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The Choice Among Accounting Alternatives and Management Compensation: Effects of Corporate Tax

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ABSTRACT: Does tax policy affect accounting choices? In this paper we examine how corporate tax affects management's accounting choices. Because (1) management compensation is typically linked to both accounting earnings and stock prices, (2) stock prices are related to cash flow distributions expected to be generated by the firm, (3) corporate-issued reports change cash flow assessments and, thus, affect compensation in a given period, and (4) changes in corporate tax rate changes the firm's cash flows, management will exploit its ability to "manage" reported accounting earnings in reaction to changes in tax rates, so as to maximize compensation. Assuming exogeneously determined generally accepted accounting principles, it is shown—using a stylized model—that increases in corporate tax rate induce choice of income-increasing accounting treatments. Empirical results applying logit analysis to a sample of compensation data are consistent with this implication of the model.

TAX policies have numerous objectives, including (1) raising revenue, (2) encouraging economic growth, (3) stabilizing the economy, (4) redistributing wealth, (5) encouraging activities recognized as priorities, and (6) prohibiting or otherwise deterring undesired actions. Often, it seems, only immediate, first order impacts of policy are the subject of deliberations. This paper addresses the subtler effects on information choices made by managers of corporations.

We focus on how tax affects management's accounting choices. Determination of generally accepted accounting principles (GAAP) is assumed exogenous; it is recognized that GAAP accord the manager some discretion in accounting choice. It is shown that increases in corporate tax rates induce choice of income-increasing accounting treatments. This implication of the stylized model developed is then tested empirically. The results confirm the model's

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implication: increases in the effective average corporate tax rate are associated with increased choice of income-increasing accounting treatments.

Section I describes the general scenario for the model, Section II models the impact of corporate tax and other parameters on accounting choice, and presents short-run and long-run analyses of the sensitivity of accounting choices to tax and other parameters. A test for the impact of tax on accounting choices is described in Section III and concluding remarks follow in Section IV.

I. The Effect of Tax on Accounting Choice—General Scenario

Responses to questionnaires mailed as part of this study indicate that management compensation is linked to both accounting earnings and stock prices through incentive plans (see, also, Conference Board [1974], Healy [1985], and Murphy [1985]). Since stock prices are related to cash flow distributions expected to be generated by the firm, corporate-issued reports that change cash flow assessments will affect compensation in a given period. Hence, management would exploit its ability to "manage" reported accounting earnings, perceived as signalling its private information, to maximize compensation.

The compensation scheme, however, is only one of the major factors affecting accounting choices. The penalties associated with inaccurate signalling is another. Legal liability to owners and others for the issuance of misleading information and reputation effects give rise to such penalties [Kraakman, 1986]. Giving explicit recognition to these factors, effects of corporate tax changes on the optimal accounting choice can be analyzed. Figure 1 illustrates this framework by a feedback cycle that encompasses the users of financial statements (e.g., equity holders, creditors, and government) and preparers of accounting statements (management). The linkage is provided by the compensation scheme and the behavior of users utilizing accounting signals (Ronen and Sadan [1981] elaborate on this linkage).

The stylized modeling of the tax impact on financial accounting, described below, features a manager who maximizes the present value of his or her compensation, and owners who maximize the present value of their wealth over a two-period horizon. The linear compensation specification (treated here as exogenous) includes a restricted stock option in addition to a bonus (percentage of accounting earnings) as indicated in the responses to questionnaires.

A penalty for inaccuracy depicting reputation effects and legal liability is introduced. While exogenously specified in the limited setting we consider here, such penalty is more correctly viewed as endogenous in the global system—emerging to minimize adverse selection costs arising from information asymmetry between managers and investors [Ronen, 1979].

The purpose of the stylized model presented in the next section is to illustrate a way in which the effects of corporate tax changes on accounting choice can be signed so as to motivate hypothesis testing. This derived sign can be shown to be robust to extensive relaxations of the seemingly restrictive assumptions made, as explained below.[1]

