  component vector of quantities (where  $k$  is the number of characteristics or dimensions) and, in general, the products of various suppliers cannot be ordered.



## ***2.2 Demand for Audit Service Characteristics***

Before proceeding further, it is useful to relate these concepts to the audit services market. First, it is important to recognize that audit services are not a consumption good, but rather a factor of production. That is, neither audit services nor their component characteristics are direct objects of utility to any ultimate consumer, and the demand for audit services is not the outcome of a standard constrained utility maximization problem. Thus, the demand for *differentiated* audit services cannot arise from a simple assumption that consumers vary in their tastes, preferences, and incomes.

As a factor of production or intermediate good, the demand for audit services is derived from the objective function of the top management of the audited company. We assume that this objective is to maximize own expected utility.<sup>4</sup> Some insight into the characteristics of the audit service which may be valued by (or increase the wealth of) top management can be derived by considering various possible relationships between top management, shareholders, and creditors.

### *Top managers are also owners and there are no creditors*

These assumptions describe a smaller closely-held company with no debt. Will audit services be demanded at all in this situation? The answer would seem to depend crucially on the size and complexity of the company and the resulting degree to which top managers can personally monitor the various activities of their subordinates. The less their personal control over the organization, the more likely an outside audit would be valuable to top management. The audit service would be part of the control system over the information produced within the organization, and hence the company's financial statements. This demand, which arises from the internal agency problems of an organization, may be termed a *control* demand. Therefore, a plausible audit service characteristic along which auditors can be differentiated is the contribution of the audit to the organization's internal control system.

### *Top managers are separate from owners and there are no creditors*

These assumptions describe a publicly held company with an all-equity capital structure (ignoring government regulations and any mandatory audit requirement). There is now an agency relationship between top management and outside shareholders.<sup>5</sup> Given the existence of this agency relationship, there is likely to be a demand for an independent attestation (audit) as to the truthfulness of the information reported by top management to the outside shareholders, and, in general, both parties (groups) might benefit from such an audit [Beaver, 1981]. The key attribute of the audit service is likely to be its *credibility* as perceived by the shareholders. Hence, this is a second characteristic or dimension along which audit services can be differentiated.

### *Effects of the introduction of debt into the capital structure*

The issuance of debt by a closely held company creates an agency relationship between the debtholder(s) as principal and an owner-manager as

agent. After the issuance of debt, the owner-manager is motivated to take actions which increase the value of the equity, but decrease the value of the debt. A major potential source of such agency costs is adoption of an investment policy in which projects with a high variance but low expected net present value are substituted for lower variance but higher net present value projects [Jensen and Meckling, 1976].<sup>6</sup> Note that the owner-manager will exclusively earn the possible high returns from high variance projects, but shares the risk of possible low returns or losses with the debtholders. This agency relationship is likely to give rise to the use of restrictive covenants in debt agreements [see Smith and Warner, 1979] as well as a demand for independent attestation to verify both the compliance with these agreements and the truthfulness of general financial information reported by the owner-manager to the debtholders. As with public shareholders, *credibility* or reputation is thus likely to be an important audit service attribute. Of course, both the manager-shareholder and manager-debtholder agency relationships will exist simultaneously if debt is issued by a publicly held company, reinforcing the demand for audit service credibility.

In summary, two major audit service characteristics arise from a consideration of the possible organization structure of the audited company:

- 1) the contribution of the audit to organization *control*, and
- 2) the *credibility* of the audit as perceived by shareholders and creditors.

The importance of these two characteristics was confirmed in a recent study of 881 small, closely held U.S. companies by O'Keefe and Barefield [1985]. Of the companies who *voluntarily* purchased audits in this sample (132 companies or 15 percent), 57 percent listed "enhances credibility (of financial statements) with outside users" as the most important reason for the purchase, while 46 percent listed "augments internal control" as the second most important reason.<sup>7</sup> Moreover, other reasons for the purchase were mentioned only infrequently (e.g., 12/17 percent listed "limits liability" as a primary/secondary reason).

A third possible characteristic which top management may value is the scope of the *product line* offered by an audit firm, in particular the availability of various management consulting type services from the audit supplier. Such product availability reduces management's search costs when seeking to acquire consulting services. In addition, it is often claimed that production of auditing creates a knowledge externality or spillover which reduces the costs of consulting services when the services are produced jointly. This issue was analyzed and tested by Simunic [1984] who found that the pricing of audit services is consistent with the hypothesis that knowledge spills over from auditing to consulting. Thus, managers in certain circumstances may be better off by purchasing the audit service from a supplier with a wide product line. However, this need not be true in all situations. For example, in the data set on publicly held companies underlying Simunic [1980; 1984], 235 of 381 companies or 62 percent purchased *no* consulting service from their auditor over a three-year period.<sup>8</sup> Further, of the 277 companies audited by a Big Eight firm, 163 or 59 percent purchased *no* consulting service from their audit firm during the period. Hence, the value of wide service scope to managers can be assumed to

vary, creating a third characteristic along which audit firms can be differentiated.

### ***2.3 Distinctions Between Characteristic Quantities, Quality of Service, and the Quantity of Inputs and Output***

Based on this analysis, a description of the audit service purchased by a particular client<sup>9</sup> from a particular audit firm requires, in principle, the specification of a vector of quantities of three service characteristics:

{control, credibility, product line} or  $\{c_1, c_2, c_3\}$ .

A unit of each characteristic is assumed to be costly to produce. For example, the offering of a line of consulting services which may or may not be demanded by a particular client is costly to the audit firm. Or the development of a certain credibility<sup>10</sup> level with outside shareholders and creditors is also costly. Therefore, each service characteristic commands a positive implicit price—say  $\lambda_1$ ,  $\lambda_2$  and  $\lambda_3$  — in the market.

With differentiated audit services, *quality* of service comparisons can be made using any dimension of interest if the quantities of the suppressed characteristics are at least equal. For example, an audit service described by the vector  $\{2, 8, 5\}$  is of higher quality than the service  $\{2, 5, 5\}$ , of lower quality than the service  $\{2, 9, 5\}$  and not comparable in quality to the service  $\{1, 10, 5\}$ .

In addition to the quantities of service characteristics from which quality of service rankings can sometimes be made, auditing also has a *pure quantity* dimension. This is so because audit service contexts differ radically across companies. We have argued that some differences in client contexts are the basis for a demand for differentiated audit services. However, other contextual differences lead to supplier choice and the delivery of a certain quantity of service on the basis of supplier efficiency considerations *in a context* taken alone. To make this distinction meaningful, it is necessary to clearly specify a base level or standard service. All client context differences which affect the resources expended by a supplier in providing the base level service are sources of pure audit quantity differences. Conversely, any context differences which lead to different choices of service vectors,  $\{c_1, c_2, c_3\}$ , are sources of product differentiation among auditors.

The base level service is defined by the simple purchase of an audit opinion.<sup>11</sup> If management only values an audit opinion *per se* (perhaps because an audit is mandated by law), then management would simply choose the least-cost producer in the circumstances. This characterization of the problem is the basis for the traditional view that all auditors deliver the same homogeneous product—an appropriate audit opinion. Empirically, it motivates a search for auditor scale economies [e.g., Danos and Eichenseher, 1982]. The hypothesis of product differentiation motivates a search *beyond* the opinion to distinguishing service characteristics. Of course, management still demands an efficient producer of a particular characteristic vector, but auditor choice is no longer a cost minimization problem. Rather, it requires explicit recognition of a benefit function to top management.

