AUDITOR PERFORMANCE AND THE VALUE OF THE FIRM:

A TEST OF ONE IMPLICATION OF AGENCY THEORY

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CHAPTER I

INTRODUCTION AND PURPOSE

Introduction

The purpose of this research was to seek evidence regarding the validity of certain predictions that can be derived using the Jensen and Meckling (1976) (hereafter J-M) agency theory framework. In their model, auditing plays a specific role in determining the value of the firm. The current study investigated this role and identified a situation which, if the J-M model is correct, should lead to a decrease in the stock price of a specific group of firms. Tests were conducted to determine the consistency of the predicted market reaction with observed phenomena.

According to Jensen and Meckling (1976), the agency theory analysis

> . . . integrates elements from the theory of agency, the theory of property rights and the theory of finance to develop a theory of the ownership structure of the firm. We define the concept of agency costs, show its relationship to the 'separation and control' issue, investigate the nature of the agency costs generated by the existence of debt and outside equity, demonstrate who bears these costs and why, and investigate the Pareto optimality of their existence. We also provide a new definition of the firm, and show how our analysis of the factors influencing the creation and issuance of debt and equity claims is a special case of the supply side of the completeness of markets problem (p. 305).

Identifying further contributions of their analysis, Jensen and Meckling (1976) state

Our theory helps explain:

> 1. why an entrepreneur or manager in a firm . . . will choose a set of activities for the firm such that the total value of the firm is less then it would be if he were the sole owner . . .
> 6. why accounting reports would be provided voluntarily to creditors and stockholders, and why independent auditors would be engaged by management to testify to the accuracy and correctness of such reports (emphasis added) (p. 306).

Briefly summarizing their analysis, agency costs are created because (1) managers and owners of companies are often different individuals, (2) owners are unable to observe all of the actions of the managers, and (3) because of the inability of owners to observe the managers' actions managers will deviate from the actions that will maximize the owners' beneficial interest in the firm. Agency costs are the financial effects of the nonoptimal managerial behavior. J-M posit that owners expect nonoptimal behavior on the part of management, estimate the effects of the divergent behavior, and penalize management accordingly. In other words, the managers bear the effects of their behavior. Therefore, managers have incentives to promise not to engage in nonoptimal behavior. The managers offer financial statements as a device by which owners can monitor management's activities. Owners recognize that they are unable to observe the preparation of the financial statements, and that managers would be able to issue false and misleading financial statements. Owners would therefore require that the financial statements be audited by independent auditors in order to obtain assurance as to the fairness of the statements. Owners are hypothesized to estimate the ability of the audited financial statements to act as an effective deterrent to certain aberrant managerial behavior. The presumption is that audited financial statements can lead to an

increase in the market value of the firm over what it would be without such statements.

The J-M analysis posits a direct relationship between the ability of an audit to limit a manager's aberrant activities and the market value of the firm. Stockholders (and potential stockholders) are thought to estimate the audit's limiting ability. This estimate is based in part on the specific auditor's past performance. The implication is that a change in expected auditor performance will lead to a change in the market value of a firm. This implication of the J-M agency theory model was the point of interest in this research. Specifically, if an event can be identified which can be expected to cause a change in the estimated value of an auditor's monitoring ability, a change in the market value of firms employing this auditor should be in evidence about the time of the signaling event.

In order to select an event that signals a decrease in auditor performance, some expectations model must be employed to determine an anticipated auditor performance level. DeAngelo (1981) showed that audit firm size can be used as a surrogate for audit firm quality. The basic premise of DeAngelo's analysis was that since large firms have more clients, if they are caught "cheating" on any one audit they are exposed to a greater potential loss in revenues than are smaller audit firms with fewer clients. The amount of the expected gain from cheating on an audit may be the same for both the small and large audit firms, but the potential loss from such actions is much more likely to offset the gain for large audit firms than it is for small audit firms. Therefore, since the large audit firm has less incentive to cheat than does a small audit firm, size of the firm can

be used as a substitute variable for expected audit quality. The DeAngelo auditor performance expectation model was employed in this research.

The event chosen as the signal of interest in this research was the July 2, 1975 Securities and Exchange Commission (SEC) sanction against Peat, Marwick, Mitchell & Company (PMM). PMM was one of the "Big 8" accounting firms and one of the largest auditing firms in the world. Using the DeAngelo expectations model, PMM was expected to provide a high level of audit performance. The SEC sanction served as a signal that the level of audit performance by PMM was less than expected. In reference to the SEC sanction, the Wall Street Journal (WSJ) (July 3, 1975) reported:

> The Securities and Exchange Commission announced a settlement with Peat, Marwick, Mitchell & Co. that bars the big accounting firm from accepting most new, publicly held clients for six months.
>
> The sanction involving 'controversies' along with a lengthy critique of the firms' auditing practices, also released yesterday, is believed to be the harshest treatment ever imposed by the SEC on a major accounting firm.
>
> The controversies cited by the SEC involve Peat Marwick's role in auditing the financial statements of five clients that all experienced dramatic-and to many investors, shocking--financial collapses or profit restrictions. These are:
>
> Penn Central Co. and Sterling Homes Corp., both in bankruptcy proceedings; National Student Marketing Corp.; Talley Industries, Inc., and Republic National Life Insurance Co.
>
> . . . the commission's 177-page opinion and order against Peat Marwick portrays an accounting concern that was operating somewhat less than competently and professionally (p. 3).

The report noted that the sanction was "the harshest treatment" imposed on a major CPA firm and that the firm "was operating somewhat less

than competently and professionally." Public notice of this sanction provided the signal of interest for the current research.

Individual law suits against auditing firms were not viewed as appropriate signals for this research due to the problem of identifying the critical point in time around which to anticipate a stock price reaction. In the eyes of the law, a person (firm) is assumed innocent until proven guilty. But when is the firm ajudged guilty by the investing public? Should a stock price reaction occur when a suit is filed, when a suit is settled, or at some time in between? The timing problem posed by legal suits is extremely difficult, if not impossible, to resolve.

The SEC sanction of PMM was believed to be an event that provided a strong signal to investors at the time of occurrence. The SEC practice was to conduct private disciplinary proceedings against professionals under investigation by the SEC. During 1974 and early 1975, the SEC was considering making public all disciplinary proceedings involving professionals who practice before the SEC. In March 1975, the SEC dropped its proposal for public discplinary proceedings. This action followed objections filed by various professional organizations which contended that even if a professional were found innocent of any wrongdoing, the resulting publicity could seriously impair the professional's practice. The privacy of the SEC investigations helps to eliminate at least part of the timing problem that exists with public legal proceedings. For this reason, the SEC sanction was used as the signal in this research.

Statement of Hypothesis

The topic of interest in this research was the relationship between firm market value and an auditor's expected performance. The agency theory analysis implies that a change in the expected performance of an auditor will be reflected by a change in the market value of the firm. The SEC sanction of PMM was the event selected as a signal leading to a revision of expectations regarding PMM's audit performance. The sanction was posited to signal a lower level of performance than was previously expected. The J-M analysis allowed the prediction of a stock price decrease (and a diminished rate of return) following the SEC sanction. The methodology employed to test for the predicted stock price reaction was a variation of the difference in stock returns methodology and is detailed in Chapter III. Two portfolios, one containing PMM client firms and one containing nonPMM client firms, were constructed and the differences in the two portfolio returns were used to test the following hypotheses:

H_0: The difference between the PMM client portfolio return and the nonPMM client portfolio return calculated during the week surrounding the SEC sanction was less than or equal to the mean difference in the portfolios' returns during nonevent weeks.

H_A: The difference bewteen the PMM client portfolio return and the nonPMM client portfolio return calculated during the week surrounding the SEC sanction was greater than the mean difference in the portfolios' returns during nonevent weeks.

Contribution and Limitations of the Research

Agency theory is purported to be an explanatory model. The J-M quote on page 1 stated that the theory explains why activities occur. Agency theory is frequently used to explain the motivation behind an

individual's behavior. The primary justification for this research was to provide evidence which will be useful in assessing the reliability of the J-M agency theory model as a tool of analysis. The observed market reaction to new information regarding the PMM auditing performance provided evidence of the consistency between the agency theory generated hypothesis and observed phenomena. The results of this empirical investigation raise serious doubts about the propriety of using the J-M agency theory framework to explain the motivational factors underlying auditor behavior.

A potential limitation of this research lies in the fact that the research, by necessity, was a market study. The agency theory analysis presented was a partial equilibrium analysis. All factors other than the perceived quality of the audit were held constant in the analysis. Observed market prices are based upon a multitude of factors, any number of which change from day to day. The research methodology employed in this study was specifically designed to attempt to control for the effects of all factors influencing the market price of stocks that are independent of the firm's auditor. The reliability of the results of this research is only as good as the ability of the research design to control for the effects of other factors unrelated to information regarding audit quality.

A further limitation of this research is that a static model (agency theory) was used to address a dynamic question. The J-M agency theory model identifies relationships in equilibrium settings. The analysis in Chapter II required a change in equilibrium. The J-M model may not be appropriate for the study of dynamic situations. However, the J-M framework has been used in a manner similar to the

manner in this research by Watts and Zimmerman (1979b) and by J-M themselves. The impact upon the validity of this research due to this potential limitation was not considered to be great.

CHAPTER II

THE THEORETICAL ANALYSIS

The Jensen and Meckling Model

Jensen and Meckling (1976, p. 308) define an agency relationship as "a contract under which one or more persons (the principals) engage another person (the agent) to perform some service on their behalf which involves delegating some decision making authority to the agent." This seems to define particularly well the relationship between the stockholders and managers of corporations. Typically, these corporations are owned by a number of stockholders and managed by individuals who may own only a small percentage of the shares outstanding. The shareholders are the principals, and the managers are the agents.

