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The use of discretionary accounting reports in management compensation contracts

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THE USE OF DISCRETIONARY ACCOUNTING REPORTS IN MANAGEMENT COMPENSATION CONTRACTS

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This dissertation is dedicated to

my parents, K.S. Natarajan and Sivakamu Natarajan

and my wife, Mallika

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ABSTRACT

THE USE OF DISCRETIONARY ACCOUNTING REPORTS IN MANAGEMENT COMPENSATION CONTRACTS

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This study examines how shareholders compensate managers using accounting performance measures. While these measures are informative about the manager's production and investment decisions and hence are useful as performance measures in evaluation and motivation, their usefulness is limited by the discretion the manager exercises in the reporting process. The trade-off between the informativeness and discretion associated with these performance measures plays a crucial role in determining the weights assigned to them in the compensation contract. This study first examines the usefulness of discretionary reports in an agency-theoretic setting and develops sufficient conditions for the reports to be useful in contracting. The intuition derived from the theoretical discussion is then used to develop testable empirical hypotheses. The hypotheses are tested using CEO compensation, accrual and cash flow data from a large sample of US firms. It is found that accruals and cash flows are, on average, assigned different weights in CEO compensation contracts and that the weight given to the accrual portion of the earnings is, on average, less than the weight assigned to the cash flow component. This is consistent with the hypothesis that the informativeness of accruals, after adjusting for managerial discretion, is less than that of cash flows. Cross-sectional analysis of the weights on the accrual measure indicates that the perceived discretion is negatively correlated with the weight. It is also found that further decomposition of accruals into discretionary and non-discretionary components improves the explanatory power of the compensation-earnings relationship. It is concluded that, on average,

components of earnings, rather than earnings itself, are used as performance measures in US corporations to reward CEOs.

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CHAPTER 1

INTRODUCTION

The objective of this study is to provide additional theoretical and empirical evidence on the use of accounting performance measures in compensating managers. Accounting performance measures are functions of the production, investment and financial reporting decisions taken by managers. They provide potentially valuable information to the shareholders about the unobservable managerial actions and help in mitigating the agency conflict. The use of these accounting performance measures in management compensation contracts is dependent on how accurately they provide information about the underlying managerial actions and to what extent this informativeness is clouded by the discretion the manager has in reporting the accounting numbers.

While accounting researchers have looked at the use of accounting performance measures in the past, the focus has been on the use of either accounting earnings or a related measure like return on equity. Empirical studies (Healy (1985), Healy et al (1987), Defeo et al (1989) and McNichols and Wilson (1988)) provide evidence that observed management compensation contracts based on accounting earnings encourage managers to take accrual decisions which maximize the welfare of the managers.[1] Anecdotal evidence from the financial press would also make one believe that compensating managers using accounting earnings would lead to accounting

[1] Healy et al (1987) and Defeo et al (1989) focus on the link between management compensation and managerial accrual decisions and provide direct evidence whereas the evidence provided by Healy (1985) and McNichols and Wilson (1988) is indirect.

manipulation. For example, a news story on management compensation in *Fortune* reports[2]

" The danger in the focus on profits is that it zooms in on just one accounting measure, one that a clever CEO may be able to manipulate, perhaps to the detriment of the company."

In another news story in the *Financial World*, the following opinion is expressed[3]

" But what is company performance? Is it growth in earnings per share? Is it some profitability measure such as return on equity? Is it cash flow? We reasoned that there is only one type of performance that is meaningful to shareholders, and that is total shareholder return, counting both stock price appreciation and dividends. Shareholder return has two other virtues: It is the only measure of performance that can be compared, unequivocally, across industrylines. It is also the only measure that cannot easily be manipulated by the CEO, with the willing cooperation of the company's accountants."

The emprical studies as well as the news stories, cited above, however, do not offer any explanation as to why rational shareholders find it in their interest to induce opportunistic behavior on the part of management. Theoretical papers (Dye(1988), Sivaramakrishnan(1990) and Verrecchia(1986)) explicitly incorporate the strategic interaction between shareholders and managers and justify the use of a single performance measure (which they interpret as accounting earnings), the reporting of which is left to the discretion of management.[4] In contrast, this study develops a theoretical model which demonstrates that *multiple* discretionary accounting reports (such as cash flows and accruals) can be useful in compensating managers even though they can be manipulated by the managers. The results of the model are used to generate empirically testable hypotheses on the differential use of cash flows and accruals as

[2]*Fortune*, April 6,1992, "How to pay the CEO right", by Geoffrey Colvin.

[3]*Financial World*, October 29, 1991, "What America's top CEOs should be paid this year", by Graef S. Crystal.

[4] The implicit assumption made here is that both cash flows and total accruals are given equal importance in evaluating the managers.

performance measures. In addition, the intuition derived from the model is used to examine empirically the cross-sectional differences in the use of accrual based performance measures. This way, this study contributes along the theoretical and empirical dimensions to the existing literature on the use of accounting performance measures in executive compensation.

The approach taken in this paper assumes that management compensation plans are used by shareholders to influence the actions of management. The design of a compensation plan is characterized by the choice of suitable performance measures and the assignment of weights to them in the contract based on their relative importance. The objective of the shareholders is to choose the contract which maximizes their expected utility at the time of designing the contract, taking into account the opportunistic behavior of the management. The manager's opportunistic behavior is reflected in the two sequential discretionary decisions he makes: (a) the production and investment decisions and (b) the reporting decision.

In the single-period contracting environment that is examined, the manager's unobservable action generates two informative signals, both of which are observed only by the manager. Sufficient conditions are developed under which discretionary reports issued by the manager (about his private information) are valuable performance measures. It is shown that, in general, the weights attached to these two performance measures in the contract are not equal.

Further, the question of how the manager's ability to manipulate the reports affects their value is explored in detail. In particular, the analysis focuses on how the manager's discretion in his reports affects the weights that are assigned to the reports in the compensation contract. Conditions are developed under which

(i) The manager has so much discretion in what to report that the reports have no value. In this case, the reports receive zero weight in the contract.

(ii) The manager exercises discretion in what to report, but the owner can costlessly undo the discretion. In this case, the manger's discretion does not affect the weights that are assigned to the reports in the contract.

(iii) The manager has a limited amount of discretion, but the owner cannot completely undo the discretion. In this case, the reports are valuable as performance measures, but the weights assigned to the reports are a decreasing function of the amount of noise that the manager's discretion adds to the respective underlying informative signals.

The first two cases represent extremes, while the third case covers the intermediate (and most plausible) situation.

This model is then applied to the use of cash flows and accruals in compensation contracts. The empirical results indicate that, on average, each of these performance measures has a positive and statistically significant weight in the compensation contract. However, the weight attached to the accrual portion of the earnings is, on average, less than the weight assigned to the cash flow component. This is consistent with the hypothesis that the accrual portion of earnings is viewed to contain more noise than the cash flow component. Under certain assumptions about the joint distribution of the performance measures, the analytical model developed in this paper suggests that the firm-specific weights that are attached to the performance measures in the contracts are proportional to the precision and adjusted mean of the respective measures. The empirical results lend some support to this. The analytical model also suggests that shareholders attach low weights to discretionary measures when they perceive the managers to possess a high degree of discretion in the reporting stage. The cross-sectional analysis in this study provides some support to this hypothesis. In general, it also seems to be the case that the valuation-informativeness of the performance measures is very different from their incentive informativeness. There is also some indication that when total accruals are very high or very low, the contracts are likely to be functions of only cash flows.

The remainder of this study is organized in the following way. The next chapter reviews prior theoretic and empirical work related to this study. Chapter 3 develops a theoretical model in an agency setting and describes the potential use of discretionary reports as performance measures and the relative weights that are attached to these measures in equilibrium. Chapter 4 derives testable hypotheses from the model and tests them using management compensation, accrual and cash flows data. Chapter 5 summarizes the results and discusses additional issues of interest.

CHAPTER 2

SURVEY OF PRIOR LITERATURE

The survey of prior literature in this chapter is in three parts. The first concerns the general issue of the choice of performance measures in agency models, the second is about theoretical models of earnings management and the third summarizes the prior empirical findings on the use of accruals in management compensation contracts. The first two parts provide the conceptual background for the analytical model developed in Chapter 3 and the last part helps in understanding how the empirical results in this study, reported in Chapter 4, supplement prior empirical work.

2.1 THE CHOICE OF PERFORMANCE MEASURES IN AGENCY MODELS

The basic feature of agency models is the unobservability of a productive action that can be implemented only by an agent who is work and risk averse. This action produces an outcome and after the agent is compensated the principal consumes the residual outcome. The central issue in the design of compensation contracts is the choice of performance measures that will be used to compensate the agent. It is intuitive that the shareholders' first choice as a performance measure is the outcome itself since it is ultimately consumed by them.[5] This reasoning, of course, implicitly assumes that the outcome is jointly observable at the time of compensating the management. The question then arises as to what other performance measures will be used by the

[5] Throughout the rest of the paper, the terms principal and shareholders are used interchangeably and so are the terms agent and manager.

shareholders in the compensation plan? This question has been addressed in the agency theoretic context by many researchers.

Holmstrom (1979) examines the value of an additional signal which is generated along with the outcome. He argues that additional information available from observing the second signal may result in the improvement of the contract which uses only the outcome. Taking x as the outcome and y as the additional signal, he defines y to be valuable if both the principal and the agent can be made strictly better off with a contract of the form $s(x,y)$ than they are with a contract of the form $s(x)$. He then develops necessary and sufficient conditions for y to be valuable.

The conditions developed by Holmstrom reduce to determining whether x is sufficient for x and y, with respect to the unobservable action a. If x is sufficient for x and y, then x carries all the information about a, and y adds nothing to the power of inference. If x is not sufficient, then y contains some information about a beyond that conveyed by x, and therefore should be used in contracting. Thus, Holmstrom effectively relates the informativeness of the signal y to its value in the contract. If y is informative, the optimal compensation contract will be of the form $s(x,y)$. However, Holmstrom's result does not indicate how y is used, or how much weight is placed on y in the contract. Banker and Datar (1989) identify necessary and sufficient conditions on the joint density function of x and y under which a linear aggregation of the two signals is optimal. In this case, the contract takes the form $s(l(a)x+m(a)y)$, where a is the optimal action taken by the agent. This structure enables them to determine the relative weights on the individual signals in the optimal linear aggregate.

In the models of Holmstrom and Banker and Datar, the outcome and the additional signal are *publicly* observable. There could be situations where y is observed only by the agent. Now, the principal must decide whether to instruct the agent to issue a report about his private information y, and how to use the report in contracting. The communication-based agency literature addresses the question as to when communication of the agent's private information is valuable. There have been two broad areas of work. When the agent observes y prior to taking his action decision he is said to have pre-decision private information and if he observes the additional signal after the action has been taken he is said to have post-decision private information.

Christensen (1981) and Baiman and Evans (1983), examine the general problem of the value of the communication of pre-decision information. Christensen specifies first-order conditions but does not identify any general conditions for communication to have value. Baiman and Evans show that when there is a strictly positive probability of the principal verifying the agent's report of y and if the honest revelation of the agent's private information is valuable then there is a strict Pareto gain associated with communication. Penno (1984) demonstrates that even without the possibility of *ex post* verification of y, communication could be valuable under some restrictive assumptions about the general structure of the probability density function of x. Melumad and Reichelstein (1987) demonstrate strict value for communication in situations where in addition to the unobservable action and agent's pre-decision private information, the agency is endowed with a publicly observable decision which may either be taken by the principal or delegated to the agent. They show that the optimal contract in the "centralized decision-communication" regime is weakly Pareto superior to the "delegated decision-no communication" regime and develop necessary conditions for situations where these contracts are performance equivalent. It is clear then that if these necessary conditions are not satisfied, then the "centralized decision-communication" regime strictly dominates the "delegated decision-no communication" regime in the Pareto sense.

Dye (1983) demonstrates under fairly general conditions that there can be strict value for communicating post-decision information even when no possibility of monitoring the truthfulness of the manager's report exists. In his model, the agent, subsequent to taking his action, receives a signal y which is correlated with the realized output x. The agent makes a report (perhaps false) about his private signal prior to observing the actual outcome x. Initially, Dye formulates the principal's problem taking into account the fact that the expected compensation to the agent must be based on not the realization of signal y per se, but on the reporting strategy corresponding to y adopted by the agent. He then applies the Revelation Principle (Myerson (1979)) to transform his problem into one where the agent always truthfully reports the value of the signal observed. The Revelation Principle is an analytical device frequently employed in the pre-decision and post-decision communication problems. It was originally designed as a technique to help characterize resource allocations in asymmetric information environments. It states that if the parties to the contract can communicate all their private information then the contract can be designed so as to make them reveal their private information truthfully. Taking y (the private information) to be sufficient for x and y with respect to a, Dye shows that communication is strictly valuable, i.e. both the principal and the agent are better off with communication, and that in equilibrium y is revealed truthfully.

Suppose the system that produces the additional signal y itself can be chosen from a set of monitoring systems. Once a particular system is chosen either by the principal or by the agent, the signal that it generates is jointly observed by both the parties to the contract. Demski, Patell and Wolfson (1984) show that decentralized choice results in weak Pareto improvement as compared to the principal himself making the choice, when the agent has private information that cannot be directly communicated and the monitoring system choice is verifiable.

2.2 THEORETICAL MODELS OF EARNINGS MANAGEMENT

The discussion so far has focused on analytical agency models which have examined the usefulness of additional information in contracting. These models can be applied to the specific problem of how shareholders use the information in financial statements to compensate managers. In an earlier work on income smoothing, Ronen and Sadan (1981) address the issue of accrual decision being used as a signaling device by the managers to communicate their private information about future cash flows to shareholders. Ronen and Sadan ignore the process by which cash flows are generated and implicitly assume that the manager has no influence over the generation of cash flows. Within such a framework, the compensation contracts serve as instruments designed by the shareholders to induce the managers reveal their private information in such a way that the valuation inferred from it by the market is as correct as publicly available information permits. The compensation scheme has the property that there is no incentive on the part of the manager to alter the signal - and the market inference about the firm's value, based on the signal, has the least possible bias, given the particular incentive scheme chosen. In this context, Ronen and Sadan develop signaling models of both classificatory and inter-temporal smoothing. In classificatory smoothing, the current period's classification of total income into ordinary and extra-ordinary income serves as a signal of manager's private information. In inter-temporal smoothing, the manager signals future cash-flows through the a series of net income numbers announced in successive periods.