II. A Stylized Model

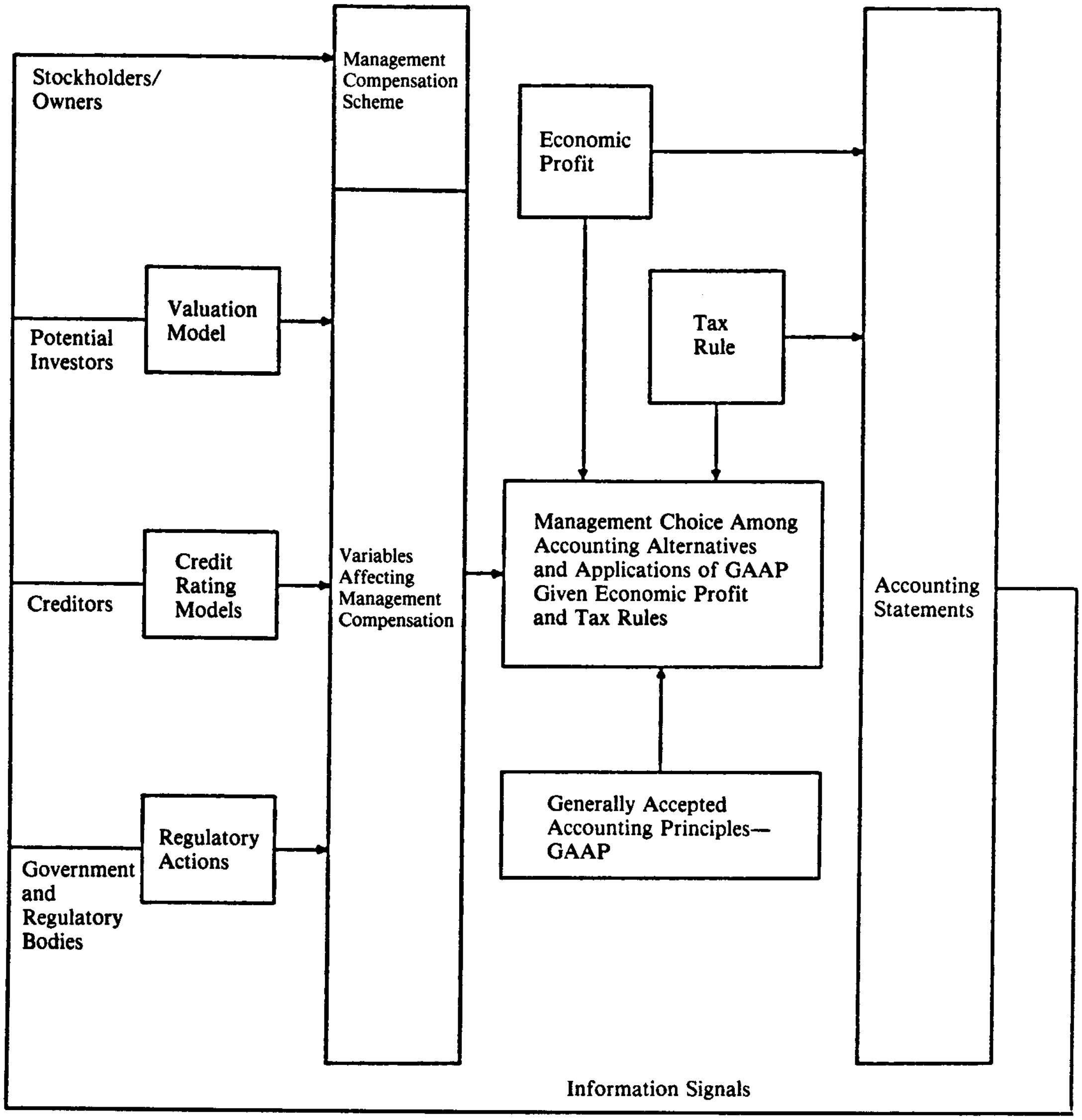
Specification

Consider risk neutral owners of a firm

[1] Proofs can be obtained from the authors.

FIGURE 1

THE PRODUCTION OF ACCOUNTING SIGNALS: AN INCENTIVE SCHEME PERSPECTIVE



which lasts for two periods[2] (0 and 1) who delegate operations to a risk neutral manager (with no initial ownership interest). No debts exist and no interim dividend is distributed. The only tax in the system is a fixed proportional corporate

[2] In the reality of a going concern, of course, no clear-cut settling up is possible as outcome (past plus potential cash flows) is not observable. This unobservability, coupled with information asymmetry endows accounting income numbers with a signalling content. Hence, more than one period must be assumed to require the reporting of accounting income.

income tax, t. Exerting only minimal effort and in the absence of bonus or option, the manager (MGR) generates cash flows I_0 and I_1 (the subscripts refer to period 0 and period 1, respectively). With a bonus ($0<\alpha<1$, multiplied by accounting income) and an option granted at time 1 (end of period 0) to acquire γV_0 ownership (where V_0 is the firm value at time 1, $0<\gamma<1$) exercisable at time 2 (end of period 1) but not earlier, MGR generates cash flows in the magnitude of $\bar{I}_0=I_0\psi$ where $\psi=1+\epsilon(\alpha+\gamma)-\epsilon/2(\alpha^2+\gamma^2)$ and ϵ is a positive constant.[3] MGR has private information in that MGR observes $\bar{I}_0$ and accurately foresees $\bar{I}_1$ at time 1. Owners, however, observe separately[4] $\bar{I}_0$ and $\bar{I}_1$ only in time 2 (end of period 1—liquidation) and hold a prior probability distribution of $\bar{I}_0$, $H(\bar{I}_0)$ and of the firm growth $F(\bar{I}_1/\bar{I}_0)$. These distributions can be used to illustrate how owners might determine α and γ at time 0 (beginning of period 0) as shown below. Accounting choice is captured by a scalar A which operates proportionally on $\bar{I}_0$ to produce accounting income $A\bar{I}_0$.[5] To value the firm at time 1, owners form an expectation of $\bar{I}_1$ $(=\bar{I}')$, which they set equal to $A\bar{I}_0$. That is, income is viewed as following a strict martingale proess, in accord with such empirical evidence as produced, e.g., by Ball and Watts [1972] and Watts and Leftwich [1977].[6] MGR faces a penalty for inaccuracy of $(\beta/\bar{I}_0)(\bar{I}_1-A\bar{I}_0)^2$. We do not derive an optimal incentive scheme (or an optimal penalty function). Indeed, given the assumption of perfect observability of the outcome of time 2, at the liquidation of the firm, an optimal penalty would have elicited the truth. However, the model's assumption that true income is observed at the end of period 2, is itself not realistic and was intended to make a solution possible. Since modeling an ongoing concern over multiple periods is extremely difficult, some simplification needs to be made to make the model tractable. Hence, in reality, an optimal penalty assuming such liquidation would not have been realistic.

In fact, given the linearity of the con-

[3] ψ can be interpreted as reflecting effort induced by the compensation scheme, $\psi_\alpha>0$, $\psi_{\alpha\alpha}<0$, $\psi_\gamma>0$, $\psi_{\gamma\gamma}<0$, invoked here conceptually to rationalize the observed (from responses to questionnaires) inclusion of bonus and options in compensation. This is in accord with evidence such as presented by Murphy [1985] documenting linkage between managerial performance and total compensation (including bonus and options) and with principal-agent models (e.g., Holmstrom [1979]) in light of the informativeness of accounting income and stock prices as corroborated by the many *event* and *market efficiency* studies. It can be shown that the derived sign of the tax effect on accounting choice (the testable implication) is invariant to the specific functional form of ψ (assumed here to attain solution specificity) and is preserved even if the effort function were omitted: it suffices to assume some $\bar{I}_0$ for a given α and γ.

[4] This assumption can be relaxed allowing for *ex post* knowledge of only the sum of the cash flows $(\bar{I}_0+\bar{I}_1)$ without changing the derived sign of the tax change. It can also be shown that an assumption that owners observe $\bar{I}_0$ at time 1 will not affect the derived sign of the tax change effect. Specifically, under most plausible conditions, they will prefer to use accounting income as a signal of $\bar{I}_1$ rather than applying their prior knowledge about $(\bar{I}_1/\bar{I}_0)$ to the observed $\bar{I}_0$. But, note that the assumption adopted in the model (owners do not observe $\bar{I}_0$ at time 1) rules out the observation by them of the accounting choice. In practice, while some accounting choices are disclosed, many are not (consider the many possible estimates of useful life, methods of deferring revenue, a variety of smoothing techniques, etc.).

[5] That is, the accounting choice can be captured by a real number within a closed interval defined by GAAP. Underlying this assumption is the possibility of a rich set of accounting treatments among which the manager can exercise discretionary choice. Given the observed cash flows, the manager can combine such accounting treatments as would produce a real number within the GAAP-allowed interval, which, when multiplied by $\bar{I}_0$ will produce the desired accounting income. Thus, A can be interpreted as a bounded real-valued function defined on subsets of accounting methods whose existence is made possible by the richness of the underlying set of possible accounting treatments. That set is, in fact, the cartesian product set of n-tuples with n financial statement items and with m_j possible accounting treatments for each item $j(j=1,2,\ldots,n)$.

