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The Pricing of Audit Services: Theory and Evidence

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1. Introduction

The question of the existence of competition among auditors has been the subject of considerable discussion in recent years. More specifically, the "Big Eight" firms as a group have been accused of monopolizing the market for audits (*Staff Study* of the Subcommittee on Reports, Accounting and Management of the Senate Committee on Government Operations [1977]). However, evidence on the issue is scanty and typically anecdotal (e.g., Bernstein [1978]). The evidence of the *Staff Study* itself is limited to concentration statistics, with the allegations relying on what has come to be called the "concentration doctrine" (Demsetz [1973]). According to this doctrine, supplier concentration is a reliable indicator of supplier behavior and performance. In this paper, I provide evidence from a test of the hypothesis that price competition prevails throughout the market for the audits of publicly held companies, irrespective of the share of a market segment which is serviced by the Big Eight firms. The evidence is based on an examination of a sample cross-section of audit fees.

In order to test the competitiveness of the audit industry using fee data, it is first necessary to develop a positive model of the process by which audit fees are determined. Since an audit fee is the product of unit price and the quantity of audit services demanded by the management of the audited company (hereafter called the auditee), cross-sectional dif-

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ferences in fees can represent either the effect of quantity differences or price differences. A positive model of the determinants of audit quantity and price suggests factors which need to be controlled before any inference about competition can be made from observed fee data.

Following Demski and Swieringa [1974], I consider the external audit to be a subsystem of an auditee's overall financial reporting system. In this regard, the audit service is viewed as an economic good to the auditee, which has substitutes and complements in consumption. Thus the quantity of auditing demanded by an auditee will result from a conventional equalization of marginal private benefits and costs.[1] However, the nature of the benefits which an auditee derives from the audit service is still an open question. I hypothesize that the potential legal liability of an auditee and auditor to financial statement users (shareholders, creditors, etc.) drives the design of external financial reporting systems. That is, the benefits are in the nature of liability avoidance. The implications of this sort of motivation are discussed later in this paper.

A second requirement for testing competition is the identification of a competitive benchmark. The typical approach in the industrial organization literature (see Weiss [1971]) is to make cross-sectional interindustry comparisons of market structure (generally measured by a concentration ratio) with performance (generally measured by an average rate of return earned by firms within an industry). In such studies, industries with "low" supplier concentration serve as a benchmark. However, any interindustry comparison of rates of return involves difficult problems of control for confounding differences, such as in risk. In this paper, the test for competition is an intraindustry comparison of prices, where the competitive benchmark is the market segment for "small" audits. An intraindustry test is possible because, as shown in table 1, the market dominance of the Big Eight firms increases significantly with the size of the audited company. Thus, I assume that price competition prevails in the submarket for the audits of "small" companies and test for the effects of increasing Big Eight concentration on prices paid by "large" auditees.

The data for this paper consist of 397 observations on audit fees and related variables obtained from a sample survey of publicly held corporations in the United States. The survey was conducted during 1977. The data were analyzed using a series of least-squares regressions where the specification of the regression equations was derived from the model of audit fee determination. Results include the identification of a number of

[1] The terms "audit" and "audit service" refer to the process of auditing, not the auditor's certificate which is attached to a set of financial statements. This distinction is necessary because the audit production function is clearly not single valued—audit processes of many different specifications can result in the same observed outcome. Much confusion can be avoided if one is careful to distinguish between these two elements. For example, while owners may demand that financial statements prepared by management be accompanied by an audit certificate, under existing institutional arrangements, it is the auditee management who demands the quantity of auditing which underlies that certificate.

TABLE 1

*Big Eight Firm Concentration Ratios in the Market for the Audits of Publicly Held Companies When Auditees Are Classified by Size**

Auditee Size as Measured by Sales (in millions)	Big Eight Concentration Ratio
$1 to $25	.59
$26 to $50	.76
$51 to $100	.82
$101 to $250	.88
$251 to $500	.91
Sales > $500	.95

* These concentration ratios are constructed from the data reported by Harris [1976] which consist of information on auditor identity, company size, etc. for 8,077 publicly held corporations. The concentration ratio is simply the number of auditees in each size class who were audited by one of the Big Eight firms, divided by the total number of companies in that class. Note that concentration ratios are generally constructed using the sales, assets, value added, or number of employees or sellers; however, such information is not available for CPA firms.

significant audit fee determinants, as well as failure to reject the hypothesis that price competition prevails throughout the market for financial audit services. The demand-based positive model of auditing developed in the paper also provides insights into the economics of auditing under current institutional arrangements.

2. *Assumptions of the Fee Determination Model*

I assume that both the auditee and auditor are risk neutral and seek to maximize their own expected profits each period. Thus, auditee management seeks to maximize the expected profits of the financial reporting entity, while the auditor seeks to maximize the expected profits of the auditing firm. Both parties can purchase resources in competitive factor markets. Further, let:

a = the quantity of resources utilized directly by the auditee in operating the internal accounting system
q = the quantity of resources utilized by the auditor in performing the audit examination
v = the per-unit factor cost of internal accounting system resources to the auditee
c = the per-unit factor cost of external audit resources to the auditor, including all opportunity costs and therefore a provision for a normal profit.

I assume that resources are utilized efficiently so that a and q not only denote inputs to the auditee's financial reporting system but also correspond to unique quantities of output constructs which may be called internal accounting control and external audit control, respectively. Thus,

a financial reporting system is completely described by the ordered pair (a, q).

Assume that the auditee and auditor are jointly and severally liable to financial statement users for losses attributable to defects in the audited financial statements.[2] Further, the benefits from the financial reporting system (a, q), derive solely from reduction of losses to financial statement users. Let the random variable, $\tilde{d}$, denote the present value of possible future losses which may arise from this period's audited financial statements. Thus, $E(\tilde{d}) = f(a, q)$. Assume that the auditee and auditor identically assess this function which has first- and second-order partial derivatives where:

$$\frac{\partial E(\tilde{d})}{\partial a} < 0 \qquad \frac{\partial^2 E(\tilde{d})}{\partial a^2} > 0 \qquad \frac{\partial^2 E(\tilde{d})}{\partial a \partial q} > 0.$$

$$\frac{\partial E(\tilde{d})}{\partial q} < 0 \qquad \frac{\partial^2 E(\tilde{d})}{\partial q^2} > 0 \qquad \frac{\partial^2 E(\tilde{d})}{\partial q \partial a} > 0.$$

And at any given level of $E(\tilde{d})$:

$$\frac{da}{dq} < 0 \qquad \frac{d^2 a}{dq^2} > 0.$$

Since liability is joint and several, actual losses will somehow be divided between the two parties. Let θ denote the ex-post fraction of losses borne by the auditor where:

$$0 \leq \theta \leq 1.$$

At the time of the audit, this loss apportionment factor is also a random variable. Assume that the auditee and auditor identically assess $E(\tilde{\theta})$ and assume that $\tilde{d}$ and $\tilde{\theta}$ are independent.

Finally, let p denote the unit price of external audit services to the auditee; that is, the price per unit of q purchased by the auditee from the auditor. The auditor's revenue derived from an audit engagement is therefore pq, or the audit fee.

3. *The Auditee's Problem When the Market for Audits Is Competitive*

An expected profit-maximizing auditee will seek to minimize the expected periodic costs of operating a financial reporting system. Let TC

[2] Section 11(f) of the Securities Act of 1933 and Section 18(b) of the Securities Exchange Act of 1934 provide for joint and several liability on the part of auditees and auditors. Under these provisions, the entire amount of damages suffered by a third party can be collected from any one of the liable persons, with that person generally retaining rights to collect from all other persons who are also liable.

denote the total costs of the system. The auditee's problem can initially be expressed as an unconstrained minimization of expected total costs:

$$\min E(\tilde{TC}) = va + pq + E(\tilde{d} \mid a, q)(1 - E(\tilde{\theta})). \tag{1}$$

In this problem, the choice variables are the systems design, (a, q), whereas v is a market parameter, $E(\tilde{\theta})$ is an unconditional expectation, and $E(\tilde{d})$ is an expectation conditional on the system's design. The value of p, on the other hand, will depend on the state of competition in the market for audit services.