Ronen and Sadan's approach does not allow for endogenous evolution of contracts and as mentioned earlier, overlooks the effort required to be put in by the agent to generate the outcome. The post-decision private information model similar to that of Dye (1983) discussed earlier, probably better characterizes the shareholders-management contractual environment. To see this, take x as the jointly observed cash flows, and y as the informative (in the sense of Holmstrom) accruals which is observed only by the agent subsequent to taking the action. The principal will contract on both cash flows and accruals and by using the Revelation Principle, the optimal contract can always be designed to make the agent reveal the accrual realization truthfully. However, in this characterization it is obvious that earnings management can never occur because there is no discretionary element associated with the reporting of y. In addition to y, let the agent also privately observe x. By the Revelation Principle, as long as the agent can issue two separate reports, it again is the case that the reports are truthful.

The fact that the Revelation Principle implies that the principal can restrict his attention to contracts which induce the agent to communicate his private information truthfully presented a major obstacle to researchers who were trying to model earnings management and managerial discretion in an agency theoretic context, because truthful revelation and earnings management are contradictory to each other. That is, a model in which truthful revelation is possible in equilibrium effectively rules out the possibility of earnings management arising as equilibrium behavior. Researchers then began to formulate models in which the Revelation Principle does not apply. Dye (1988) got over this problem in the following way. In a single period model, he shows that there could be an internal demand (i.e. purely from the point of designing the optimal compensation contract) for earnings management when the manager can not communicate all of his private information.

The following are the salient features of Dye's model of internal demand for earnings management. The shareholders employ a manager to perform a productive action a for them. The action, which is not observable by the shareholders, combined with a random state of nature, produces an outcome x (which may be interpreted as cash flows though Dye does not explicitly recognize it that way). The outcome is only observed by the agent. Subsequent to taking the action, and possibly after observing the outcome, the agent observes some additional information y. A key difference between Dye's 1982 model and this model should be understood at this stage. It is not necessary for y to be informative about a in this model. The timing of the observation of y with reference to the observation of x is also not critical. However, y should be observable only after the action decision has been taken.

In this setting, Dye defines a feasible reporting set Y(x;y) as one from which the manager's single report about x and y can be generated. It is assumed that it is prohibitively costly for the manager to report y. Let z be the report that the manager makes. The report is made by the manager after observing x and y. If z is outside Y(x;y) the shareholders know that the manager's report is false, although they do not learn anything about x or y. Dye explains that the constraint on the feasible reporting set arises due to the fact that there are restrictions on the manager's action from sources like the internal and external auditors, audit committees, GAAP and the law. He also incorporates a cost element in the analysis. He defines $c(x,z,y)$ as the cost incurred by the manager when he reports that the earnings are z when they are actually x and the private information is y. Truth telling is costless to the manager i.e. $c(x,x,y) = 0$ and $c(x,z,y) \geq 0$ when $z \neq x$. Dye defines that earnings management takes place if the agent does not report $z = x$, for some realizations of the x and y pair. He goes on to show that when the communication from the agent about y is blocked, and given some mild regularity conditions on c(.) and the compensation contract $s(z)$, earnings management always takes place.

The reason the Revelation Principle does not work in Dye's model is due to the combination of the following three factors: (i) the constraint on the single dimension of the managerial report when actually there are two dimensions to the information asymmetry between the manager and the agent (ii) the partial blocking of the manager's message space i.e. the way Y(x;y) depends on x and y and (iii) the structure of the non contractible costs i.e. $c(x,z,y)$. Dye's proof exploits the fact that very low levels of earnings management are essentially costless to the manager. If the shareholders want the manager not to engage in earnings management they will therefore have to give him a constant wage contract but this will make him take the lowest possible action. So, if the shareholders want to implement an action other than the lowest possible action they will have to necessarily tolerate some earnings management in this model.

Verrecchia (1986) also looks at situations where the outcome is only observed by the agent. Once again, a single report r is issued by the manager when he actually knows the realizations of the outcome x and another variable ε. Blocked communication arises because of the smaller dimensionality of the report as compared to the dimensions of information of asymmetry. The manager's feasible reporting set is $Y(x,\varepsilon) = (-\infty,$

max(α+x+ε , x-c)]. The parameter α is chosen by the principal in equilibrium. $c > 0$, is a deadweight loss incurred by the principal if $\alpha+x+\varepsilon < r(x,\varepsilon) \leq x-c$. The main differences between Dye's and Verrecchia's models are:

(a) The principal's choice of the parameter α, which gives him partial control over the feasible reporting set in Verrecchia's model,

(b) The differential nature of the modeling of personal costs; in Verrecchia's model the personal costs are incurred by the principal if the agent issues a report under the adverse action alternative; in Dye's model, the personal costs are incurred by the agent. Also, in Verrecchia's model the principal incurs a fixed cost for any alteration of the reported income (no matter how big ε is). Whereas in Dye's model, the cost c(.) is continuous - i.e. a little manipulation is "free".

(c) In Dye's model, the additional signal y may or may not be informative about the agent's action, whereas, in Verrecchia's model, ε is taken to be a strictly noisy term which is not informative about a at all.

The main result in Verrecchia's paper establishes that the optimal contract may induce the manager to use discretion in his reporting choice. Under certain assumptions on the production function, the noise p.d.f. and the preference structure of the agent, Verrecchia shows that managerial discretion is a feature of the equilibrium and the principal chooses an α which induces the financial reporting alternative for some realizations of ε and the adverse action alternative for other realizations. It should be noted that a value of zero for the deadweight cost c makes the principal's choice of α equal to $-\infty$ and will make the agent always reveal x truthfully irrespective of the value of ε, if the equilibrium contract is increasing in the report.

Both these models rely critically on the assumption of the true outcome not being observed by the principal until after the time the principal compensates the agent. They are also single period models and the agent's private information affects the contract through its effect on the feasible reporting set. Sivaramakrishnan (1990) discusses the issue of compensating the agent on an aggregate measure other than cash flows in a two-period context. The agent has private (imperfect) information about the second period's outcome and the first period cash flow at the end of the first period, and there is blocked communication (in the sense that the agent can only issue a single report at the end of the first period on his two dimensions of private information). Using Lambert's (1983) basic two period agency model, and under certain assumptions on the second period production function and the compensation contract, he shows that a contract which results in the agent not reporting the actual first period outcome with strictly positive probability (i.e. at least for some realizations of the first period outcome and the agent's private information) is strictly Pareto superior to the contract which always induces truthful reporting of outcome. The informativeness of the first period private information about the second period outcome and the blocked communication assumption help him derive the above result.

2.3 EMPIRICAL EVIDENCE ON THE USE OF ACCRUALS IN MANAGEMENT COMPENSATION CONTRACTS

The models of earnings management discussed so far implicitly assume that earnings management takes place in equilibrium and go on to justify it in a rational and strategic shareholders-management contracting environment. In the next few pages, I discuss the empirical evidence on the relationship between management compensation contracts and discretion exercised by managers in financial reporting. Healy (1985) examines the relationship between discretionary accrual decisions taken by the managers and the existence of short term bonus plans in their firms. He uses a two-period model to characterize the discretionary accrual decisions taken by a risk averse manager as a function of the income before discretionary accruals (which by his definition is cash flows plus non discretionary accruals), and hypothesizes that managers are more likely to choose income-decreasing accruals when their bonus plan upper or lower bounds are binding, and income-increasing accruals when these bounds are not binding. His observation is motivated by the fact that the bonus plans described in corporate proxy statements specify a cap on the amount of money that can be allotted to the bonus pool as a function of earnings, and also that certain target earnings are required to be achieved for a non-zero allotment.

Healy's sample consists of bonus plan details for 94 companies from the Fortune 250 over the period 1930-1980. His sample did not include firms which operated both performance plans and bonus plans, and those firms which awarded bonuses to their managers but did not give details on bonus contracts. Healy estimates earnings' upper and lower bounds for each company-year in his sample, using actual plan definitions. Using cash flows as proxy for cash flows and non-discretionary accruals, Healy assigns his sample observations (each of which is a company-year) to portfolio UPP if cash flows from operations exceed the upper bound. The observation is assigned to portfolio LOW if earnings are less than the lower bound. The rest of the observations are assigned to portfolio MID. Healy then checks whether his UPP and LOW portfolios had significantly more negative accruals as compared to the MID portfolio, when the plans have both upper and lower bounds and finds this in fact to be the case. Healy repeats his test taking accounting procedure changes as a proxy for non discretionary accruals. This replication does not support his hypothesis. While he finds that there is a high incidence of voluntary changes in accounting procedures during the years following the adoption or modification of a bonus plan, he does not find that managers change accounting procedures to decrease earnings when the bonus plan upper or lower bounds are binding.

It is pertinent to note the following points with respect to Healy's analysis. He assumes that there is a positive relationship between the money transferred to the bonus pool and the actual bonus that is paid out of the pool to the manager. He does not check whether this indeed is the case. There is no evidence in his analysis as to whether there is a high correlation between the actual award made to the manager and the amount the bonus contract specifies is to be transferred to the bonus pool. Healy also mentions that bonus contracts usually permit unallocated funds to be available for future bonus awards. This seems to indicate that the awards that are made in a particular year are likely to be a function of the current period transfer as well as previous transfers. In view of all these, it is not at all clear as to what the exact nature of relationship between actual bonus award to a particular executive and the bonus formula is.

Healy's classification of the accruals into non discretionary and discretionary components is intuitive, but as he admits readily, it is frequently the case that one observes the total accruals rather than the individual components. This makes him use proxies for discretionary accruals which limits his analysis. Also, the two period model that he uses does not explicitly incorporate any unobservable action choices by the agent or report choices that would give rise to the compensation contract in the first place. Healy's model also restricts him to looking only at contracts which explicitly define their bonus formulas. There has been empirical evidence to the effect that a significant number of firms have implicit compensation formulas (see Antle and Smith (1985) and

Lambert and Larcker (1987)) which are closely associated with accounting earnings. In fact, Healy had to drop close to 50% of his original sample because details of the bonus contracts were not publicly available even though these companies awarded bonuses to their managers.

McNichols and Wilson (1988) look at one component of discretionary accruals namely, the provision for bad debts. Their objective is to examine whether managers manipulate earnings. In the first stage of their analysis, using cross-sectional data, they regress the provision for bad debts on the beginning balance in the allowance for bad debts account, current and future expected writeoffs and interpret the projection error (RESPROV) as the discretionary accrual decision taken by the manager. They restrict their analysis to firms whose receivables are an important subset of total assets and whose provision for bad debts is large relative to earnings. In the second stage, compensation data for the firms is used to select performance measures (which are basically ROA based) highly correlated with cash compensation. The selected performance measures are used as partitioning variables, to partition the sample into deciles. This partitioning procedure is different from that of Healy, who used actual plan upper and lower bounds and had only three types of portfolios.

McNichols and Wilson test two hypotheses concerning earnings management. Under the first, the income smoothing hypothesis, the prediction is that the highest decile of the sample will be associated with high values of RESPROV and the lowest decile with lower values. The second hypothesis is developed along the lines of Healy (1985). Here, the prediction is that, the highest and the lowest deciles will be associated with low values of RESPROV and the intermediate deciles with high values. The results support the hypothesis that the discretionary component of the provision for bad debts is income-decreasing for firms whose earnings are unusually high or low.

Healy, Kang and Palepu (1987) examine the effect of accounting procedure changes on cash salary and bonus compensation to CEOs. For their analysis, they look at two kinds of accounting changes, one that typically increases earnings (a change to straight line depreciation) and another that decreases earnings (a change to LIFO). Their analysis differs from that of Healy in one important respect. They do not look at the actual bonus formulas but posit an implicit relationship between the salary and bonus and the level of reported accounting earnings. They conduct their analysis on each firm separately, using a time-series rather than a cross-sectional approach. They also specify an exogenous structure to the contract and like Healy, ignore the moral hazard associated with the manager's effort and report choice. The motivation behind their study is the fact that the compensation committee, acting on behalf of the shareholders, always has an option to unravel the effect of accounting changes from the reported earnings and compensate the managers on "as-if" earnings. Given this fact, they check whether there is an adjustment to the statistical relation between compensation and earnings subsequent to an accounting change. Their test results indicate that (1) subsequent to the accounting changes, cash salary and bonus awards are based on reported earnings rather than "as-if" earnings (2) the parameters of the compensation-earnings relation change for both the test and control firms subsequent to the accounting changes and (3) the potential impact of the method changes on salary and bonus payments is small relative to economy-wide changes in compensation. The more important question of why rational shareholders should compensate the managers on reported earnings rather than "as-if" earnings is left unanswered in their discussion.

Another study, which looks at whether managers were compensated on "as-if" earnings measure or reported earnings measure, after they had taken an income increasing accrual decision, is Defeo, Lambert and Larcker (1989) (hereafter referred to as DLL). They analyze the relation between the earnings effects associated with an equity-for-debt swap and changes in executive compensation and wealth. The swap transaction enables the corporation to report an accounting gain equal to the difference between the book value and the market value of the debt. Similar to Healy et al., DLL's study is motivated by the fact that the firms which execute a swap have to report the magnitude of swap's effect on accounting earnings in their annual report. DLL argue that disclosure of this information should make it easy for the shareholders to control any conflicts of interest with the managers that might arise regarding the desirability of the swap transactions. DLL specify an exogenous linear structure on the relationship between cash compensation and accounting earnings and regress compensation on earnings with an adjustment for first-order autocorrelation. Their empirical results indicate that the executives of firms completing a swap transaction experience an *increase* in cash compensation. This increase is largest both in absolute magnitude and statistical significance for firms whose compensation plans are more "accounting oriented" (i.e., firms whose management would be expected to experience the greatest increase in compensation assuming that the accounting gain produced by the swap flows through the contract). DLL also point out that the finding that firms permit the accounting gain to flow through the cash compensation contract is consistent with, but does not imply, the proposition that executives personally profit from the swap.