[6] However, it can be shown that any prediction function under which $\bar{I}'$ is monotone increasing, linear or convex, in accounting income will not change the derived sign of the tax effect so long as the bounded and injective penalty is convex in A.

tract, the optimal penalty would be any arbitrarily large constant levied upon any departure from the (eventually) observable truth. In practice, such a penalty may not be enforceable as the wealth of managers is bounded and, hence, private contracting may not be feasible under the circumstances. Thus, we observe the incidence of state-imposed penalties such as nonconserving procedures like incarceration and other resource-wasting punishments.

The purpose of the assumed penalty function is to mimic the penalties that might be perceived by corporate managers in reality. Discussions with litigators of suits against corporate directors and officers indicate that suits arise primarily when income fluctuates and, in particular, when it decreases significantly. Further, the larger the deviations, the larger the apparent impact on stock prices, the larger are likely to be the damages suffered and claimed by investors, and the larger the settlements. For tractability, the penalty was assumed symmetric and proportional to squared error. This penalty function is representative of a large class of penalty functions that are generally realistic. Indeed, it can be shown that any injective and bounded penalty that is convex in A will preserve the implied impact of tax on accounting choice as long as the cash flow predicted by investors $\bar{I}'$ is monotone increasing and linear or convex with accounting income. One would expect a convex penalty function in practice, as extreme deviations of income from what is expected will generally cause more extreme penalties (possibly in the form of legal case settlements). And a penalty represented by a step function that imposes a large levy only if income is considerably overstated and no or little levy otherwise (as in the typical case of litigations only when income is drastically down) can be approximated by convex functions that will yield the same implications. Note also that the implications are not altered with changes in the β parameter specified in the penalty function. This parameter can also be viewed as incorporating the probability perceived by the manager to be attached to incurring the penalty.

Corresponding to A, tax rules of measurement are represented by a scalar Z, such that taxable income for period 0 is $Z\bar{I}_0$. The terminal value of the firm at time 2, V_1 is assumed to exceed V_0.[7] Tax rate changes are viewed as surprises—unanticipated in advance by MGR or the owners. Finally, these specifications are common knowledge as of time 0 and can be summarized in the event sequence (Exhibit 1).

We distinguish between conformity ($A = Z$) and nonconformity ($A \neq Z$). Choice among accounting alternatives is generally conducted within a context of nonconformity. Only the choice of inventory valuation method is subject to conformity in that LIFO can be used for tax purposes only if it is also applied for financial reporting purposes. The flexibility of choice accorded managers with respect to all other (than inventory valuation) accounting treatments makes it practical to analyze the impact of tax on accounting choices within an environment of nonconformity. We analyze both cases because a comparison of the implications of conformity with those of nonconformity could be pertinent to the evaluation of the Internal Revenue Service policy of sometimes considering the requirement of conformity with respect to accounting treatments.

[7] Since the terminal value of the option at time 2 is $\text{Max}[0, \gamma(V_1 - V_0)]$, this assumption allows it to be expressed as $\gamma(V_1 - V_0)$. Because of the option's nonmarketability, as the information gathered from the companies in the sample revealed, the option is different from the one described by Black and Scholes [1973].

EXHIBIT 1
THE EVENT SEQUENCE

Activity Period	0	1	
Time:	0	1	2
Events:	Owners have available to them distribution functions $H(\bar{I}_0)$ and $F(\bar{I}_1/\bar{I}_0)$ and set contract parameters α and γ	$\bar{I}_0$ Realized and observed by manager. $\bar{I}_1$ accurately foreseen by manager A chosen by manager $A\bar{I}_0$ Reported V_0 Established	$\bar{I}_1$ Realized and observed by owners. $\bar{I}_0$ observed by owners

Solution

Given the cash balance at time 1 $(\bar{I}_0-\alpha A\bar{I}_0-(Z\bar{I}_0-\alpha A\bar{I}_0)t)$, and under conformity, V_1 becomes:

$$V_1^c=[\bar{I}_0-\alpha A\bar{I}_0-(A\bar{I}_0-\alpha A\bar{I}_0)t][1+r(1-\alpha)(1-t)]+\bar{I}_1-(\bar{I}_1+\bar{I}_0-A\bar{I}_0)(\alpha+t-\alpha t) \quad (1)$$

while under nonconformity:

$$V_1^n=[\bar{I}_0-\alpha A\bar{I}_0-(Z\bar{I}_0-\alpha A\bar{I}_0)t][1+r(1-\alpha)(1-t)]+\bar{I}_1-(\bar{I}_1+\bar{I}_0-A\bar{I}_0)\alpha-[(\bar{I}_0+\bar{I}_1)(1-\alpha)-Z\bar{I}_0+\alpha A\bar{I}_0]t. \quad (2)$$

V_0 is obtained by discounting V_1 at the rate r and with $\bar{I}_1$ (not observed by owners at time 1) replaced by $\tilde{I}'$ and with $\bar{I}_0$ replaced by $\tilde{I}$, the expectation under $H(\bar{I}_0)$. Thus, under conformity we have:

$$V_0^c=\{[\tilde{I}-\alpha A\bar{I}_0-(A\bar{I}_0-\alpha A\bar{I}_0)t][1+r(1-\alpha)(1-t)]+\tilde{I}'-(\tilde{I}'+\tilde{I}-A\bar{I}_0)(\alpha+t-\alpha t)\}\lambda \quad (3)$$

and under nonconformity:

$$V_0^n=\{[\tilde{I}-\alpha A\bar{I}_0-(Z\bar{I}_0-\alpha A\bar{I}_0)t][1+r(1-\alpha)(1-t)]+\tilde{I}'-(\tilde{I}'+\tilde{I}-A\bar{I}_0)\alpha-[(\tilde{I}-\tilde{I}')(1-\alpha)-Z\bar{I}_0+\alpha A\bar{I}_0]t\}\lambda \quad (4)$$

where $\lambda=1/(1+r)$.

Note that the owners are fully aware that MGR will choose A that will maximize his or her present value and, hence, are not duped into using the imperfect signal $A\bar{I}_0$ in the determination of V_0 for either fixing the option's price or for portfolio recomposition decisions. Rather, being aware of the nature of information asymmetry, the owners decide to use the manager's signal, $A\bar{I}_0$ to formulate expectations about future cash flows, while simultaneously designing α and γ optimally within their linear contract, and in light of the existing penalty function (induced by potential stockholder and SEC litigation) so as to minimize misrepresentation to an extent that is consistent with their wealth maximization.