An auditor's minimum supply price per unit of q is marginal cost. Alternatively, his minimum fee for different levels of audit quantity will be equal to his incremental expected total cost, denoted $E(\tilde{C})$, where:

$$E(\tilde{C}) = cq + E(\tilde{d} \mid a, q)E(\tilde{\theta}). \tag{2}$$

Note that the auditor's expected costs are a function of the auditee's financial reporting system. Since by definition, the parameter c includes all costs of a unit of q, including a normal return,[3] when the market for audits is competitive $pq = E(\tilde{C})$, and the auditee's problem becomes:

$$\min E(\tilde{TC}) = va + cq + E(\tilde{d} \mid a, q)E(\tilde{\theta}) + E(\tilde{d} \mid a, q)(1 - E(\tilde{\theta})) \tag{3}$$

or simply:

$$\min E(\tilde{TC}) = va + cq + E(\tilde{d} \mid a, q). \tag{4}$$

The necessary condition for the expected cost minimization is:

$$\frac{\partial E(\tilde{TC})}{\partial a} = \frac{\partial E(\tilde{d})}{\partial a} + v = 0 \quad \text{or} \quad -\frac{\partial E(\tilde{d})}{\partial a} = v.$$

$$\frac{E(\tilde{TC})}{\partial q} = \frac{\partial E(\tilde{d})}{\partial q} + c = 0 \quad \text{or} \quad -\frac{\partial E(\tilde{d})}{\partial q} = c.$$

This condition states that the auditee will demand quantities of a and q up to the point where the marginal reduction in expected liability losses is equal to the auditee's marginal resource cost. The solution to this system of equations under competition is denoted $(\hat{a}, \hat{q})$.

While the solution values $(\hat{a}, \hat{q})$ are obtained simultaneously, the nature of internal accounting systems and external auditing suggests that implementation of the solution by the auditee is sequential, that is, $\hat{a}$ is followed by $\hat{q}$. This is consistent with the normal technical auditing model wherein an auditor's audit program design is a function of the internal accounting system. However, to what extent does the model allow for independent action on the part of auditors in attaining the solution $(\hat{a}, \hat{q})$? In other words, given that the auditee has computed $(\hat{a}, \hat{q})$ and

[3] It is reasonable that an auditor's return to capital be computed per unit of q rather than per engagement, since an auditor's capital itself is predominantly general rather than engagement specific.

installed the internal accounting system $\hat{a}$, what additional conditions are necessary for the auditor to perceive that an audit examination of scope $\hat{q}$ is in his own best interests? An agreement on the amount of the audit fee, $p\hat{q}$, insures only that $q \leq \hat{q}$, since for larger values of q an auditor would fail to earn a normal return. To insure that audit scope is in fact equal to $\hat{q}$, it is necessary to assume (in a single-period model) that the auditee is able to evaluate q.

It is also worth noting that the solution $(\hat{a}, \hat{q})$ is invariant to the incidence of third-party liability. Equation (3) will reduce to equation (4) for all values where $0 \leq E(\tilde{\theta}) \leq 1$. This result holds because the auditee expects to incur all systems costs and is assumed to be indifferent about whether costs occur in the form of the cost of internal accounting systems $(v\hat{a})$, the external audit fee $(c\hat{q} + E(\tilde{d} \mid \hat{a}, \hat{q})E(\tilde{\theta}))$, or the expected present value of the auditee's share of residual liability losses $E(\tilde{d} \mid \hat{a}, \hat{q})(1 - E(\tilde{\theta}))$. However, attainment of the competitive solution when $E(\tilde{\theta}) > 0$ requires that the auditee recognize that p is not a fixed value but a function, $p(a, q)$. In addition, when $E(\tilde{\theta}) > 0$, the auditee must be able to analyze the component terms of equation (2). Thus, if one assumes that analysis is costly, the imposition of third-party liability upon the auditee alone is preferable to a regime of joint and several liability, unless there are sufficient offsetting benefits associated with existing arrangements.

4. The Auditee's Problem in a Noncompetitive Market Setting

Suppose that a dominant subset of auditors (e.g., the Big Eight firms), through collusion, agree to limit price competition so as to introduce an element of monopoly profit into audit prices. Let m represent the amount of monopoly rent included in the unit price p.[4] The fee schedule of an auditor who was a member of the cartel would be:

$$pq = (c + m)q + E(\tilde{d} \mid a, q)E(\tilde{\theta}).$$

Substituting into equation (1) and simplifying, an auditee would seek to:

$$\min E(\tilde{TC}) = va + (c + m)q + E(\tilde{d} \mid a, q).$$

And the necessary condition for the minimization would be:

$$-\frac{\partial E(\tilde{d})}{\partial a} = v$$

$$-\frac{\partial E(\tilde{d})}{\partial q} = c + m.$$

[4] In principle, a group of auditors acting as a cartel could be expected to compute and incorporate into p, a joint profit-maximizing value of m. However, to demonstrate the effects of monopoly pricing, determination of the optimum m is not necessary and I merely assume that $m > 0$.

By inspection, the revised solution value of q, denoted q_m, must decrease relative to $\hat{q}$. In addition, since:

$$\frac{\partial^2 E(\tilde{d})}{\partial a \partial q} > 0,$$

the reduction of q makes the value of $\partial E(\tilde{d})/\partial a$ more negative at any a, and thus the desired quantity of internal accounting under monopoly, denoted a_m, must be greater than $\hat{a}$. However, because of diminishing substitutability between internal accounting and external audit resources in controlling liability losses, it must also be true that:

$$E(\tilde{d} \mid a_m, q_m) > E(\tilde{d} \mid \hat{a}, \hat{q}), \quad \text{and} \tag{5}$$

$$E(\tilde{TC} \mid a_m, q_m) > E(\tilde{TC} \mid \hat{a}, \hat{q}). \tag{6}$$

That is, monopoly pricing induces a substitution away from q toward a relatively less productive resource, a, which results in an increase in the desired level of expected residual liability losses (relation (5)). This effect can be described as a decrease in the quality of the auditee's financial reporting system because financial statements are now more likely to be defective, resulting in larger expected liability payments to third parties. In summary, auditor monopoly reduces the quantity demanded of external auditing and results in lower-quality, higher-cost financial reporting systems.

By definition, monopoly pricing increases the unit price of external auditing, p. However, the effect upon observable audit fees is indeterminate. That is:

$$pq_m \gtreqless p\hat{q},$$

depending upon the price elasticity of demand implicit in the auditee's cost minimization problem at the competitive solution point $(\hat{a}, \hat{q})$. If the implicit demand function is inelastic in the vicinity of the point $(c, \hat{q})$, then for small values of m, the audit fee would increase, while if demand was elastic in that vicinity, the audit fee would decrease.

While the increase in p has no clear implication for the audit fee itself, I have shown that the auditee's total systems costs must increase in a monopoly setting. However, $E(\tilde{TC})$ includes an unobservable cost component, $E(\tilde{d} \mid a, q)(1 - E(\tilde{\theta}))$, the share of residual losses expected to be incurred directly by the auditee. Unless the entire increase in $E(\tilde{TC})$ occurs in this unobservable component, which is unlikely,[5] monopoly pricing will increase an auditee's observable systems costs, or:

$$va_m + pq_m > v\hat{a} + p\hat{q}.$$

[5] For this to occur, it is necessary that $E(\tilde{\theta}) = 0$ and that the entire increase in $E(\tilde{TC})$ be in the expected residual loss component.