A frequent assumption is that both parties in the corporate agency relationship are utility maximizers. If so, then it follows from agency theory that management may not always act in the best interest of the stockholders. De Alessi (1973) identified one reason for divergence between the interest of management and owners in the following passage:

> The accounting periods relevant to a manager's wealth would roughly be limited to those occurring during his tenure in office, and this time horizon would necessarily be shorter than a shareholder's to whom all future accounting periods matter (p. 848).

J-M (1976, p. 308) identify costs created by this divergence. They point out that stockholders can limit the divergence from their

interest by establishing the proper incentive plans for management[1] and by incurring monitoring costs designed to limit management's activities. Monitoring costs consist of both costs of observing the activities of management and costs incurred to control management's activities. In some situations, "bonding costs" will be incurred to guarantee that management will not engage in certain harmful activities or that the owners will be compensated if management does. Even when the stockholders and managers incur the optimal amount of monitoring and bonding costs, a divergence may still exist between managers' decisions and optimal decisions from the stockholders' viewpoint. The wealth effect of this loss in stockholder welfare is termed the residual loss. The sum of the monitoring costs, bonding costs, and the residual loss is identified as agency costs.

Agency costs are the driving force behind the J-M analysis. Owners of a firm wish to maximize firm value. One way to increase firm value is to hire auditors to monitor management and thereby reduce managers' aberrant activities.

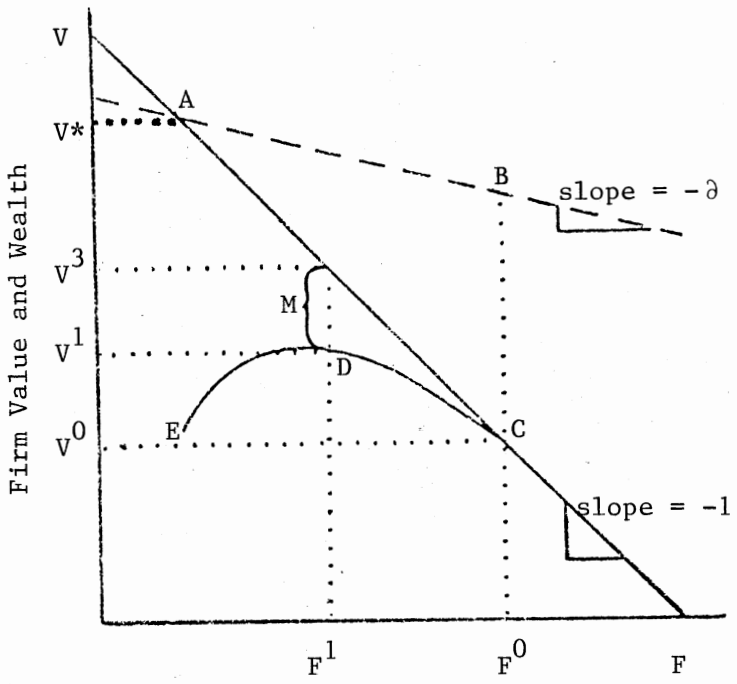
Figure 1(a) illustrates the relationship between firm value, manager's expenditure on non-pecuniary (hereafter NP) benefits and the effects of auditing. The analysis herein presented assumes that investors value a firm as the present value (PV) of future cash flows. An increase (decrease) in the PV of future cash inflows leads to an increase (decrease) in the value (or PV) of the firm. An increase (decrease) in the PV of future cash outflows leads to a decrease (increase) in the value of the firm. A direct relationship exists between firm value and the PV of cash inflows while an inverse relationship exists between firm value and the PV of cash outflows. All cash

flows referenced in the discussion of Figure 1 are assumed to refer to the PV of current and future cash flows. For ease of presentation, the PV notation is dropped during the remainder of this discussion relating to Figure 1.

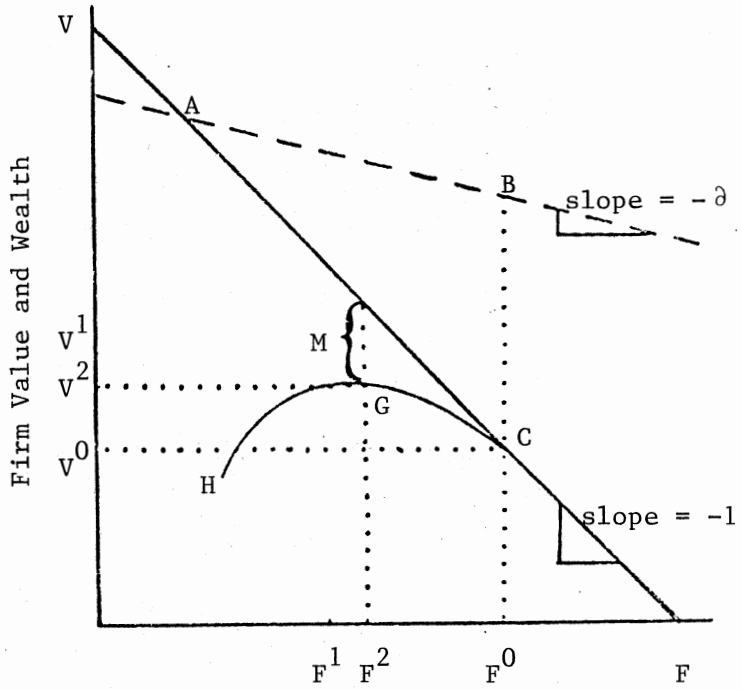
Line VF in Figure 1(a) represents the trade-off between the market value of the firm and a manager's NP expenditures. One dollar spent on NP benefits reduces the value of the firm one dollar. Therefore, VF has a slope of minus one. As a 100% owner of the firm, a manager's budget constraint is represented by VF. After selling a $(1-\partial)$ share of the firm, a manager's ownership share is ∂. A manager's share of one dollar of the firm's resources spent on NP benefits is now ∂; i.e., his share of the reduction of firm profits is his ownership share--∂. The broken line AB has slope equal to minus ∂ and represents a manager's trade-off between wealth and NP expenditures; i.e., AB is his new budget constraint. If point A was a manager's optimal location[2] prior to the sale to outside owners, the new budget constraint would pass through point A since a manager could choose the same wealth and level of NP benefits as when he was a 100% owner.

Assume that with ownership share ∂, the manager's optimal location is point B. His NP expenditure is F^0 and the related value of the firm is V^0. Assuming the equity market makes an unbiased estimate of the manager's actions, the outside investor would anticipate the NP expenditure of F^0 and would be willing to pay only $(1-\partial)$ times V^0 for a $(1-\partial)$ share of the firm. The wealth effect is the decrease in firm value from a point such as V^* to V^0.

Outside equity holders can usually influence a manager's consumption of NP benefits by expending resources to monitor and control management's



(a)



(b)

Figure 1. Firm Value and the Manager's Expenditures on Non-Pecuniary Benefits

actions. The present value of future monitoring expenditures by the outside equity holders reduces the value of the firm to them, dollar for dollar. This reduces the maximum price they will pay for their share of the firm.

Figure 1(a) identifies the effects of monitoring on the manager's actions and the value of the firm. Curve CDE represents a constraint on the NP benefits that can be taken by management when monitoring activities such as auditing financial statements are taken into account. The precise shape and location of CDE is dependent upon the outside owners' estimate of the limiting ability of the monitoring activity. The assumption is made that increases in monitoring expenditures decrease F but at a decreasing rate; i.e., there are decreasing returns to scale of monitoring activities such as independent audits. Suppose the estimate is that an expenditure of M can reduce the manager's NP expenditures from F^0 to F^1 and increase the value of the firm from V^0 to V^1 ($V^1 = V^3-M$). The amount the buyer would pay for a $(1-\partial)$ share of the firm, assuming an expenditure of M for monitoring, would be $(1-\partial)$ times V^1.

The effect of taking monitoring possibilities into account is to increase the amount paid for a $(1-\partial)$ share of the company. Both with and without monitoring, the buyer would pay $(1-\partial)$ times the present value of the future net cash flows and would therefore be indifferent between the two levels of expenditures. The price paid with monitoring is greater because the present value of the future net cash flows is greater. Then, if the market makes an unbiased estimate of the effects of the monitoring expenditures, the manager retains the increase in the market value of the firm that occurs as a result of entering into contracts to provide monitoring.

The above analysis is a general representation of the relationship between monitoring, a manager's consumption of NP benefits, and the market price of a share of the firm. The suggestion has been made that the price an investor will pay for a share of the firm is related to the investor's estimate of the amount of perquisites (or NP benefits) that can be taken by the manager. In turn, investors' estimate of the monitoring activity's ability to limit the manager's aberrant behavior influences the estimated amount of perquisites that can be taken by the manager.

The point of interest in this research is the determiniation of the effect of new information concerning the limiting power of the monitoring activity--auditing. Given the firm value determination framework presented in Figure 1, it is a simple matter to determine the effect on firm value of discovering an audit failure. Viewing Figure 1(b), if it is discovered that the audit limited the manager's consumption of NP benefits to F^2 instead of F^1 for a given firm, it can be seen that the value of the firm would fall to V^2. Alternatively, if the manager converts firm assets to personal use, the value of the firm will be decreased by the amount of the assets converted (plus the amount estimated to be converted in the future). While this result would appear to be a relatively simple exercise, determining the effect of just such a revelation on other firms that engage the offending auditor may be a more difficult task. Watts and Zimmerman (1979b) address this issue with the following statement:

> If the market observes the auditor failing to monitor management, it will adjust downwards the share price of all firms who engage this auditor (to the extent to which the auditor does not reduce agency costs) (p. 279).