After appropriate substitutions, the present value, at time 1, of the manager's total compensation (denoted M) can be shown to be:

$$M=\alpha A\bar{I}_0+(\bar{I}_1+\bar{I}_0-A\bar{I}_0)\alpha\lambda+\gamma\lambda(V_1-V_0)+\lambda\alpha r[\bar{I}_0-\alpha A\bar{I}_0-(Z\bar{I}_0-\alpha A\bar{I}_0)t]-\lambda\beta(\bar{I}_1-A\bar{I}_0)^2/\bar{I}_0. \quad (5)$$

With α and γ given, the manager maximizes equation (5) with respect to A

(yielding A^*) under conformity:

$$A_c^* = I_1/I_0 + \{\alpha r(1-\alpha)(1-t) + \lambda\gamma(1-\alpha)(1-t)[r^2(\alpha t - \alpha - t) - 1]\}/2\beta \quad (6)$$

and under nonconformity:

$$A_n^* = I_1/I_0 + \{\alpha r(1-\alpha+\alpha t) + \lambda\gamma[(1-\alpha)(1-t)\{-\alpha r^2(1-t) - 1\}]\}/2\beta. \quad (7)$$

The comparative static analysis (in the short-run) in this paper with regard to the sensitivity of A^* to t and other parameters does not depend on the optimal determination of the exogenously given α and γ. But an equilibrium solution triple $(\alpha^*, \gamma^*, A^*)$ is required to derive long-term implications (such as when either because of elapsed time or reduced renegotiation costs α and γ are optimally adjusted to change in t).

α^* and γ^* are chosen by owners at time 0 so as to maximize the present value of their time 2 terminal wealth, correctly anticipating MGRs determination of A^*, using the α and γ specified in his time 0 contract as parameters. V_M (the present value maximized by the owners at time 0) will, thus, equal the present value of the terminal value of the firm minus the present value of MGRs option:

$$\text{Max}_{\alpha,\gamma} \quad V_m = [V_1 - \gamma(V_1 - V_0)]\lambda^2 \quad (8)$$

subject to $A^* \in \text{Argmax}\ M$.

Explicit expressions for both α^* and γ^* are difficult to obtain. It is possible, however, to derive an explicit expression for γ^* with multiple solutions for which α^* can be found implicitly.[8] Because of the analytical complexities, the results of numeric analysis will be presented below to characterize the equilibrium $(\alpha^*, \gamma^*, A^*)$.

Short-Run Analysis

Here, we adopt a short-run perspective and focus on the sensitivity of A^* to t and other parameters of interest when owners are assumed not to optimally adjust α and γ in the short-run in light of exogenous shocks in t. Such a scenario becomes realistic from an empirical standpoint if renegotiation of the parameters α and γ in the compensation contract is either too costly or time consuming.

Under conformity we have:

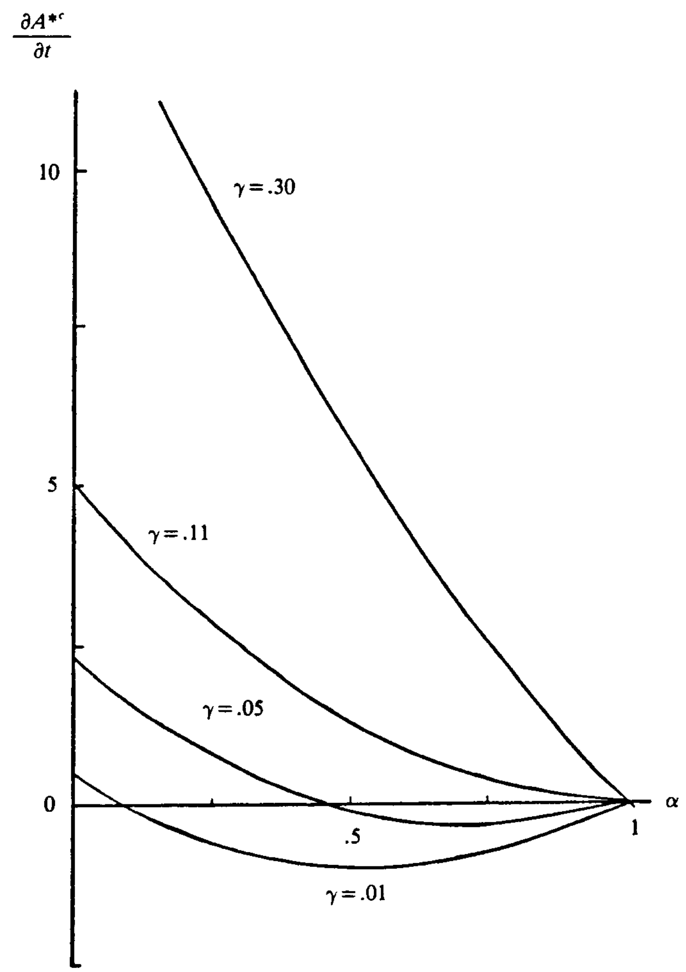
$$\frac{\partial A^{*c}}{\partial t} = [(\alpha-1)/2\beta][\alpha r + \lambda\gamma\{2r^2(\alpha t - \alpha - t) - 1 + r^2\}]. \quad (9)$$

Analysis of equation (9) reveals that when α is substantially higher than γ, then $\partial A^{*c}/\partial t < 0$ and vice versa when α is small. Figure 2 depicts this relation for $t = .5$ and $r = .1$. When γ is small (.01 only) $\partial A^{*c}/\partial t$ is almost always negative (except for extremely small αs). If, however, γ is large (approximately .11 in our setting) $\partial A^{*c}/\partial t$ is always positive for any size of α. When, for example, γ equals 0.05, $\partial A^*/\partial t$ changes sign around $\alpha = .5$.

This suggests that, under conformity, a MGR who owns an option to buy a large portion of the firm will, *ceteris paribus*, make more use of income-increasing accounting treatments given a high corporate tax rate; however, if the size of his or her option is small, MGR will more intensively use income-increasing accounting treatments when the bonus is small (small α) and will more intensively use income-decreasing accounting treatments if the bonus is large (large α). When the option is large and tax is increased, the option's value relative to the

[8] The analytical derivations that yield the equations for α^* and γ^* are cumbersome and can be made available upon request in computer output form. The analytical solution was derived by making use of MACSYMA—a computer program which derives highly sophisticated solutions to analytical algebra. The program was developed at MIT and was applied in this research with the help of the Courant Institute of Mathematical Science at New York University.