5. *The Effects of Auditor Production Economies on Financial Reporting Systems*

While I assume that the factor costs of resources are uniform to all auditors, the production functions of audit firms may nevertheless differ. In the model, production is measured by reduction of expected liability losses. Therefore, allowing for production function differences implies that $\partial E(\tilde{d})/\partial q$ may vary across auditors.

If specific auditors enjoy unique economies in production, then these firms will earn economic rents, but the characteristics of auditee financial reporting systems, including audit fees, will not be affected. Such economies are not of interest here. Alternatively, there may exist sources of economies which can be exploited, at least potentially, by more than one auditor. If there is competition among the auditors who achieve the economies, then rents would be bid away and audit prices would decrease. In addition, in equilibrium, auditees would only demand services from those auditors who fully achieved the available economies.

The necessary condition for the minimization of expected costs with economies is:

$$-\frac{\partial E(\tilde{d})}{\partial a} = v$$

$$-\lambda\frac{\partial E(\tilde{d})}{\partial q} = c \quad \text{or} \quad -\frac{\partial E(\tilde{d})}{\partial q} = \frac{c}{\lambda}$$

where the parameter $\lambda \geqq 1$ denotes an auditor's relative efficiency in reducing expected losses. For auditors who achieve economies, $\lambda > 1$. I will denote the auditee's expected cost-minimizing solution with economies as (a_e, q_e). The characteristics of this solution are the reverse of the monopoly results. That is, while p decreases, the sign of the change in audit fee is indeterminate, since the auditee is motivated to substitute q for a and the net change in pq depends on the price elasticity of the implicit demand function for external auditing. As in the case of monopoly, unless the entire change occurs in the auditee's share of residual losses, which is unlikely, then:

$$va_e + pq_e < v\hat{a} + p\hat{q}.$$

6. *Effects of Variations in Assessed Loss Functions*

The loss function, $E(\tilde{d}) = f(a, q)$, will vary across audit engagements. The assessment of this function by the auditee and auditor can be expected to reflect all available information, including historic loss experiences under similar circumstances. The spatial location of the function assessed for a specific engagement can be influenced by many factors, including the legal environment and various internal characteristics of the engagement, which I call determinants of loss exposure. Possible

variables which might be associated with such differences are discussed in a later section. At this point, I simply note that a uniform upward displacement of the loss function in the $(E(\tilde{d}), a, q)$ space, that is, greater loss exposure at any (a, q), increases the marginal benefits from expected loss reduction and results in expansion of the cost-minimizing financial reporting system. Note that there is no change in relative prices. Rather, the expansion of a and q is complementary. As a result, each of the three components of the auditee's expected total costs, namely, va, pq, and $E(\tilde{d} \mid a, q)(1 - E(\tilde{\theta}))$, can be expected to increase. Finally, this increase in demand for both control resources will occur under any and all of the three industry scenarios—competition, monopoly, and auditor economies—discussed in the previous sections.

7. *Summary of the Model and Development of the Test for Competition*

The implications of the model, in the form of directional changes in the auditee's decision variables and related costs, are summarized in table 2. The changes described in the first two columns of the table are measured against the competitive solution; the last two columns describe the effects of differences in assessed loss functions and the loss-sharing ratio. The characteristics of auditee financial reporting systems are grouped into two categories, unobservable and observable. Included in the former are the auditee's share of residual losses, the price of audit services, and the quantities of internal accounting control and external audit control which the auditee demands.

TABLE 2

Implications of the Model with Respect to Cross-Sectional Differences in the Characteristics of Auditee Financial Reporting Systems

	Monopoly Pricing	Production Economies	Increase in Auditor's Share of Losses	Increase in Loss Exposure
Unobservable:				
Auditee's share of residual losses $E(\tilde{d} \mid a, q)(1 - E(\tilde{\theta}))$	+	−	−	+
Unit price of the audit service (p)	+	−	+	none
Quantity of internal accounting control (a)	+	−	none	+
Quantity of external audit control (q)	−	+	none	+
Observable:				
Audit fee (pq)	Depends on implicit price elasticity of demand		+	+
Cost of internal accounting control (va)	+	−	none	+
Sum $(va + pq)$	+	−	+	+

Recall from the assumptions of the model that a and q either can be thought of as generalized quantities of factor inputs or as output constructs. As outputs, these quantities are not observable. It is the output construct, external audit control, which is priced in the market for audit services and the price, p, is likewise not observable. Rather, we can only observe the fee, pq. In the case of internal accounting, there is no intervening output market and thus no market price. However, assuming efficiency in resource use, va and pq are commensurable.

Based on the model, the hypothesis that price competition prevails throughout the market for audit services can be tested using the sum of observable systems costs, $va + pq$. Before I develop the test, note that while the Big Eight firms have been accused of monopolizing the market for audit services, these firms are also the most likely to have exploited available economies of scale. Furthermore, scale economies can exist in either a monopolistic or a competitive market setting. Note also that audit services may be differentiated. With respect to product differentiation, the market for audits is a hedonic market (see Rosen [1974]). That is, differentiated products are not observed directly but rather are revealed by differences in prices which are associated with differences in observed product characteristics. In auditing, the principal differentiating characteristic of the service is likely to be the identity of the supplier, and again it is the Big Eight firms which enjoy visibility and brand-name recognition among buyers. Thus, the pricing of audit services can be expected to be complex, and any price differences between Big Eight firms and other auditors must be interpreted with care.

Given these considerations, to test the hypothesis of competition it is first necessary to control for cost differences arising from differences in loss exposure and the expected loss-sharing ratio. Call the cost not explained by these factors the cost residual. Next, classify auditee corporations into two size categories, "small" and "large,"[6] and classify auditors as Big Eight or non-Big Eight firms. The purpose of the auditee size classification is to partition the market into a segment where auditees can and do purchase services from a large number of suppliers and which can therefore be assumed competitive, and a segment where the Big Eight are highly dominant and may behave as a cartel. Differences in the average cost residuals between auditees using Big Eight and those using non-Big Eight firms can then be interpreted using table 3. Note that the test requires a joint comparison of differences in average cost residuals in both market segments; that is, results in the "large" auditee segment can only be interpreted by reference to the competitive benchmark. Finally, in interpreting possible findings, I assume that if the Big Eight firms collude to increase prices in the "large" auditee segment, their non-Big Eight competitors would seek to expand market share and price consist-

[6] For the moment, the bound between these categories is not specified.

TABLE 3

Test for Competition: Interpretation of Possible Differences in Average Residual Total Systems Costs of Auditees Using Big Eight versus Non-Big Eight Auditors across Market Segments

Results for the "Large" Auditee Segment	Results for the "Small" Auditee Segment		
	$(CRE \mid 8) > (CRE \mid \bar{8})$	$(CRE \mid 8) = (CRE \mid \bar{8})$	$(CRE \mid 8) < (CRE \mid \bar{8})$
$(CRE \mid 8) > (CRE \mid \bar{8})$*	Competition with differentiated product to the Big Eight	Monopoly pricing by the Big Eight	Monopoly pricing by the Big Eight together with scale economies to the Big Eight
$(CRE \mid 8) = (CRE \mid \bar{8})$	Competition with differentiated product to the Big Eight together with diseconomies to non-Big Eight with "large" auditees**	Competition without any scale economies to the Big Eight	Monopoly pricing by the Big Eight together with scale economies to the Big Eight
$(CRE \mid 8) < (CRE \mid \bar{8})$	Competition with differentiated product to the Big Eight together with diseconomies to non-Big Eight with "large" auditees	Competition with diseconomies to non-Big Eight with "large" auditees	Competition with scale economies to the Big Eight

* $(CRE \mid 8)$ denotes the average residual costs of auditees using a big Eight firm and $(CRE \mid \bar{8})$ denotes the average residual costs of auditees using a non-Big Eight firm.