In summary, two important characteristics, specific to financial reporting in a strategic shareholders-management contracting environment, stem out of the discussion in this chapter. These are,

(a) Discretionary accounting reports, specifically, accounting earnings, are used in contracts even though they can be manipulated.

(b) In a rational and strategic environment, earnings management can take place only under certain conditions. As discussed earlier in the context of the Dye and Verrecchia models, these conditions typically guarantee that the Revelation Principle can not be applied to the situation under study.

CHAPTER 3

THEORETICAL CHARACTERIZATION OF THE USE OF DISCRETIONARY REPORTS IN CONTRACTS

3.1 INTRODUCTION

In this chapter, I develop a theoretical agency model which describes the conditions under which discretionary reports can serve as useful performance measures in incentive contracts. I also investigate the weights that are attached to the reports in the contract and examine how these weights are affected by the interaction between the informativeness of the underlying private signals and the discretion the agent has in reporting them. Even though the analysis in this chapter focuses on the use of two distinct discretionary reports, the underlying intuition can be extended to situations where multiple discretionary reports are used as performance measures in contracts.

The analytical model that is developed in this paper takes into account some of the characteristics summarized in the previous chapter. Similar to the Dye and Verrecchia models, this model also looks at a single-period contracting environment. However, in their models, the contract is based on a single discretionary report issued by the manager. They interpret the discretionary report as accounting earnings. In contrast, the model developed in this paper attempts to describe situations where the principal uses two performance measures which are in the form of two distinct discretionary reports issued by the manager. I operationalize, in the empirical analysis that follows in chapter 4, the discretionary reports as cash flows from operations and total accruals.[6]

3.2 A NUMERICAL EXAMPLE

The following highly stylized example demonstrates the essential features of the model that is developed later in this chapter. Consider a merchandizing firm which buys its goods for cash and makes both cash and credit sales. The sales effort a put in by the manager is unobservable and can possibly be one of the two effort levels a_h and a_l. It generates cash flows x (which is the difference between the actual cash sales generated out of the effort and the cost of goods sold) and also a signal y about the credit worthiness of the debtors (which indicates whether or not the debtors will default on their payment in the next period). x and y can respectively take two possible values each, x_h and x_l (corresponding to a high cash flow and a low cash flow), and y_h and y_l (corresponding to the debtors paying in full in the next period or defaulting).

The manager has square root utility for wealth and has a reservation utility of θ and disutility for effort equivalent to $V(a_h)$ or $V(a_l)$ depending on the level of effort, with $V(a_h) > V(a_l)$. The probabilities with which the signals x_h,x_l, y_h and y_l occur under the two effort levels are given below:

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[6] The implicit assumption here is that the shareholders have access to cash flows and total accruals information before managers are compensated. There is some evidence that shareholders get information on cash flows and total accruals very soon after the availability of the earnings information. Bernard and Stober (1989) indicate that in 10% of their sample, both cash flows and total accrual information were publicly available in less than 8 days after the earnings announcement date. For the other 90%, the median number of trading days between the availability of cash flows information and the earnings information was around 24 days.

	x_l	x_h
a_l	0.6	0.4
a_h	0.4	0.6

	y_l	y_h
a_l	0.5	0.5
a_h	0.2	0.8

In the above setting, if x and y are publicly observed by both the principal and the agent, it can be verified the optimal second best contract that implements a_h is the following payment schedule:

S1: $s_1 = s(x_l,y_l) = b - (264/79)\ c$ $\quad$ $s_2 = s(x_l,y_h) = b + (6/79)\ c$

$s_3 = s(x_h,y_l) = b - (64/79)\ c$ $\quad$ and $\quad$ $s_4 = s(x_h,y_h) = b + (56/79)\ c$

where $b = V(a_h) + \theta$ and $c = V(a_h) - V(a_l)$. The total expected cost of implementing a_h is $(b^2 + (96/79)\ c^2)$.

Now consider a situation where the cash flows and the credit-worthiness of the credit customers are observed only by the manager. The manager reports an adjusted version of cash flows, r_l, after privately observing a sales forecast for next period. This sales forecast, m, can either be "good" (m_1) or "bad" (m_2) with equal probability. The manager can adjust the cash flows by deferring some of the sales he has already generated to the next period (by delaying shipping) or by deferring some portion of the advertising and marketing expenses to next period. The adjusted cash flows reported by the manager can possibly be one of the two values, r_{11} and r_{12}, and the manager can exercise partial discretion in reporting. This partial discretion is reflected in the restriction on the set of possible reports the manager can choose his report from, for certain realizations of x and m. Formally,

R1: $R(x_l,m_1) = \{r_{11}\}$ and $R(x_l,m_2) = R(x_h,m_1) = R(x_h,m_2) = \{r_{11},r_{12}\}$

i.e. the manager has to report a cash flow number of r_{11} when the true cash flow is x_1 and the forecast is "good". For all other realizations of x and m, the manager has complete discretion and can report any one of the two cash flow numbers r_{11} and r_{12}.

The manager also issues a report on the provision for bad debts, r_2, based on the realization of the credit-worthiness of the customer that is generated out of his sales effort (y_h or y_l) and an independent confirmation (communicated only to the manager) by a credit-reporting agency, n, which confirms y 80% of the time (i.e. Prob($n_1 = y$ is accurate) = 0.8 and Prob($n_2 = y$ is inaccurate) = 0.2). Once again, the manager can exercise partial discretion in reporting the provision for bad debts and can report either r_{21} or r_{22}. The reporting sets for various realizations of n and y are

R2: $R(y_l,n_1) = \{r_{21}\}$ and $R(y_l,n_2) = R(y_h,n_1) = R(y_h,n_2) = \{r_{21},r_{22}\}$.

The principal will now have to estimate the usefulness of the reports in contracting with the agent after duly taking into account their informativeness (in terms of their ability to provide useful information about the agent's sales effort) and the discretion the agent has in reporting them. The principal should also design the contract in such a way that the agent, acting in his own interest, implements the effort level the principal wants and also chooses a reporting rule which matches exactly with the principal's expectations. Given the above structure, it can be verified that the optimal second best contract that implements a_h is given by the following payment schedule:

S2: $s_1 = s(r_{11},r_{21}) = b - (154/29)\,c$ $\qquad$ $s_2 = s(r_{11},r_{22}) = b - (4/29)\,c$

$s_3 = s(r_{12},r_{21}) = b - (133/58)\,c$ $\qquad$ and $\qquad$ $s_4 = s(r_{12},r_{22}) = b + (21/29)\,c$

The total expected cost of implementing a_h is $(b^2 + (56/29)\,c^2)$. While designing this contract, the principal assumes that the agent will report r_{12} whenever he observes any one of (x_1,m_2), (x_2,m_1) and (x_2,m_2) and communicate r_{22} whenever any of (y_l,n_2),(y_h,n_1) and (y_h,n_2) is observed. The probabilities with which the signals occur under the two effort levels are given below (assuming *x,y,m* and *n* are independent) :

$a=a_h$	r_{21}	r_{22}
r_{11}	.032	.168
r_{12}	.128	.672

$a=a_l$	r_{21}	r_{22}
r_{11}	.12	.18
r_{12}	.28	.42

Given the contract in **S2**, it is easy to verify that the reporting rule chosen by the agent exactly matches with the principal's expectations.

Comparing S1 and S2, one can see that the contract using the discretionary reports r_1 and r_2 is less efficient than the one that uses the signals *x* and *y*. This is because of the extra noise that is present in the discretionary reporting system. When *x* and *y* are not available, it is clear that the principal would use the discretionary reports as performance measures so long as the expected outcome corresponding to a_h is more than that corresponding to a_l to the tune of $(b^2+(56/29)\,c^2 - (\theta+a_l)^2)$.[7] The equilibrium contract is a function of the differing informativeness of the underlying "true" signals (*x* and *y*), the noise in the discretionary reports (created as a result of the aggregation of *x* and *m* and *y* and *n*, respectively) and the discretion the manager has in making his reports (captured through the different feasible reporting sets corresponding to the different realizations of the private signals).

The role played by the feasible reporting set can be better understood if one looks at the following extreme situations. Consider reporting sets R1 and R2 of the form

[7] This is because the principal will pay a constant wage of $(\theta+a_l)^2$ to implement a_l.

R1: $R(x_l,m_1) = R(x_l,m_2) = \{r_{11}\}$, $R(x_h,m_1) = R(x_h,m_2) = \{r_{12}\}$ and

R2: $R(y_l,n_1) = R(y_l,n_2) = \{r_{21}\}$, $R(y_h,n_1) = R(y_h,n_2) = \{r_{22}\}$.

It is clear that the contract based on r_1 and r_2 is as efficient as the one based on x and y. In other words, the principal finds r_1 and r_2 as informative as the underlying "true" signals.

Now, suppose the reporting sets are of the form

R1: $R(x_l,m_1) = R(x_l,m_2) = R(x_h,m_1) = R(x_h,m_2) = \{r_{11},r_{12}\}$ and

R2: $R(y_l,n_1) = R(y_l,n_2) = R(y_h,n_1) = R(y_h,n_2) = \{r_{21},r_{22}\}$.

In this case, it is impossible for the principal to design a contract that would extract some useful information from r_1 and r_2 about the agent's sales effort.

This example captures some of the essential features of an accounting-based performance evaluation system. The performance measures are used by rational shareholders who understand that the manager takes operating and reporting decisions that maximize his compensation. The shareholders design the contract after duly taking into account the trade-off between the informativeness and the discretion associated with the various reports, the restriction on the reporting set and the correlation between the various performance measures (in terms of their ability to communicate the underlying action). The analytical model developed in the next section looks at the shareholders' problem in a more general setting and develops conditions under which the reports are used in a non-trivial manner in the contract.

3.3 BASIC FRAMEWORK

It is assumed that the shareholders (the principal) employ the manager (the agent) to perform a productive action a which can only be observed by the manager. The action a , combined with a state of nature, generates two signals, x and y. The manager alone observes the realization of x and y.[8] The shareholders have an option to ask for two reports, r_1 and r_2 , about the agent's observation of x and y and use them as performance measures in compensating the manager. The manager issues the reports after observing both x and y. Similar to other agency models, I employ the following assumptions to place additional structure on the analysis.

(A1) The principal is risk neutral and his utility for his residual wealth is given by V - s, where V is the outcome generated by a, and s the compensation paid to the manager. V could be any deterministic function of the informative signals (x and y), the action and some other signal z (which is independent of the action) i.e. V = V(x,y,a,z). I assume that V cannot be used as a performance measure in compensating the manager.[9]

(A2) The agent's utility as a function of his compensation s and effort a is given by U(s) - G(a), where U'(s) > 0, U"(s) < 0 and G'(a) > 0. His one period reservation

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[8] x and y can be interpreted as any stochastic variables that are generated as a result of the productive action taken by the agent and which are observed only by the agent. For example, x can be the "true" cash flows arising out of the manager's action or the "true" output (in situations where the manager has discetion to reject or accept production lots that fall along the acceptance-rejection margin) and y can be any of the following : the manager's private estimates of expected uncollectibles, expected obsolete inventory and the expected useful life of plant and machinery.

[9] There are many reasons why V cannot be used in the contract. As Gjesdal (1981) points out (1) The outcome may be freely observable by some of the parties to the contract but not collectively (or objectively) observable (2) The outcome observation may be made "later", that is, beyond the time the manager is compensated. It is also possible (as pointed out by Baker(1991)) that V cannot be contracted upon, as in the case where the organization's residual claims are not traded, or if the organization's output is some social good which cannot be objectively measured.

utility is θ. This is determined by external factors, and is common knowledge at the time of contracting.

(A3) x and y are informative at the margin about the agent's action; i.e. they are not statistically sufficient for each other, with respect to the action a. This assumption implies that if both x and y are observable, the contract offered by the principal will be of the form $s(x,y)$.

(A4) The first order approach, as described in Holmstrom (1979), is assumed to characterize the agent's choice of effort.

Similar to the discussion in Dye (1988), I assume that the feasible reporting sets, from which the manager can issue his reports, r_1 and r_2, are constrained due to restrictions from sources such as internal and external audit committees, GAAP and the law. I also allow for the possibility that the manager has superior information regarding the set of reports that are feasible given his observation of x and y. I model this additional information by assuming that, in addition to x and y, the manager also observes the realization of random variables m and n that are independent of the agent's action, a.

As discussed in the previous section, the restriction on the reporting sets plays a crucial role in determining whether or not r_1 and r_2 are used in the contract. Consider the situation where the reports can only be issued from the sets $[l_1,h_1]$ and $[l_2,h_2]$. l_1, h_1, l_2 and h_2 are constants and l_1 and l_2 are lower than h_1 and h_2 respectively. In this case, the set of feasible reports does not depend on the agent's actions or on the realization of the variables x and y. Therefore, the agent can select the lowest possible effort level and still issue any report in the feasible set. The only way to get the agent to report truthfully is to make the contract independent of the report. The principal does not benefit from using the reports in the contract and the lowest action will always get implemented since the principal will pay a constant wage. On the other hand, let the sets be restricted to $[x-u,x+u]$ and $[y-v,y+v]$,where u and v are positive constants known to both the parties at the time the contract is agreed upon. It can be shown that the principal derives the same expected utility as in the situation where x and y are publicly observed and that the contract is always of the form $s(r_1,r_2)$. For example, if $s^*(x,y)$ (the optimal contract when x and y are jointly observed) is increasing in (x,y) then $s(r_1,r_2) = s^*(r_1-u, r_2-v)$. The manager exercises discretion while reporting r_1 and r_2, in the sense that they are never equal to x and y, but this discretion is predictable. When $u=v=0$, the manager has no discretion in making the reports, and the model reduces to Holmstrom's (1979) basic two-signal model. In the general case, where the reporting sets are $[l_1(x,y,m.n,a),h_1(x,y,m,n,a)]$ and $[l_2(x,y,m,n,a),h_2(x,y,m,n,a)]$, the optimal contract could be of the form $s(r_1,r_2)$ or $s(r_1)$ or $s(r_2)$ or even a constant wage depending on whether the benefit that accrues to the principal due to the marginal informativeness of the reports is greater or less than the cost of inducing the manager to make the reports.