If the pure quantity of auditing is measured by  $q$ , then an audit service fee can be denoted as

$$F = (\lambda_1 c_1 + \lambda_2 c_2 + \lambda_3 c_3)q.$$

While audit fee data are not examined in this paper, some examples of fee determination are useful to illustrate the ideas. Suppose that a client wishes to purchase a base level service—an audit opinion. Management deems the audit valueless in controlling the organization and has no use for consulting services. Since some auditor must sign the opinion, credibility or  $c_2$  can arbitrarily be assigned a minimum value of 1. Hence the characteristic vector demanded would be the base level  $\{0,1,0\}$  and the fee would be

$$\hat{F} = \lambda_2 \hat{q}$$

where  $\hat{q}$  depends on company size, complexity, etc. Consider now an identical company, except that management values the auditor's ability to perform certain consulting services as needed. Say the desired characteristic vector is  $\{0, 1, 1\}$ . Note that this is a higher quality service. The service fee would be

$$\hat{F}' = (\lambda_2 + \lambda_3)\hat{q} \text{ where } \hat{F}' > \hat{F}.$$

The fee now reflects the presence of both attributes and is scaled by  $\hat{q}$ . Finally, suppose there exists another identical company in terms of size, complexity, etc. whose top management chooses an audit service which improves organization control, has a higher credibility with outsiders than the base level, and is obtained from a supplier who is capable of rendering certain consulting services as needed. Say the vector  $\{2, 3, 1\}$  characterizes this service. The fee for this service, which is of higher quality than in the previous case, would be

$$F' = (2\lambda_2 + 3\lambda_3 + \lambda_3)\hat{q} \text{ where } F' > \hat{F}' > \hat{F}.$$

What is the role of service inputs in this fee model?<sup>12</sup> The outputs of the audit service are the quantities  $\{c_1, c_2, c_3\}$  and  $q$ . These outputs are related to inputs through a production function, but the relationship need not be simple. For example, it seems likely that control and credibility are largely joint products, thus restricting the values  $c_1$  and  $c_2$  can assume. On the other hand, the breadth of the available product line is not a function of variable audit service inputs but requires the incurrence of a fixed cost by the auditing firm. Higher levels of available services presumably are associated with higher fixed costs. Thus, distinguishing between inputs and output is important in conceptualizing the audit service; but detail specification of the input/output relationship is not possible, nor usually necessary.

## ***2.4 Product Location in Characteristics Space***

If audit services are differentiated, then the question arises as to what service designs will be offered for sale in the market? Also, can a given audit firm be expected to supply a single type of service (i.e., a vector with specific characteristics  $\{\hat{c}_1, \hat{c}_2, \hat{c}_3\}$ ) or simultaneously supply a variety of characteristic vectors? These are important issues from the point of view of both purchasers and producers. Audit firms presumably want to design services so as to maximize economic rents; conversely, the services (and prices) which emerge

in market equilibrium affect the welfare of purchasers. In the economics literature, these issues are described as “product location” decisions since the insights are frequently derived by analogy from formal models of spatial competition.

Consider first the question of whether a producer will offer a single or multiple characteristic vectors. For typical goods, it is common to observe a company which produces and markets a variety of product types. For example, in a study of product characteristics of the U.K. fertilizer industry, Shaw [1982] found that 69 different compound fertilizers were available in 1978 from three major producers. These products largely differed only in composition with respect to the three plant nutrients—nitrogen, phosphorus, and potash. In this setting, labeling presumably allows the consumer to choose the most suitable product for a particular situation, and the identity of the selling firm may well be irrelevant.

As product characteristics become more subtle and thus more difficult to enumerate and measure, a company will use separate brand names to identify products with specific sets of characteristics. For example, automobile manufacturers sell a variety of models which presumably differ as to the amounts of the characteristics—transportation, safety, prestige, etc.—each provides. In the limit, if a company is (somehow) precluded from developing a multiplicity of brands, the relevant brand will be the name of the company itself. In that situation, where the nature of the product precludes direct communication of component characteristics and the firm name is the brand, each supplier will produce a product with a single set of characteristic quantities.

Turning to the location decision, rent seeking suppliers can be expected to locate (i.e., choose a vector) in response to demand and the location choices of other suppliers. Unfortunately, the economics literature offers few general results on equilibrium location choices, as solutions are very sensitive to alternative plausible assumptions about the behavior of competitors, the nature of the space in which competition occurs, and the distribution of customers [Eaton and Lipsey, 1975]. However, some insights can be obtained by considering the basic factors which affect the location decision [see Waterson, 1984].

Three cost elements enter into economic models of location:

- a. a transportation cost per unit of distance,
- b. production costs which can consist of a fixed and/or variable component,  
and
- c. relocation costs.

The existence of fixed costs is crucial to the solution. If there are no fixed costs of production, then firms will simply produce at all points at which there are customers. That is, demand will be perfectly satisfied without the incurrence of transportation costs. The assumption of fixed costs implies that the number of suppliers must be limited to maintain profitability; hence customers will vary in distance from the nearest supplier. A second key assumption concerns the possibility of relocation. That is, once a supplier chooses a location, are there costs of relocation? In general, if relocation is costless but there are fixed production costs, there is no unique equilibrium solution [Eaton and Lipsey,

1975]. Conversely, if initial location choice is irreversible and suppliers enter a market sequentially, then the equilibrium location pattern will be symmetrical for a uniform distribution of customers. For example, if buyers are uniformly scattered along a line segment of fixed length, sellers will anticipate that unusually large “gaps” in the market will be filled by competitors and hence will array themselves at equally spaced intervals [Waterson, 1984]. However, if customers are located in clusters, a closer packing of suppliers will occur in areas of high demand density with the “gaps” increasing in width in areas of low demand density [Shaw, 1982].

Let us now relate these ideas to the audit service. If different quantities of control, credibility, and product line scope can be readily observed and measured by top management (i.e., these attributes are like nitrogen, phosphorus, and potash!), it would seem that each audit firm can produce a multiplicity of characteristic vectors to meet (perhaps imperfectly if there are fixed costs) client demand. However, even if top management possesses such complete information, the situation is complicated by the fact that *credibility is purchased solely to influence the decisions of shareholders and creditors*. These outside parties, who may be numerous and geographically scattered, are very unlikely to possess complete information. We therefore conclude that, for them, the audit firm’s brand name or reputation is the relevant measure of credibility. However, brand name will be less important for the other two characteristics where the outputs (and inputs) can be more easily observed by top management, who directly value these characteristics. An implication is that each audit firm will be identified with a single level of credibility at any moment in time, but may offer a multiplicity of control levels and, perhaps, product scope levels.<sup>13</sup> In the next section, we analyze the auditor choice decision given this information asymmetry and develop more precisely our notions of credibility, brand name, and reputation.

With respect to the product location decision of auditors, the first step is to identify the analogues of transportation, production, and relocation costs. Note that transportation costs are incurred whenever suppliers and customers are physically separated. Thus, in a characteristic space, an analogous cost arises if, given the equilibrium distribution of characteristic vectors of suppliers, top management incurs an opportunity loss of wealth or utility. For example, suppose managers rationally want to purchase an audit of near zero credibility, but no such service is available on the market. Acquiring a credible audit implies an opportunity loss or transportation cost.<sup>14</sup> Or suppose management wants an audit of certain credibility from a supplier who also specializes in a certain type of consulting service, but no such supplier exists. Again, an opportunity loss is incurred. From the previous discussion, note that such opportunity losses will arise only if there are fixed costs of producing at certain locations, that is, particular characteristic vectors.