** The combinations wherein the costs of *large auditees only* are lower when a Big Eight firm is the auditor would be evidence of economies to the Big Eight or diseconomies to the non-Big Eight when performing large audits. Note that this is not evidence of economies to auditor size, arising, for example, from staff specialization, since the effect is limited to a certain audit context. As a result, I would interpret such findings as evidence of diseconomies to smaller auditors when servicing large auditees.

ent with their own cost conditions, rather than to maintain the cartel price.

8. *Control Variables for Differences in Loss Exposure*

Little is presently known about sources of variations in liability loss exposure across audit engagements. To obtain some initial insights, I discussed the question with Chicago-area representatives of each of the Big Eight firms and with representatives of a number of organizations

writing professional liability insurance coverage for accountants.[7] From these discussions, the following general factors were identified as possible determinants of loss exposure: (*a*) the size of the auditee, (*b*) the complexity of the auditee's operations, (*c*) auditing problems associated with certain financial statement components, especially inventories and receivables, (*d*) the industry of the auditee, and (*e*) whether the auditee is a publicly or closely held company. The data for this research were obtained solely from publicly held corporations and thus were homogeneous with respect to the last factor. The variables and their measures used to control for the remaining factors are described below. Each variable is assigned a mnemonic name for ease of further reference.

SIZE OF THE AUDITEE

I measured the size of the auditee by the entity's total year end assets (variable name *ASSETS*). A priori, the stock of assets seems more closely related to possible loss exposure than would an accounting flow measure, such as revenue, because defective financial statements which result in a lawsuit frequently involve some deficiency in asset valuation. In addition, external auditors have traditionally approached the audit process through the ending balance sheet, relying on the fact that verification of balance sheet components indirectly verifies reported income. Note also that both internal accounting and external auditing are sampling-based processes. To the extent that increases in measured total assets of auditees reflect increases in the number of individual elements which comprise the accounting populations of which total assets are composed, then the sample size required to achieve a given level of control will increase at a decreasing rate. Thus, I hypothesized that the positive relationship between *ASSETS* and both q and a is nonlinear.

COMPLEXITY OF THE AUDITEE'S OPERATIONS

Loss exposure can be expected to increase, the greater the decentralization and diversification of the financial reporting entity. Both of these aspects of complexity increase the number of decision centers in an organization whose activities need to be monitored. The recent controversy over illegal corporate payments and the resulting internal control requirements imposed by the Foreign Corrupt Practices Act reflect the overall problem of controlling large decentralized organizations.

In this study, I measured decentralization by the number of consolidated subsidiaries which are included in the auditee's financial statements (variable name *SUBS*). The diversification of the auditee is measured using two variables: (1) the number of Standard Industrial Classification System two-digit industries in which the auditee operates, less one

[7] Information was obtained from the following insurers: American Home Assurance Company, the St. Paul Companies, Chubb Custom Market, Inc., Crum & Forester Insurance Companies, and Lloyd's Underwriters' Non-Marine Association.

(variable name *DIVERS*), and (2) by the ratio of the auditee's foreign to total assets at year-end (variable name *FORGN*).

RECEIVABLES AND INVENTORIES

Auditors have long recognized that certain accounting populations involve potentially greater loss exposure through the loose notion of "relative audit risk" (see, e.g., Lenhart and Defliese [1957]). In this sense, both receivables and inventories are "risky" balance sheet components. Specific auditing procedures (confirmation and observation) are recommended for these accounts. Moreover, the valuation of these items is a complex task, requiring a forecast of future events. Liability exposure is thus expected to vary cross-sectionally with the relative size of receivables and inventories in different auditee balance sheets. To control for these differences, I used the two ratio variables: receivables to total assets at year-end (variable name *RECV*) and inventories to total assets at year-end (variable name *INV*).

PRINCIPAL INDUSTRY OF THE AUDITEE

While loss exposure may well vary with the industry(ies) in which an auditee operates, there is really no basis to hypothesize any specific industry effects. However, possible differences in q and a associated with industry classification were also investigated in the sample data.

9. *Control Variables for Differences in the Assessed Loss-Sharing Ratio*

A plausible, and probably the only measurable, determinant of $E(\tilde{\theta})$ is evidence of auditor or auditee financial distress. Recall that the auditor and auditee are assumed to assess identical distributions on $\tilde{\theta}$. Evidence of auditor financial distress increases the probability that the realization of $\tilde{\theta}$ will be $\theta = 0$; that is, all losses must be paid by the auditee because the auditor is insolvent. Thus $E(\tilde{\theta})$ would decrease. Conversely, evidence of auditee financial distress increases the probability that realized $\theta = 1$, due to auditee insolvency, and $E(\tilde{\theta})$ would increase.

Because public accounting firms are private partnerships, evidence which might be used to assess possible financial distress of auditors is difficult to obtain. As a result, I did not control for this effect.

I used three variables to control for cross-sectional differences in $E(\tilde{\theta})$ arising from auditee financial difficulty. The first is a measure of the auditee's accounting rate of return in the current year, the ratio of net income to total assets at year-end (variable name *PROFIT*). $E(\tilde{\theta})$ is expected to increase as the rate of return decreases. Note that rate of return measures have been found useful in bankruptcy studies (e.g., Beaver [1968] and Altman [1968]) for discriminating between "failed" and "nonfailed" firms. The second variable is a (0, 1) variable which was

assigned a value of one if an auditee had incurred a net loss during any one of the current or two prior fiscal years (variable name *LOSS*). Finally, I used another (0, 1) variable to identify those auditees who received a "subject to" qualified audit opinion in the current year (variable name *SUBJ*). A "subject to" qualification is given when there exist significant uncertainties which may result in future losses to the auditee. In the United Kingdom, Firth [1978] found that the issuance of an opinion form equivalent to a "subject to" (namely, "asset valuation" and "going concern" qualifications) by a U.K. auditor had a significant negative impact on the market price of the auditee's securities. Thus, the conditions which underlie the issuance of a "subject to" opinion were hypothesized to affect the assessment of $E(\tilde{\theta})$ such that $E(\tilde{\theta})$ increases when *SUBJ* takes on a value of one.

10. Differences in Auditor Production Functions

There has been essentially no previous research in the area of auditor production functions and sources of production economies. In my study, I did not investigate directly any specific sources of economies to scale. Rather I inferred the presence of some unspecified economies to firm size if, as described in table 3, the residual systems costs of "small" companies using Big Eight auditors were, on average, lower than the costs of "small" companies using non-Big Eight auditors.[8] The argument is analagous to a test for scale economies based on the survivor principle (see Stigler [1968]), in that the current state of the industry might arise from any number of factors which increase the relative efficiency of the Big Eight firms.

I did, however, control for the possible source of production function differences across engagements brought about by reductions in q because of auditor learning over time. The reduction of cumulative average costs through learning during successive performances of a task has been observed in several physical production situations. A similar phenomenon can be expected in auditing if the auditee employs a given auditor for a number of years. Normally, the effects of learning would be measured using time series of production and cost data. But, a learning effect can also be observed in a cross-section of audit fees if the effect is sufficiently large and the length of auditee/auditor association varies in the sample. To control for possible differences in q from this source, I included as a control variable the number of years an auditee has used its current

[8] To infer the presence of scale economies to the Big Eight, it is both necessary and sufficient that $(CRE \mid 8) < (CRE \mid \bar{8})$ in the competitive market segment. Of course, if the Big Eight do not price as a cartel, then the same relationship would be observed in the market segment for "large" audits.

auditor (variable name *TIME*).[9] The relationship between *TIME* and q was hypothesized to be negative.

11. Measurement of the Dependent Variables

The auditee's total observable systems costs consist of the two components, va and pq. Since the audit fee is a payment made in a market transaction, measurement of pq was relatively straightforward. This element of total cost is denoted by the variable named *FEE*.

Identification and measurement of the empirical counterpart of the va component was substantially more difficult. From the model, note that internal accounting resources are only relevant to a test for competition among external auditors if the (a, q) resources are substitutable. In order to obtain a relevant measure of va for purposes of this study, it was sufficient to identify and measure those elements of internal systems costs which could reasonably be substituted for external audit services. Based on this argument, I measured va using the salaries paid by the auditee to its internal auditors. This element of total cost is denoted by the variable named *ICOST*.