(A5) For every quadruple (x,y,m,n) observed by the manager, after he has performed the action a, the manager's reports r_1 and r_2 can only be from the sets
$R_1(x,y,m,n,a) = [l_1(x,y,m,n,a),h_1(x,y,m,n,a)]$ and
$R_2(x,y,m,n,a) = [l_2(x,y,m,n,a),h_2(x,y,m,n,a)]$, respectively,
where $l_i(x,y,m,n,a) \leq h_i(x,y,m,n,a)$, $i=1,2$, for all the quadruples (x,y,m,n) and for all $a \in A$. The functions $l_i(x,y,m,n,a)$ and $h_i(x,y,m,n,a)$ denote the lower and the upper bounds, respectively, on the set of feasible reports from which r_i can be issued, given the realizations of (x,y,m,n,a). It is assumed that the principal and the agent have full knowledge about the functions $l_i(x,y,m,n,a)$ and $h_i(x,y,m,n,a)$

at the time of contracting and that they are non-trivial functions of *x* and *y*, respectively.[10]

It should be noted here that the principal will be able to observe only the reports r_1 and r_2 and cannot necessarily unravel the individual values of *x* and *y*. Let $f(r_1,r_2;a)$ denote the joint probability density function of r_1 and r_2. Note that this joint density function depends on the reporting strategy that the manager adopts.

Given the above assumptions, the principal's problem (denoted as P1 hereafter) is,

$$\max_{s(r_1,r_2),\ a\ ,\ r_1(.),\ r_2(.)} \int\int [V-s(r_1,r_2)]\ f(r_1,r_2;a)\ dr_1\ dr_2$$

subject to :

(C1) $\int\int [U(s(r_1,r_2)) - G(a)]\ f(r_1,r_2;a)\ dr_1\ dr_2 \geq \theta$

(C2) $a \in A$ maximizes $\int\int [U(s(r_1,r_2))-G(a)]\ f(r_1,r_2;a)\ dr_1\ dr_2$

(C3) $r_1 \in [\ l_1(x,y,m,n,a),\ h_1(x,y,m,n,a)]$ and $r_2 \in [\ l_2(x,y,m,n,a),\ h_2(x,y,m,n,a)]$ maximize $U(s(r_1,r_2))$ for all quadruples (x,y,m,n)

(C1) and (C2) correspond to the reservation utility constraint and the constraint on the agent's action choice given that the action is unobservable. These are identical to Holmstrom's (1979) basic two-signal model. (C3) is the constraint that arises due to the fact that the manager will always make utility maximizing reports (within the bounds of

[10]For the rest of the paper, the shorter expressions $l_1(.)$, $l_2(.)$, $h_1(.)$ and $h_2(.)$ will be used interchangeably with the longer $l_1(x,y,m,n,a)$ etc.,

the relevant reporting set) after he has observed (x,y,m,n) i.e., there is no more uncertainty at the time the agent chooses r_1 and r_2.

Examining (C3) closely, one can see that, whenever the optimal contract $s(r_1,r_2)$ is strictly differentiable and montonically increasing or decreasing in its arguments over the entire range of r_1 and r_2, it is the case that the agent's optimal reporting strategy (which the principal exactly anticipates in equilibrium) is to always report values of r_1 and r_2 that are either upper or lower bounds of the reporting sets. This is because U'(.) is strictly positive. In view of this, the distributional characteristics of the joint density functions of $\{r_1=l_1(.), r_2=l_2(.)\}$, $\{r_1=l_1(.), r_2=h_2(.)\}$, $\{r_1=h_1(.), r_2=l_2(.)\}$ and $\{r_1=h_1(.), r_2=h_2(.)\}$ play a key role in the design of the optimal compensation contract.

(A6) $l_i(x,y,m,n,a)$ and $h_i(x,y,m,n,a)$ are random variables (being functions of the random variables x,y,m and n) and the joint distribution of $(l_1(.),l_2(.),h_1(.),h_2(.))$ can be derived from that of (x,y,m,n) provided the determinant of the 4x4 Jacobian matrix of (x,y,m,n) with respect to (l_1,l_2,h_1,h_2) does not vanish anywhere in the domain of (l_1,l_2,h_1,h_2).

3.4 SUFFICIENT CONDITIONS FOR THE USE OF THE REPORTS IN THE CONTRACT

The main result established in this section identifies situations where the principal offers a contract which is based on both the discretionary reports. Before going to this result in Proposition 1, it is useful to split the principal's problem P1, into three steps. In the first step, the principal fixes reporting rule $r(.) = \{r_1(.),r_2(.)\}$and solves for the optimal contract $s^*(r_1,r_2)$ and the optimal action a^*, duly taking into account (C1) and

(C2). He then checks whether it is indeed optimal for the agent to report *r(.)* given $s^*(r_1,r_2)$. If so, $r(.) = \{r_1(.), r_2(.)\}$ is classified as a feasible reporting rule that is implementable by the optimal contract. Let R_f be the set of all such reporting rules.[11] For every rule in R_f, it is the case that the constraint (C3) is satisfied automatically. It is possible that under certain situations R_f could be empty.

Let R_f^C be the complement of the set R_f. It is apparent that, for every reporting strategy in R_f^C, the solution to the principal's problem when (C1),(C2) and (C3) are the constraints is different from the solution when only (C1) and (C2) are the constraints. In the second step, for every reporting rule in R_f^C (the set of all rules not implementable by the optimal contract), the principal chooses a pair $(s^{**}(r_1,r_2),a^{**})$ so as to maximize his expected utility subject to (C1),(C2) and (C3).[12] It need not be the case that a^{**} is interior for all the rules in R_f^C. For certain rules the cost of satisfying the constraint (C3) may be so high that the principal's best strategy may be to pay a constant wage and make the agent take the lowest possible action.

Let R be the full set of reporting rules (R is the union of R_f and R_f^C). For every r(.) in R, the solution to the principal's problem is of the type $(s^*(r_1,r_2),a^*)$ if r(.) belongs to R_f and $(s^{**}(r_1,r_2) ,a^{**})$ otherwise. In the third and final step, the principal chooses that reporting rule (and the associated contract-action pair), which yields the highest expected utility, from the set of all reporting rules and thus completely solves P1.

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[11] For any rule $r=\{r_1(.),r_2(.)\}$ in R_f , it is the case that the optimal contract is identical to the one derived under the Holmstrom two-signal model when r_1 and r_2 are jointly observed. This is because (C3) becomes a redundant constaint since it is automatically satisfied in equilibrium. That is, any reporting rule r in R_f is implementable costlessly.

[12] Note that , for every r(.) in R_f^C, $(s^{**}(r_1,r_2), a^{**})$ - the solution to the principal's problem when (C1),(C2) and (C3) are the constraints, yields strictly lower expected utility to the principal when compared to $(s^*(r_1,r_2), a^*)$ - the solution that ignores (C3), since the principal has to incur a strictly positive cost to satisfy (C3).

Let P1 be such that R_f is non-empty and that, atleast for some reporting rule in R_f, the optimal action is interior. It is clear that the principal finds the reports useful in equilirium. This particular aspect of the solution to the principal's problem is focused on for further discussions. Sufficient conditions, for situations where at least one of $\{(l_1,l_2),(l_1,h_2),(h_1,l_2),(h_1,h_2)\}$ is a feasible reporting rule implementable by the optimal contract (i.e belongs to R_f), are developed in Proposition 1. For later use in Proposition 1, the following likelihood ratios are first defined:

$$L_1(l_1,l_2,a) = \frac{f_a(l_1,l_2)}{f(l_1,l_2)} \qquad L_2(l_1,h_2,a) = \frac{f_a(l_1,h_2)}{f(l_1,h_2)}$$

$$L_3(h_1,l_2,a) = \frac{f_a(h_1,l_2)}{f(h_1,l_2)} \qquad L_4(h_1,h_2,a) = \frac{f_a(h_1,h_2)}{f(h_1,h_2)}$$

I also document the nature of the optimal contract for the following five cases :

Case 1 : The principal does not ask for any report and offers a constant wage. The agent takes a_l, the lowest possible action. The optimal contract is,

$$s = U^{-1}(G(a_l) + \theta) \qquad \text{(E1)}$$

The corresponding expected utility derived by the principal is $EP(a_l) = E((V-s);a_l)$.

Case 2 : The principal assumes that the agent always issues the lowest possible reports, l_1 and l_2, and solves his problem accordingly subject to the agent's reservation utility and action choice constraints. Let a_{ll} be the corresponding optimal action that the principal wants the agent to implement. The optimal contract then satisfies

$$\frac{1}{U'(s_{ll}(l_1,l_2))} = \lambda_1 + \mu_1 \frac{f_a(l_1,l_2;a_{ll})}{f(l_1,l_2;a_{ll})} \quad \text{for all } (l_1,l_2) \qquad \text{(E2)}$$

Let the corresponding expected utility the principal derives in equilibrium be $EP(a_{ll})$.

Case 3 : The principal assumes that the agent always issues the lowest possible report for r_1 and the highest possible report for r_2 and solves his problem accordingly subject to the agent's reservation utility and action choice constraints. Let a_{lh} be the corresponding optimal action that the principal wants the agent to implement. The optimal contract then satisfies

$$\frac{1}{U'(s_{lh}(l_1,h_2))} = \lambda_1 + \mu_1 \frac{f_a(l_1,h_2;a_{lh})}{f(l_1,h_2;a_{lh})} \quad \text{for all } (l_1,h_2) \qquad \text{(E3)}$$

Let the corresponding expected utility the principal derives in equilibrium be $EP(a_{lh})$.

Case 4 : The principal assumes that the agent always issues the highest possible report for r_1 and the lowest possible report for r_2 and solves his problem accordingly subject to the agent's reservation utility and action choice constraints. Let a_{hl} be the corresponding optimal action that the principal wants the agent to implement. The optimal contract then satisfies

$$\frac{1}{U'(s_{hl}(h_1,l_2))} = \lambda_1 + \mu_1 \frac{f_a(h_1,l_2;a_{hl})}{f(h_1,l_2;a_{hl})} \quad \text{for all } (h_1,l_2) \qquad \text{(E4)}$$

Let the corresponding expected utility the principal derives in equilibrium be $EP(a_{hl})$.

Case 5 : The principal assumes that the agent always issues the highest possible reports, h_1 and h_2, and solves his problem accordingly subject to the agent's reservation utility and action choice constraints. Let a_{hh} be the corresponding optimal action that the principal wants the agent to implement. The optimal contract then satisfies

$$\frac{1}{U'(s_{hh}(h_1,h_2))} = \lambda_1 + \mu_1 \frac{f_a(h_1,h_2;a_{hh})}{f(h_1,h_2;a_{hh})} \quad \text{for all } (h_1,h_2) \qquad \text{(E5)}$$

Let the corresponding expected utility the principal derives in equilibrium be $EP(a_{hh})$.

(A7) The agency problem is non-trivial i.e.

$EP(a_l) << \min\{EP(a_{ll}), EP(a_{lh}), EP(a_{hl}), EP(a_{hh})\}$

Proposition 1

Let assumptions A1 to A7 hold. The principal will always ask for the reports r_1 and r_2 and use them in a non-trivial way in the contract if,

(a) L_1 is monotone decreasing in l_1 and l_2 when evaluated at a_{ll} <u>or</u>

(b) L_2 is monotone decreasing in l_1 and monotone increasing in h_2 at a_{lh} <u>or</u>

(c) L_3 is monotone increasing in h_1 and monotone decreasing in l_2 at a_{hl} <u>or</u>

(d) L_4 is monotone increasing in h_1 and h_2 when evaluated at a_{hh}

<u>Proof :</u>

The proof is in Appendix A1.

It should be noted that Proposition 1 gives only sufficient conditions for the use of r_1 and r_2 in the contract. It is possible that there could be situations where the sufficient conditions are not satisfied but the principal may still offer a contract based on both r_1 and r_2. The important issue is to determine how stringent the conditions described in Proposition 1 are, in order to check whether the situations in which the discretionary reports are used are not of measure zero.

Consider the situation where the joint p.d.fs of r_1 and r_2 (corresponding to the four cases $\{r_1=l_1(.)\ ,\ r_2=l_2(.)\}$, $\{r_1=l_1(.)\ ,\ r_2=h_2(.)\}$, $\{r_1=h_1(.)\ ,\ r_2=l_2(.)\}$ and $\{r_1=h_1(.)\ ,\ r_2=h_2(.)\}$) parametrized by the agent's action a, are given by

F1:

$$f^{ll}(l_1,l_2;a) = \mathrm{Exp}\{\ p^{ll}(a)\ l_1+q^{ll}(a)\ l_2 - z^{ll}(a) + w^{ll}(l_1) + t^{ll}(l_2 - \gamma l_1)\ \}$$

$$f^{lh}(l_1,h_2;a) = \mathrm{Exp}\{\ p^{lh}(a)\ l_1+q^{lh}(a)\ h_2 - z^{lh}(a) + w^{lh}(l_1) + t^{lh}(h_2 - \gamma l_1)\ \}$$

$$f^{hl}(h_1,l_2;a) = \mathrm{Exp}\{\, p^{hl}(a)\, h_1 + q^{hl}(a)\, l_2 - z^{hl}(a) + w^{hl}(h_1) + t^{hl}(l_2 - \gamma h_1) \,\}$$

$$f^{hh}(h_1,h_2;a) = \mathrm{Exp}\{\, p^{hh}(a)\, h_1 + q^{hh}(a)\, h_2 - z^{hh}(a) + w^{hh}(h_1) + t^{hh}(h_2 - \gamma h_1) \,\}$$

$p^{ij}(a)$ and $q^{ij}(a)$ {i=l,h and j=l,h} are required to be non-trivial functions of *a*. That is, I assume that the joint density functions belong to a sub-class of the exponential family of density functions.[13] Let us further assume that A (the set of feasible actions that can be taken by the agent) is restricted to the positive real line. A wide choice of functions (for example linear, power and exponential) for $p^{ij}(a)$ and $q^{ij}(a)$ {i=l,h and j=l,h} exist that always satisfy the sufficient conditions in Proposition 1.