The point to note is that in order to see a stock price decrease for a given firm, it is not necessary to show the extent to which an auditor failed to reduce agency costs for that firm. If it is discovered that an auditor has performed at less than the anticipated level, investors may adjust their estimates of the limiting power of this auditing firm's audit. This may lead to a change in the stock price of all firms that engage the auditor in question.

Figure 1(b) is a graphical representation of the result of new information concerning an auditor's performance being presented to investors. Suppose information is presented indicating that the performance by a company's auditor on this company's audit was less than originally anticipated. Specifically, suppose that it was discovered that an expenditure of M for auditing services had limited management's NP expenditures to F^2 and not F^1 as had originally been anticipated. As can be seen the value of the firm would fall from V^1 to V^2.

An important consideration relates to the impact on other firms that engage this auditor. Observing an auditor "failing to monitor management" to the extent anticipated on another firm's audit might cause a revision of each investor's estimate of the limiting power of the audit on each and every audit that the auditor performs. Should this revision occur, for each firm that engages this auditor, investors would shift downward their curve CDE in Figure 1(a) to a new location, such as curve CGH in Figure 1(b).[3] The curve shifts "downward" because a greater expenditure must be made on the audit than originally anticipated in order to limit management's NP expenditures to any level. The predicted result is that each firm with financial statements audited by this auditor should observe a decrease in their stock price

when adverse information concerning their auditor's performance is released.[4]

The preceding paragraph was the basis for the question of interest in the current research. If information was discovered which indicated an auditor was performing at less than the anticipated level, did the observed stock returns of this auditor's clients reflect the hypothesized stock price decrease? Before presenting the methodology used to test the hypotheses presented in Chapter I, the following section contains a review of the literature concerning the propriety of certain agency theory assumptions.

Review of Related Literature

Two of the concerns that exist with respect to the viability of the J-M agency theory model as a tool of analysis are reviewed in this section. The first concern involves the existence and significance of NP benefits. The second concern is whether the model is applicable only to the 100% manager owned firm or whether the model can be extended to cover a broader range of management-ownership combinations.

The reliability of the J-M model as a tool of analysis depends to a large extent upon the existence and the significance of NP benefits. Furubotn and Pejovich (1972) presented a comprehensive review of the literature concerning the ability of management to engage in behavior that is nonoptimal from the viewpoint of the stockholders. The article noted the existence of incentives for management to consume NP benefits, but there was no consensus (at least at the theoretical level) on management's ability to consume NP benefits.

Theoretical debates aside, evidence indicating the existence of NP expenditures in practice would add support to the validity of the J-M agency theory model. A recent U. S. News and World Report labor article (September 8, 1981, pp. 61-62) reported on the use of perquisites by managers. The report stated that perquisites (or perks) are very popular. They supplement executives' salaries which are eroded by inflation. The article stated that perks range from as little as 5 to 10% of salary to as much as 25 to 30%. The article also reported that managers do not like to report perks to stockholders. Many companies sweep perks "under the rug" and occasionally ask accountants to camouflage perks under other categories.

The Wall Street Journal (WSJ) (December 21, 1981, p. 6) provided further evidence that management perks have gone undisclosed. In "Vornado Broke Rules, SEC Charges" the WSJ reported that the Securities and Exchange Commission (SEC) charged that Vornado, Inc. failed to disclose company cars, a chauffeur, and opera tickets, among other items, provided to company officers during the period 1975-1980.

It appears then that perquisites are found in practice. An interesting point to note is that the "perks" referred to in the preceding articles consisted of expenditures on benefits such as company cars, free medical exams, use of vacation resorts, free sports tickets and even personal bodyguards. These are some of the more visible forms of perquisites. A more subtle form of perquisite identified by J-M (1976, p. 313) is the decision by the manager not to devote effort to pursue new profitable ventures. In other words, NP benefits may accrue to management by work avoidance or shirking.

If shirking can be accepted as a perquisite, the loss in firm value due to perquisites or NP benefits could surely be significant. One manifestation of shirking could be the existence of an inadequate internal control system to safeguard company assets and to maintain the integrity of the financial reporting system. The result could be loss of company resources due to carelessness or misappropriation and/or materially misleading financial statements. In this context, an audit failure could result from an over evaluation of internal control which could lead to under performance of substantive tests.

Hughes and Cox (1981) provided another example of shirking. They posited that conflicts of interest may exist within firms which inhibit productivity. The failure of management either to reduce or eliminate these conflicts is shirking. Hughes and Cox hypothesized that the audit could be a means of reducing these conflicts. If the audit can both reduce expenditures on the more visible forms of perquisites and lead to greater productivity through a reduction in shirking, then the audit may well play a significant role in stock price determination.

The foregoing discussion suggested that perquisites exist and that the value of perquisites may be more than trivial. If these suggestions are in fact true, and if the audit can be used to limit managements' aberrant activites, then the relationship hypothesized by the J-M agency theory model should exist when 100% management-owned firms first offer ownership shares to outside parties.

In extending the agency theory analysis to the more typical case of the manager owning either no stock or a small fraction of the firm's outstanding shares of stock, Watts and Zimmerman (1979a) hypothesized that agency costs are borne (at least partially) by the

manager in the form of wage adjustments. The owners are aware that management has incentives to engage in activities divergent from the owners' best interest. The owners then estimate the monetary effects of the management's divergent activities and adjust management's salary accordingly.

This wage adjustment process is consistent with that hypothesized by Ng (1978), Ng and Stoeckenius (1979), Wallace (1980), and Antle (1980). According to these works, the owner sets a management compensation scheme that will encourage alignment of the interests of the manager and the interests of the owner.[5] This compensation scheme is based upon the owner's subjective probability distributions for the manager's and auditor's possible actions and upon the owner's conditional probability that the audit will detect an error in management's report (the company's financial statements), given that an error exists. The compensation scheme specifies penalties to be assessed for nonoptimal behavior on the manager's part that is revealed by the financial statements and/or the auditor's report.

The wage adjustment process just outlined permits a stock price adjustment for new information concerning an auditor's performance. The stock price reaction may exist, in part, because the wage contract is specified at the beginning of the period covered by the contract. If information is discovered after the contract is set that would cause investors to decrease their estimate of the conditional probability that the audit will detect an error given that one exists in the financial statements, then the onwer would wish to decrease the manager's wage to reflect this information but would be unable to do so because he is bound by the original contract. Any failure to

adjust the wage will be reflected in a stock price adjustment. The current owner(s) will bear the loss in firm value due to such new information.

Watts and Zimmerman (1979a) noted that the J-M analysis may be applicable to the case where owners hire managers with no ownership interest in the firm. The J-M analysis continues to be applicable to this new situation because, since information is costly, the owners will not obtain all information necessary to make a full adjustment of the managers' wages. Potential investors will realize this and adjust the price paid for a share of the firm accordingly. In essence, the managers and the current firm owners will be combined and the combination will be treated as the owner/manager in the J-M analysis.

In summary, this chapter contains a presentation of the J-M agency theory model that predicts a specific stock price reaction to information concerning the "quality" of the service provided by an auditor. The existence and significance of NP benefits is of fundamental importance to the J-M agency theory model. Evidence has been presented suggesting that perquisites exist and may be substantial. The suggestion has also been made that the J-M analysis may be appropriate to a broad range of management/onwership combinations. The implication is that the model may be useful for predicting stock price reactions.

ENDNOTES

[1]See Berhold (1971), Heckerman (1975), Ross (1973, 1974), and Wilson (1968) for literature concerning construction of incentives for the agent to act in the principal's interest.

[2]The optimal locations mentioned in reference to Figure 1 were assumed to be points of tangency between relevant indifference curves and budget constraints. The indifference curves were omitted from the graphs to reduce clutter.

[3]Note that the adjusted curve would go through point C, since an expenditure of zero for monitoring would give a firm market value of V^0.

[4]DeAngelo (1981) hypothesized just such a stock price reaction when it is discovered that an auditor has failed to provide the level of service previously anticipated. The article noted a "negative impact on firm value of retaining an auditor who has been shown to 'cheat'" (p. 310). Cheating in the DeAngelo context is an auditor providing a lower level of assurance on financial statements than the level called for in the auditor's employment contract.

[5]For a formal mathematical representation of the process, see Ng and Stoeckenius (1979) and Antle (1981).

CHAPTER III

METHODOLOGY

As described in Chapter II, the J-M agency theory model hypothesizes a specific relationship between firm value and auditor performance. This relationship is noted in Watts and Zimmerman (1979b) and DeAngelo (1981). Both of these works contend that anticipation of the hypothesized stock price reaction can be used to help explain the motivation behind observed owner, manager, and/or auditor behavior. The existence of the proposed firm value-auditor performance relationship is vital to conclusions reached by Watts and Zimmerman, and DeAngelo.

The purpose of this study was to investigate the proposed relationship between auditor performance and the value of the firm. The preceding chapters contained a presentation of the need for this study, the theoretical development that allows the specification of the hypothesis of interest, and a review of current literature on this issue. The purpose of this chapter is to present the development of the methodology used to test the hypothesis of interest. This chapter consists of the following sections: methodological considerations, methodological overview, time frame determination, sample selection, portfolio return construction, and test statistic.

Methodological Considerations

The purpose of this section of Chapter III is to present a discussion of certain research design alternatives available for

security price research. The section begins with a general discussion of the market model (MM) methodology, which is often employed in such studies. The section continues with a general discussion of an alternative research methodology, the difference in returns methodology. The conditions under which each research design choice dominates the other and the conditions under which the two methodologies are equivalent are noted. The section concludes with a discussion of the assumptions underlying the methodology employed in this research.