FIGURE 2
THE SENSITIVITY OF THE ACCOUNTING MIX TO A TAX CHANGE UNDER DIFFERENT COMPENSATION SCHEME PARAMETERS WHEN ACCOUNTING AND TAXABLE INCOME ARE THE SAME



α=Bonus applied as a percentage of accounting income
γ=Percentage of firm value at time 1 granted as option to MGR
t=Corporate tax rate
A^{*c}=Optimal accounting choice under conformity

bonus is reduced and A will increase (even though it further reduces the value of the option) under the new equilibrium. On the other hand, when the option value is very small relative to the bonus, the impact of a tax increase on the manager's share of the interest income the firm earns in period 1 becomes more important relative to the option value and the bonus, and a tax rate increase induces a decrease in A to mitigate the adverse effect of the tax on the manager's share of the corporate interest income. These results are due to the intricate interplay between the bonus and options under conformity.

Under nonconformity we have:

$$\frac{\partial A^{*n}}{\partial t} = \alpha^2 r/2\beta + [\lambda\gamma/2\beta](1-\alpha) \\ [2\alpha r^2(1-t)+1] \qquad (10)$$

since α, β, γ, and t are all positive and smaller than 1, and assuming $I_0>0$ we can conclude that $\partial A^{*n}/\partial t>0$, implying that under nonconformity, an increase in corporate income tax will increase the use of income-increasing accounting treatments and, conversely, when the tax rate is decreased, income-decreasing accounting treatments will be used. Intuitively, at the margin, an increase in corporate income tax rate decreases the value of the option relative to the bonus. Since the corporation is taxed based on a number that differs from accounting income, an increase in A improves (at the margin) the bonus without substantially affecting the value of the option; subsequently, managers will increase A under the new equilibrium. Of course, under the new equilibrium, the expected penalty will also change with a change in A, with the direction of change depending on $\bar{I}_1/\bar{I}_0$.

As to parameters other than t, numerical analysis shows A^{*c} (the A maximizing M) to be sensitive to both α and γ, with higher degree of sensitivity exhibited to γ. An increase in γ decreases A^{*c} (i.e., will induce managers to increase the use of income-decreasing accounting treatments), whereas an increase in α increases A (an increase in the manager's bonus will trigger an increased use of income-increasing accounting treatments). Also, A^* increases with an increase in $\bar{I}_1$ and the rate of discount (but is not very sensitive to the latter).

Long-Run Analysis

Numerical analysis was conducted to determine the sensitivity of the equilibrium (α^*,γ^*,A^*). For every given t, 10,000 (α,γ) pairs (with α and γ each varying in intervals of 0.1) within [0,1] were used to derive $A_t^*(\alpha,\gamma)$ and $Vm_t(A^*,\alpha,\gamma)$ for assigned values of the constants I_0, I_1, β, and ϵ. Pairs $\{\alpha^*(t),\gamma^*(t)\}$ that maximized Vm_t were then identified. With each pair is associated an A_t^* that maximizes M_t. The resulting equilibrium path of the triple (α^*,γ^*,A^*) in t shows (under conformity) that A^{*c} increases generally and over most of the domain with t in a stepwise fashion. Under nonconformity, A^{*n} is shown to be nondecreasing in t over all the domain. Different parameters were used with similar results under both conformity and nonconformity.

Since, with the exception of the FIFO-LIFO choice, no conformity is required, one would expect A^* to generally increase with t, even under continuous and instantaneous adjustment of the compensation scheme parameters α^* and γ^*. As noted above, increase in t decreases the option's value (relative to the bonus) and, under nonconformity, realignment of the equilibrium toward increased bonus and, thus, increased A^* is intuitively appealing. Note the implication that, at the margin, A will increase even if it is in excess of $\bar{I}_1/\bar{I}_0$, thus incurring higher penalty, as the expected marginal penalty would be more than offset by the expected marginal increase in bonus given the increase in the tax rate.

III. Evidence on Accounting Choice

Development of Hypotheses

The analysis in Section II leads to the following testable (in principle) hypotheses.

(1) In the case of nonconformity, a higher corporate income tax rate will be associated with accounting choices that tend to increase reported earnings. That is, such a relation is expected to be observed in both the short-run (α^* and γ^* are not adjusted contemporaneously with change in t) and the long-run (α^* and γ^* are adjusted contemporaneously with change in t).

(2) Under conformity, and in the short-run, the relation between the corporate tax rate and the accounting mix depends on the compensation scheme. If γ is large, $\partial A^{*c}/\partial t$ is always positive; if γ is small, $\partial A^{*c}/\partial t>0$ for small αs, and $\partial A^{*c}/\partial t<0$ for large αs.

Since, excepting the FIFO-LIFO choice, no conformity is required[9] (and, thus, a case of nonconformity can be viewed to prevail generally), and since no independent empirical evidence is available regarding whether the short-run or the long-run scenario obtains, implication (1) above (invariant under both scenarios) is more pertinent and encompassing. To a limited extent, implication (2) can be viewed as a joint hypothesis that (a) a short-run scenario obtains and (b) the FIFO-LIFO choice, which requires conformity, is treated differently from other methods (which do not require conformity).

For the purpose of the test, we focus on accounting methods that are easily identifiable and relatively simple to evaluate. The accounting methods selected were the inventory valuation method (FIFO vs. LIFO) which represents the only case of conformity, depreciation method (accelerated vs. straight line), the treatment of the investment tax credit (flow-through vs. deferral), the method of amortization of past service pension costs (long vs. short period of amortization), and finally, the treatment of interest on long-term projects developed within the firm (capitalization vs. noncapitalization). Of course, differences in these methods applied across firms do not reflect all the differences in accounting treatment, and to this extent, our ability to interpret the results would be somewhat limited.

Under hypothesis (1) and independent of the compensation schemes, a higher effective tax rate will be associated with the use of an income-increasing mix of techniques (that is, firms would tend to use straight-line depreciation, flow-through method for the treatment of investment tax credit, a long period for the amortization of past service pension costs, and the capitalization of interest costs). Given the nature of the sample—stable or growing firms in an inflationary period—it is safe to maintain that this mix would be income increasing. The choice of these accounting alternatives will have affected the entire multi-period distribution of earnings, but, as Hagerman and Zmijewski [1979] did, we assume that management could switch when the alternative being employed was no longer useful. Ideally, one should assign appropriate weights to each of the accounting choices whose impact on reported earnings may differ. However, because of substantial variations in such possible impacts across firms and industries, this was not feasible.