While the test for competition is based on residual differences in the sum of *FEE* + *ICOST*, the individual components may differ in degree of measurement error and are each of interest. Therefore, in the analyses which follow, I examine the behavior and determinants of the separate components as well as of the sum.

The variables, their measures, and hypothesized relationships are summarized in table 4. The average residual difference in the systems costs of auditees across the two auditor classes is measured by the coefficient of a (0, 1) variable named *AUDITOR* which is assigned a value of one when the auditor is a Big Eight firm. The questionnaire used to obtain data on these variables is available on request.

12. Design and Results of the Survey

The basis for the survey was the list of publicly held corporations and their auditors comprising the 1976 edition of *Who Audits America*? This list includes 8,077 companies classified by sales volume and auditor identity. A stratified sample of 1,207 companies was contacted during 1977 through a questionnaire mailed to a principal financial officer of the corporation. The size of the sample was based on an informal assessment of the marginal benefits-costs of sampling and an expected response rate of 30 to 40 percent.[10] The sample is stratified by size of auditee (companies

[9] As learning occurs, an external auditor becomes relatively more efficient in reducing losses and, from the model, the auditee is motivated to substitute q for a. However, adjusting a control system is probably costly, and I do not expect to observe nor do I control for this effect in the empirical work.

[10] The response rate to the Financial Executive Institute's audit fee survey of its members was 41 percent (Hobgood and Sciarrino [1972]).

TABLE 4

Summary of Variables and Hypothesized Relationships

	Name	Relationship to Auditee's Systems Cost Component	
		FEE	*ICOST*
Control variables for differences in loss exposure:			
1. Total assets at year-end	*ASSETS*	+	+
2. Number of consolidated subsidiaries	*SUBS*	+	+
3. Number of two-digit SIC industries in which auditee operates, less one	*DIVERS*	+	+
4. Foreign assets ÷ total assets at year-end	*FORGN*	+	+
5. Accounts, loans, and notes receivable ÷ total assets at year-end	*RECV*	+	+
6. Inventories ÷ total assets at year-end	*INV*	+	+
Control variables for differences in the assessed loss-sharing ratio:			
7. Net income ÷ total assets	*PROFITS*	−	N/A
8. (0, 1) variable where (1) if auditee incurred loss in any of last three fiscal years	*LOSS*	+ N/A	
9. (0, 1) variable where (1) if auditee received a "subject to" qualified opinion	*SUBJ*	+	N/A
Control variable for differences in auditor production functions:			
10. Number of years auditee has used current auditor	*TIME*	−	N/A
Auditor identity:			
11. (0, 1) variable where (1) if auditor is a Big Eight firm	*AUDITOR*	any—see table 3	
Dependent variables:			
12. Amount of current year's external audit fee	*FEE*		
13. Salaries paid to internal auditors in current year	*ICOST*		

with sales less than $125 million versus those with sales greater than that amount) and by auditor group (Big Eight firm versus non-Big Eight firm). The "small" auditee segment was bounded at $125 million, since the marginal Big Eight market share for clients of this size and larger approaches 90 percent. Thus the hypothesis that competition prevails in the market for audits of companies greater than about this size becomes difficult to maintain, a priori.[11]

[11] That is, a market share this large would surely be sufficient evidence, to a believer in the "concentration doctrine," that the market segment was not competitive. Even a smaller

TABLE 5
Responses by Stratum

	Small Auditees (sales less than $125 million)	Large Auditees (sales greater than $125 million)	All Auditees
Big Eight auditor:			
Sample requests	333	425	758
Usable responses	117	172	289
Response rate	35%	40%	38%
Non-Big Eight auditor:			
Sample requests	326	123	449
Usable responses	70	38	108
Response rate	21%	31%	24%
All auditors:			
Sample requests	659	548	1207
Usable responses	187	210	397
Response rate	29%	37%	33%

Within each stratum, sample units were selected at random. Response rates by stratum are shown in table 5. Follow-up second requests were sent to approximately 50 percent of initial nonrespondents, with an emphasis on those strata with a low response rate.

13. *Test for Nonresponse Bias*

I examined the possibility that respondents and nonrespondents were not homogeneous with respect to relevant characteristics by comparing the values of variables reported by early and late respondents, a standard test for nonrespondent biases (see Oppenheim [1966]). Means and standard deviations (where applicable) of the values of reported variables for the two groups are shown in table 6. The early respondents are those whose replies were received during the first three weeks (the declared due date of the mailing), while the late respondents consist primarily of those companies who replied to the second request.

Note from table 5 that nonresponse was more frequent among smaller companies and those auditees using non-Big Eight auditors. Table 6 shows that while the size of early and late respondents was approximately the same, a substantially larger proportion of late respondents used a non-Big Eight auditor. This supports the argument that late respondents were good proxies for nonrespondents. Since the mean values of the various other variables were substantially identical, the data obtained do not seem to be biased. However, I still cannot explain the reluctance of companies using non-Big Eight auditors to respond to the survey.

market share might be sufficient to support an allegation of monopoly, but there is no basis to determine a minimum required share. Thus the bound is necessarily somewhat arbitrary.

TABLE 6
Test for Nonresponse Bias

		188 Early Respondents	47 Late Respondents
ASSETS:	mean	$389,125M	$384,682M
	std. dev.	(918,908)	(756,725)
SUBS:	mean	13	15
	std. dev.	(20)	(44)
DIVERS:	mean	.89	.91
	std. dev.	(1.32)	(1.47)
FORGN:	mean	.07	.06
	std. dev.	(.17)	(.13)
RECV:	mean	.23	.24
	std. dev.	(.16)	(.18)
INV:	mean	.23	.26
	std. dev.	(.18)	(.28)
PROFIT:	mean	.06	.06
	std. dev.	(.07)	(.05)
LOSS:	percent of companies with net losses	20%	21%
SUBJ:	percent of companies with a "subject to"	10%	10%
TIME:	mean	18	19
	std. dev.	(13)	(16)
FEE:	mean	$170M	$193M
	std. dev.	(258)	(337)
AUDITOR:	percent of companies using a Big Eight auditor	71%	42%

14. *Test of the Determinants of Audit Fees*

Data received from the respondents are summarized in table 7, using means and standard deviations (in parentheses) for the arithmetic variables, and the percentage of observations when the variable takes on a value of one for the categorical variables.

The hypotheses about the determinants of the audit fee component of total observable costs were tested by obtaining least-squares' estimates of the coefficients of the variables in the following linear regression function:

$$\frac{FEE}{ASSETS^{e}} = b_0 + b_1 SUBS + b_2 DIVERS + b_3 FORGN + b_4 RECV + b_5 INV + b_6 PROFIT + b_7 LOSS + b_8 SUBJ + b_9 TIME + b_{10} AUDITOR + \tilde{u}$$

where the variables were constructed as described in table 4, and where the error term, $\tilde{u}$, was assumed to have the standard properties.[12] The

[12] Examination of various scatter plots of residuals indicates that the residual variance is homogeneous when the square-root transformation is used. However, with the cube-root transformation, as well as with a log transformation of *ASSETS*, which was also examined, the error variance is correlated with *ASSETS*. When the exponent is varied from .33 to .5, the signs of significant coefficients are unchanged and there are only small changes in the *t*-values for all coefficients.