Since very little is known about the production functions of public accounting firms, we can only speculate about the importance of fixed costs in producing a level of control, credibility, and product scope. However, it seems likely that there are significant fixed costs associated with a firm’s capital commitments. The most important of these will be the technology adopted and the human capital (expertise) of professional staff. For example, Kinney [1985] has argued that auditing firms can be categorized on an audit technology

dimension into “unstructured” vs. “structured” firms. The first group tends to minimize the constraints imposed on professional judgment whereas the second uses statistical methods, decision aids, etc. to constrain and “improve” judgment. It seems plausible that fixed costs increase as “structure” increases. Fixed costs are also likely to increase as the professional staff becomes more specialized (narrow). For example, the offering of a specialized consulting service to clients, such as industrial engineering for plant design and cost control, no doubt adds to an audit firm’s fixed costs.

Two conclusions follow from this discussion. First, auditing firms probably vary in the level of fixed costs they incur. Second, the higher the fixed cost commitment, the less flexible the firm will be in producing a variety of characteristic vectors. This seems to be the basis for the often heard claim that small audit firms are more flexible in meeting a client’s demands, although large firms may be more efficient in performing specific, complex tasks. With respect to the three audit service characteristics, fixed costs can be important in all cases. As a result, all possible combinations of control, credibility, and product scope are not likely to be available in the market.

Finally, consider the costs incurred by an audit firm when attempting to move from one characteristic vector to another vector. Typically, relocation costs are those fixed production costs which are “sunk” at a specific location. These costs may be particularly high when information about characteristics is conveyed by the brand name. Schmalensee [1978] points out that, for consumer goods, the “repositioning” of brands can be so costly that it is frequently cheaper to simply abandon an established brand whose sales have fallen to low levels and introduce a new brand. Again, while there is no empirical evidence on the point, such costs are likely to exist in auditing. For example, if an audit firm invests in structured technologies which facilitate the production of high levels of control and credibility but are unnecessary for producing low levels of these characteristics, an attempted move from the high level will be costly. Or, if a firm enters into an employment contract with a specialized consultant, firing the consultant will be costly. Perhaps most important, as with consumer goods, it may be very costly for a firm to change the credibility level associated with its brand name. In fact, high costs of directly relocating a brand may be an important motivation for mergers between CPA firms.

If costs of relocation are substantial (therefore locations more or less fixed), the characteristic vectors of audit firms will tend to be separated. For example, there will be an array of credibility levels associated with firm brands. Thus any grouping of suppliers into broad classes such as Big Eight vs. non-Big Eight is necessarily arbitrary and should be tested for within-group homogeneity. Note, however, that audit firm product vectors *will* tend to be clustered in response to concentrations of client demand.

## ***2.5 Welfare Implications of Product Differentiation***

When dealing with differentiated products, a social welfare question which can be asked is this: given a location equilibrium, will the variety of characteristic vectors offered for sale in the market be optimal?<sup>15</sup> This evaluation involves a trade-off. On the one hand, the greater the variety of characteristic vectors,

the better the market caters to diverse consumer tastes and preferences. On the other hand, the assumption of differentiated products (imperfect substitutes) implies that the demand curves faced by suppliers are downward sloping and equilibrium must occur where average production costs are still falling. Thus differentiated products imply a loss of efficiency. Unfortunately, the welfare properties of the free market solution depend on the specific values of parameters. That is, in general too many or too few product varieties may be produced and sold [Friedman, 1983]. Hence beyond these general statements the economic literature offers no conclusion about the welfare implications of product differentiation in auditing from the usual perspective.

However, a somewhat different question appears to be more relevant here; namely, is it socially desirable for auditors to offer differentiated services *at all* to their clients? Since the demand for auditing is not a consumption demand but rather is derived from top management's objective function which is assumed to be maximization of *own* wealth or utility, are demand differences, in some sense, socially legitimate? There is no special problem if top management's objective is consistent with the objectives of shareholders and creditors. Such mutuality of interests would occur with respect to the characteristics *control* and *product line scope*. That is, all three parties are presumably interested in efficient monitoring of organization subordinates and efficient acquisition and utilization of consulting services. However, the credibility characteristic is clearly different in that the purpose of auditor credibility is to ameliorate an agency problem between top management and the other two groups. Thus, the legitimacy of product differentiation on this dimension is likely to be a controversial, but interesting question. To answer the question, we must analyze the nature, role, and demand for credibility in more detail.

### III. Auditor Credibility and Auditor Choice

#### 3.1 Nature of Audit Service Credibility

Dopuch and Simunic [1982] describe auditor credibility as follows (p. 407):

An auditor's attestation to the authenticity of financial statements adds credibility to these top management assertions. Credibility is judged by users. More credible reporting simply means a report is more likely to be truthful or lack intentional misrepresentation. . . . Shareholders will rationally expect that attestation by a credible auditor reduces the probability that management is able to successfully conceal 'self-serving behavior.'

This is consistent with both Watts and Zimmerman [1980] and De Angelo [1981(b)] who argue that the *ex ante* value of an audit to shareholders and creditors depends on these individuals' (or "the market's") perception of the joint probability that a given auditor will discover errors and irregularities in a set of financial statements and report those findings truthfully (without omission or bias).<sup>16</sup> Recall that this is also De Angelo's definition of audit quality.

The concept can be made more precise by considering a simplified Bayesian model of an auditor's decision problem. Assume an auditor faces a two-action, two-state reporting decision where the states of nature are: ( $s_1$ ) — the financial



statements are correct, and  $(s_2)$  — the financial statements are materially incorrect. The available actions are:  $(a_1)$  — give an unqualified opinion, or  $(a_2)$  — give an appropriately qualified or adverse opinion. Assume the auditor has performed all the usual audit tests at a certain intensity level, measured by  $n$ , which yield possible signals,  $t$ . Further, the test results,  $\hat{t}$ , indicate the presence of only immaterial errors. Then the posterior probability of  $s_2$  will be:

$$p''(s_2|\hat{t},n) = \frac{1(\hat{t}|n,s_2)p'(s_2)}{1(\hat{t}|n,s_2)p'(s_2) + 1(\hat{t}|n,s_1)(1-p'(s_2))}$$

where

$p''$  = a posterior distribution on the states

$p'$  = a prior distribution on the states

$1$  = a likelihood function

This expression can be simplified if it is assumed that the auditor cannot commit a Type I error. That is, if the auditor receives a signal,  $\hat{t}$ , which indicates material errors are present, he will keep sampling. If the state of nature is  $s_1$ , additional evidence should lead to the discovery that sampling error is responsible for the faulty signal. Thus,  $1(\hat{t}|n,s_1) = 1$  and<sup>17</sup>

$$p''(s_2|\hat{t},n) = \frac{1(\hat{t}|n,s_2)p'(s_2)}{1(\hat{t}|n,s_2)p'(s_2) + (1-p'(s_2))}$$

Assume that, given  $p''(s_2)$ , the auditor will take action  $a_1$ .

A measure of the credibility of the *financial statements* (the ‘‘package’’) reflecting all available information about management, the auditor, and organizational and environmental factors would be  $1 - p''(s_2)$ . On the other hand, a measure of the credibility of the *auditor*, or audit service, is  $1 - 1(\hat{t}|n,s_2)$ , which is the power of the auditor’s tests (the complement of the probability of a Type II error).