The methodology often followed in market studies makes use of the MM. The MM and ordinary least squares (OLS) parameter estimation provide a method whereby the return on a security is partitioned into two components: systematic and unsystematic. The systematic component is that part of the security return that is linearly related to the return on the market portfolio. The unsystematic component is the residual portion of the security return and is uncorrelated with the systematic component.

An advantage to using the MM (as opposed to using the raw return itself) is that the effects of extraneous factors related to market wide movements, which may be unrelated to the question of interest in the research, can be extracted from the return on an investment in an individual security. However, Beaver (1981) noted that the MM makes no assumption about the stochastic process generating a security return. The MM is simply an artificial partitioning of a security into two orthogonal components. If the true return generating process is multi-factored, the MM "filters out" only that portion of the return linearly related to the market portfolio. The portions of the return relating to other factors unrelated to the question of interest and unrelated to

the market portfolio continue to be reflected in the residual return. Therefore, residual returns obtained from the MM may still reflect information unrelated to the question of interest (i.e., the MM may not filter out enough of the effects of extraneous information). Consequently, the variance of the MM residual may be greater than the variance of a truely firm-specific security return metric. The result is that although tests conducted using the MM residual may be more powerful than tests using only the raw return, they may be less powerful than a test using the truely firm-specific return metric.

Recent studies have discovered evidence indicating that the true security return generating process may well be multi-factor. For example, Foster (1975) discovered evidence indicating industry factors may impact on individual security returns. Foster found that the R^2 for the regression equations for insurance industry firms were increased significantly by including in the regression calculations, in addition to a market index, an industry index. In addition, King (1966) and Sunder (1973) noted the need to control for industry effects and Kross (1982) included an industry index along with a proxy for the market index.

It appears, then, that due to the omission of relevant variables from the model, the MM may not provide the least variance security return metric. A methodology which may mitigate the effects of variables omitted from the regression equation is the difference in security returns methodology. Under this methodology, control portfolio construction procedures are employed that are designed to create treatment and control portfolios that have security returns that behave in a similar manner. This is attempted by matching treatment

and control firms based on the similarity of a number of items hypothesized to influence the generation of a security's return. Each treatment firm is matched with a control firm with a similar systematic risk (as measured by the beta of the MM), from the same industry (as identified by the Standard Industrial Classification (SIC) code), and of the same relative size (as measured by either total assets or total sales) or some combination of the above mentioned criteria. (For example, Harrison (1977), Ingram (1978), and Ricks (1982) matched firms on beta and industry; Meek (1983) matched firms on industry and size; and Vigeland (1981) matched firms on beta, industry, and size.) The major difference between the treatment and control samples is that the control sample is selected from the pool of firms either hypothesized not to be affected by the question of interest in the research or hypothesized to be affected in a manner opposite to that of the treatment sample firms.

Such control sample construction procedures are designed to assure that treatment and control samples are of highly similar composition. The assumption is that any factor not related to the event being tested should affect the treatment and control samples similarly. Therefore, any unusual treatment sample activity not observed in the control sample during the event period is assumed attributable to the information contained in the signal of interest. The security return metric used for testing is the difference in treatment and control sample returns.

The motivation for the use of the difference in returns methodology is the desire to filter out of a test statistic the influence of all factors not related to the question of interest in the research. In

other words, the desire to obtain a least variance security return measure motivates the use of the difference in returns methodology. The variance of the security return metric, difference in returns, is

$$\text{var}(d_{i,j}) = \text{var}(r_i) + \text{var}(r_j) - 2\ \text{cov}(r_i, r_j) \qquad (1)$$

where $\text{var}(d_{i,j})$ = variance of the difference between the returns of security i and security j,

$\text{var}(r_i)$ = variance of the return of security i,

$\text{var}(r_j)$ = variance of the return of security j, and

$\text{cov}(r_i, r_j)$ = covariance between the returns of the two securities.

The matching procedures typically employed attempt to maximize the covariance term of equation (1). Maximizing the covariance term leads to the minimum variance for the return metric, difference in returns.

The specific matching procedures that have been employed may not have led to the maximum covariance between the returns of the matched pair firms. The matching procedures that have been used may have captured some of the factors that lead to a covariance between two returns, but other factors may have existed that influenced security returns that were not considered in the matching process that was employed. In addition, matching firms on the similarity of their betas from the MM was unappealing. This was because knowledge of the betas of two securities does not imply any relationship between the returns of the two securities. Information implied by knowledge of two securities betas can be demonstrated by the following example. The beta obtained from the MM is calculated as

$$b_i = \text{cov}(r_{it}, r_{mt})/\text{var}(r_{mt}) \qquad (2)$$

where $cov(r_{ij}, r_{mt})$ = covariance between security i's return and the return on the market portfolio, and

$var(r_{mt})$ = variance of the market portfolio.

The correlation between the return on security i and the market is calculated as

$$p_{im} = cov(r_{it}, r_{mt}) / \sqrt{(var(r_{it}) * var(r_{mt}))} \quad (3)$$

where p_{im} is the correlation between return i and the market. If b_1 equals b_2 and $var(r_{1t})$ equals $var(r_{2t})$, then from equations (2) and (3), it can be shown that p_{1m} equals p_{2m}. In other words, equality of the betas for two securities can imply equal correlation of each security's returns with the market return.

However, information about the correlation between each security's return and the market provides little information relative to the correlation between the returns of the two securities themselves. Muliak (1972) noted

> The fact that two variables correlate moderately and equally well with a third variable is no guarantee that the first two variables are even moderately correlated. In other words, inferences from correlation coefficients are not trasitive across variables (p. 329).

The fact that the returns of firm 1 and the returns of firm 2 are correlated with the return on the market portfolio does not guarantee that the firm 1 return is correlated with the firm 2 return. The two firms' returns <u>may</u> be correlated, but in the absence of additional information, one cannot make this determination based on similarity of the two firm's betas from the MM.

A superior procedure for matching treatment and control firms in past studies would appear to have been to match the firms based on the observed relationship between the returns of the two firms over a

period covering the time span of the research. Such a matching procedure would have had the potential to overcome the shortfalls of the control sample selection procedures typically employed. While matching firms based on similarity of betas may result in two firms which have correlated returns, matching on the correlation between the two securities' returns would have assured the desired result. Matching on the observed relationship also would have assured that all factors impacting on a security's return (excluding the event of interest in the research) were captured.

The matching of treatment and control firms for the current research was accomplsihed by matching on the observed security return relationships that existed over the time period covered by the research. The expectation was that by matching on the maximum correlations observed, the covariance term of equation (1) would have been maximized. The result was that the difference in returns was expected to be a minimum variance security return measure.

Beaver (1981) analyzed the power of tests conducted using the difference in returns methodology. The magnitude of the variance of the return metric, difference in security returns, was compared to the magnitude of the variance of the treatment firm residuals obtained using the MM. Beaver noted certain conditions that should be met before the difference in returns methodology would be superior to a methodology based on residual returns. The conditions are: (1) the treatment and control portfolios must have the same betas; (2) the variance of the security returns for both portfolios must be equivalent; (3) the time series correlation among the returns comprising the two portfolios must exceed .5; and (4) the assumption must be made that the equality of

the betas imply an equality of the expected returns of the two portfolios.

The sample selection procedures in the current research may have provided two portfolios for which Beaver's conditions held sufficiently well to justify the use of the difference in returns methodology. The sample selection procedures were expected to provide two relatively large portfolios that were diversified across industries. When this occurs, the portfolio returns can be (and were) expected to approximate the market return. The betas of the two portfolios were both expected to be equal to approximately one. In addition, the equality of the variance of the treatment and control firms' security returns was assumed. To further satisfy Beaver's conditions, the equality of the two firms' betas must be assumed to imply equality of the expected returns of the two portfolios. As noted above, in the absence of additional information about the relationship between the two securities, this implication can not always be assumed to hold. However, the control sample selection procedures employed in this study were designed to obtain firms which did have an observed relationship between one another. The matching procedure employed indicated that the assumption of equality of expected portfolio returns was not unreasonable.

The final condition noted by Beaver was that the time series correlation among the firms comprising the portfolios exceed the .5 level. Correlation is thought to be greatest when the security returns under investigation are drawn from overlapping time periods. If the time series correlation can ever be expected to exceed the .5 level, it would be expected to occur when the research consisted of a large

number of overlapping time periods. The current research contains not only overlapping time periods, but identical time periods from which security returns were obtained. The commonality of the time periods covered by the research indicated that the correlation had the potential to be relatively high. In addition, the firms were matched on the basis of time series correlation. Therefore the anticipated level of time series correlation among the firms comprising the treatment and control portfolios was expected to exceed the .5 level in this study.

The difference in returns methodology was selected as the research design for this study because this research design was expected to provide a minimum variance security return metric. Matching firms based upon the maximum correlations observed was expected to maximize the covariance term of equation (1). The result was that the variance of the difference in returns was expected to be minimized. The assumption was also made that the conditions noted by Beaver (1981) were met and the return metric, difference in security returns, may have been superior to a return metric based upon a residual return analysis. The following sections of Chapter III contain a detailed presentation of the specific methodology employed in the current study.

Methodological Overview

The event of interest in this research was the July 2, 1975 SEC sanction of PMM. A group of PMM client firms were identified. This group of firms was examined for the existence of data missing from the Center for Research in Security Prices (CRSP) daily returns tape for the time period under consideration and all firms with missing data were eliminated from further consideration. Control portfolio

selection procedures were then applied and a control portfolio with a high degree of correlation with the treatment portfolio was obtained. One hunred independent weekly observations of the treatment-control portfolio difference were obtained and the mean and variance of these observations were used to test whether the difference in returns for the even week were significantly greater than the mean difference of the 100 nonevent weeks.