TABLE 7
Descriptive Statistics for Variables

		By Auditee Size		By Auditor Group	
	397 Total Observations	187 Auditees with Sales Less Than $125 million	210 Auditees with Sales Greater Than $125 million	289 Auditees Using a Big Eight Auditor	108 Auditees Using a Non-Big Eight Auditor
FEE	$206.6M	$77.1M	$322.0M	$226.6M	$153.0M
	(277.1)	(71.4)	(355.0)	(266.9)	(297.2)
ICOST	$112.0M	$29.0M	$202.8M	$141.0	$ 45.5M
	(271.0)	(83.0)	(361.8)	(308.2)	(134.2)
ASSETS	$555.1MM	$176.7MM	$891.9MM	$695.6MM	$178.9MM
	(1,194.5)	(640.7)	(1,147.7)	(1,311.8)	(672.8)
SUBS	16.9	7.0	25.6	18.1	13.4
	(30.5)	(13.9)	(37.8)	(31.1)	(28.8)
DIVERS	.9	.6	1.3	1.0	.7
	(1.4)	(.9)	(1.6)	(1.4)	(1.1)
FORGN	.07	.05	.11	.08	.05
	(.15)	(.11)	(.17)	(.15)	(.11)
RECV	.23	.24	.18	.23	.23
	(.17)	(.18)	(.11)	(.17)	(.14)
INV	.23	.25	.23	.20	.29
	(.19)	(.21)	(.17)	(.17)	(.23)
PROFIT	.06	.06	.06	.06	.07
	(.06)	(.08)	(.04)	(.04)	(.08)
LOSS	16.3%	25.7%	8.1%	13.8%	23.1%
SUBJ	8.0%	8.5%	7.6%	8.0%	9.3%
TIME	19.0 yrs.	13.7 yrs.	23.8 yrs.	19.9 yrs.	16.6 yrs.
	(15.2)	(12.0)	(16.1)	(15.8)	(12.9)
AUDITOR	72.5%	62.0%	82.0%	100.0%	0.%

dependent variable was deflated by some power transformation of *ASSETS*, denoted $ASSETS^e$, in order to linearize the $FEE = g(ASSETS)$ relationship. I used a power transformation because, in the absence of a theory from which the form of the function, g, can be derived, the exponent for a power transformation can readily be estimated. Thus, if $FEE = wASSETS^e\tilde{v}$, then $\ln FEE = \ln w + e(\ln ASSETS) + \ln \tilde{v}$, and a least-squares estimate of the exponent is simply the $\hat{e}$ in the regression of $\ln FEE$ on $\ln ASSETS$.

Note that by using size-deflated audit fees as the dependent variable, an implicit interaction is assumed between $ASSETS^e$ and each of the independent variables and the error term in the determination of the observed undeflated value of *FEE*. That is, the effect of each of the independent variables in the regression function was assumed to be conditional on auditee size.

Using this approach, the result of the first step in the data analysis yielded a regression of $\ln FEE$ on $\ln ASSETS$ of:

$$1n\ FEE = 3.33 + .45(1n\ ASSETS)$$
$$t = 9.1 \qquad t = 22.7$$
$$R^2 = .57$$
$$n = 397 \text{ observations.}$$

Taken alone, the variable *ASSETS* is a very significant determinant of the audit fee, with a nonlinear relationship, as hypothesized. While the estimated exponent for the *ASSETS* transformation is .45, the test of the determinants of the ratio, $FEE/ASSETS^e$, may be sensitive to the specific transformation which is used. Therefore, I fitted the regression function using both a somewhat larger exponent value of .5 (a square-root transformation) and a somewhat lower value of .33 (a cube-root transformation). The best results were obtained with a .5 exponent and are shown in table 8. However, overall results were not sensitive to this variation in the exponent.[13]

Table 8 shows the regression coefficients, their standard errors (in parentheses), and various regression statistics. Coefficients which are significant at the .05 level in a one-tail or two-tail *t*-test (as appropriate) are marked with an asterisk. The correlation matrix of the variables is displayed in table 9. Column 1 of table 8 includes all usable observations, while the last three columns, which are relevant to the test for competition, exclude twenty-four responses received from banks (SIC code 60). Bank respondents were excluded from the test both because none of the banks in the sample was audited by a non-Big Eight firm, and they were outliers with uniformly very low values for the dependent variable. The coefficient for the variable *BANK* in column 1 is for a (0, 1) variable (given assigned a value of one for these twenty-four respondents).

Examination of the data also revealed that the dependent variable was systematically low for public utility companies (SIC code 49). However, the twenty-two utilities in the sample were audited both by Big Eight and non-Big Eight firms. Thus, I included in the regression another (0, 1) variable, denoted *UTILITY*, whose observations were retained for the test of competition. In addition, a power transformation (using a .5 exponent) of the variable *SUBS* and a log transformation of the variable *TIME* helped to linearize the fitted function.

A final modification of the regression function, made after a preliminary examination of the data, was to partition the Big Eight firms into the two groups, Price Waterhouse & Co. ((0, 1) variable named *AUDITOR-PW*) and the remaining seven firms ((0, 1) variable named *AUDITOR-7*). This was done because, as shown in table 10, the average value of the dependent variable varied across the Big Eight, with Price Waterhouse

[13] This is the hypothesized specification of the function. As explained below, certain ex-post modifications of the regression function were made after a preliminary analysis of the data.

TABLE 8

Regression of (FEE/ASSETS$^{.5}$) on Explanatory Variables

	Hypothesized Sign of Coefficient	397 Total Observations	373 Observations Excluding Banks	Excluding Banks: 171 Auditees with Sales Less Than $125MM	Excluding Banks: 202 Auditees with Sales Greater Than $125MM
SUBS$^{.5}$	+	.96*	1.01*	1.32*	.93*
		(.14)	(.15)	(.37)	(.18)
DIVERS	+	1.03*	.99*	1.82*	.72*
		(.26)	(.27)	(.55)	(.31)
FORGN	+	14.88*	14.72*	14.37*	14.61*
		(2.45)	(2.53)	(5.27)	(2.88)
RECV	+	9.06*	9.72*	6.15*	18.93*
		(2.29)	(2.41)	(3.06)	(4.46)
INV	+	7.26*	7.42*	6.46*	9.09*
		(1.86)	(1.90)	(2.57)	(2.98)
BANK	none	−9.79*			
		(1.63)			
UTILITY	none	−2.97*	−2.83*	−1.64	−1.62
		(1.59)	(1.63)	(4.01)	(1.87)
PROFIT	−	2.52	2.58	1.81	1.53
		(5.52)	(5.64)	(6.74)	(12.20)
LOSS	+	1.83*	1.85*	2.12*	.93
		(.92)	(.94)	(1.20)	(1.73)
SUBJ	+	2.71*	2.84*	3.84*	.81
		(1.19)	(1.23)	(1.90)	(1.73)
LOG(TIME)	−	−.43	−.23	1.18	−1.58
		(.86)	(.89)	(1.34)	(1.28)
AUDITOR-PW	none	.76	.94	.78	1.20
	+ or −	(1.14)	(1.18)	(1.88)	(1.61)
AUDITOR-7		−1.66*	−1.69*	−1.84	−1.15
		(.77)	(.79)	(1.08)	(1.21)
Intercept		5.67	5.14	3.84	5.14
Std. error of the estimate		6.32	6.45	6.57	6.30
Adjusted R^2		.46	.42	.28	.51
F		26.79	23.6	6.5	18.4
FEE/ASSETS$^{.5}$					
mean		13.0	13.61	12.61	14.54
std. dev.		(8.58)	(8.49)	(7.74)	(8.98)

* An asterisk indicates that the regression coefficient is significant at the .05 level in a one-tail or two-tail (as appropriate) t-test. Standard errors of the regression coefficients are shown in parentheses.

a high-value outlier both in average deflated fees received and, as will be shown, in auditees' average deflated internal costs.[14]

[14] It is interesting to note that the ranking of the Big Eight by average deflated fees in table 10 corresponds closely to the verbal description of each firm recently given by Bernstein [1978]. Quoting Bernstein, the firms are described in sequence: PW—"the premier accounting firm"; AY—"not aggressive, super professional"; E & W—"not on the competitive edge"; DHS—"not aggressive, strong auditors"; AA—"aggressive . . . emphasize growth"; PMM—"very aggressive . . . price cutter"; TR—"very aggressive . . . price cutter"; CL—"most aggressive of the eight . . . price cutter."