The p.d.f.s in the preceding paragraph also have the property that the functions $p_a^{ij}(a)$ and $q_a^{ij}(a)$ represent the product of the adjusted sensitivity and precision of the individual reports that belong to the relevant report combinations (l_1,l_2) and so on.[14] For the class of densities in F1, the conditions in Proposition 1 reduce to checking whether the adjusted sensitivity of the various reports are negative or positive (as the case may be) when evaluated at the corresponding optimal action.

[13] When the signals r_1 and r_2 are jointly observed, the joint density functions described in F1 guarantee that the optimal contract will be a function of a linear combination of the signals. Banker and Datar (1989) identify necessary and sufficient conditions on the joint density function of the signals under which linear aggregation is optimal and also determine the relative weights on the individual signals in the optimal linear aggregate.

[14] Precision is the inverse of the variance and adjusted sensitivity is the change in the expected value of the signal, with respect to the agent's effort, adjusted for its correlation with the other signal. Specifically, when l_1 and l_2 are observed, $p_a^{l}(a) = \dfrac{\left(\dfrac{\partial E(l_1)}{\partial a} - \dfrac{\mathrm{Cov}(l_1,l_2)\dfrac{\partial E(l_2)}{\partial a}}{\mathrm{var}(l_2)}\right)}{\mathrm{var}(l_1)}$ and so on.

It is easy to generate examples which satisfy the requirement in F1 by using elementary joint density functions of x,y,m and n. Let x,y,m and n be independently distributed of each other with exponential p.d.f with means $a,a,1$ and 1 respectively. Let $l_1(x,y,m,n,a) = |x-ma|$, $h_1(x,y,m,n,a) = x+ma$. $l_2(x,y,m,n,a) = |y-na|$ and $h_2(x,y,m,n,a) = y+na$. It can be verified that,

$$f^{ll}(l_1,l_2;a) = \mathrm{Exp}\left(-\frac{l_1}{a} - \frac{l_2}{a} - 2\log(a) \right)$$

$$f^{lh}(l_1,h_2;a) = \mathrm{Exp}\left(-\frac{l_1}{a} - \frac{h_2}{a} - 3\log(a) + \log(h_2) \right)$$

$$f^{hl}(h_1,l_2;a) = \mathrm{Exp}\left(-\frac{h_1}{a} - \frac{l_2}{a} - 3\log(a) + \log(h_1) \right)$$

$$f^{hh}(h_1,h_2;a) = \mathrm{Exp}\left(-\frac{h_1}{a} - \frac{h_2}{a} - 4\log(a) + \log(h_1) + \log(h_2) \right)$$

3.5 STRUCTURE OF THE OPTIMAL CONTRACT WHEN THE PRODUCTION FUNCTION IS MULTIVARIATE NORMAL

To derive testable predictions, I impose additional structure upon the model. I assume that the vector **j'** =(x,y,m,n) is quadrivariate normally distributed with mean vector **m'** = (pa,qa,0,0) and variance-covariance matrix **V** . p and q are assumed to have non-zero values. Let **A** be a t x z matrix with rank t and $t \leq z$. One very useful characteristic of the multivariate normal distribution is the fact that **Aj** is multi-variate normal if **j** (a z x 1 vector) is multivariate normal. Let

$$\mathbf{V} = \begin{pmatrix} \sigma_1^2 & \rho\sigma_1\sigma_2 & 0 & 0 \\ \rho\sigma_1\sigma_2 & \sigma_2^2 & 0 & 0 \\ 0 & 0 & \sigma_3^2 & 0 \\ 0 & 0 & 0 & \sigma_4^2 \end{pmatrix} \quad \text{and} \quad \mathbf{A} = \begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \end{bmatrix}$$

Then the mean of the vector **(Aj)'** = (x+m,y+n) is **m'A'** = (pa,qa) and the variance-covariance matrix is,

$$\mathbf{AVA'} = \begin{bmatrix} \sigma_1^2+\sigma_3^2 & \rho\sigma_1\sigma_2 \\ \rho\sigma_1\sigma_2 & \sigma_2^2+\sigma_4^2 \end{bmatrix} = \begin{bmatrix} \sigma_5^2 & \rho_1\sigma_5\sigma_6 \\ \rho_1\sigma_5\sigma_6 & \sigma_6^2 \end{bmatrix}$$

where $\sigma_5 = \sqrt{\sigma_1^2+\sigma_3^2}$, $\sigma_6 = \sqrt{\sigma_2^2+\sigma_4^2}$ and $\rho_1 = \dfrac{\rho\sigma_1\sigma_2}{\sigma_5\sigma_6}$.

It is also assumed that the agency is endowed with the reporting system **R** = $\{R_1(x,y,m,n,a) = [x+m\ ,\ x+m+K_1] = [l_1,h_1]\ ,\ R_2(x,y,m,n,a) = [y+n\ ,\ y+n+K_2] = [l_2,h_2]\ \}$. Both the shareholders and the management know the values of K_1 and K_2 which are strictly positive constants. Given the above, it can be verified that

$$\frac{f_a(l_1,l_2;a)}{f(l_1,l_2;a)} = \frac{1}{(1-\rho_1^2)}\left[l_1\left(\frac{p}{\sigma_5^2} - \frac{\rho_1 q}{\sigma_5\sigma_6}\right) + l_2\left(\frac{q}{\sigma_6^2} - \frac{\rho_1 p}{\sigma_5\sigma_6}\right) + a\left(\frac{2\rho_1 pq}{\sigma_5\sigma_6} - \frac{p^2}{\sigma_5^2} - \frac{q^2}{\sigma_6^2}\right)\right] = D^{ll}(l_1,l_2)$$

$$\frac{f_a(l_1,h_2;a)}{f(l_1,h_2;a)} = \frac{1}{(1-\rho_1^2)}\left[l_1\left(\frac{p}{\sigma_5^2} - \frac{\rho_1 q}{\sigma_5\sigma_6}\right) + (h_2-K_2)\left(\frac{q}{\sigma_6^2} - \frac{\rho_1 p}{\sigma_5\sigma_6}\right) + a\left(\frac{2\rho_1 pq}{\sigma_5\sigma_6} - \frac{p^2}{\sigma_5^2} - \frac{q^2}{\sigma_6^2}\right)\right]$$
$$= D^{lh}(l_1,l_2)$$

$$\frac{f_a(h_1,l_2;a)}{f(h_1,l_2;a)} = \frac{1}{(1-\rho_1^2)}\left[(h_1-K_1)\left(\frac{p}{\sigma_5^2} - \frac{\rho_1 q}{\sigma_5\sigma_6}\right) + l_2\left(\frac{q}{\sigma_6^2} - \frac{\rho_1 p}{\sigma_5\sigma_6}\right) + a\left(\frac{2\rho_1 pq}{\sigma_5\sigma_6} - \frac{p^2}{\sigma_5^2} - \frac{q^2}{\sigma_6^2}\right)\right]$$
$$= D^{hl}(h_1,l_2)$$

$$\frac{f_a(h_1,h_2;a)}{f(h_1,h_2;a)} = \frac{1}{(1-\rho_1^2)}\left[(h_1-K_1)\left(\frac{p}{\sigma_5^2} - \frac{\rho_1 q}{\sigma_5\sigma_6}\right) + (h_2-K_2)\left(\frac{q}{\sigma_6^2} - \frac{\rho_1 p}{\sigma_5\sigma_6}\right) + a\left(\frac{2\rho_1 pq}{\sigma_5\sigma_6} - \frac{p^2}{\sigma_5^2} - \frac{q^2}{\sigma_6^2}\right)\right].$$
$$= D^{hh}(h_1,h_2)$$

Let $U'(s(.)) = J(s(.))$ and let $J^{-1}(.)$ be the inverse function of J(.). The equilibrium can be summarized as,

1) If $\frac{p}{\sigma_5^2} - \frac{\rho_1 q}{\sigma_5\sigma_6} < 0$ and $\frac{q}{\sigma_6^2} - \frac{\rho_1 p}{\sigma_5\sigma_6} < 0$, $s(l_1,l_2) = J^{-1}((\lambda + \mu\, D^{ll}(l_1,l_2))^{-1})$ and the agent reports (l_1,l_2).

2) If $\frac{p}{\sigma_5^2} - \frac{\rho_1 q}{\sigma_5\sigma_6} < 0$ and $\frac{q}{\sigma_6^2} - \frac{\rho_1 p}{\sigma_5\sigma_6} > 0$, $s(l_1,h_2) = J^{-1}((\lambda + \mu\, D^{lh}(l_1,h_2))^{-1})$ and the agent reports (l_1,h_2).

3) If $\frac{p}{\sigma_5^2} - \frac{\rho_1 q}{\sigma_5\sigma_6} > 0$ and $\frac{q}{\sigma_6^2} - \frac{\rho_1 p}{\sigma_5\sigma_6} < 0$, $s(h_1,l_2) = J^{-1}((\lambda + \mu\, D^{hl}(h_1,l_2))^{-1})$ and the agent reports (h_1,l_2).

4) If $\frac{p}{\sigma_5^2} - \frac{\rho_1 q}{\sigma_5\sigma_6} > 0$ and $\frac{q}{\sigma_6^2} - \frac{\rho_1 p}{\sigma_5\sigma_6} > 0$, $s(h_1,h_2) = J^{-1}((\lambda + \mu\, D^{hh}(h_1,h_2))^{-1})$ and the agent reports (h_1,h_2).

Another characteristic of the optimal contract (also discussed by Banker and Datar (1989)) is that $s(r_1,r_2)$ reduces to $s(vr_1+ w\, r_2)$, where the weights v and w are each proportional to the product of their precision and adjusted sensitivity.[15] Banker and Datar, however, examine situations where the two signals are jointly observed, whereas, in the present analysis, r_1 and r_2 are discretionary reports issued by the manager.

The weights v and w depend on a number of factors. For instance, when one or both of the signals y and n is very noisy (i.e., σ_3 and/or σ_4 is very high) w is practically

[15]Precision is the inverse of the variance and adjusted sensitivity is the change in the expected value of the signal , with respect to the agent's effort , adjusted for its correlation with the other signal. Specifically, the precision of r_1 is $1/\sigma_5^2$ and adjusted sensitivity is $(p - \frac{\rho_1 \sigma_5 q}{\sigma_6})$ and for r_2, the precision is $1/\sigma_6^2$ and adjusted sensitivity is $(q - \frac{\rho_1 \sigma_6 p}{\sigma_5})$.

zero and r_2 plays an insignificant role in the contract. Similar logic holds for the weight v. Suppose q is zero. Then, the weight attached to r_2 in the linear aggregate has the same sign as the weight attached to r_1, if the reports are negatively correlated, and the opposite sign otherwise. The contract $s(vr_1 + w\, r_2)$ further reduces to $s(r_1+r_2)$(i.e., the optimal contract is a function of a single performance measure which is the sum of the reports) only when $\frac{p}{q} = \frac{\sigma_5^2 + \rho_1\sigma_5\sigma_6}{\sigma_6^2 + \rho_1\sigma_5\sigma_6}$.

3.6 SUMMARY

In summary, the model developed in this chapter suggests that :

1) Under certain conditions, it is useful for the principal to ask for reports from the agent (about the agent's private information) even when there is a possibility that the agent's reports may not be truthful, and use them as performance measures.

2) The conditions are : (a) the agent's private information is informative about his action, (b) the discretion the agent can exercise in making the reports is limited, and (c) the bounds on the reporting set themselves are informative.

3) In the special case where (a) the agent privately observes informative signals x and y and non-informative signals m and n, (b) the reporting set is limited to $[x+m, x+m+K_1]$ and $[y+n, y+n+K_2]$ and (c) x,y,m and n are quadrivariate normally distributed, the optimal contract has the property that the reports are linearly aggregated. The weights that are used in the aggregation are proportional to the precision and adjusted sensitivity of the respective measures.

CHAPTER 4

EMPIRICAL ANALYSIS

4.1 INTRODUCTION

In this chapter, testable hypotheses of the predictions of the analytical model (discussed in the preceding chapter) are developed. These hypotheses are then tested using a large sample of management compensation, accrual and cash flows data. The empirical analysis focuses on whether accruals and cash flows are used as distinct performance measures in management compensation contracts. It is also checked whether the weights attached to these accounting performance measures in the compensation contract is proportional to their adjusted sensitivity and precision. Accruals and cash flows are further decomposed into discretionary and non-discretionary components and it is also examined whether the shareholders are sophisticated enough in using these components appropriately to compensate the manager. Cross-sectional tests are carried out to see whether there is any association between proxies for managerial discretion and the weight attached to accruals in the contract.

A couple of related empirical issues are also examined as part of the empirical analysis. It is checked whether the weights attached to accruals and cash flows in the valuation of the firm is different from the weights attached to them in determining management compensation. It is also investigated whether the compensation contracts are piece-wise linear (rather than all-linear) in accruals.

4.2 EQUIVALENT REGRESSION FRAMEWORK

Under the quadrivariate normality assumption for the production function, the equation characterizing the optimal contract is,

$$\frac{1}{U'(s(r_1,r_2))} = \lambda + \frac{\mu}{(1-\rho_1^2)}\left[r_1\left(\frac{p}{\sigma_5^2} - \frac{\rho_1 q}{\sigma_5\sigma_6}\right) + r_2\left(\frac{q}{\sigma_6^2} - \frac{\rho_1 p}{\sigma_5\sigma_6}\right) + a\left(\frac{2\rho_1 pq}{\sigma_5\sigma_6} - \frac{p^2}{\sigma_5^2} - \frac{q^2}{\sigma_6^2}\right)\right] \qquad \text{(E6)}$$

When the manager's utility for his compensation is $\log(s(r_1,r_2))$[16], (E6) reduces to a simple linear relationship[17], i.e.

$$s(r_1,r_2) = \beta_0 + \beta_1 r_1 + \beta_2 r_2 \qquad \text{(E7)}$$

Comparing equations (E6) and (E7), we find that

$$\beta_1 = \frac{C}{a}\left[\frac{pa}{\sigma_5^2} - \frac{\rho_1 qa}{\sigma_5\sigma_6}\right] \text{ and}$$

$$\beta_2 = \frac{C}{a}\left[\frac{qa}{\sigma_6^2} - \frac{\rho_1 pa}{\sigma_5\sigma_6}\right]$$

where C is strictly positive.[18] The sign of $\frac{\beta_1}{\beta_2}$ is determined by the sign of $\frac{\left[\frac{pa}{\sigma_5^2} - \frac{\rho_1 qa}{\sigma_5\sigma_6}\right]}{\left[\frac{qa}{\sigma_6^2} - \frac{\rho_1 pa}{\sigma_5\sigma_6}\right]}$. Let $\gamma_1 = \left[\frac{pa}{\sigma_5^2} - \frac{\rho_1 qa}{\sigma_5\sigma_6}\right]$ and $\gamma_2 = \left[\frac{qa}{\sigma_6^2} - \frac{\rho_1 pa}{\sigma_5\sigma_6}\right]$. γ_1 and γ_2, which

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[16]In prior research, Lambert and Larcker (1987) assume a general power utility function for the agent's utility and find that assuming logarithmic utility (which corresponds to the limit of the power utility function $U(s) = s^{1-k} / (1-k)$ when k approaches 1) has little impact on the regression estimates. Many prior studies have also used linear relationships between compensation and performance measures, implicitly assuming a logarithmic utility for the agent. Therefore, this assumption about the agent's utility function seems to be reasonably in tune with prior research.