Time Frame Determination

The objective of this research was to determine if a stock return decrease occurred around the date of the July 2, 1975 SEC sanction. The length of the test period necessary to capture the hypothesized reaction was difficult to determine. Verrecchia (1980, p. 63) suggested that, because there is a cost involved in processing information, there exists "a relationship between the rapidity of price adjustments to information and the accuracy or reliability of the information, as it is perceived by investors." Based on a competitive two-person trading game analysis, Verrecchia (1980, p. 87) concluded, ". . . as the precision associated with the information (as determined by a consensus judgment among investors) increases, the rapidity of price adjustments to the information will increase correspondingly." The "precision" of the signal (the SEC sanction) in the current research was difficult to estimate.

The test period in this research was arbitrarily chosen to be the five day trading period that began two days before the date of the sanction and that ended two days after that date. The five day trading periods used in this research are referred to as weeks. The event week

included the trading days of June 30, July 1, 2, 3, and 7. The Friday following the SEC sanction was the Fourth of July and the market was closed on that day. The sanction was announced on July 2 by the SEC and was covered extensively in the WSJ on July 3. The event week contained a full trading day which took place five days after the date of the release of the SEC sanction and four days after the sanction was reported in the WSJ. The event week was believed to be a sufficiently long period of time in which to capture a stock return reaction to the sanction, should one have occurred.

A residual inspection procedure was conducted to determine if an extended time period appeared necessary. Scholes and Williams (1977) (hereafter S-W) have shown that, due to nontrading, OLS estimates of the MM are biased when applied to daily return data. S-W estimates of the parameters of the MM tend to reduce the bias inherent in OLS estimates of the MM parameters. The S-W estimates are

$$a_i^* = \frac{1}{T-2} \sum_{t=2}^{T-1} r_{it}^s - B_i^* \frac{1}{T-2} \sum_{t=2}^{T-1} r_{it}^s ,$$

where the supercripts s denotes the observed rate of return; and

$$B_i^* = (B_i^- + B_i + B_i^+)/(1+2p_m) ,$$

where B_i^-, B_i, and B_i^+ are the OLS estimates of the MM obtained by regressing r_{it} on $r_{m,t-1}$, r_{mt}, and $r_{m,t+1}$, respectively; and p_m is the autocorrelation coefficient for the market index, r_m. The S-W estimates were calculated for each sample firm using the 150 day period beginning 170 trading days and ending 21 days before the July 2, 1975 event date. The equally weighted index on the CRSP tape was used as a proxy for the market index. The parmeters thus obtained were used to calculate the

estimated residual returns for each sample firm for the 41 trading day period centered on the July 2, 1975 event date. Ninety-five percent confidence intervals for each firm's residuals were plotted for each sample firm along with the estimated residuals themselves. In addition, the cumulative average residual (CAR) for both the treatment and control portfolios were calculated as

$$CAR_d = \sum_{j=1}^{d} \sum_{i=1}^{n} u_{i,j} / n$$

where d = day -20 to 20,

n = the number of firms in each portfolio, and

$u_{i,j}$ = the residual return for firm i on day j.

The analysis of the individual residual plottings as well as the examination of the CAR for each portfolio provided no evidence that the event period should be extended beyond the five trading day period used in the research.

The total time period under consideration in this research was 211 weeks. Two hundred of these weeks were used for treatment and control portfolio matching and nonevent week return calculations. Ten weeks (five on each side of the event week) were held out of all calculations. This was done to attempt to eliminate any bias that may have been induced by market reaction to the SEC sanction during these weeks. The remaining week was the week of the July 2, 1975 SEC sanction of PMM, the event week.

The 200 weeks that were used for matching and the nonevent week return calculations were identified as weeks w = -155, ..., -6 and w = 6, ..., 55 where w = 0 was defined as the event week. One hundred of these 200 weeks were selected at random and used to calculate the

return differences employed for hypothesis testing. These weeks were selected at random in order to provide an assurance of independence between the observations used for testing purposes. Any given observation selected, implies little about any other observation selected. The remaining 100 weeks were used to match treatment and control portfolios.

The following time line is presented to clarify the distribution of the weekly periods covered by this research. The symbol, |-|, represents one, five trading day period which is denoted as a week. The E represents the week of the SEC sanction, the event week; each D represents a randomly selected week used in calculating the difference in portfolio returns; each M represents a week used in matching treatment and control firms; and each W represents one of the five weeks on each side of the event week that were withheld from all calculations.