TABLE 9
Correlation Matrix of the Variables
(Excluding Bank Respondents)

	SUBS[5]	*DIVERS*	*FORGN*	*RECV*	*INV*	*UTILITY*	*PROFIT*	*LOSS*	*SUBJ*	*LOG (TIME)*	*AUDITOR*	
											PW	7
FEE/ASSETS[5]	.47	.32	.43	.23	.21	−.29	.01	.05	.10	.02	.12	−.11
SUBS[5]		.35	.41	0	−.06	−.15	−.02	−.14	0	.15	.08	.03
DIVERS			.12	−.02	.12	−.11	−.05	−.06	0	.14	.05	.08
FORGN				.11	.07	−.13	.06	−.15	−.05	.12	.07	.08
RECV					−.02	−.26	−.05	.11	.05	−.15	.03	−.04
INV						−.27	0	.04	−.07	−.03	0	−.13
UTILITY							−.09	−.11	0	.21	−.02	.11
PROFIT								−.11	0	0	−.02	−.06
LOSS									.24	−.17	−.03	−.06
SUBJ										−.08	−.05	.02
LOG (TIME)											.04	.05
AUDITOR-PW												−.45

TABLE 10
Average Fees Paid to Big Eight Auditors Deflated by ASSETS$^{.5}$
(Excluding Bank Respondents)

	Number of Observations	*FEE* Mean ÷	*ASSETS*$^{.5}$ Std. Dev.
Price Waterhouse & Co	44	16.4	9.1
Arthur Young & Co.	16	15.0	7.7
Non-Big Eight firms	108	14.1	8.8
Ernst & Whinney	30	14	8.5
Deloitte Haskins & Sells	27	13	9.8
Arthur Andersen & Co.	57	12.7	8.8
Peat Marwick Mitchell & Co.	30	12.5	8.0
Touche Ross	20	11.8	5.6
Coopers & Lybrand	41	11.6	6.8

Note that the individual regression coefficients across the last three columns of table 8 are similar. A formal test of the homogeneity of the "small" and "large" auditee segments yielded an F-statistic of 1.3 with (13,347) degrees of freedom and resulted in failure to reject (at the .05 significance level) the null hypothesis that the overall regression relationship is homogeneous across the two auditee size categories.[15] However, homogeneity of the audit fee regression across auditee size classes is not, in itself, a sufficient test for competition, because possible auditee substitution toward or away from internal accounting resources has not been controlled. For the same reason, the uniformly negative coefficients of *AUDITOR*-7 and the uniformly positive coefficients of *AUDITOR–PW* cannot be interpreted at this point.

15. *Test of the Determinants of the Sum of Control Costs*

In order to interpret the *AUDITOR* coefficients, it was necessary to examine the behavior of total systems costs. Of the 397 observations, 333 respondents provided information on the variable *ICOST*. Respondents who failed to provide the information were typically large, decentralized, consolidated entities for whom the cost of collecting the data might likely

[15] The test statistic (Johnston [1972])is:

$$F = \frac{(SS_1 - SS_2 - SS_3)k}{(SS_2 + SS_3)/(m_2 + m_3 - 2k)}$$

where

SS_1 = residual sum of squares for the total observations (excluding banks) regression
SS_2 = residual sum of squares for Sales < \$125*MM* regression
SS_3 = residual sum of squares for Sales > \$125*MM* regression, and
k = 13(number of variables); $m_2 = 171$; $m_3 = 202$.

Substituting:

$$F = \frac{(14997 - 6824 - 7488)/13}{(6824 + 7488)/(171 + 202 - 26)} = \frac{52.7}{41.2} = 1.3.$$

be high. Of the 333 complete responses, nineteen were from banks, which reduced the available observations for the test of competition to 314.

Proceeding as in the analysis of the audit fee data, the regression of $1n(FEE + ICOST)$ on $1n(ASSETS)$ yielded an estimated slope coefficient, $\hat{e}$, of .55. This value is sufficiently close to one-half to justify use of the square-root transformation of $ASSETS$ as the size deflator for each cost component, and thus for their sum.

The least-squares' estimates of the coefficients of the variables in the linear regression function:

$$\frac{FEE + ICOST}{ASSETS^{.5}} = b_0 + b_1 SUBS + b_2 DIVERS + b_3 FORGN + b_4 RECV + b_5 INV + b_6 PROFIT + b_7 LOSS + b_8 SUBJ + b_9 TIME + b_{10} AUDITOR\text{-}PW + b_{11} AUDITOR\text{-}7 + b_{12} UTILITY + \tilde{u}$$

are displayed in table 11, together with various regression statistics. As in table 8, the standard errors of the coefficients are shown in parentheses, while coefficients which are significant at the .05 level are marked with an asterisk. In these results, the sets of auditor coefficients are of principal interest, with the remaining variables included solely for purposes of control.

Finally, for completeness, I display in table 12 the least-squares' coefficient estimates of the variables hypothesized to be determinants of $ICOST$. The regression function is:

$$\frac{ICOST}{ASSETS^{.5}} = b_0 + b_1 SUBS + b_2 DIVERS + b_3 FORGN + b_4 RECV + b_5 INV + b_6 AUDITOR\text{-}PW + b_7 AUDITOR\text{-}7 + b_8 UTILITY + \tilde{u}.$$

Results are presented using the same format as in table 11. Four observations were deleted from column 1 as outliers, representing very small companies who used some internal auditors with very high values for the constructed dependent variable.

A scan of table 12 shows that the regression results are, on the whole, unsatisfactory. The low adjusted R^2 and the lack of significance and inconsistent signs of many of the control variables suggest that the determinants of $ICOST$ are not correctly specified and/or that there is significant error in the measurement of this variable.

TABLE 11

Regression of {(FEE + ICOST)/ASSETS$^{.5}$} on Explanatory Variables

	314 Observations Excluding Banks	160 Auditees with Sales Less Than $125MM	154 Auditees with Sales Greater Than $125MM
SUBS$^{.5}$	1.58*	1.34*	1.35*
	(.21)	(.43)	(.28)
DIVERS	1.70*	2.22*	1.35*
	(.41)	(.66)	(.54)
FORGN	12.88*	12.38*	12.09*
	(3.41)	(6.40)	(4.12)
RECV	9.74*	7.39*	25.72*
	(3.22)	(3.67)	(6.79)
INV	8.73*	9.16*	7.71*
	(2.52)	(3.03)	(4.41)
UTILITY	−2.75	−1.36	−2.32
	(2.17)	(4.60)	(2.68)
PROFIT	.57	−.63	.37
	(7.26)	(7.77)	(18.11)
LOSS	.56	.89	2.18
	(1.22)	(1.41)	(2.53)
SUBJ	2.88*	4.49*	.25
	(1.63)	(2.19)	(2.57)
LOG (TIME)	1.41	2.19	−1.54
	(1.23)	(1.63)	(1.93)
	5.71*	2.64	8.42*
AUDITOR-PW	(1.57)	(2.23)	(2.34)
	−.82	−1.58	−.02
AUDITOR-7	(1.04)	(1.27)	(1.79)
Intercept	4.16	3.35	6.89
Std. error of the estimate	8.00	7.48	8.23
Adjusted R^2	.44	.26	.51
F	21.9	5.6	14.2
(FEE + ICOST)/ASSETS$^{.5}$			
mean	17.14	14.1	20.33
std. dev.	(10.75)	(8.7)	(11.75)

* An asterisk indicates that the regression coefficient is significant at the .05 level in a one-tail or two-tail (as appropriate) t-test. Standard errors of the regression coefficients are shown in parentheses.