### 3.2 Demand for Credibility

It is generally agreed that a major purpose of financial statements is to provide information which is useful in assessing a company’s future cash flows [e.g., Beaver, 1981]. It is also reasonable to assume that when top management has agency relationships with creditors and shareholders, errors in financial statements (both historical statements and those to be delivered in the future) will not be merely random or capricious. Rather, such errors will tend to reflect top management’s own expected utility maximizing motives, which will typically be to induce financial statement users to *overestimate* these flows.<sup>18</sup> The probability that such errors are detected *ex ante* (before users assess the firm’s cash flows) increases with the credibility of the audit.

The cash flows of the firm are important because the wealth of users will be a function of such flows and any errors in their assessment. For example, unrecorded liabilities may cause a banker to assess a downward biased probability of the borrower’s bankruptcy and hence, charge too low an interest

rate. Or, overstated historical revenues may cause a purchaser of common stock to pay an inflated price relative to the true value of shares. Of course, if the error is subsequently discovered, an injured user will seek to recover his losses from any person who, through negligence or fraud, created the error or failed to detect and report it. But such *ex post* compensation is not likely to be complete. As a result, users will value a credible audit *ex ante* and, ignoring the costs of auditing, prefer more credibility to less.

In order to transform the *ex ante* value of credibility to users into an effective demand for credibility by top management, it is necessary to identify a mechanism through which costs to users from possible financial statement errors are imposed (at least partially) *ex ante* on top management. A reasonable assumption is that users of financial statements are rational and “price protect” themselves in transactions with management. That is, they anticipate the costs that top management, acting in its own self-interest, can impose upon them, and adjust the terms of contracts accordingly. An extreme form of “price protection” is refusal to transact. For example, a bank may demand a high rate of interest on a commercial loan where the application is supported by unaudited financial statements, or may simply refuse to make such a loan. Or a prospective shareholder will submit a low bid for stock if the company’s financial statements have not been verified by a credible auditor, or may refuse to buy such shares. Thus, under the rational user assumption, top managers will demand credible auditing *in their own interests*.

The auditor’s decision problem from the previous section can be extended to provide insights into the demand for credibility. Assume a particular user assesses the present value of a company’s future cash flows, given all the available information, including a set(s) of *unaudited* financial statements, as the value,  $\emptyset$ .<sup>19</sup> However, if these statements contain a material error(s), actual cash flows will yield a lower present value of  $\emptyset - w$ . The user’s wealth is some increasing function,  $g$ , of the firm’s cash flows. Thus, the user’s expected wealth is

$$[1 - p'(s_2)]g(\emptyset) + p'(s_2)g(\emptyset - w) \quad \{3.1\}$$

where  $p'$  is his assessed prior distribution on the states.

Note that a credible but costless audit can benefit the user in two ways:

- 1) The audit can induce a Bayesian revision of  $p'$  to a posterior distribution,  $p''$ . If  $p''(s_2) < p'(s_2)$ , the user’s expected wealth is increased.
- 2) If the user is risk averse, the auditor may function as an insurer against the risk of loss of  $w$ , thus increasing the user’s expected utility. However, after assuming the risk, the auditor will himself be motivated to minimize the insurance premium by performing an audit examination. This will lead to a Bayesian revision of the *auditor’s* prior,  $p'$ , to a posterior distribution,  $p''$ .

In both cases, if audit credibility were costless, a perfect audit, which reduced  $p''(s_2)$  to zero, would be demanded.<sup>20</sup>

### 3.3 Determinants of the Level of Credibility Demanded

However, credibility is not a free good and its cost is normally borne by the audited company. Given the other audit service attributes, the auditor's fee for credibility is  $\lambda_2 c_2 q$  and for a specific company (fixed  $q$ ), an increase in  $c_2$  requires an increase in audit intensity,  $n$ . Thus, choice of credibility can be conceptually reduced to choice of  $n$ .

The ideal way to proceed at this point would be to specify a model of the determination of audit intensity in a multiple person setting, obtain an optimum solution, and perform comparative static analysis to identify demand determinants. However, this approach is not possible as no such model exists.

A more restrictive but useful approach is to consider the choice of  $n$  by a representative risk neutral user in a single-person decision setting. That is, the user either performs the audit himself or delegates its performance to an auditor whose interests are perfectly aligned with his own. Assume there is an audit technology and an associated cost function,  $\gamma(n)$ . Given  $p'$ ,  $g(w)$ , and a loss from Type I error,<sup>21</sup> all assessed by the user, an optimum audit intensity,  $n^*$ , can be calculated by performing a Bayesian preposterior analysis. It is well known (e.g., see Kinney, 1975) that, in this setting,  $n^*$  is an increasing function of two key parameters of the problem, the loss from Type II error,  $g(w)$ , and the value of  $p'(s_2)$ . Assume the "auditor" performs this optimum examination, receives the signal  $\hat{t}$ , which indicates no material errors exist, and issues an unqualified opinion. Then the representative user's expected wealth after the audit is

$$[1 - p''(s_2|\hat{t}, n^*)]g(\emptyset - \gamma(n^*)) + p''(s_2|\hat{t}, n^*)g[\emptyset - w - \gamma(n^*)] \quad \{3.2\}$$

where  $\gamma(n^*)$  is also the auditor's fee,  $\lambda_2 c_2 q$ . The net gain from auditing, and receiving an unqualified opinion, to the risk neutral user is  $\{3.2\}$  minus  $\{3.1\}$ . This must be positive, since  $n^*$  was computed optimally by equalizing the marginal value of information to marginal audit cost.

This analysis suggests that users' demand for credibility will depend on two factors:

- 1) the larger the loss from material financial statement error, the higher the level of audit service credibility demanded, and
- 2) the higher the prior probability users assess that the financial statements will be materially in error, the higher the level of credibility demanded.

If users can price protect themselves in transactions with management, these factors can also be expected to drive top management's demand for audit credibility.

Before proceeding further, it is useful to consider the exact sources of the benefits from credibility implicit in our analysis of the problem. Expression  $\{3.1\}$  states that user wealth is lower in state  $s_2$  than in  $s_1$ . It is the avoidance of this loss which drives the demand for credibility. In some cases, by detecting material errors when they exist, an audit can simply *shift a cost* from users to top management. However, in the majority of cases, when no material errors are detected (or detected errors are corrected), an audit can *overcome an information asymmetry* between management and users about the presence of material errors in the financial statements. This is valuable to managers whose

statements (unknown to users) are, in fact, “fairly presented.” Finally, the knowledge that an audit will be performed can have a direct *productive effect*, resolving a “moral hazard” problem [e.g., Baiman, 1982] thus reducing agency costs in the relationship between top management and users. This will occur if managers anticipate that a credible audit will reduce their ability to conceal actions (e.g., shirking) that are not in the best interests of users.

In addition to these effects an audit may also have some insurance value to risk averse users. But such a role is dubious, since auditors are not strictly liable for losses to users; even under the most severe liability statutes, an auditor can invoke a “due diligence” defense. However, recent court decisions [e.g., Collins, 1985] suggest that this insurance role of auditors may be increasing in importance.

### ***3.4 Effect of Information Asymmetry About Audit Service Production***

If one assumes that users can observe the production function of the auditor, hence the power of the auditor’s tests and the level of credibility delivered, *any* auditor could supply *any* level of credibility demanded by top management.<sup>22</sup> But this is clearly *not* the case. The auditor has complete information about his production process, and top management may be able to observe audit production imperfectly. However, users are precluded from directly observing the performance of the audit. As stated in the last section, this information asymmetry will cause users to rely upon the auditor’s brand name or reputation as a surrogate measure of audit service credibility. We now develop this argument.