[17]With a normal production function and a logarithmic utility function it is important to verify whether the argument of the logarithmic function (i.e. the agent's salary) will be positive for large negative realizations of the performance measures. This issue is addressed in Appendix A3.

can be completely estimated as functions of the means, standard deviations and covariance of the performance measures, are the adjusted precision-weighted means of r_1 and r_2 respectively.

The linear relationship in (E7) arises from a single-period characterization of the contracting environment. To operationalize it empirically, for further analysis with time-series data, it is also assumed that, for every firm in the sample, the single-period model gets implemented every period with no change in the production function or the agent and shareholder preference structures.[19] This precludes the use of a multi-period contract by the principal, even though, as Lambert (1983) points out, it is beneficial for the shareholders to offer multi-period contracts to the managers.

The linear relationship in (E7) has the regression model equivalent

$$s_t = \beta_0 + \beta_1 r_{1t} + \beta_2 r_{2t} + \varepsilon_t \qquad t=1,..,T \qquad \text{(E8)}$$

where s_t is the management compensation for the period t, r_{1t} and r_{2t} are the discretionary accounting reports issued by the manager and ε_t an error term. The ε_t are assumed to be i.i.d. normal with zero mean.[20]

4.3 RESEARCH HYPOTHESES

The following research hypotheses are tested by analyzing the results of the regression model in (E8).

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[18]The means of the performance measures are simple multiples of the action a. This enables one to express β_1 and β_2 as simple functions of the adjusted precision-weighted means. In general, they will be proportional to adjusted precision-weighted sensitivities.

[19]The assumption that the same optimal action gets implemented every period is equivalent to assuming that the means and variances of the performance measures do not change with time.

[20]The error term is included so as to account for any omitted independent variables uncorrelated with the performance measures.

H1 : The agent's reports are not used as performance measures in contracting, i.e.

$\beta_1 = 0$ versus the alternative $\beta_1 \neq 0$ and

$\beta_2 = 0$ versus the alternative $\beta_2 \neq 0$

H2 : The weights attached to the two discretionary reports are equal, i.e.

$\beta_1 = \beta_2$ versus $\beta_1 \neq \beta_2$.

H3 : The ratio of weights attached to the reports in the contract and the ratio of their adjusted precision-weighted means have the same sign. This hypothesis is tested by checking whether the signs of the two ratios match more than by chance.

$$P=\text{Prob}(\text{sign } \frac{\beta_1}{\beta_2} = \text{sign} \frac{\gamma_1}{\gamma_2}) = 0.5 \text{ versus the alternative } P > 0.5$$

H4 : The ratio of weights attached to the reports in the contract and the ratio of their adjusted precision-weighted means are equal i.e.

$$\frac{\beta_1}{\beta_2} = \frac{\gamma_1}{\gamma_2} \quad \text{versus} \quad \frac{\beta_1}{\beta_2} \neq \frac{\gamma_1}{\gamma_2}$$

H1 is a direct test of Proposition 1 since the rejection of the null hypothesis will mean that the discretionary reports are used as performance measures in the agent's compensation contract. H2 will provide evidence on whether there is any benefit to the shareholders in using the two reports as two distinct performance measures instead of aggregating them into a single measure.[21] Tests of H3 will validate the predictions of the model, developed in Chapter 3, to the actual relationship observed between managerial compensation and the performance measures.[22] If the model is a reasonable description

[21]If operating cash flows and total accruals are the two discretionary reports on which the manager is compensated, this is equivalent to checking whether it is beneficial for the shareholders to use cash flows and total accruals instead of earnings.

[22]It is not the case that the validity of the model (in terms of its prediction about the relationship between the ratio of weights attached to the performance measures and the ratio of their adjusted precision weighted means) can be tested by checking whether their signs are independent. Consider, for example, the situation where the observed ratios are always opposite in sign. A test of independence will reject the null but the evidence is obviously contrary to what the model predicts. On the other hand, if the test of H3 rejects the null, it is always the case that the observed evidence is closer to the prediction of the

of the actual relationship, one would expect H3 to be rejected. Tests of H4 once again provide evidence on the applicability of the model but are stronger than H3.

4.4 CHOICE OF PERFORMANCE MEASURES

The contracting variables r_1 and r_2 are known only to the shareholders and manager. The specification implied by the model for these variables is very broad in the sense that they could be interpreted as any two of the many reports issued by the manager. For the purposes of the bulk of my empirical analysis, I interpret accruals and operating cash flows as the two performance measures, r_1 and r_2. There are a number of reasons for the choosing these components of earnings. They are reported at the end of the accounting period by the manager and therefore managers and shareholders can contact on them. They vary sharply in their informativeness (in terms of their ability to communicate the production and investment decisions made by the manager) and in the discretion that the manager exercises in reporting them. It is also the case that previous research has found a strong association between compensation and accounting earnings and it is possible that this association is more due to the two components being used as two distinct performance measures rather than being aggregated into one.[23] For the rest of the paper, cash flows are referred to as "CASO" and accruals as "TACC" and the earnings as "EARN".

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model. Suppose H3 is rejected. If the corresponding test of independence also rejects the null, we have strong evidence on the validity of the model. If independence cannot be rejected, we will have weak evidence. It is clear that the test of H3 provides primary evidence on the validity of the model and test of independence can provide information only in conjunction with it.

[23]Previous empirical research has looked at components of total accruals i.e., current and non-current accruals, from the point of their information content(Wilson (1986) and Bernard and Stober (1989)) and discretionary and non-discretionary accruals, from the point of their role in management compensation (Healy (1985)).

There is some weak evidence that cash flow based performance measures are actually used in practice to determine the funds allotted to bonus pools.[24] However, as mentioned earlier, it need not be the case that the final cash compensation paid to the manager is proportional to the amount allocated to the bonus pool.[25] I assume that cash flows from operations and total accruals are used as implicit performance measures and analyze the compensation, cash flows and accruals data to check whether this indeed is the case.

Compensation is measured as salary and bonus. This is a limitation to the analysis since cash compensation is only part of the total compensation package (Antle and Smith (1985) discuss the measurement of the individual components of the manager's total compensation). However, cash compensation usually represents a substantial proportion of the CEO's total remuneration.[26] I measure the earnings, total accruals and operating cash flows in two different ways (based on the prior empirical work of Rayburn (1986) and Livnat and Zarowin (1990)) and carry out empirical tests on the resulting two samples which, for the rest of the analysis, are denoted as S1 and S2. Appendix A2 describes the way the performance measures were computed from the Annual Industrial Compustat. The following regression models are then evaluated for every firm in the sample. All the variables are adjusted for inflation and expressed in constant 1970 dollars.

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[24]In a 1988 survey, Sibson & Company report that 5% of the companies in their survey use target cash flow/cash flow-based return on investment as a performance measure.

[25]For example, the Chief Financial Officers of Ashland Oil , E-Systems and Tenneco mention (Institutional Investor - Nov 1990) that cash generation is tied to management compensation in their companies and that cash flow is measured down to the individual contract level. However, the proxy statement for Ashland Oil for the year 1989 specifies that the total bonus distributed is not to exceed 6% of net income excluding operating items calculated on a primary basis. In case of E-Systems, the amount allotted to the bonus pool is not to exceed 7.5% of the consolidated net profits before provision for income taxes. Tenneco simply states that bonus is awarded based on performance goals achieved.

[26]Surveys by Booz *et al* (1983) and Hay Associates (1981) report that salary plus bonus represents between 80% and 90% of total compensation.

R1 : $COMP_t = \beta_0 + \beta_1 \ TACC1_t + \beta_2 \ CASO1_t + \varepsilon_t$ and

R2 : $COMP_t = \beta_0 + \beta_1 \ TACC2_t + \beta_2 \ CASO2_t + \varepsilon_t$

Tests of H3 require estimates of γ_1 and γ_2. For S1, these are estimated as

$$\gamma_1 = \frac{\mu(TACC1)}{\sigma^2(TACC1)} - \frac{\rho(TACC1,CASO1)\mu(CASO1)}{\sigma(TACC1)\sigma(CASO1)} \text{ and } \gamma_2 = \frac{\mu(CASO1)}{\sigma^2(CASO1)} - \frac{\rho(TACC1,CASO1)\mu(TACC1)}{\sigma(TACC1)\sigma(CASO1)}$$

where $\mu(.)$ and $\sigma(.)$ refer to the sample mean and standard deviation of the relevant performance measure and $\rho(.)$ is the sample correlation coefficient. The estimation is similar for S2.

4.5 SAMPLE SELECTION

The compensation data was collected from the *Forbes* annual survey for the years 1970-1988. Balance Sheet and Income Statement data were collected from the Annual Industrial Compustat for the years 1970-1988. The following selection criteria were used to arrive at the final sample.

1) Same fiscal year-end throughout the sample period.

2) Availability of all the component information (as detailed in Appendix A2) to estimate TACC1 and CASO1 (or TACC2 and CASO2 as the case may be) for at least one or more years during the sample period.

3) Availability of compensation data.

4) At least 14 years of time series data in the sample period.

The number of firms surviving each of the above criteria is given below.

	S1	S2
Total Number of firms in Annual Industrial Compustat	2478	2478
Firms with same fiscal year end throughout sample period	1131	1131
Firms surviving criterion 2	862	867

Firms surviving criterion 3	396	394
Number of firms in final sample	250	217
Total number of firm years in final sample	4280	3574

4.6 PRIMARY RESULTS

Tables 1 and 2 contain descriptive statistics for firms in S1 and S2. The industry composition for the firms in the two samples is nearly identical, with close to 75% of the firms belonging to the light industry and manufacturing categories. The median firm-specific average annual executive salary and bonus in constant 1970 dollars is $ 228,640 for S1 and $ 228,880 for S2. More than 90% of the time series means of TACC1 and TACC2 were found to be negative, indicating that, in general, the total accrual adjustments made to the operating cash-flows to arrive at the earnings number are negative. The mean sample correlation between total accruals and cash flows is high (-0.8025 for S1 and -0.8004 for S2)[27] and this means that multi-collinearity may be a problem in the regression models R1 and R2. This issue is addressed later.

Table 3 gives the mean correlations between the performance measures used in R1 and R2. These means are computed cross-sectionally using firm-specific sample correlations of 217 firms which belong to both S1 and S2. This table shows that the two total accrual measures TACC1 and TACC2 have a high correlation of 0.8952 and the cash-flow measures CASO1 and CASO2 are correlated to the extent of 0.9049. There is some evidence, at least for the purposes of analysis in this paper, that the simpler measures TACC1 and CASO1 may perform as well as the other set of performance

[27]For comparative purposes, the correlation between the total accruals and cash flows reported by Rayburn (1986) is -0.81. Her measures, however, are scaled by the market value of equity at the beginning of the period and are not CPI adjusted.

measures. In addition, they have the added advantage that they result in a greater number of firms being included in the final sample. The rest of the discussion, therefore, focuses only on S1.

Table 4 gives a summary of the firm-specific regression statistics for the regression model R1. The mean β_1 is 1.416 and the mean β_2 is 1.646. 194 β_1s and 213 β_2s out of a total sample of 250 (78% and 85% respectively) are positive. The mean adjusted R-squared of 0.345 and the first quartile adjusted R-squared of 0.094 suggest some support for the overall specification of R1. However, the mean first-order autocorrelation of 0.301 raises some concern that the models might be mis-specified. When autocorrelation is present, the OLS estimates are less efficient than the GLS estimates that take account of the autocorrelation. Also, the variances of the estimators are themselves biased. The OLS estimates, however, are unbiased. The tests of hypotheses H1 and H2, based on OLS standard errors of the estimates, should therefore be interpreted with caution. Tests of H3 which use only the signs of the OLS regression coefficient estimates, will not be affected by the significant autocorrelation. Correction for autocorrelation and the resulting change in the results of tests of H1 and H2 are discussed later.

It is also interesting to analyze whether we can learn anything by a regression of COMP on just TACC1. It is easy to verify that the regression coefficient will be equal to $\beta_1 + \frac{\beta_2 \ \rho(\text{TACC1},\text{CASO1}) \ \sigma(\text{CASO1})}{\sigma(\text{TACC1})}$. It will be the same as the coefficient of TACC1 in R1, only when the cash flows and total accruals are uncorrelated. From Table 1, we note that they are negatively correlated and from Table 4, we note that for 88% of the firms in the sample, both β_1 and β_2 have the same sign. This implies that, in general, a regression of COMP on TACC1 is likely to produce a regression coefficient biased towards zero. A similar argument also shows that, in general, a regression of COMP on CASO1 will again produce a regression coefficient biased towards zero.