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-155 -154 -153 . . . -5 -4 -3 -2 -1 0 1 2 3 4 5 . . . 52 53 54 55
|---|----|----|-|-|-|--|--|--|--|-|-|-|-|-|-|-|-|-|--|--|--|--|
  D    M    M  D M D  W  W  W  W  W E W W W W W M M D  D  D  M  D
```

Gonedes (1973), Grant (1980), and Oppong (1980) have implied that up to five years may be a reasonable time period to assume a stable security return relationship. The time span of this research covered a total of just over four years (June 1, 1972 through August 5, 1976). This time span was selected as a compromise between the need for a sufficiently short period of time to assure a stable security return relationship and the need for a sufficient number of observed weekly returns to maintain a large number of degrees of freedom for hypothesis testing.

Sample Selection

Both a treatment and a control sample of firms were obtained. The treatment sample consisted of all firms:

1. Which were listed as PMM clients in the 1976 edition of Who Audits America[1] (WAA) or were identified by the WSJ as having changed audit firms from PMM between June 30, 1975 and December 31, 1975.

2. Which had 1974 sales (as reported in WAA) of $10 million or greater.

3. Which had security returns listed on the CRSP daily returns file.

4. Which had no missing data on the CRSP daily returns file for the matching and the testing periods.

The 1976 edition of WAA served as the basis for identifying PMM client firms. Requirement (2) was invoked in order to make the identification procedure manageable. The assumption was made that the likelihood of a small firm being included on the CRSP tape and ultimately being included in the treatment sample was remote. An examination was conducted to determine the reasonableness of this assumption. No evidence was discovered that indicated that a large number of these smaller firms would, in fact, have been included in the ultimate treatment portfolio. If evidence had been discovered that indicated that a large number of potential treatment firms were excluded by requirement (2), this matching procedure would have been deleted.

The control group sample was created by matching each treatment firm with a nonPMM[2] client firm that had security returns which were highly correlated with the treatment firm's security returns for the time period under consideration. This was accomplished as follows: all firms listed on the CRSP tape with no missing data for the time

period under study were identified. The daily stock returns for all firms so identified were converted into weekly returns using the procedure described in the following section of this chapter. The correlation was calculated between the treatment firm's weekly returns and all other firm's weekly returns for the 100 weeks identified as matching weeks. For each treatment firm, one control firm was selected. Each control firm was matched with only one treatment firm. The expectation was that one potential control firm might have been the highest correlated firm with more than one treatment firm. Therefore, some criterion had to be employed to allow the selection process to be completed. The control sample was selected so as to maximize the average correlation between the treatment-control matched pair firms ultimately chosen. To meet this objective, for each treatment firm, the ten firms whose returns were most highly correlated with the treatment firm were listed, along with the correlation coefficient for each possible match. The match ultimately selected was that combination which led to the smallest reduction in the average matched pair correlation between the two portfolios. This particular matching procedure was expected to result in a high degree of correlation between the treatment portfolio return and the control portfolio return. In other words, maximizing the correlation at the individual firm level was expected to provide treatment and control portfolios which were maximally correlated at the portfolio level.

The disadvantage to the methodology employed in this research was that two firms may be matched based on "spurious correlation." Such an occurrence was a real concern. However, the deleterious effects of such an occurrence were unclear. Since the relationship

observed between the matched pairs appeared to exist across the time span covered by the correlation calculations, it was expected to exist during the event week also. If this expectation was reasonable, the SEC sanction would still have been the appropriate differentiating factor during the event week and the methodology employed in the current research may have been appropriate. If so, then the matching procedure employed may have provided a stronger test (due to a higher level of covariance) than the matching procedures typically employed in security return studies, while sacrificing little in the way of generality of the results.

Portfolio Return Construction

The matching procedures used in this research required the conversion of daily security returns obtained from the CRSP tape into weekly returns. This was accomplished by applying the following transformation:

$$r_{i,w} = \left(\prod_{t=1}^{5} (1 + r_{i,t}) \right) - 1$$

where $r_{i,w}$ = return on the ith firm for week w, and

$r_{i,t}$ = return on the ith firm for day t.

The above procedure resulted in a transformation of the returns on a security from 1,055 trading days listed on the CRSP daily returns file into 211 weekly returns.

Once the above conversion was completed for all firms on the CRSP tape with no missing data for the time period under study, the treatment and control firm matching was accomplished. After this process was completed, the data for the individual treatment firms was converted

into a treatment portfolio return and the data for the control firms was converted into a control portfolio return by applying the following conversion process:

$$r_{b,w} = \frac{\sum_{i=1}^{N} r_{i,w}}{N}$$

where $r_{b,w}$ = return on portfolio b in week w,

$r_{i,w}$ = return on the ith firm of portfolio b for week w, and

N = number of securities in portfolio b.

The weekly return on a portfolio consisted of the return for a five-day period, t = 1 to 5, on an equal investment in firms i, i = 1, ..., N, beginning on the morning of t = 1 with the sale occurring the evening of t = 5.

Test Statistic

The difference in weekly returns was calculated both at the individual matched pair level and at the portfolio level. The difference at the matched pair level was calculated as:

$$d_{i,w} = r_{ci,w} - r_{ti,w}$$

where $d_{i,w}$ = difference for pair i during week w,

$r_{ci,w}$ = return on the ith control firm during week w, and

$r_{ti,w}$ = return on the ith treatment firm during week w.

The difference at the portfolio level was then calculated as:

$$d_{p,w} = r_{c,w} - r_{t,w}$$

where $d_{p,w}$ = difference in portfolio returns during week w,

$r_{c,w}$ = return on the control portfolio during week w, and

$r_{t,w}$ = return on the treatment portfolio during week w.

The mean difference and the related standard deviation for the 100 random weekly differences was computed as:

$$\bar{d}_p = \frac{1}{100} \sum_{w=1}^{100} d_{p,w}$$

$$S_d = \sqrt{\frac{\sum_{i=1}^{100} (d_i - \bar{d})^2}{99}}$$

where $\bar{d}_p$ = mean difference in weekly returns, and

S_d = standard deviation of the weekly differences.

At the portfolio level, since both portfolios were expected to reflect the market portfolio, the expected value of the mean difference was near zero for nonevent periods. The treatment and control portfolio weekly returns were expected to be equivalent. The precise expected value of the return difference was not critical given the methodology employed, i.e., only the relative position of each expected portfolio return relative to the mean location determined during the nonevent weeks was important in determining the expected value of the event week difference. During the week of the sanction, the nonPMM portfolio return had an expected value equal to the mean nonPMM portfolio return calculated during the nonevent weeks. The PMM portfolio return was hypothesized to be below the mean value for the PMM portfolio calculated during the nonevent periods. The difference (control return minus treatment return) in the returns of the two portfolios during the event week was therefore expected to be positive and above the mean difference

during nonevent periods. The difference activity at the matched pair level was expected to react in the same manner as the portfolio level. A one tailed z test was used to determine if the observed difference in the weekly returns were consistent with the hypothesized return activity. Formally, the null and alternative hypotheses were:

$$H_0: \quad d_E \leq \bar{d}$$

$$H_A: \quad d_E > \bar{d}$$

where the subscript E represents the event week. Thus, under the null hypothesis the statistic

$$z_{calc} = (d_E - \bar{d})/S_d$$

has a z distribution with the mean equal to zero and a variance equal to one.[3] The approximate observed significance level was calculated at the portfolio level. The individual matched pair z statistics were presented as descriptive measures of the treatment-control matched pair return activity. In addition, the number of matched pair difference z statistics which exceeded critical values for significance levels of .05 and .10 were noted for matched pairs where the normality of the distribution of the 100 nonevent week differences could not be rejected at the .10 significance level. The normality of the underlying distribution was assessed by reference to the Kolomogorov-Smirnov D-statistic calculated for each difference stream.

The results of the data analysis based on the above noted tests are presented in Chapter IV. The tests conducted provided unexpected results. In order to obtain additional evidence pertaining to the direction of the security return activity during the week of the SEC

sanction, a test was conducted using S-W estimates of the parameters of the MM for the PMM client portfolio only. The S-W estimates were calculated using the 100 week matching period. The estimates were made by regressing the treatment portfolio weekly returns on the weekly values of an equally weighted index. The index was constructed by converting the equally weighted index from the CRSP daily returns file into weekly values. The conversion process was the same as that used to convert the daily security returns into weekly values. The S-W estimates were then used to calculate the residual weekly return for the treatment portfolio using the 100 nonevent test weeks and the week of the SEC sanction.

A z test was conducted to determine if the residual return during the week of the SEC sanction was significantly below the mean residual obtained from the 100 nonevent weeks. The residual return test provided results consistent with the difference in the returns tests in terms of the direction of the security return activity. The result of the residual return test is reported in Chapter IV along with the results of the tests performed using the difference in returns methodology.

ENDNOTES

[1]The 1976 edition was based on data obtained from financial statements for years ended in 1975.

[2]The identity of each of the sample firms' auditor was obtained by reference to WAA. The identity of each firm's auditor was verified by reference to Moody's Industrial Manual where possible.

[3]The z test was used in the current research instead of the t test because the sample size of 100 observations was deemed large enough to justify the assumption that the sample mean and the sample variance equaled the true population parameters. With the population parameters assumed to be known, the use of the z test is appropriate. In addition, the test performed was analogous to the two sample t tests in the special case where n_2 equals 1. In this case, the t statistic is calculated as

$$t_{calc} = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2 n_1 + s_2^2 n_2}{n_1 + n_2 - 2} \cdot \frac{n_1 + n_2}{n_1 n_2}}}$$

where s_i^2 = the variance of sample i and

n_i = the number of observations in sample i.

In the current research, n_1 equals 100, n_2 equals 1, s_2^2 equals zero, and $\bar{X}_2$ equals the event week realization. The t calc reduces to

$$t_{calc} = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{s_1^2 \frac{101}{99}}}$$

The difference between the calculated t and the calculated z would be so small that the two tests would provide essentially equivalent results.

CHAPTER IV

DATA COLLECTION AND RESULTS OF THE DATA ANALYSIS

Sample Selection

An examination of the 1976 edition of WAA provided a list of 968 firms which were identified as PMM clients. Of these, 243 firms (25%) reported sales under $10 million. In order to assess the potential impact of the $10 million sales limitation on the treatment sample (see requirement 2, p. 35), the percentage of the PMM client firms with sales of $10 million (as listed in WAA) which were ultimately included in the treatment portfolio was determined. Of the 20 firms with listed sales of $10 million, only one met all other sample selection requirements and was ultimately included in the treatment sample. Given that only 5% of the potential treatment firms with $10 million of sales was ultimately included in the treatment portfolio, the loss in potential treatment firms due to the $10 million sales limitation was assumed to be insignificant. Therefore, the $10 million lower limit on reported sales was invoked and the 243 firms with sales under $10 million were eliminated from further consideration.

Of the remaining 725 firms (968-243), 383 were not listed on the CRSP daily returns tape (requirement 3, p. 35) and were deleted from the study. An additional 165 firms were deleted due to the existence of missing data (either no data listed or the CRSP missing data code encountered) on the CRSP tape for the time period under study. The

application of the listed treatment identification procedures resulted in a total treatment sample of 177 firms identified as PMM clients.

The identification of the control sample was accomplished by identifying the ten nonPMM client firms that had weekly returns that were most highly correlated with each treatment firm over the period used for matching purposes. To produce this listing, the correlation was calculated between the returns of each of the 177 treatment firms and the returns of all 1,401 nonPMM client firms listed on the CRSP tape with no missing data for the period under study. Correlation coefficients were calculated over the 100 weeks used for matching purposes and were stored in a matrix that contained 177 columns and 1,401 rows. The columns represented treatment firms and the rows represented potential control firms. Using this matrix, each column was searched for the top ten correlation coefficients. A list was made containing the CRSP identification numbers and the correlation coefficients of each of the top ten correlated firms for each of the 177 treatment firms. From this list a new list was made containing the identification number for each treatment firm matched with the identification number of the treatment firm's highest correlated firm. The new list was searched for nonPMM firms that appeared more than once on the list. A firm being listed more than once signified that this particular firm was ranked as the highest correlated firm with more than one treatment firm. In the instances where multiple treatment firms were most highly correlated with one nonPMM client firm, all but one of these treatment firms were matched with a control firm that ranked as other than the highest correlated firm. The particular treatment-control combination ultimately chosen was that