A possible method which could be suggested to overcome the information asymmetry would be simple disclosure of the details of the auditor’s examination. In fact, one could even argue that the current stylized claim to audit performance “in accordance with generally accepted auditing standards” is sufficient, since the reader is informed that the auditor “did what he should have done” in the circumstances. However, the auditor is an economic agent who can be expected to pursue his *own* self-interest, and such disclosures and claims are in themselves meaningless. This is so because the information asymmetry is associated with a moral hazard problem between the auditor and users. In the absence of observation, the user has no reason to believe that the auditor has performed the examination he claims to have performed.

Note that users (as principals) can attempt to resolve this moral hazard problem by contracting with the auditor on mutually observable information of some sort. This approach is taken in two agent analyses of the auditing problem, such as in Antle [1982]. However, these models are of little empirical relevance because, in the real world, such contracting simply does not occur. Moreover, even the terms of any contract between the top management and the auditor are not observable to users.

Hence, because an auditor cannot directly communicate, in a meaningful way, variations in the power of his tests and users value different levels of credibility in different circumstances, *auditors must specialize* in the delivery of credibility levels. That is, while an auditor’s credibility may change over time, it must be fixed at a moment in time across engagements. Returning to the

fertilizer example, an auditor cannot combine different proportions of nitrogen, phosphorus, and potash as required by users and sell these different products in uniform, unlabeled bags!

As a result, each auditor's brand name or reputation will imply delivery of a certain level of credibility and, at any moment, there is a fixed rank ordering of auditors based on perceived credibility. Top management's choice among different credibility levels thus requires a choice among auditors.

**3.5 Reputation Investments, Audit Failure, and Auditor Liability**

An auditor can acquire a reputation to perform audits of a certain level of credibility through various means. For example, it is likely that he must invest in technology, physical facilities, personnel and their knowledge, organization control systems, etc. to efficiently produce a credibility level. Moreover, it is reasonable to assume that efficient production of more powerful audit tests requires a higher level of such investments. Thus users could infer the auditor's credibility level by observing these investments directly, through advertising, or through informal communication of various sorts. Note that auditor specialization imposes a far lower information burden upon users than would a need to infer varying credibility *for each auditor for each audit!* Note also that the higher the level of fixed investments which are specialized to production of a certain credibility level, the higher the relocation costs and the more stable the auditor's brand name over time.

A potentially useful source of information about brand name is the rate of audit failure for which an auditor is held to be liable. However, the connection is not a direct or simple one. Consider the following descriptions of four possible engagements:

	Case 1	Case 2	Case 3	Case 4
$p'(s_2)$	.2	.5	.5	.5
$g(w)$	\$1	\$1	\$2	\$2
$n$	$n_1$	$n_2$	$n_3$	$n_1$
		$(n_2 > n_1)$	$(n_3 > n_2 > n_1)$	
$1 - \beta$	.90	.95	.99	.90
Auditor	X	Y	Z	Z
$p''(s_2)$	.02	.05	.01	.09

In Case #1, the user's assessment of the prior probability of material error and the loss from such an error leads to a demand for audit credibility of  $1 - \beta$  (where  $\beta$  is the conditional probability of a Type II error) of .90. The user believes this power of a test will be delivered by auditor X and, after observing an unqualified opinion signed by auditor X, will assess a posterior probability of undetected material error, of .02. Note that  $1 - p''(s_2)$  or .98 is the user assessed credibility of the financial statement package. In Case #2, since the user assesses a higher prior probability of material error, he demands a higher power test which, he believes, is supplied by auditor Y. Case #3, with a higher assessed error cost, motivates a demand for a still higher level of credibility, which the user believes is supplied by auditor Z.

An audit failure occurs when there is actual *ex post* discovery of a material error in a set of audited financial statements. Note that, when auditing is costly, a rational user anticipates this possibility whenever  $p''(s_2) > 0$ . However, if an error is actually discovered, a user who relied on the auditor's brand name is motivated to seek recovery of losses suffered on account of the error and may file suit against the auditor (and top management). The auditor, on the other hand, will raise a due diligence defense and maintain that he was not negligent in the performance of the audit.<sup>23</sup> If the auditor complied with generally accepted auditing standards and obtained evidence deemed by the court to be sufficient and appropriate *in the circumstances*, he will not be liable to the user.

If the user, the auditor, and the court all have homogeneous assessments of  $p'(s_2)$  and  $g(w)$ , then auditors X, Y and Z should *not* be liable in Cases #1 to 3. In each instance, the auditor promised to deliver a certain level of credibility through his brand name and did so. However, in Case #4, auditor Z is expected to deliver a test whose power is .99 but fails to perform such a test. The user believes the posterior probability of loss is .01, but faces an actual probability of loss of .09. If an audit failure occurs, a lawsuit is filed, and the court agrees with the user's parameter assessments (i.e., that a .99 audit was appropriate in the circumstances), the auditor should be found negligent and liable to the user for losses.<sup>24</sup>

Given this process, what rates of successful litigation can users expect to observe with respect to auditors and what is the information conveyed by these rates? Because of the inherent uncertainties surrounding the audit and litigation process, the auditor's credibility level which is assessed as delivered *ex post* can be viewed as a drawing from a probability distribution, whose mean is the current credibility level associated with a brand name. Under these circumstances, *the normal rate of successful litigation across all credibility levels should be approximately uniform*. Any auditor can be found negligent in supplying a service, no matter what the exact specification of that service. Thus auditor "hit rates" provide no information about the absolute or relative (across auditors) powers of auditors' tests as such. However, if an auditor experiences an unusually high "hit rate" during a period, this may be evidence that he is reducing his delivered credibility level to a lower value. That is, the rate provides information about deterioration (intentional or unintentional) of the auditor's reputation. Conversely, if the auditor experiences an unusually low rate, this may be evidence that he has increased the power of his tests beyond expected levels and is repositioning his brand name by investing in reputation.

### ***3.6 Implications of the Analysis for Auditor Behavior***

An auditor's brand name or reputation is the basis on which users predict the level of credibility he will deliver. A wealth maximizing auditor can be expected to position his brand in the market seeking to maximize his monopoly rents. That is, he will seek a niche where there is high demand and few competitors. In addition, if there are sunk costs associated with a particular credibility level, his return on these immovable investments is a quasi-rent [Klein, Crawford and Alchian, 1978]. To protect his rents an auditor is motivated to maintain intertemporal stability in his delivered credibility level. Other things being equal, the higher the rents, the greater the motivation to

maintain the level of service [Klein and Leffler, 1981]. However, note that rents can exist at *any* credibility level in the market.

It is useful to contrast this result with De Angelo's claim, discussed in Section 1, that larger audit firms will report more truthfully than smaller firms for fear of losing their larger aggregate quasi-rents. Note that De Angelo focuses on the second aspect of credibility, that an auditor will *report* his findings honestly, rather than the probability of *discovery* of errors in audit testing which is the focus of our analysis. This is an important difference because an auditor who fails to report a known material error commits a fraudulent act, not mere negligence. Penalties for fraud, if discovered, tend to be severe no matter what the circumstances. In particular, potential penalties an auditor faces *personally*, such as a jail sentence and loss of certification and license to practice, probably override any concerns with rents. Thus, one can reasonably argue that the probability of deliberate misrepresentation by auditors is constant, regardless of the auditor's brand name. However, a reporting issue may well arise when the criteria determining what constitutes an error and/or materiality are ambiguous. These situations require the exercise of professional judgment and the ability to make decisions deemed to be "correct" *ex post* can vary among auditors. Such abilities can readily be encompassed in the concept of power of test and hence auditor brand name.