As discussed earlier, the high correlation among the independent variables TACC1 and CASO1 (or TACC2 and CASO2 as the case may be) may result in multicollinearity. The collinearity diagnostics that are reported in Table 4 help in determining the seriousness of multicollinearity in R1 and R2. The Condition Number that is reported refers to the ratio of the square root of the largest eigenvalue to that of the lowest of the X'X matrix and VARI1 and VARI2 refer to the proportion of variance of β_1 and β_2 explained by the largest eigenvalue. The mean Condition Number for the firms in S1 is 11.501 and mean values of VARI1 and VARI2 are 0.754 and 0.942 respectively. Based on the heuristics suggested by Belsley, Kuh and Welsch (1980), the regression estimates β_1 and β_2 are degraded if the Condition Number is greater than 30 and both VARI1 and VARI2 are greater than 0.5. This was found to be the case in only 5 firms out of the 250 in S1.

Ignoring for the moment the effect of the significant first order autocorrelation on the standard errors and hence on the resulting sample t statistics corresponding to the regression coefficients β_1 and β_2, we find that both H1 and H2 are rejected at very low significant levels. In fact, in the test of H1, the entire sample of 250 firms need be equivalent to only 3 independent observations for the average Z statistic (obtained by aggregating standardized t statistics cross-sectionally) corresponding to β_1 to be significant at the 0.01 level. In the case of β_2, the corresponding number of equivalent independent observations is 2. Non-parametric tests (both sign and sign-rank) of H1 also reject the null hypothesis at very low levels. The χ^2 statistic testing the equality of β_1

and β_2 and the non-parametric test statistics are also significant at low levels, indicating that significantly different weights on average are attached by the shareholders to the cash flows and the total accruals components. In addition to the χ^2 test (which assumes independence across the sample observations), an additional test is also conducted to adjust for the difference in standard errors of the β_1 and β_2 coefficients across the sample. In this test, a z-statistic is constructed by normalizing the t-statistic corresponding to β_2-β_1 (which is represented as t(β_2-β_1) and is evaluated using the variance-covariance matrix of the regression coefficients), and then this z-statistic is aggregated. From Table 4, one finds that the 250 sample observations need be equivalent to a minimum of 35 independent observations for the z-statistic to be significant at the 0.01 level in the test of H2.

The tests of H3 are carried out by comparing the sign of $\frac{\beta_1}{\beta_2}$ with that of $\frac{\gamma_1}{\gamma_2}$ (the ratio of the adjusted precision-weighted means of the performance variables). H3 suggests that if the model fits the observed data, the signs should match significantly better than when the match happens by chance. It is found that 199 out of 250 $\frac{\beta_1}{\beta_2}$ have the same sign as the corresponding $\frac{\gamma_1}{\gamma_2}$. The relevant Z and χ^2 statistics are all significant at the 0.01 levels, lending some support to the validity of the model and the assumptions made. Tests of H4 yield mixed results. The parametric t-statistic testing the equality of $\frac{\beta_1}{\beta_2}$ and $\frac{\gamma_1}{\gamma_2}$ cannot reject the null at the 0.1 level. Assuming that the estimate of $\frac{\gamma_1}{\gamma_2}$ has a very low standard error, it is also possible to examine H4 by constructing the z-statistic corresponding to (β_1 - $\frac{\beta_2\gamma_1}{\gamma_2}$). Even if all the ($\beta_1$ - $\frac{\beta_2\gamma_1}{\gamma_2}$) estimates are considered independent, the null in H4 cannot be rejected at the 0.01 level. On the other hand, the non-parametric tests reject the null hypothesis at 0.01 level.[28]

Tests of H3 and H4 based on the regression coefficients reported in Table 4 are affected by values of β_2 which are very close to zero. The high standard deviation of 10.66 for $\frac{\beta_1}{\beta_2}$ actually results from values which range from -109.381 to 106.04. To examine the sensitivity of the tests of H3 and H4 to this problem a subsample of 139 firms is chosen on the basis of the t statistic associated with β_2. Table 4A shows the results for this subsample for which $t(\beta_2)$ is significant at 0.05 level. The standard deviation of $\frac{\beta_1}{\beta_2}$ goes down significantly to 0.36 and the range is from -1.102 to 2.13. The results of tests of H1,H2 and H3 are very similar to those for the full sample. Both parametric and non-parametric tests of H4 on the subsample, however, reject the null at low significant levels.

As discussed earlier, interpreting the test statistics for the tests of H1 and H2 in Table 4 is confounded by the significant first order autocorrelation in R1. Assuming that the residuals R1 follow a first-order autoregressive process, Table 5 reports the results for the following modified version of R1.

AR1: $COMP_t = \beta_{0a} + \beta_{1a}\ TACC1_t + \beta_{2a}\ CASO1_t + v_t$

[28] To check whether the significant correlation between CASO and TACC affects the tests of the hypotheses, I partitioned the sample of 250 firms into two groups on the basis of the correlation. The mean value of correlation for the "high" subgroup is -0.6686 and that for the "low" group is -0.9364. Tests of H1,H2 and H3 conducted on each of these subgroups yielded similar results as in Table 4. The number of correct matches in the test of H3 in these subgroups is 90/125 and 109/125 respectively. Once again tests of H4 yielded mixed results. For the "low" group both parametric and non-parametric tests could not reject the null whereas for the "high" group the non-parametric tests rejected the null and the parametric test could not.

$v_t = \varepsilon_t - \alpha v_{t-1}$ where ε_t are i.i.d. normal with zero mean and variance σ^2.

This alternative specification of the residuals has the characteristic that the fundamental linear relationship predicted by the model in (E7) is still retained. The standard errors of the regression coefficients are now expected to be efficient and their estimates unbiased. The tests of H1 and H2 reported in Table 5 are therefore expected to be more reliable than those in Table 4. Model AR1 is estimated using the *two-step full transform method.*[29] This method is basically Generalized Least Squares, using the OLS residuals to estimate the covariances across observations. In the first step, the variance-covariance matrix of v, namely Σ (which can be expressed as $\sigma^2 V$) is computed up to the scale factor σ^2 using the estimate of α, the first-order autocorrelation coefficient. The regression coefficients are then efficiently estimated in the second step and σ^2 is unbiasedly estimated using GLS. Two measures of R-squared are reported in Table 5. The adjusted regression R-squared is a measure of the fit of the structural part of the model after transforming for autocorrelation and is computed using the error sum of squares of the transformed regression problem. The total adjusted R-squared is computed using the final error sum of squares of the original equation. The error sum of squares are calculated using the regression coefficient estimates from the transformed regression. The mean first-order autocorrelation of transformed residuals of 0.171 (compared to 0.301 for the original model) and the adjusted regression R-squared of 0.298 suggest that the AR1 specification of the error term may be reasonable. Further,

[29]The Cochrane-Orcutt method can also be used. However, the disadvantage is the loss of the first observation during the transformation. For small samples, Harvey and McAvinchey (1978) suggest the use of a full transformation method rather than the Cochrane-Orcutt method. Other methods that can be used are unconditional or exact least squares (ULS) or maximum likelihood (ML). These methods estimate the parameters by minimizing the sum of squares and maximizing the log likelihood respectively. However, computationally, these methods are more complicated than the two-step full transform method. Also, Harvey and McAvinchey (1978) observe that when the auto regressive parameter is not too large, the two-step full transform method is as efficient as the ML method.

the mean total R-squared of 0.488 is a substantial improvement over the OLS mean R-squared values in Table 4. The mean (median) estimates of β_{1a} and β_{2a} are 1.391 (0.698) and 1.539 (0.814) respectively.[30] 206 β_{1a}s and 217 β_{2a}s out of a total sample of 250 (82% and 87% respectively) are positive. Tests of H1 and H2 (which use efficient estimates and unbiased standard errors of regression coefficients) provide evidence that the total accrual measure is used as a performance variable and that the cash flow measure and the total accrual measures are attached different weights in the contracts. In tests of H3, the number of correct matches goes up marginally to 205. Once again, the high Z and $\chi 2$ statistics indicate that the signs match significantly more than what is to be expected by chance. However, both parametric and non-parametric tests of H4 reject the null at very low levels. Table 5A reports the results of the tests of H1,H2,H3 and H4 on a subsample of firms for which $t(\beta_{2a})$ is significant at the 0.05 level. The results are not very different from those for the full sample.

4.7 THE EFFECT OF SEGREGATING THE NON-DISCRETIONARY AND DISCRETIONARY COMPONENTS OF REPORTS

The two-signal model developed in Chapter 3 can be generalized to a multiple signal scenario where *n* discretionary reports (each based on a private informative signal arising out of the agent's action and subject to different degrees of reporting discretion) are used as performance measures. Once again, if the informativeness of the private signal is substantially larger than the discretion the manager has in reporting it, one would expect that a non-trivial weight on the corresponding report in the manager's

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[30]Defeo,Lambert and Larcker (1989) report that the mean (median) value of the regression coefficient in an AR1 model of firm-specific regression of compensation on net income is 1.41 (0.91). The variables are measured in 1967 dollars. In a cross-sectional regression of change in cash compensation on the change in net income, Jensen and Murphy (1988) report a coefficient of 0.194. They measure their variables in 1986 dollars.

compensation contract. In this section, proxies for the non-discretionary and discretionary components of the total accruals and cash flows are developed and these proxies are then used to examine whether the non-discretionary and the discretionary components vary in their ability to convey useful information about the manager's action.

The following OLS regressions are estimated on a firm by firm basis using data from the period 1950-1969. Out of the original sample of 250 firms, only 190 had at least 9 or more time-series observations during the estimation period.[31]

ER1: $TACC1_t = \delta_0 + \delta_1 DREV_t + \delta_2 GPPE_t + \varepsilon_t$ and

ER2: $CASO1_t = \upsilon_0 + \upsilon_1 DREV_t + \upsilon_2 GPPE_t + \varepsilon_t$

where $DREV_t$ is the change in inflation adjusted revenue from the year t-1 to year t and $GPPE_t$ is the gross property, plant and equipment in year t.[32]

The expectations model for total accruals was first developed by Jones (1989). The rationale for the use of the gross property, plant and equipment is to control for the non-discretionary portion of the depreciation expense of total accruals, and the use of change in revenue is to control for the non-discretionary portion of the change in working capital. The expectations model for the cash flows is developed in similar spirit to segregate the discretionary component of cash flows (if any) using the same independent variables to control for size and normal growth.

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[31]In the 1950-1969 estimation period, several observations for current maturities of long-term debt were missing from the COMPUSTAT. Hence, the TACC1 measure was calculated without adjusting for current maturities of long-term debt.

[32]GPPE is made up of various layers of assets recorded at their historical costs. Hence, adjusting GPPE for inflation may create an artficial measure which has no physical significance. Therefore, GPPE rather than an inflation adjusted-GPPE is used as the independent variable.

The results of the OLS regressions, ER1 and ER2, are summarized in Table 6. Since the changes in the individual components of the working capital are not all in the same direction as the change in DREV, it is not possible to predict unambiguously the sign of δ_1. The mean δ_1 is 0.0419 with an associated mean t-statistic of 0.658. The 190 sample observations need be equivalent to 20 independent observations for the associated z-statistic to be significant at the 0.01 level. Since a high GPPE leads to a higher depreciation expense which in turn makes the total accruals measure more negative, one would expect δ_2 to be negative. The expectations model for total accruals has a mean δ_2 coefficient of -0.0384 and an associated mean t-statistic of -1.86. The 190 sample observations need be equivalent to only 3 independent observations for the z-statistic associated with δ_2 to be significant at the 0.01 level. The mean adjusted R^2 is 0.2912 with a first quartile value of 0.022. The mean first order auto-correlation is -0.173 and in general, the expectation model for total accruals seems to be correctly specified.[33]

In the expectations model for cash flows, one expects both υ_1 and υ_2 to be positive since an increase in either DREV or GPPE is expected to increase cash flows (assuming of course that cash flows cannot be manipulated for reporting purposes by managers). The mean υ_1 is 0.021 with a mean t-statistic of 0.073 and even if all sample observations are independent, the associated z-statistic is not significant at the 0.01 level. On the other hand, the mean υ_2 is 0.139 with a mean t-statistic of 4.67 and an associated z-statistic which is significant at the 0.01 level even if all sample observations are dependent and grouped as a single observation. The mean adjusted R^2 is 0.506 with a first quartile value of 0.276. It is also interesting to note that, at every quartile of the

[33]Jones (1989) conducts firm-specific time-series regression of total accruals on DREV and GPPE (after adjusting all the variables by the total assets at the end of the period). For the 23 firms in her sample, she reports a mean R^2 of 0.232 and mean regression coefficients of 0.035 and -0.033 on DREV and GPPE respectively.

sample, the adjusted R^2 of the cash flows expectations model is substantially larger than that of the total accruals expectations model. This observation seems to suggest that the discretionary component of total accruals is relatively more significant than the discretionary component of the cash flows.

The OLS estimates of the regression coefficients $\delta_0,\delta_1,\delta_2,\upsilon_0,\upsilon_1$ and υ_2 are then used to generate proxies for the various discretionary reports. Two sets of independent variables are generated, one in which the discretionary component of the total accruals alone is considered and another in which the discretionary components of cash flows and total accruals are aggregated into a single report. The following OLS regressions are estimated during the test period 1970-1988.

DR1 :

$$COMP_t = \tau_0 + \tau_1\, NDACC1_t + \tau_2\, CASO1_t + \tau_3\, DACC1_t + \varepsilon_t$$

$$\text{where } NDACC1_t = \delta_0 + \delta_1\, DREV_t + \delta_2\, GPPE_t \text{ and}$$

$$DACC1_t = TACC1_t - NDACC1_t$$

DR2 :

$$COMP_t = \psi_0 + \psi_1\, NDACC1_t + \psi_2\, NDCASO1_t + \psi_3\, DISCRT_t + \varepsilon_t$$

$$\text{where } NDCASO1_t = \upsilon_0 + \upsilon_1\, DREV_t + \upsilon_2\, GPPE_t \text{ and}$$

$$DISCRT_t = TACC1_t + CASO1_t - NDACC1_t - NDCASO1_t$$

The regressions DR1 and DR2 were estimated on a firm-specific basis for a total of 189 firms (out of the 190 firms for which $\delta_0,\delta_1,\delta_2,\upsilon_0,\upsilon_1$ and υ_2 were estimated) using data from the test period of 1970-1988. Table 7 summarizes the descriptive statistics for the variables used in the DR1 and DR2 regressions. The cross-sectional distributions of the firm-specific time-series averages of DACC1 and DISCRT are particularly interesting. The DACC1 measure has a median value of 24.65 and a first quartile value of -12.18 and it seems to be the case that both income-decreasing and income-increasing discretionary accrual decisions are represented cross-sectionally, with the income increasing decisions having a slight majority. The DISCRT measure, on the other hand, has negative values for both the first and third quartiles and this suggests that an overwhelming majority of the discretionary decisions are income-decreasing.[34] There seems to be no particular reason as to why this should be the case. Ex-ante, if the researcher believes that both income-increasing and income-decreasing decisions are equally represented in the sample, DACC1 seems to capture that characteristic in a better way than DISCRT.