combination that led to the highest average correlation across the treatment-control matched pairs.

In order to clarify the matching procedure employed, consider the following example. Assume that treatment firm A was correlated with the nonPMM firm C at the .80 level and was correlated with the nonPMM firm D at the .70 level. Also assume that treatment firm B was correlated with firm C at the .60 level and was correlated with nonPMM firm E at the .40 level. The application of the selection process in this instance would result in an A-D combination and a B-C combination. This particular combination would result in an average correlation between the two pairs of .65 [(.70 + .60)/2]. Any other combination chosen would have resulted in a lower average correlation for the two pairs of firms (and would have had the same effect on the average correlation coefficient for the entire portfolio).

Table I displays the number of PMM client firms that were matched with their first highest, second highest, etc. correlated nonPMM client firms. As can be seen from the table, 133 or 75.1% of the treatment firms were matched with the nonPMM firm with stock returns most highly correlated with the respective treatment firm. Another 33 firms or 18.7% of the treatment sample were matched with the nonPMM firm that ranked as the second most highly correlated firm with the respective treatment firm. Only 6.3% of the treatment firms were matched with control firms that ranked lower than the second most highly correlated firm. Certain implications that can be drawn from Table I are presented in the following section of this chapter.

TABLE I

TREATMENT-CONTROL CORRELATION RANKINGS

Rank	Number of Firms	Percentage
1	133	75.1
2	33	18.7
3	5	2.8
4	4	2.2
6	1	.6
7	1	.6
Totals	177	100.0

Table II presented below displays information pertaining to the distribution of the treatment-control correlation coefficients. Although the lowest correlation coefficient was .3766, 90% of the matched pairs had a correlation coefficient of .5 or greater. Table II shows that the average correlation was .5954. The median correlation coefficient was .5901. The data in Table II provided an indication that the matching procedures employed in the current research provided matched pairs of firms that exhibited a fairly strong degree of association with one another.

In addition to the data in Table II, the average correlation achievable had each treatment firm been matched with its highest correlated firm was calculated. The purpose of this calculation was to assess the impact on average correlation of matching firms with other than their highest correlated firm. The average of the 177 maximum matched pair correlations was .6005. The reduction in average

correlation was only .0051. If average matched pair correlations can act as a surrogate indicator for the strength of the portfolio correlation, the reduction in portfolio correlation appears to have been minimal due to the matching criteria employed.

TABLE II

DISTRIBUTIONAL PROPERTIES OF THE TREATMENT-CONTROL CORRELATION COEFFICIENTS

Deciles of the Distribution of the 177 Matched Pairs:

10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
.5012	.5367	.5522	.5695	.5901	.6049	.6264	.6544	.6960	.8125

Other Distributional Properties of the 177 Matched Pairs:

Mean Correlation Coefficient	.5954
Standard Deviation	.0808
Range	.3766 to .8125

Aggregate Treatment-Control Portfolio Correlation Coefficient:

Portfolio Correlation Coefficient	.9884

The actual portfolio correlation coefficient was .9884. A correlation coefficient of this magnitude was not unexpected. The treatment-control matching procedures were expected to lead to a high degree of correlation at the portfolio level. Aggregation to the portfolio level was expected to diversify away a portion of the "noise" contained in the individual returns themselves. If the basic return generation

process for each of the matched pairs was similar (which was the assumption underlying the matching criteria employed), reduction of random noise elements in the returns could be expected to lead to portfolio returns which reflect the association between the true underlying return generation processes. In addition and as noted previously, both the treatment and control portfolios were expected to be composed of a highly diversified (in terms of industry classifications) group of firms. Given relatively large diversified portfolios, both sets of portfolio returns can be expected to approximate the returns on the market portfolio. When this occurs, a high degree of correlation between the returns of the two portfolios can be expected.

The portfolio selection procedures employed provided both a treatment sample and a highly correlated control sample. The final step undertaken in the portfolio selection process was to search for evidence of other events which may have influenced the returns of individual firms and which may have been unrelated to the SEC sanction of PMM. A search for information relating to any of the 354 sample firms during the months of June and July, 1975 was accomplished by reference to the Wall Street Journal Index. Particular attention was paid to the dates of earnings announcements for each of the sample firms. No sample firm had an earnings announcement during the event week and no other information was discovered which indicated the need to make any adjustment of the sample firms obtained.

In addition to the above mentioned information search, a residual inspection procedure was conducted. For each firm, S-W (see Chapter III, pp. 32-33) estimates of the parameters of the MM were obtained using daily data covering a 150 day period which began 170 days prior

to the event date. The cumulative average residual (CAR) was calculated for each portfolio over the 41 day period centered on the date of the SEC sanction. Examination of the CAR for each portfolio provided no indication of abnormal portfolio return activity. Had unusual return activity been discovered, a more intensive search for information relating to the sample firms would have been undertaken.

The information search undertaken in this research provided no indication of conflicting signals that might interfere with investigation of the question of interest in the current research. Therefore, all 177 matched pairs were used in the tests reported in the remainder of this chapter. Before presenting the results of tests performed, the following section contains a discussion of the potential impact of correlated data on the presentation of matched pair data.

Correlated Returns and Matched Pair Data

Time series correlation is a potential problem in any security return study where the returns under investigation are obtained from overlapping time periods. As noted previously, the current research contains identical time periods from which security returns were obtained. This fact itself indicated that the potential existed for a high degree of correlation among the returns comprising the sample portfolios. The problem presented by such correlation was that nonindependence among the matched pairs may have limited the applicability of inferences drawn based on the joint distribution of the z statistics presented in the following section of this chapter.

The data in Table I indicated that time series correlation existed among certain of the firms of the two portfolios. Although 75.1% of

the firms were matched with their highest correlated firm, nearly 25% of the firms were matched with a firm other than their highest correlated firm. The highest correlated firms for this latter 25% were contained in the control portfolio, but were matched with another treatment firm. The implication is that there existed the potential for up to 50% of the treatment-control matched pairs to have exhibited some degree of dependency with other firms.

If the correlation suggested by Table I along with other sources of correlation existed and was significant, the statistics presented for the 177 individual matched pair differences may not be independent and interpretation of the joint distribution of the z statistics presented should be made with caution. Some may question the wisdom of even presenting the individual return data given the apparent strong possibility of dependencies among returns. The individual paired return data is presented in this study even though evidence indicates dependencies may exist in the data. Since the data under scrutiny consists of matched pair differences, the possibility exists that the differences themselves may be independent. The process of converting raw returns into return differences may tend to remove part or all of the dependencies between the individual returns themselves and may provide security return measures which are independent across firms. For example, assume that treatment firms A and B exhibited a high degree of dependencies. Also assume that control firms C and D were independent. The return differences obtained from the A-C pair may have been totally unrelated to the difference string obtained from the B-D pair. Sufficient doubt about the severity of the cross-sectional correlation between the matched pair differences appeared

to exist to justify the inclusion of the data and to justify the consideration of the joint distribution of the z statistics applicable to the data.

Analysis of the Matched Pair Differences

As noted above and in Chapter III, z statistics are presented for both the matched pair differences and for the portfolio differences. For the z statistic to be applicable, the underlying distribution of the difference in the security returns between the treatment and control samples must be approximately normal. The Kolmogorov-Smirnov (K-S) goodness of fit test was performed on the 100 nonevent week differences for each of the 177 matched pairs. The test was conducted using the Univariate procedure of the Statistical Analysis System computer package. The deciles of the distribution of the observed significance level (OSL) of the K-S test statistics are presented in Table III.

TABLE III

DECILES OF THE DISTRIBUTION OF THE OBSERVED SIGNIFICANCE LEVEL OF THE K-S D STATISTIC FOR THE 100 NONEVENT WEEK DIFFERENCE STREAMS

Deciles	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
OSL	<.01	.022	.05	.10	>.15	>.15	>.15	>.15	>.15	>.15

Examination of Table III reveals that for 50% of the difference streams, the null hypothesis of a normal distribution can not be rejected at a .15 level of significance. Another 10% of the matched pair difference streams have an OSL of greater than .10 (the difference following the 40th decile has an OSL of .101). For the treatment-control matched pairs where the normality of the distribution of the 100 nonevent week differences could not be rejected at the .10 level of significance, consideration of the levels of significance provided by the z tests may be appropriate. Therefore, the z statistics are presented in Table IV for the 105 matched treatment-control pairs where the normality of the underlying distribution could not be rejected at the .10 level of significance.

For the remaining 40% of the matched pair difference streams (a total of 72), normality of the distribution of the 100 nonevent week differences was rejected at the .10 level of significance. For these 72 treatment-control matched pairs, levels of significance based on the standard normal tables may be misstated. While not technically representing standard normal variables (i.e., the differences were not normally distributed), the calculated z statistics convey information concerning both the distance from the mean of the nonevent week differences of a single observation and on which side of the mean the observation lies. Therefore, the z statistics for the 72 matched pairs where the distribution of 100 nonevent week difference was rejected at the .10 significance level were combined with the z statistics for the other 105 matched pairs and the resulting 177 matched pair z statistics were presented in Table V. The z statistics were presented jointly in order to draw inferences based on the entire sample of matched pair differences.

TABLE IV

DISTRIBUTIONAL PROPERTIES OF THE Z STATISTICS FOR 105 MATCHED PAIRS WITH INDICATED NORMAL NONEVENT WEEK DIFFERENCE STREAMS

Deciles of the Distribution									
10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
-1.335	-.981	-.750	-.523	-.261	.054	.490	.648	1.229	1.755

Extreme Values	
Lowest Five	Highest Five
-3.079	1.465
-2.729	1.630
-2.194	1.702
-2.124	1.754
-2.098	1.755

TABLE V

DISTRIBUTIONAL PROPERTIES OF 177 MATCHED PAIR Z STATISTICS

Deciles of the Distribution									
10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
-1.536	-1.031	-.729	-.500	-.192	.018	.390	.648	1.066	3.455

Extreme Values	
Lowest Five	Highest Five
-3.079	1.754
-2.855	1.755
-2.764	1.969
-2.729	2.019
-2.403	3.455

Recall that the portfolios' difference in the event week was expected to be above the mean difference during the nonevent weeks (see p. 40). To imply support for the hypothesized return reaction, the calculated z value must be positive. Examination of Table IV reveals little support for the hypothesized security return reaction. The univariate critical value for the .05 significance level for the z statistic is approximately 1.645. Examination of the list of extreme values reveals that only 3 of the z statistics (2.9%) were greater than this critical value. The critical value for an OSL of .10 is approximately 1.282. Table IV indicates that no more than 10% of the calculated z statistics exceeded this critical value. Moreover, the median z statistic of -.261 was consistent with the null hypothesis.

The data in Table V is based on the full 177 matched pairs. The results reported in Table V appear consistent with those reported in Table IV. The median z statistic was less than zero, which implies no support for the hypothesized return reaction.

Although the data in Table IV and V provide very little support for the hypothesized return reaction, care must be taken in placing reliance on this data. The assumption of normality of the distribution of the nonevent week differences was not rejected in the instances where significance levels of the z statistics were reported. However, normality of the distribution is only one precondition for placing reliance on the joint distribution of the z statistics reported. Independence among the observations is also assumed and is of vital importance when making inferences based on the joint distribution of the z statistics. As noted previously, the question of independence among observed returns remains unanswered. Therefore, implications