Returning to De Angelo, our analysis then differs from hers in two basic ways. First, her focus on the probability of misrepresentation as the element of credibility on which audit firms differ casts an unnecessarily pejorative tone on product differentiation. Second, she makes an extreme assumption about relocation alternatives—namely, if an auditor is caught cheating, he will lose his other clients. Thus her quasi-rents from multi-period pricing motivate stability of location, but the auditor's choice is simply the current location (which is a mechanistic function of audit firm size) and being out of the market! By contrast, in our analysis, the prospect of earning monopoly rents motivates an auditor's brand name location while the desire to maintain monopoly rents and quasi-rents from any immovable resources motivates an auditor to remain in that location over time.

To summarize and illustrate these ideas, consider how auditors are expected to match-up with a set of available clients. Assume three companies where users value low, medium, and high levels of auditor credibility, respectively, and three auditors (X, Y and Z) exist. Assume the auditors agree with user assessment of  $p'(s_i)$  and  $g(w)$  and hence with the power of tests appropriate in each situation. Also, the auditors have homogeneous production functions and can produce the three levels of auditing for \$100, \$200, and \$300, respectively. The possible auditor-company pairings are shown below:

	Credibility Demanded		
Auditor	Low	Medium	High
X	\$100	\$200	\$300
Y	\$100	\$200	\$300
Z	\$100	\$200	\$300

Assume audit services are differentiated but an auditor can “tailor” an examination to the demands of users through explicit contracting. Now if the audits were put up for bid, each auditor’s bid would at least cover his costs for each client and, in a competitive setting, auditor choice would be indeterminate.

Now assume auditors have brand names in the eyes of users where  $X \rightarrow$  low,  $Y \rightarrow$  medium,  $Z \rightarrow$  high. The bids on the main diagonal are clearly acceptable to users. However, the upper right hand off-diagonal bids are not acceptable because the production process is not observable. Moreover, even if auditors are liable for negligence, these bids are still not acceptable so long as users value credibility *ex ante* because litigation is not a perfect substitute for loss prevention (i.e., users do not expect full loss recovery from the auditor).

The off-diagonal bids at the lower left are somewhat more problematic. Given the brand names, the bids are acceptable to users, who would appear to be receiving a free good from auditors Y and Z. Moreover, since auditors agree with users as to the power of tests appropriate in the circumstances, there is no expected auditor liability problem! The difficulty here arises from the assumption that production functions are homogeneous. If, in fact, there are fixed costs of producing a particular credibility level and higher credibility production is associated with higher fixed costs, then these off-diagonal bids would tend to be higher, for a given company, than those on the main diagonal. Thus auditor choice would be determined consistent with the perceived brand name.

Finally, note that in this example since there is only one auditor appropriate for each company, auditors will earn monopoly rents. However, in general, there can be many auditors at a particular location in the limit driving monopoly rents to zero [see Rosen, 1974].

### **3.7 An Alternative View: Credibility As a Posterior Probability**

In previous subsections, auditor credibility has been identified with the power of the auditor’s tests. An alternative possibility is to associate it with the posterior probability of financial statement error, or  $1 - p''(s_2)$ . Note that this corresponds with what has previously been labeled the credibility of the financial statement package. This alternative view is attractive because it assumes that users care about the possibility of financial statement errors and their consequences, but not about the separate contributions of the auditor and top management. Consistent with this assumption, auditors may be liable for all undetected material financial statement errors, but users still value credibility *ex ante* because expected loss recovery is not complete. In this setting, an auditor’s brand name would imply a level of  $1 - p''(s_2)$ . That is, different auditors would be associated with a different posterior probability that the financial statements were erroneous. However, the Bayesian revision would be performed only by the auditor; users would be concerned only with  $p''(s_2)$ . In effect, the user delegates to the auditor the responsibility for performing tests consistent with various prior probabilities of error.

The demand for different levels of  $1 - p''(s_2)$  can be derived from the different dollar (or utility) consequences users face in different circumstances. That is, the greater is  $g(w)$ , the higher the level of credibility demanded. Since auditor tests and  $p''(s_2)$  are not observable directly, users must still rely upon



the auditor's brand name which must be assessed from various sources of information, including advertising, levels of fixed investment, etc. However, the rate of successful litigation against an auditor can now be associated more directly with a brand name.

As before, an auditor is motivated to deliver  $1 - p''(s_2)$  consistent with his brand name to preserve rents at that location. However, since auditors are liable for all undetected errors, the "hit rate" observed will be a proxy for  $p''(s_2)$ . Note that each auditor expects to incur a particular "hit rate" and such rates are expected to vary. But since auditing is costly, so long as there are variations in dollar consequences, variations in auditor credibility and "hit rates" are desirable from an economic point of view. Again, being a low credibility auditor does not have pejorative implications! If auditors in this situation were allowed to invoke a negligence defense, then the above implications would still go through, so long as the success of such defenses were randomly distributed across auditors and engagements.

While this alternative view of auditor credibility seems to capture certain aspects of reality (e.g., the delegation for responsibility to the auditor) better than when credibility is identified with the power of the auditor's tests, both scenarios have essentially the same implications for auditor choice.

### ***3.8 Auditor Choice by Top Management***

In the previous section we identified three audit service characteristics, control ( $c_1$ ), credibility ( $c_2$ ), and product line ( $c_3$ ), which top management may value. Levels of control and product line will be demanded through management's desire to maximize corporate profits or firm value as a determinant of management's own compensation. Since there is no conflict between users and management with respect to these two characteristics, the choice can be expected to be optimal from both groups' point of view.

There is a conflict between users and management with respect to auditor credibility, and management can be expected to make an optimal choice, given its own interests. However, if users are rational and price protect themselves when transacting with management, this choice can be expected to at least directionally reflect users' demand determinants.

Formally, top management's problems of choosing an optimum set of audit service characteristics for a period can be described as follows:

$$\begin{aligned} \text{Max} \quad & \theta[\phi(c_1, c_2, c_3) - wp''(s_2|c_2) - F(c_1, c_2, c_3)] \\ & (c_1 c_2 c_3) \quad \quad \quad \{3.3\} \\ \text{s.t.} \quad & c_1 - k(c_2) = 0 \end{aligned}$$

where  $\theta$  is some benefit function to top management and  $F$  is the audit fee function. Note that the audit service determines an expected present value of net cash flows to the firm as perceived by financial statement users. If users are "price protected" then top management expects to gain from the purchase of credibility. Also, a constraint is included to recognize that control and credibility are likely to be joint products in production and hence not independent in the audit fee function.

Management's solution to this problem determines an optimum characteristics vector,  $(c_1^*, c_2^*, c_3^*)$ . However, there is no guarantee that this vector of characteristics will be available in the market since, we have argued, production of all three characteristics likely involves fixed costs. Thus, the final step will be a choice of the specific auditor who minimizes opportunity cost (i.e., the "transportation cost") associated with the suboptimal choice.