Data

Unlike inventory and depreciation methods, the accounting treatment of

[9] This will not be valid in the future under the "Alternative Minimum Taxation" provisions under Section 55 of the Internal Revenue Code of 1986.

other items was not always disclosed in the corporate annual reports. Therefore, a questionnaire eliciting this and, also, data on compensation schemes, was mailed to the *Fortune* 1,000 largest companies. Two hundred two companies responded but only 145 disclosed their names. Telephone follow-ups were used to obtain missing information from corporate controllers. Where some of the data could not be obtained (such as when a company did not disclose its name and submitted only a partial response) the company was excluded from the sample. The data covered the fiscal year ending December 31, 1979 (the Appendix shows the distribution of the responding companies by volume of sales and industry). Thirteen companies reported an option plan only (group 1), 37 a bonus plan only (group 2), 142 a mixed bonus option plan (group 3), and 10 neither a bonus nor an option plan. These data pertain to explicit contracts only and they do not reflect implicit arrangements that are not written into contracts.[10]

Method

The primary independent variable of interest is the corporate effective tax rate. Because the tax rate varied little over time with no apparent shocks, a cross-sectional regression was used. Firm-size is introduced as a second explanatory variable in one of the regressions. The dependent variable (accounting choice) is dichotomous with respect to each of the accounting methods selected. Thus:

$$Y_i = \alpha + \beta X_i + U_i$$

where $Y=1$ if the accounting method tends to increase income and $Y=0$ if the method tends to decrease income; X_i is the company i's effective average tax rate. The model assumes a constant tax rate, i.e., marginal tax rate = average tax rate = a constant. The tax rate is specifically modelled as an average tax rate which multiplies taxable income and is independent of its magnitude. Therefore, the proper empirical representation of the tax variable is the empirically observed (effective) average tax rate. As the empirical analysis is based on a cross-sectional regression and not a time-series, changes in the average tax rate examined in the model are empirically represented as cross-sectional variations in the average tax rate across the companies in the sample.

Because the dependent variable is dichotomous, a logit transformation was used where possible.[11] Otherwise, for cases in which the samples are too small for use of logit, heteroscedasticity was largely removed by scaling the variables by the standard deviation of the error terms in a weighted least squares regression.

Since it is necessary to observe the joint effect of tax on the *mix* of accounting choices and not on each separately, the (0,1) values assigned to treatments are summed over the (k) treatments used in each regression. The combined dependent variable, thus, obtains a value ranging between 0 and k;[12] then 0 is assigned

[10] Additional data limitation forced us to use (with the exception of group 1) smaller samples in the tests as explained below.

[11] Logit transformations are appropriate whenever the modelling involves discrete, or qualitative, dependent variables. A comprehensive description of logit modelling is provided in Hanushek and Jackson [1977] or Fienberg [1980]. Snedecor and Cochran [1976, p. 494] suggest that the logit transformation is advisable when each cell contains 20 or more observations.

[12] For some treatments, values between 0 and 1 are possible. For example, the amortization of past service pension cost is allowed over a period of 10, 20, 30, or 40 years. We give ten years the value of 0, 20 the value of 1/3, 30 the value of 2/3, and 40 the value of 1. Similarly, the combination of two depreciation methods may yield a value between 0 and 1 to the extent that the proportion of each method could be identified.

(to the dependent variable) if such value is smaller than or equal to $k/2$ and 1 is assigned otherwise. Thus, the mix of k accounting methods is now reflected in the combined dependent variable. This procedure arbitrarily assigns equal weight to each treatment. Zmijewski and Hagerman's [1981] evidence indicates that the results are not likely to be sensitive to arbitrary assignment of weights to different treatments.

Two observations are noteworthy at this point. First, because we were not able to obtain the precise magnitudes of α and γ from the companies that responded to the questionnaires, these are not included as independent variables; but note that their impact on the implications of the tax rate for accounting choice is incorporated in the model as they are allowed to vary optimally with the variations in the tax rate within the long-run analysis. Hence, the hypothesized sign of the coefficient is not affected by their omission. What is affected by the omission is the estimated magnitude of the tax rate coefficient—it will be biased to the extent that α and γ are not independent of the tax rate (see, e.g., Maddala [1977, p. 156]) as, by the very nature of the equilibrium, one does not expect them to be. Without data on α and γ, it is not possible to estimate the bias *empirically*. However, numerical analysis of the equilibrium triple (α^*,γ^*,A^*) reveals negative (positive) association between $\alpha^*(\gamma^*)$ and t; and from the short-run numerical analysis reported in Section II above, the theoretical coefficients of α and γ as independent variables in a regression with A^* as a dependent variable should be positive and negative, respectively. Hence, the *theoretical* bias is negative [Maddala, 1977, p. 156]. In other words, the estimated coefficient of the tax rate would be biased downward and its variance upward. Thus, in a test for a positive sign, we would have a conservative test, both of the sign and of the significance of the coefficient. As to the short-run case, since α and γ are assumed to be constant relative to t, the estimated coefficient is expected to be unbiased.

Second, the model abstracts from variables such as covenant constraints as cited by Daley and Vigeland [1983] to affect accounting manipulations and, in particular, the decision as to whether to capitalize or expense research and development costs. But noninclusion of such variables is unlikely to confound the empirical results, since closeness to covenant constraints is not likely to be systematically related to tax rates; hence, the tax rate coefficient would still be unbiased, although its estimated variance will be upward biased. This will result in a conservative test of significance for the coefficient.[13]

The sample of companies was divided into three groups: those with a stock option plan, those with a bonus plan, and those combining option and bonus.

Specific Tests and Results

The Case of Conformity—Short-Run Scenario. For the option only (group 1) the implication of the model is that $\partial A^{*c}/\partial t$ is always positive (including the treatment of inventory, see the statement of hypothesis (2) above). Therefore, the inventory method is combined with the others into a dependent variable which reflects all methods ($k=5$). For this

[13] Suppose it is argued that closeness to covenant constraints implies that the company suffered cumulative losses and, hence, had available to it loss carryforwards that reduced the effective average tax rate during the year of the empirical test. This negative correlation coupled with the documented positive association between closeness to covenance constraints and choice of income-increasing accounting choices would bias the tax coefficient downward and result in a conservative test of the sign of the coefficient.

group, a positive relation between the dependent variable and the effective tax rate[14] is expected.