drawn based on the z statistics reported in Table IV and V should be viewed with some skepticism.

The data reported in Table V however does serve the purpose of assessing the likelihood that a small number of large observations may have unduly influenced the results of the portfolio test presented in the following section. The mean z statistic for the full 177 matched pairs was -.223. Table V lists the 5 largest and the 5 smallest z statistics. These 10 observations were deleted from the sample and the mean z statistic was recomputed. Deleting these 10 observations caused an increase of .003 in the mean z statistic. Such a small shift in the value of the mean z statistic indicated that there was a small likelihood that the 10 extreme z statistics had a strong influence on the portfolio test reported in the following section. This procecure was repeated deleting the 10 largest and 10 smallest values with similar results. The examination of the data in Table V did not provide an indication of significant outliers among the z statistics. The result of the portfolio test presented in the following section can be interpreted as being based upon a general return movement and not the result of a few large outliers.

Analysis of Portfolio Differences

In addition to the K-S tests that were calculated for the 100 nonevent week differences for each of the 177 matched pairs, the K-S test was performed on the 100 nonevent week differences for the overall portfolio. Normality of the underlying distribution could not be rejected at the .15 level of significance. This was as expected since each portfolio difference was the mean value of the 177 paired

differences for the given week in question. Even though a large number of the individual difference streams were found to be other than normally distributed, the central limit theorem states that the mean values would tend to be normally distributed. The result of the K-S test at the portfolio level was therefore consistent with the central limit theorem.

The result of the z test at the portfolio level was consistent with the results obtained from analysis of the matched pair data. A positive z statistic would have been consistent with the hypothesized security return reaction. The large negative z statistic obtained provides evidence of a significant increase in the security returns of PMM client firms during the test period as compared to the security returns of the matched nonPMM client firms. Formally, the conclusion reached based upon the z test presented was that the null hypothesis of a smaller event week difference in portfolio returns could not be rejected.

Even though the formal conclusion based on portfolio differences is failure to reject the null hypothesis, the strength of the OSL reported in Table VI implied that the portfolio of PMM client firms experienced a significant security return increase vis-a-vis the nonPMM client portfolio. This result was particularly interesting and led to an extended investigation into the return activities of each portfolio.

The apparent increase of the PMM client portfolio return vis-a-vis the nonPMM client portfolio could have been due to a reduction of the return of the nonPMM client portfolio, an increase in the return of the PMM client portfolio, or a combination of both. To determine the source of the perceived return reaction, the event week return for each portfolio was compared to the mean return for each portfolio

calculated during the nonevent weeks. A z test was conducted on each portfolio return. The results are reported in Table VII.

TABLE VI

PORTFOLIO DIFFERENCE Z TEST

Mean Difference (during nonevent weeks)	- .0010
Standard Deviation	.0056
Event Week Difference	- .0159
Z-calc	-2.6607
OSL	.9961

TABLE VII

TREATMENT PORTFOLIO AND CONTROL PORTFOLIO Z TEST

	Treatment	Control
Mean Return (during nonevent weeks)	-.0025	-.0035
Standard Deviation	.0284	.0295
Event Week Return	.0090	-.0069
Z-calc	.4056	-.1161
OSL	.6855	.8994

The agency theory model as presented, implied no directional effect of the SEC sanction on the control portfolio returns. Therefore, the OSL reported in Table VII were based on a two tailed test and represent the probability of obtaining a greater z value, sign ignored.

The observed PMM portfolio return during the week of the July 2, 1975 SEC sanction was opposite the hypothesized direction. The observed nonPMM portfolio return was slightly below the mean return for the nonPMM portfolio calculated during the nonevent weeks. However, neither portfolio event week return was significantly different from the mean nonevent return for each respective portfolio.

One additional test was conducted to further examine the security return reaction of the PMM client portfolio. The MM was used to adjust the PMM client portfolio returns for the effects of market wide movements. S-W estimates of the parameters of the MM were calculated over the 100 matching weeks. These estimates were then used to calculate the estimated residual for the PMM client portfolio over the 100 nonevent weeks used for portfolio return difference calculations under the difference in returns methodology. The MM procedure converted the PMM client portfolio returns used in other tests herein reported into residual returns. The result was that the MM test was based on the same underlying data as that reported on in Table VII. Similar to the z test reported in Table VII, the event week residual return for the PMM client portfolio was compared to the mean residual return for the 100 nonevent weeks. The results are reported in Table VIII. For a more detailed explanation of the methodology employed, see Chapter III, p. 41.

The results reported in Table VIII were consistent with those reported in Table VII. The residual for the event week was in excess of the mean residual during nonevent weeks. However, the residual movement was not significant at the .5 level. To be consistent with Table VII, the OSL represented the probability of obtaining a greater z value, with the sign ignored.

TABLE VIII

TREATMENT PORTFOLIO RESIDUAL RETURN Z TEST

Mean Residual (during nonevent weeks)	-.0001
Standard Deviation	.0056
Event Week Residual	.0027
Z-calc	.5026
OSL	.6150

Neither the analysis of the individual portfolio returns nor the analysis of the residual returns of the PMM client portfolio provided any support for the hypothesized return reaction. Conclusions drawn from the consideration of the results of the primary data analysis in conjunction with the supplementary data analysis herein reported are contained in Chapter V.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

Conclusions

Testing at both the individual matched pair level and the portfolio level provided consistent results. No evidence was discovered which implied support for the hypothesized security return reaction for the group of PMM firms investigated. The results obtained from the matched pair data should be viewed with the caveat in mind that the individual difference streams may not have been independent of one another. However, the consistency of the results between the two levels of analysis suggests that the results of the matched pair data analysis was representative of the general stock price reaction for the period examined. The primary conclusion drawn from this research was that SEC sanction did not lead to a decrease in the return of PMM client firms during the week surrounding the date of the sanction.

The results of the supplementary investigation at the portfolio level provided evidence supporting the directional return reactions that were implied by the analysis of the portfolio differences. However, the individual supplementary tests themselves did not reveal a security return reaction that was significant at even the .5 level. As with the results of the primary difference analysis, the results of the supplementary investigation provided no support for the return reaction that was predicted using the agency theory framework.

The results of the difference analysis at the portfolio level implied a potential secondary conclusion. The secondary conclusion was that the security return of the PMM portfolio increased during the event week vis-a-vis the return of the nonPMM portfolio. The findings of a significant return increase were not supported by the results of the other tests performed. However, the consideration of the joint movement of the treatment and control returns provided by the difference methodology included more information than did the supplementary tests. The assumption was made that the difference methodology provided tests which were better able to detect small return shifts. With respect to the analysis of the separate portfolio returns, this assumption was supported by an analysis of the magnitude of the variances of the security return metrics employed by the various tests. The difference in returns methodology and the residual return methodology were found to provide tests of equivalent strength.

The variance of the portfolio level difference was 0.000031. The variance of the treatment and control portfolio returns were 0.0008044 and 0.000872 respectively. The variance of the treatment portfolio residual was 0.000032. The test provided by the portfolio level difference was clearly stronger than the test provided by examining the separate portfolio returns themselves. However, the strength of the test of the differences in portfolio returns was approximately equal to the strength of the test provided by analysis of the treatment portfolio residual return. Given that these two tests were of equivalent strength (as measured by the magnitude of the variances of the respective return metrics), the fact that the return difference test indicated a significant return movement while the residual analysis

did not indicate a significant movement was attributed to a change in the relationship between the treatment and control portfolios during the week of the sanction. If this change in relationships was due in part to a response to the SEC sanction, the test results imply that the prediction made using agency theory model was incorrect. If the changed relationship between the two portfolios was simply an indication of instability of the return generation process during this period, the test results imply little about the agency theory prediction. The stability of the relationship between the two portfolios was not specifically addressed in this study.

The results of the tests conducted in this study were unclear as to whether or not a security return reaction occurred that was opposite to the prediction drawn from agency theory. The results of the test were clear in that no support for the agency theory prediction was found. Finding a lack of support for the hypothesized security return reaction was in and of itself not all that surprising. Recalling the presentation of the J-M agency theory model in Chapter II, the hypothesized adjustment in firm value was thought to be a response to a change in the estimated amount of perquisites that can be taken by management. The amount of the obvious perquisites (such as plush offices, use of company assets for personal use, etc.) that can be taken by management may be trivial for a large company. Perquisites become nontrivial when shirking is included as a perquisite. However, if one considers the nature of the audit process, it is precisely the first class of perquisites which an audit is designed to uncover.

The audit process usually consists of an evaluation of internal control followed by substantive testing. The purpose of the evaluation

of internal control is to assess the level of reliance that can be placed on the client's accounting system. This evaluation determines the level of substantive tests that need to be performed. The substantive tests are designed to evaluate account balances. An examination of account balances is quite different from an evaluation of the level of management shirking. If the audit is designed to examine only the more obvious forms of perquisites and these perquisites are insignificant to a company, a change in the level of expected auditor performance would not necessarily be expected to result in a significant security return reaction.

However, the implications of substandard audit performance may go much further than implications regarding management consumption of perquisites. The major concern would appear to be whether or not financial statements are materially misstated. Perquisites may provide management with incentives to falsify financial statements, but such perquisites may rarely lead to materially misstated financial statements. A greater incentive to falsify financial statements may come from management compensation schemes or from the desire of management simply to keep their jobs.

The preceding discussion suggests that the quality of the audit performance should impact upon the market value of the firm. The results of the current research found no support for such a hypothesis. A possible implication of the current research is that no one single event relating to auditor performance is sufficient to significantly influence the market value of the auditor's client firms. This findings has implications with respect to the current agency theory model. In short, the hypothesized security return reaction to any

one signal may not be significant and should not be considered a major motivational factor in explaining an auditor's or a manager's behavior.

Recommendations for Future Research

The immediate extension of this particular research is to replicate the study using some other methodology. This would provide evidence indicating whether or not the results obtained in this study were an anomaly of the research design. Particular attention should be paid to the question of the stability of the treatment-control matching criteria.

A secondary extension of this study would be to repeat the study using other signals which indicate a change in expected auditor performance. Should results of such a study indicate an increase in the security returns of the treatment firms, a reevaluation of the J-M agency theory and its underlying assumptions would be in order.

A further extension would be to gather evidence of the perceived importance of the level of effort and quality of the auditor. Dopuch and Simunic (1979) reported that 89% to 99% of the corporate Chief Executive Officers or Presidents replied "yes" to the question "Do you consider it important that your stockholders be somewhat familiar with the name and reputation of your company's CPA firm?" An interesting study would be to compare management's perceptions with those of bank loan officers, investment analysts, and possible CPAs themselves. These participatns perceptions could then be compared to the role in which agency theory casts perceptions of auditor quality and performance.

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VITA

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