### 3.9 Illustrative Example

To illustrate some of the ideas concerning auditor choice developed in this section, consider the simple case of a company with no debt solely owned by a 100 percent owner and manager who wishes to sell 50 percent of his common shares to an outsider or "user" who will assume an active role in future management. (That is, no external agency relationship is created. The situation when a new agency relationship arises is examined subsequently.) Assume the company has been in business for one year and the owner has prepared a set of unaudited financial statements which show a net operating cash flow of \$10,000 for the year. The user is risk neutral and has an opportunity rate of return on investment of 10 percent. Assume that the user believes the company's cash flows will follow a random walk in perpetuity. Thus, the best point estimate of future cash flows is simply the level earned last year.

If the user knows the financial statements to be accurate, the assessed value of the firm will be \$100,000 and the user should be willing to pay up to \$50,000 for a 50 percent interest. However, this is not likely to be the case. Rather, the user will recognize that the owner-manager has an incentive to overstate the reported cash flows of the firm, but not all owner-managers will necessarily do so. If the financial statements are in fact erroneous (assume the true cash flows were only \$8,000 last year), the true value of the firm is \$80,000.

Suppose the user assesses a prior probability of .3 that the financial statements are in error. Since the user can price protect himself through his offering price for the shares, it would appear that he would be willing to pay no more than 50 percent of the expected value, or \$47,000. Since the manager who prepared the financial statements knows their true state, he knows that this price is too high. Thus, he would gladly accept the offer of \$47,000 if the statements were erroneous, but would reject it if the statements were correct and auditor credibility was available to convince the user of their truthfulness.

Assume, for the moment, that the statements do *not* contain material errors. Suppose an optimum audit, which maximizes  $\{3.3\}$ , costs \$3,000 and induces a Bayesian revision of probabilities by the user from  $p'(s_2) = .3$  to  $p''(s_2) = .1$ . Such an optimum audit implies an optimum level of credibility, or  $c_2^*$ , purchased by the manager or (suppressing  $c_1$  and  $c_3$ )

$$\begin{aligned} \max \quad & .5[\$100,000 - \$20,000 p''(s_1|c_2) - F(c_2)] = \\ & .5[\$100,000 - \$20,000 (.1) - \$3,000] = \$95,000. \end{aligned}$$

Note that  $\theta = .5$  in this case is the fraction of equity being sold to the user. Thus, if the financial statements are correct and the auditor cannot commit a type I error, he will issue an unqualified opinion. Having seen this opinion and the identity of the auditor, the user is willing to pay up to \$47,500 for the

shares. Since the user is price protected both with or without the audit, it is the *manager* who gains from the purchase of credibility.

Returning to the question of the appropriate offering price if there is no audit, consider the transaction in a market context. Suppose, for example, that ten investment opportunities of identical characteristics are available to the user. Furthermore, his prior probability of error is correct in the sense that three managers have overstated their reported cash flows while seven have not done so. If the user, without seeing an audit, offers to purchase a 50 percent interest in some firm at \$47,000, he can be *certain* that only a manager who misrepresented his cash flows will accept! Thus, he would not, in fact, offer \$47,000, but only \$40,000. At this price he will be fully protected against loss and managers whose financial statements are correct will be motivated to purchase auditor credibility, as described above. Thus, in a market context, where there are many similar potential users, there will be a distribution of auditor - client pairings, with perhaps some managers, who misrepresented their cash flows, purchasing no auditor credibility.

This example illustrates only one possible situation in which auditor credibility is valued by managers. The case is referred to in the literature as an "adverse selection problem" [e.g., Baiman, 1982] and credibility here serves as a signal of a manager's honesty, which itself is exogeneously given. However, since the user is fully price protected against manager misrepresentation, auditor credibility may also *change* the reporting behavior of a manager. For example, since the manager whose statements are unfair has fooled no one in this illustration, he may be motivated to correct existing errors and submit to a credible audit to increase the selling price of the shares.

Now consider the same situation, except that the user does not intend to assume an active role in the management of the firm, but will retain the former owner as the manager. Thus an agency relationship, and an attendant moral hazard problem arises. To forecast future cash flows as simply a continuation of the historical flow (either \$10,000 or \$8,000) would be naive, since the future agency costs which can be expected to result from the manager's reduced ownership interest in the firm are being ignored. Given the manager's known future trade-off between firm value and perquisite consumption, assume the user forecasts maximum agency costs to be \$1,000 per year.

In the absence of the agency relationship, the user would have assessed a prior probability of error of  $p'(s_2) = .3$ . However, knowing that the agency relationship will be created, we argue that the user is likely to assess a *higher* prior probability that the financial statements are erroneous. This is so because it is in the manager's interest to try to induce the user to bear some or all of the future agency costs through an initial overvaluation of the firm. Moreover, the *larger* the expected future agency costs, the *larger* the difference between the true and reported cash flows is likely to be. Returning to the example, if the manager still reports \$10,000 and the user believes cash flows could have been \$8,000 with a probability of  $p'(s_2) = .4$ , he will offer  $\frac{1}{2} [(\$8,000 - \$1,000) \div .1] = \$35,000$ . Again, managers who have not misrepresented their cash flows are motivated to hire auditors of appropriate (and relative to the previous case, higher) credibility. Conversely, given the user's complete price protection, managers who have initially misrepresented their cash flows may be motivated to change their reporting and purchase a credible audit.

Finally, in this case, if the user views a credible audit *now* as a commitment that such audits will continue to be obtained in the future, he may reduce the amount of his forecasted future agency costs below \$1,000. This is so because a credible audit prevents (imperfectly) managers from concealing the effects of such behavior (e.g., shirking, consuming excess perquisites, etc.) by overstating the cash flows reported in future financial statements. Depending upon the manager's utility trade-off between firm value now and the present value of future perquisite consumption, it may be optimal for the manager to commit to such future audits, thereby increasing the selling price of the shares.

#### IV. Concluding Comments

In this paper, we have analyzed the nature of differentiated audit services and the determinants of auditor choice. The perspective on the audit services market developed here differs significantly from the typical textbook view of auditing where any auditor can do anything, and also, we believe, from the conventional thinking of auditing practitioners and academics. Two conclusions in particular should be emphasized: First, we have argued that differentiation on an auditor credibility dimension arises from differences in demand which are themselves a function of differences in company characteristics. Thus, a ranking of audit firms on a credibility dimension has no pejorative implications. Second, given such differences in demand and auditor location, we expect to observe a relatively stable distribution of auditor-client pairs which reflects the optimum decisions of top management under existing circumstances. As we have seen, both the relationship between top management, the auditor, and financial statement users, and the characteristics of the audit service are quite complex. Our objective has been to develop a logical structure for this complex reality as a basis for understanding different auditor choices by top managements of different companies.

#### End Notes

1. Note that in his study of Australian audit fees, Francis [1984] found no evidence of low-balling. Also, while De Angelo demonstrates that "low balling" in first period bids is an equilibrium strategy in a world of certainty, it is not obvious that this bidding strategy is necessarily an equilibrium under uncertainty. However, even if low-balling does occur, the "strength" of the collateral bond will decrease over time as the initial fee discount is recovered through quasi-rents. Since auditor-client pairings tend to be long-lived (about 20 years on average), the motivational impact of the residual collateral bonds that will exist at any moment in time is not obvious.