Group 2 (bonus plan only) is subdivided into (1) companies selecting all accounting treatments consistently in the same direction (either income increasing or income decreasing), and (2) companies selecting accounting treatments in opposite directions (each company selecting some income increasing treatments and some income decreasing ones). For the first subgroup (companies with consistent choices) it is assumed that the A^* obtained is a corner solution and that the inventory method is chosen to increase income when the other accounting treatments increase income and vice versa. In other words, the companies were assumed to obtain their optimum either at the maximum A or the minimum A and, hence, to want to use all accounting choices to attain either of the extreme points. Accordingly, the inventory method was combined with the other into a joint dependent variable ($k=5$) that is expected to be positively associated with the effective tax rate. As to the second subgroup, A^* is assumed to be interior so that the inventory method would be chosen so as to change income in a direction opposite to that of the other methods. For this subgroup, a separate regression is run for the inventory method with a dependent variable assuming 0 or 1 (LIFO or FIFO), expected to be negatively associated with the tax rate. The dependent variable combining the four remaining methods characterized by nonconformity was, however, expected to be positively associated with the tax rate.

Out of the 13 companies of the first subgroup, four did not disclose all the required data. To increase the sample, six more companies that did not pay bonuses to their management in 1979 were identified (from *Business Week* [May 12, 1980]) thus, bringing the sample size to 15. Because of its small size (where logit is not applicable) a weighted least square regression whereby all the variables were divided by the standard deviation of the error term, was run (see regression 1 in Table 1). The coefficient, while positive, is not statistically significant, and augmenting the sample with 11 companies with a small bonus (less than one percent of net profit) and a large option (more than one percent of outstanding stock) still failed to yield statistical significance. Weighted least square regressions 2 and 3 (Table 1) featuring, respectively, the inventory method and the combined remaining four methods of the 33 companies of the second subgroup (four ineligible observations were deleted), also yield coefficients with signs as expected, but not statistically significant.

The Case of Nonconformity. The short-run scenario analysis of Section II implied that $\partial A^{*c}/\partial t$ can be either positive or negative in the case of conformity (only the inventory method). But, since only the choice of LIFO for inventory is subject to conformity, the five treatments taken as a whole (including the inventory method) can be combined to reflect a choice of accounting mix under nonconformity. Under a long-run scenario as well, A^* always increases in t. Therefore, it is hypothesized that the dependent variable combining all five methods is positively associated with the effective average tax rate. Regression 4 in Table 1 shows the weighted least

[14] As of December 31, 1979, the effective corporate income tax rate differs from the statutory rate due to different state and local taxes, different size of investment tax credit, and some minor items. Thus, different corporations are subject to different effective tax rates. The effective rate used here is the ratio of income tax effectively paid over taxable income (as reported in the 10-Ks). Five companies in the sample reported a negative effective tax rate and were omitted.

TABLE 1
ASSOCIATION BETWEEN ACCOUNTING CHOICE AND EFFECTIVE TAX RATE
RESULTS OF WEIGHTED LEAST SQUARES REGRESSION

$$Y_i = \alpha + \beta X_i + U_i$$

Regression	Group Description	Group n	Binary Dependent Variable (0 or 1)	Expected Sign of Coefficient	Estimated Coefficients (t-statistics, one-tail) Intercept	Estimated Coefficients (t-statistics, one-tail) X	R^2	F-statistic
1	1 (Option Only)	15	All Methods ($k=5$)	+	.925 (1.14)	.360 (.406)	.12	.17
2	2 (Bonus Only)	33	Inventory	−	1.301 (1.61)	−.498 (−.55)	.01	.31
3	2 (Bonus Only)	33	All But Inventory ($k=4$)	+	1.562 (.20)	1.119 (1.26)	.05	1.58
4	3 (Bonus and Option)	102	All Methods ($k=5$)	+	.385 (.85)	.974 (2.00)*	.04	4.00

Y_i = Accounting Choice of Firm i
X_i = Effective Average Tax Rate of Firm i
* Significant at the .025 level

square results for the mixed bonus option companies whereby the dependent variable combines all five methods. Only 102 companies (out of the original 142 in this group) for which the necessary information was available has been included in this regression. The coefficient of the tax rate is positive as hypothesized and significant at the 0.025 level.

Because of the relatively larger number of the mixed bonus option companies, it was possible to use the logit test (with standard-deviation-scaled variables) in Table 2. Regression 1 in Table 2 yields a coefficient that is positive (as expected) and significant at the one percent level.

Watts and Zimmerman [1978] argue that the bigger the company, the more it is exposed to political pressure, and the more it will tend to reduce its reported earnings. They presented responses of companies to an income-decreasing standard proposed by the Financial Accounting Standards Board that were consistent with the political pressure hypothesis. This may imply that large corporations, even when facing a high tax, will not necessarily prefer accounting methods that tend to increase reported earnings since political costs could exceed the benefits. Table 2 features a logit test using sales as a second explanatory variable (a surrogate for size) which has correlation with the tax rate of approximately 0.01.

Results when assets surrogated for size were very similar and are, therefore, omitted. The tax rate coefficient is positive, whereas the sales coefficient is negative; both are statistically significant at the .025 level or higher. However, the negative coefficient attached to sales could be explained in terms of equations (6) and (7) *without* invoking potential political pressures: if large firms are associated with smaller growth (in the sense of relatively small I_1/I_0) they would select a lower A^* than would smaller size firms with possibly larger I_1/I_0. Note that such association is not

TABLE 2

ASSOCIATION BETWEEN ACCOUNTING CHOICE AND EFFECTIVE TAX RATE
RESULTS OF WEIGHTED LOGIT REGRESSION FOR COMPANIES WITH
MIXED BONUS OPTION PLANS CONSIDERING ALL FIVE ACCOUNTING METHODS
($n=102$)

Regression 1: $Y_i=\alpha+\beta X_i+U_i$
Regression 2: $Y_i=\alpha+bX_i+cS_i+\omega_i$

Regression	Expected Sign of Coefficients	Estimated Coefficients (t-statistic, one-tail) Intercept	X	S	R^2	F-statistic
1	+	−.098 (−.47)	1.261 (2.32)**		.57	5.40
2	X: + S: −	−.757 (−1.47)	2.841 (4.61)***	−.000002 (−1.96)*	.70	10.67

Y_i = Accounting Choice of Firm i
X_i = Effective Average Tax Rate of Firm i
S_i = Sales for Firm i
* Significant at the .025 level
** Significant at the .01 level
*** Significant at the .001 level

independently observable, as I_1/I_0 represents the ratio of "effortless" true cash flow.