16. *Discussion and Interpretation of Results*

Findings with respect to the hypothesized control variables are summarized in table 13. The significance tests of the *FEE* determinants are from column 2 of table 8 (recall that these regression results are generally homogeneous across auditee size classes), while only those variables whose coefficients are statistically significant in both columns of table 12 are listed as significant determinants of *ICOST* (these regression results are not homogeneous across the two columns).

The control variables for differences in loss exposure describe aspects of the external audit and internal control environment. Note that the selection of specific aspects of the environment as control variables

TABLE 12

Regression of (ICOST/ASSETS$^{.5}$) on Explanatory Variables

	156 Auditees with Sales Less Than $125MM	154 Auditees with Sales Greater Than $125MM
SUBS$^{.5}$	.03*	.04*
	(.01)	(.01)
DIVERS	.25	.95*
	(.19)	(.31)
FORGN	4.55*	−.11
	(1.68)	(2.37)
RECV	.42	3.97
	(1.01)	(3.93)
INV	−.10	.07
	(.84)	(2.59)
UTILITY	.75	−.88
	(1.26)	(1.47)
AUDITOR-PW	.81	6.03*
	(.61)	(1.37)
AUDITOR-7	−.24	1.57
	(.35)	(1.04)
Intercept	.76	2.24
Std. error of the estimates	2.09	4.86
Adjusted R^2	.09	.25
F	2.8	7.5
Dependent variable		
mean	1.34	6.77
std. dev.	(2.19)	(5.63)

TABLE 13

Summary of Significance Tests on Hypothesized Control Variables

	Significant Relationship (at .05 level) with	
	Audit Fees	Internal Audit Costs
Control variables for differences in loss exposure:		
ASSETS	Yes	Yes
SUBS	Yes	Yes
DIVERS	Yes	No
FORGN	Yes	No
RECV	Yes	No
INV	Yes	No
Control variables for differences in expected loss sharing ratio:		
PROFIT	No	Does
LOSS	Yes	not
SUBJ	Yes	apply
Control variable for differences in auditor production functions over time:		Does not
TIME	No	apply

follows from the hypothesis that avoidance of third-party liability losses motivates the design of auditee control systems. The fact that all variables in this group (namely, *ASSETS*, *SUBS*, *DIVERS*, *FORGN*, *RECV*, and *INV*) are statistically significant determinants of audit fees supports the descriptive validity of this hypothesis with respect to the external audit component of the system. However, the same variables are far less successful in explaining cross-sectional variation in internal audit costs. The latter result may indicate either that liability avoidance is not a primary motivator in the design of internal systems, or the presence of significant measurement problems.

The quantity of internal accounting control relevant to external financial reporting is a construct in the model whose empirical counterpart can only be measured with substantial error. For example, internal auditors are likely to be involved both in the verification of financial data for external reporting and in monitoring operating efficiency and the adherence to general management policies. Since the principal benefit from these other activities is not liability avoidance, a failure to separate these costs by various internal audit activities leads to misspecification of the regression function for observed internal audit costs. Although further research on this problem is necessary, the overall results reported here nevertheless do not support a rejection of the hypothesis that liability avoidance drives the design of financial reporting systems.

The control variables for differences in the assessed loss-sharing ratio represent alternative measures of auditee financial distress. The insignificance of the *PROFIT* variable and significance of the two categorical variables, *LOSS* and *SUBJ*, suggest that $E(\tilde{\theta})$ and therefore p do not vary continuously with the profitability of auditees. Rather, the auditor's expected share of residual liability losses seems to increase only with evidence of significant deterioration in the auditee's operations or prospects.

The fact that audit fees were not found to vary systematically with *TIME* could indicate either that learning effects were "swamped" by the noise in a cross-section, or that auditors pursue multi-period pricing policies, in that they average the expected cost reduction of learning over time. With such policies, learning effects could not be observed in fee data.

For the test of competition, the test statistics are the *AUDITOR* coefficients in table 11, interpreted using table 3. For both "large" and "small" auditees and for the observations in total, the *AUDITOR*–7 coefficients are not significantly different from zero. Thus, the hypothesis that price competition prevails throughout the market for audits of publicly held companies cannot be rejected. Indeed, since average fees for audits by seven of the dominant firms are lower throughout the market than the fees of their non-Big Eight competitors (table 8) and the fact that coefficients of *AUDITOR*–7 in table 11 still tend to be negative,

the results suggest that the Big Eight firms enjoy scale economies which are passed on as lower prices to auditees. This is obviously an important issue which deserves further research.

Finally, with respect to Price Waterhouse & Co. (PW), the significantly positive coefficient of *AUDITOR-PW* in column 1 of table 11, which is consistent across auditee size classes, indicates that the clients of this firm, on average, use higher cost control systems. However, this is not evidence of monopoly pricing by PW, since the obvious and best substitute for a PW audit is not the employment of additional internal auditors, but rather an external audit by some other Big Eight firm. Note that both the separate audit fee (from table 8) and internal cost components (from table 12) are differentially greater for PW auditees. In the regressions, the PW classification variable may be a proxy for omitted variables describing certain unknown differentiating characteristics of PW clients which affect the quantities (a, q) demanded by these companies. Thus, auditees using PW may demand control systems of greater than average quality. Alternatively, the significantly positive coefficient of *AUDITOR-PW* (relative to *AUDITOR-7*) in table 8 may represent a price difference paid by auditees for a differentiated service. That is, a PW audit may possess some utility-bearing characteristics to auditees which command a positive implicit price in the market. While it is not possible to distinguish between the two interpretations, clearly PW, PW clients, or both are somehow differentiated from other class members.

17. Concluding Comments

One of the impediments to understanding the audit service is the ambiguity of the relationship between auditors, audited companies, and external financial statement users. Auditors are exhorted, in their codes of ethics, for example, to be independent and objective; yet they are hired and compensated by auditees. The finding of the Commission on Auditors' Responsibilities [1978] that "many users appear to misunderstand the role of the auditor and the nature of the service he offers" is therefore not surprising.

In the positive model of auditing developed in this paper, the essential interdependence of the auditee's and auditor's economic interests is recognized. The model allows for auditor independence in the sense that the auditor implements q as a complement to the internal accounting system, a. An auditee demands a positive quantity of auditing because external auditors have some advantage (relative to internal systems) in certain aspects of control. In the model, therefore, an auditor is independent in the same sense as is any supplier of a service who seeks competently to perform a task demanded by a customer. The auditee and auditor are not always adversaries. Although their economic interests may diverge in ex-post litigation, as each tries to minimize losses, the hypothesis regarding liability avoidance motivation implies that, at the

time of the audit, there is a mutuality in the auditee's and auditor's private interests vis-à-vis the external world.

The question of whether the avoidance of third-party liability is a dominant source of expected benefits which drives the design of auditee financial reporting systems is an important one because of a possible externality which can thereby result. Expected liability losses are a private cost, and the legal system is the screen through which losses suffered by third parties are filtered. An alternative would be to force the auditee to internalize expected losses to users by relating the quality of control system design to the market valuation of the auditee's firm. In that way, variations in the quality of control systems as perceived by the market would affect the risk–return characteristics of auditees' securities. Note, however, that currently neither internal control costs nor external audit fees are information which is publicly available to market agents. Thus, under current arrangements, market reaction to alternative systems designs can only be a tenuous auditee motivator, at best. The Securities and Exchange Commission recently did propose a requirement that management disclose and discuss weaknesses in its internal controls. But in the final version of *Accounting Series Release No. 250*, the SEC withdrew a proposed rule that external audit fees be disclosed. One argument in support of required disclosure of audit fees could be the avoidance of potential externalities, to the extent that the audit fee is a good measure of the quality of auditing purchased.

Finally, the failure to reject the hypothesis that price competition prevails throughout the market for audits of publicly held companies suggests that observed differences in Big Eight concentration across the market may be essentially irrelevant. That is, concentration statistics, by themselves, cannot support the allegation that the Big Eight firms are monopolizing the market for audit services.

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