2. Let  $q_i$  denote the quantity of product of the  $i^{\text{th}}$  firm and  $p_j$  denote the price of the product of the  $j^{\text{th}}$  firm, then the cross elasticity coefficient is

$$\eta_{ij} = (\partial q_i / \partial p_j) / (q_i / p_j)$$

where  $q_i = f_i(p)$  is the demand function faced by firm  $i$  and  $p = (p_1, \dots, p_m)$  is the vector of prices for the products of the  $m$  firms in the industry.

3. However, as noted earlier, there is a further complicating factor in such studies in that an audit *fee* is *not* a simple *price*, but rather the product of price times quantity of service purchased.

4. The standard assumption is that managers' utility functions include both wealth and effort as arguments. Managers are assumed to derive utility from wealth and disutility from effort. However, auditors and their services do *not* enter directly into the utility function.

5. The agency relationship has a long history as a form of social interaction. Ross [1973] characterizes the agency relationship as arising "between two (or more) parties when one, designated as the agent, acts for, on behalf of, or as representative for the other, designated the

principal, in a particular domain of decision problems.” Because the agent is himself an expected utility maximizing individual, it is unrealistic to assume that he will always necessarily act so as to maximize the expected utility of the principal. However, the principal can limit the divergence of interests by establishing incentives for the agent and by incurring monitoring costs. Likewise the agent may incur bonding costs to guarantee to the principal that he will not take certain actions. But these mechanisms are unlikely to perfectly align the divergent interests of the principal and agent(s)—it is, in fact, unlikely to be optimal to try to do so—with the result that there will still be some residual loss. Note, however, that the expanded opportunity set which the agency relationship allows must yield a net benefit to the principal (and perhaps the agent), else the relationship would simply not arise [see Jensen and Meckling, 1976].

6. In addition to this potential “asset substitution” problem, Smith and Warner [1979] list three other sources of conflict between an owner-manager and debtholders:

1) dividend payment—increasing dividend payout after the debt issuance (in the extreme, paying a liquidating dividend to shareholders, leaving the debtholders with a worthless claim).

2) claim dilution—unexpectedly issuing additional debt of equal or higher priority after the current debt issuance.

3) underinvestment—refusing to invest in positive net present value projects whose primary benefit accrues to the bondholders.

7. While only 15 percent of the companies voluntarily purchased a full audit, another 69 percent purchased either a review or compilation service, which are lower cost partial substitutes for the audit service. Moreover, as with the audit, the primary and secondary reasons given (with essentially the same frequencies) for the purchase of these audit substitutes were “control” and “credibility.”

8. In this data set, consulting services were defined to include any non-audit service *except* corporate tax work (i.e., return preparation, planning, etc.).

9. Throughout this monograph, the term “client” refers to the top management of a company.

10. A complete discussion of the exact nature of audit credibility is deferred until Section 3.

11. More precisely, it is the purchase of the best form of audit opinion (i.e., unqualified, qualified, or adverse) which management can expect given the characteristics of the financial statements being audited.

12. A related question is—how does the model compare to the way audit fees are ostensibly determined in practice? Audit services not performed under a fixed fee arrangement are normally billed using a set of hourly rates for the various grades of professional labor utilized. Even with a fixed fee, the amount bid can be conceived as a function of expected labor usage and the billing rate structure. But this process only defines a “standard fee” or upper bound on the amount collected. The standard fee may be discounted for a variety of reasons including perceived inefficiencies in labor usage, because the job utilizes resources which would otherwise be idle or underemployed, or under the pressure of competition. In addition, of course, the process through which standard billing rates are set is not known, hence the (billing rate x time) model is not a particularly useful way to view the process of audit fee determination.

13. Product scope would be measured by the expertise of the firm in supplying various types of consulting services. At a moment in time, the total level of such firm expertise is fixed. Note that it is the fixed costs associated with maintaining an expertise level for sale as needed which will cause the implicit price of scope ( $\lambda_3$ ) to be positive. However, only certain subsets of the total service package may be relevant and therefore priced to certain subsets of clients. For example, the ability to design and install computerized hospital accounting systems will be relevant to some clients but irrelevant to others. Hence, an audit firm may simultaneously offer different levels of  $c_3$  to different types of companies.

14. The offering of “near audit services,” such as reviews and compilations, by public accounting firms represents an attempt to reduce client opportunity losses in this situation.

15. The criterion of optimality normally used is whether the sum of consumer’s surplus plus producers’ excess profits is maximized [Schmalensee, 1978]. In an auditing context, consumer surplus can be interpreted in the normal way except that the demand curve is derived from top management’s objective function.

16. Auditors frequently distinguish between “errors,” which are mechanistically caused by deficiencies in financial reporting systems, and “irregularities,” which are the result of intentional attempts to bias, conceal, or otherwise misrepresent financial information. We make no distinction between these situations. However, it has been suggested that optimum audit program design,

given the possible presence of “irregularities,” must recognize the gaming nature of the situation [Fellingham and Newman, 1985].

17. This is essentially the audit risk model proposed by the Canadian Institute of Chartered Accountants [CICA, 1980].

18. Auditors have long recognized that the greatest risk with respect to the financial statements of publicly held companies (and companies with significant debt) is that assets, and hence net income, are overstated. The reasonableness of this concern was confirmed by St. Pierre and Anderson’s [1984] study of 129 lawsuits filed against auditors in the U.S. during the 1960’s and 1970’s. Of the 334 alleged errors in these suits “none. . . concerned errors in *undervaluing* assets, recognizing *inadequate* amounts of revenue, or recognizing *excessive* expenses” (p. 242).

19. To focus on the essential auditing aspects of the problem, assume a world of certainty, except for the state of the financial statements.

20. This statement assumes that the audit evidence indicates that no material errors exist. Presumably, if top management knew that a perfect audit would be performed, they would not attempt to deceive users. However, if this were not the case, the perfect audit still would resolve all uncertainty. Knowing that  $p^*(s_2) = 1$ , users could behave accordingly.

21. If the user falsely rejects the null hypothesis that the financial statements do *not* contain material errors, he may choose not to transact with top management or may request contract terms which will not be acceptable to management. In either case, the user loses whatever net benefits were available to him in the “trade.”

22. Assuming the auditor was technically capable of performing an audit of the company—given its size, complexity, geographic dispersion of operations, etc.; that is, he can deliver the required  $q$ , efficiently. Also, efficient production of higher levels of credibility may require higher fixed costs. This is discussed in Section 3.5.

23. This is, in fact, his “worst case” defense under statutes such as the Securities Act of 1933. Under the Securities Exchange Act of 1934, and probably under common law appealing to the Ultramares decision, the auditor can claim a mere absence of gross negligence or fraud as his defense.

24. For what amount of damages should the auditor be liable? In principal, since the auditor increased the user expected loss by \$.16 through his negligence, this should be the amount of damages assessed *each time the auditor is negligent*. However, not all instances of negligence are likely to be discovered *ex post*. While negligence by the auditor increases the *probability* of undetected material error (e.g., from .01 to .09 in case #4), negligence need not result in an actual audit failure. For example, assume auditor Z performs 100 audits in a given year (such as case #4) where users expect .99 credibility but only .90 is delivered. Users expect three audit failures and losses of \$6. However, suppose nine audit failures occur causing losses of \$18. Users will presumably seek damages of \$18 but only \$12 should be awarded, else the auditor is being implicitly held to a perfect audit standard. Conversely, if users are only awarded the increase in expected loss *in each case filed* or  $\$.16 \times 9 = \$1.44$ , they are grossly undercompensated. How much would actually be awarded is, of course, an open question but there is no apparent mechanism which would motivate a court to award the correct amount of \$12.

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