IV. CONCLUDING REMARKS

This paper shows the existence of an equilibrium solution to the managers' and the owners' maximization problem involving choice of the accounting operator on the part of the manager and choice of the compensation parameters on the part of the owners, when the compensation scheme is linear. Optimality of the compensation scheme was not of concern. The analysis focuses on the sensitivity of the optimal accounting solution to changes in the tax rate and some other parameters of the problem. The main conclusion drawn from the model is that in the case of "nonconformity," a higher corporate income tax rate will be associated with an income-increasing accounting mix. In the case of "conformity" and in the "short-run" (before α^* and γ^*, the optimal bonus and option, respectively, are optimally adjusted following a tax rate change), the results depend on the structure of the managers' compensation scheme; if the option is relatively large, the use of income-increasing accounting treatments is positively related to the tax rate, while if the option is relatively small, the relationship is positive when the bonus is small, and negative when the bonus is large. Nonetheless, since managers operate in an environment whereby the only item treated under "conformity" is inventory, we hypothesized that, in general, the optimal accounting operator increases with an increase in the tax rate and, conversely, decreases with a decrease in the tax rate.

Some remarks on the optimal accounting choice are noteworthy. First, the optimal accounting choice is more sensitive to the specification of the option plan (the proportion of the firm's value offered in the form of option) than it is to the specification of the bonus (the percentage of reported income distributed as a bonus to the manager).

Second, compensation schemes as specified in our model do not seem to be sufficient to guarantee an interior solution for the accounting operator that is consistent with owners' wealth maximization. Some penalty for inaccuracy in conveying expectations appears necessary. This is consistent with the observation of penalties associated with potential litigation costs and losses inherent in suits against managers, as well as reputation effects. While the social arrangement imposing such penalties is exogenous to our system, it is nonetheless endogenous to a global framework wherein owners and others lobby for the arrangement in their own self-interest.

Third, even with this penalty, the accounting policy is sensitive to the specification of α and γ, and moreover, A, the accounting operator (the choice among accounting treatments) is important for owners as a signal of managers' expectations.

Fourth, the sensitivity of the optimal accounting choice to tax rate change differs as between cases of conformity and nonconformity. This implies that, in policy deliberations, the Internal Revenue Service and accounting regulatory bodies should not be indifferent between the two policies.

Fifth, the optimal choice of accounting policy does not seem sensitive to the discount rate, although in the absence of an assumed penalty for inaccuracy, higher sensitivity could be observed.

The test presented in this paper focuses on the sensitivity of the accounting choice to the change in corporate income tax rate. The main result is consistent with the implication of the model. Logit analysis of a group of 102 companies that offered both bonus and option exhibited a significant positive relationship between the choice of accounting mix (the accounting operator A) and the effective tax rate. Further, in this analysis (with R^2 as high as .7034) we confirm the results of earlier work by Watts and Zimmerman [1978], Hagerman and Zmijewski [1979], and Zmijewski and Hagerman [1981], indicating that the choice of income-increasing accounting treatments is negatively correlated with corporate size. Our model provides a theoretical rationale for this observation to the extent that sales are negatively correlated with growth (in the sense of the ratio of "true" incomes).

Although the model is highly simplified (e.g., it suppresses uncertainty and some multi-period aspects), it can be used as a framework within which examination of other variables is possible, pending the development of proper means of measurement. Included are corporation size and political costs associated with different accounting policies as a result of the exposure of the reporting firms to public and regulatory scrutiny. These variables can be formalized and included in the equation for the manager's total compensation.

Appendix

Distribution of Companies by Sales

Sales (in Million $)	*Number of Firms*
0–500	35
501–1000	22
1001–5000	59
5001–20000	15
20001–70000	14

Distribution of Companies by Industry

Industry	*Number of Firms*
Metals and Minerals	16
Oil, Gas, and Mining	15
Food	14
Chemicals	11
Industrial and Farm Equipment	10
Automotive	8
Paper, Fiber, and Wood	8
Communications	7
Electronics	7
Glass, Concrete, Gypsum	6
Pharmaceuticals	5
Tires and Rubber	5
Refineries	4
Textile and Vinyl	4
Office Equipment	3
Leisure	3
Consumer Parts	3
Brewing and Beverage	3
Appliances	3
Aviation	3
Heavy Equipment	2
Publishing	1
Conglomerates	1
Total	142

REFERENCES

Ball, R., and R. Watts, "Some Time-Series Properties of Accounting Income," *The Journal of Finance* (June 1972), pp. 663–681.

Black, F., and M. Scholes, "The Pricing of Options and Corporate Liabilities," *Journal of Political Economy* (May/June 1973), pp. 637–654.

Conference Board, *Top Executive Compensation* (Conference Board, 1974).

Daley, L. A., and R. L. Vigeland, "The Effects of Debt Covenants and Political Costs on the Choice of Accounting Methods: The Case of Accounting for R&D Costs," *Journal of Accounting and Economics* (December 1983), pp. 195–211.

Fienberg, S. E., *The Analysis of Cross-Classified Categorical Data* (The MIT Press, 1980).

Hagerman, R. I., and M. E. Zmijewski, "Some Economic Determinants of Accounting Policy Choice," *Journal of Accounting and Economics* (August 1979), pp. 141-161.
Hanushek, E. A., and J. E. Jackson, *Statistical Methods for Social Scientists* (Academic Press, 1977).
Healy, P. M., "The Effect of Bonus Schemes on Accounting Decisions," *Journal of Accounting and Economics* (April 1985), pp. 85-107.
Holmstrom, B., "Moral Hazard and Observability," *Bell Journal of Economics* (Spring 1979), pp. 74-91.
Kraakman, R. H., "Gate Keepers: The Anatomy of a Third-Party Enforcement Strategy," *Journal of Law, Economics, and Organization* (Spring 1986), pp. 53-64.
Maddala, G. S., *Econometrics* (McGraw-Hill Book Company, 1977).
Murphy, K. J., "Corporate Performance and Managerial Remuneration: An Empirical Analysis," *Journal of Accounting and Economics* (April 1985), pp. 11-42.
Ronen, J., "The Dual Role of Accounting: A Financial-Economic Perspective," in J. L. Bicksler, Ed., *Handbook of Financial Economics* (North Holland Publishing Company, 1979), pp. 415-454.
———, and S. Sadan, *Smoothing Income Numbers: Objectives, Means, and Implications* (Addison-Wesley Publishing Company, 1981).
Snedecor, G. W., and W. G. Cochran, *Statistical Methods*, Sixth Edition (Iowa State University Press, 1967).
Watts, R. L., and R. W. Leftwich, "The Time Series of Annual Accounting Earnings," *Journal of Accounting Research* (Autumn 1977), pp. 253-271.
———, and J. Zimmerman, "Towards a Positive Theory of the Determination of Accounting Standards," THE ACCOUNTING REVIEW (January 1978), pp. 112-134.
Zmijewski, M. E., and R. L. Hagerman, "An Income Strategy Approach to the Positive Theory of Accounting Standard Setting/Choice," *Journal of Accounting and Economics* (August 1981), pp. 129-149.