Collinearity seems to be a bigger problem for the set of independent variables used in DR2 as compared to DR1. The NDCASO1 measure seems to be highly correlated with both DISCRT and NDACC1 as can be seen from the median values of -0.8963 and -0.9761. This is also reflected in the distribution of the condition number in Panel 1 of Tables 8 and 9. The mean condition number for DR1 is 24.078 and for DR2 is 92.148. In addition, at every quartile, the condition number for DR2 is greater than DR1. While Panel 1 gives the summary statistics for the DR1 and DR2 regressions, Panel 2 of Tables 8 and 9 gives the aggregate test statistics generated using the firm-specific regression results. In Panel 2, tests of significance for the individual coefficients are conducted over the entire sample, whereas tests of comparison of two or more regression coefficients are conducted only on the sub-sample which survived the Belsley, Kuh and Welsch heuristic.[35]

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[34]Further investigation shows that out of a total sample of 3591 firm-years, 2200 (61.2%) DACC1 values and 641 (17.9%) DISCRT values were positive.

[35]With three performance measures, the criterion classifies the regression-estimates as degraded due to multi-collinearity whenever the condition number is greater than 30 and any two of the associated variance proportions are greater than 0.5.

The cross-sectional means of the regression coefficients τ_0, τ_1, τ_2 and τ_3 are all positive. 179 (94.7%) of the τ_0, 125 (66.1%) of the τ_1, 157 (83.1%) of the τ_2 and 157 (83.1%) of the τ_3 are positive. In fact, it is the case that the total sample of 189 observations need be equivalent to only 1,7,2 and 3 independent observations respectively, for the z-statistics associated with τ_0, τ_1, τ_2 and τ_3 to be significant at the 0.01 level in two-tailed tests testing the null of $\tau_i = 0$ (i=1,2,3 and 4) against the alternative of $\tau_i \neq 0$. Multi-collinearity problems restrict the sample used in tests of equality of two or more regression coefficients to 146. The weights given to the non-discretionary and discretionary components of total accruals are significantly different at the 0.01 level and the total sample of 146 observations need be equivalent to only 13 independent observations for this to hold good. It is also the case that the weights given to the non-discretionary component of accruals and cash flows are significantly different from each other. However, the weights given to cash flows and discretionary accruals are not significantly different and there seems to be no logical explanation for this. The test of equality for all three of the slope coefficients is significant at the 0.01 level and overall there is reasonable evidence to suggest that the various discretionary reports in DR1 are attached significant and different weights. The mean first order correlation coefficient is 0.19, the median is 0.22, and autocorrelation does not seem to be a serious problem.

In case of DR2, the cross-sectional means of ψ_0, ψ_1, ψ_2 and ψ_3 are all positive and 170 (89.9%) ψ_0s, 130 (68.8%) ψ_1s, 139 (73.5%) ψ_2s and 148 (78.3%) ψ_3s are positive. In fact, it is the case that the total sample of 189 observations need be equivalent to only 1,8,5 and 4 independent observations respectively, for the z-statistics associated with ψ_0, ψ_1, ψ_2 and ψ_3 to be significant at the 0.01 level. Tests of equality of two or more of the slope-coefficients are severely constrained by the presence of multi-collinearity. These tests could be conducted over only one-third of the sample. For this sub-sample, there is weak evidence that the coefficients are different from each other.

In summary, the empirical results in this section demonstrate that the shareholders use the discretionary and non-discretionary components of the earnings differentially (because these components differ in their incentive-informativeness) and that it is also the case that the accruals and cash flows portion of the non-discretionary components are assigned different weights. Further, the evidence seems to suggest that it is more likely that cash flows, non-discretionary accruals and discretionary accruals are used as performance measures rather than non-discretionary cash flows, non-discretionary accruals and a discretionary measure which consists of the discretionary components of both accruals and cash flows.

4.8 ASSOCIATION BETWEEN WEIGHTS ON REPORTS AND MEASURES OF DISCRETION

In the previous sections, it was shown that the proxies for various discretionary reports are given non-trivial weights in the performance evaluation of the manager. It was also demonstrated analytically that, keeping the informativeness constant, the higher the discretion the lower the weight on the discretionary report. Unfortunately, empirical testing of this hypothesis is constrained by two factors - (a) it is difficult to measure managerial discretion and (b) the informativeness of the agent's private signal differs from firm to firm.

This section attempts to look into the relationship between the weights attached to the discretionary reports (the analysis is restricted to the regression coefficient of total accruals, β_{1a}, in model AR1 and the coefficient of discretionary accruals, τ_3, in model DR1) and proxies for the measures of discretion. For the rest of this section, it is assumed that the informativeness of the private signal captured in the discretionary report is approximately the same across the firms in the sample. The firm-specific time series averages of the following proxies are used to measure discretion.[36]

$$PLTA = \frac{\text{Net property plant and equipment (8)}}{\text{Total Assets (6)}}$$

$$RECSAL = \frac{\text{Receivables (2)}}{\text{Net sales (12)}}$$

$$LEVER = \frac{\text{Long-term debt (9)}}{\text{Market value of equity (24*25)}}$$

$$EARNADJ = \frac{|\text{Restated Earnings (118) - Earnings (18)}|}{\text{(Restated Earnings + Earnings) / 2}}$$

IFTNT = Number of times the compustat footnote item for earnings, (aftnt(10)) is either AC,GI or GP during the sample period.

$$MABSERR = \frac{|\text{value-line earnings forecast - actual earnings}|}{\text{stock price}}$$

All the proxies are constructed in such a way that a high value for any of these is equivalent to a high level of managerial discretion. There are a variety of reasons for interpreting the above measures as proxies for managerial discretion. PLTA is high if a particular firm has a large portion of its total assets in plant, property and equipment. It is likely, therefore, that the manager can effect significant changes in income by changing the depreciation method, by revising the estimates of useful life of PPE, and by

[36]The numbers in brackets refer to the relevant compustat items.

timing the write-off of obsolete assets. A higher value of PLTA is therefore expected to signify a higher level of managerial discretion. A high value for RECSAL signifies that the manager has a higher degree of discretion in the way provisions for bad debts are made and in the write-off of bad debts.[37] The LEVER proxy is a measure for the firm's leverage. Previous studies on the relationship between debt covenants and accounting choice provide evidence that leverage proxies for closeness to covenants. There is also evidence to the effect that closeness to covenants induces managers to choose income-increasing accounting methods. Hence, it is hypothesized that higher the leverage the higher will be the discretion exercised by the manager in the reporting of the income. The EARNADJ measure captures the extent to which the restated earnings differ from the actual earnings and the IFTNT measure captures the frequency with which the management changes accounting methods. The MABSERR measure captures the fact the higher the managerial discretion is, the more the difficulty that an analyst has in forecasting the earnings of the firm. The standardization of the forecast error by the stock price is made to facilitate cross-sectional comparison.

Panel 1 of Table 10 gives the descriptive statistics and Panel 2 the correlation structure. If all the proxies are identical in terms of their ability to predict the total discretion the manager has in manipulating accounting earnings, one would expect them to be highly positively correlated with each other. This does not seem to be the case. In fact, 11 of the 15 correlations are not significantly different from zero at the 0.01 level. The logical explanation seems to be that these proxies are not measuring the total discretion but individual components of managerial discretion that have low correlation with each other cross-sectionally (i.e. the relative weights of these components vary from

[37]It is also possible to measure the discretionary part of the provision for bad debts (McNichols & Wilson (1988)) and use it as a measure of discretion.

firm to firm). Consider, for example, a trading company that has very low plant, property and equipment and which extends a lot of credit to its customers. This company has very low PLTA but high RECSAL, and the discretion (that the manager has in manipulating income) primarily stems from the decisions pertaining to provision for bad debts and write-off of uncollectibles. This type of firm will induce a negative correlation between PLTA and RECSAL in the sample and will tend to cancel out the positive correlation induced by firms with a large fraction of their assets in plant, property and equipment and which have high RECSAL. Consider also two firms, one of which is a highly levered, manufacturing company that is cash-starved and which has low RECSAL (since it will try to make only cash sales), high LEVER and high PLTA and another that is similar in every respect but which has very low debt. In this case, while for both firms the discretion is primarily a function of the depreciation expense and PLTA captures this, the two firms will tend to cancel each other out when the correlation between PLTA and LEVER is estimated. Both firms, on the other hand, will contribute towards a negative correlation between PLTA and RECSAL in the sample.

More generally, managers usually have the flexibility to take a number of discretionary accounting decisions (some of them income-decreasing and some of them income-increasing) and the summary effect of these decisions is usually reflected in the earnings number. While each of the proxies captures some of this effect, none of them can possibly be a perfect measure of managerial discretion. This problem is partially addressed by examining the relationship between managerial discretion and the report's weight in the contract in a number of ways such as non-parametric analysis, multiple regression, and linear discriminant function analysis.

The non-parametric analysis results shown in Panel 1 of Table 11. The ranking variables are the weights of accrual measures, β_{1a} and τ_3 and their respective t-statistics. The t-statistics are included to control for the different standard errors of the regression coefficients across the firms. The partitioning variables are the various proxies for managerial discretion. The cell entries corresponding to a particular ranking variable and the partitioning variable are the Wilcoxon-z statistics testing the null hypothesis of no difference between the low and high samples (based on the partitioning variable) against the alternative that the high sample will on average have a low rank (based on the ranking variable). The numbers in the brackets are the numbers of firms belonging to the low and high groups, respectively. For example, the cell entry corresponding to PLTA and β_{1a} is computed in the following way. The total sample of 250 is first ranked on the basis of β_{1a} with the lowest β_{1a} getting a rank of 1 and the highest a rank of 250. In the second step, the PLTA variable is used to divide the sample equally into "Low" and "High" groups. The WilcoxonZ statistic is then computed as $Z = \frac{W - 0.5\,n\,(m+n+1)}{mn(m+n+1)/12}$ where W is the sum of ranks of the elements in the "High" sample and m and n are the number of elements in the "low" and "high" groups. If the proxy is a "good" measure of managerial discretion and if a high degree of managerial discretion is linked to a low weight being attached to the report in the contract, one would expect the Z-statistic to be negative and significant.

17 out of the 24 Z-statistics in Panel 1 are negative. 5 of them significant at the 0.01 level, 3 at the 0.05 level and 3 at the 0.1 level. Based on the statistics associated with PLTA, MABSERR, and LEVER, one concludes that these proxies are possibly better measures of managerial discretion than the other three. The statistics associated with ranking variables τ_3 and $t(\tau_3)$ are generally weaker than those associated with β_{1a} and $t(\beta_{1a})$ and this could possibly be due to the measurement problem in splitting the

total accruals measure into discretionary and non-discretionary components. Panel 2 gives the descriptive statistics associated with the cross-sectional multiple regression of each of the dependent variables β_{1a},$t(\beta_{1a})$,τ_3 and $t(\tau_3)$ on all of the proxies. The explanatory powers for β_{1a} and $t(\beta_{1a})$ regressions are marginally higher than those of τ_3 and $t(\tau_3)$. 17 out of the 24 slope co-efficients are negative with 2 of them significant at the 0.01 level and 1 at the 0.05 level. PLTA, and to some extent RECSAL seem to be significant in explaining the cross-sectional variation in the various dependent variables.

Panel 3 shows the results of the linear discriminant function analysis. The ranking variables β_{1a},$t(\beta_{1a})$,τ_3 and $t(\tau_3)$ are used to divide the overall sample into two groups - "low" and "high". If one assumes that the six-variate vector of [PLTA,RECSAL,LEVER,EARNADJ,IFTNT,MABSERR] is distributed multivariate normally with a common variance-covariance matrix across the two groups, it is possible to develop a linear discriminant function and reclassify the sample on the basis of their LDF scores. If the underlying difference between the two groups is captured by the six-variate vector the misclassification probability (i.e. the frequency with which a "L" group member gets classified into "H" and vice versa) is expected to be very low. From Panel 3, one finds that the misclassification probability varies from 0.36 to 0.45. There is only weak support for the hypothesis that the variation in the six-variate vector is systematically linked to the variation in the weights or the t-statistics of weights attached to the report.

In summary, the results in this section are consistent with rational shareholders attaching low weight to the report in those companies where they perceive the managerial discretion to be high. Even though the evidence is weak, it is difficult to think of any other explanations which would be consistent with the results.

4.9 THE USE OF DISCRETIONARY DEPRECIATION EXPENSE AND DISCRETIONARY PROVISION FOR BAD DEBTS IN CONTRACTS

The analysis in section 4.8 provided weak evidence that capital intensive firms and firms with high receivables to sales ratio attach low weights to discretionary accruals in management compensation contracts. This section focuses on two specific components of accruals related to the above ex-ante measures of discretion. It is hypothesized that the estimated discretionary component of depreciation expense and bad debts expense will be given significantly different weights when compared to that portion of earnings which excludes these discretionary items.

I develop two expectation models to estimate the discretionary depreciation and discretionary bad debts. In one model, the change in depreciation expense is modeled to be a linear combination of additions and deletions to plant, property and expenditure. Using this model, the following firm-specific regressions, ER3, are estimated for all the firms that had a minimum of 12 years of data during the period 1970-1988.

$DDEPRN_t$ = Change in depreciation expense (Compustat item 14) from the period t-1 to t

$$= \kappa_0 + \kappa_1 ADDN_t + \kappa_2 DELN_t + \varepsilon_t$$

The $ADDN_t$ variable is available from Compustat data and the $DELN_t$ variable is estimated from the following accounting equation:

Deletions during the period = Beginning Gross Plant,Property and Equipment + Additions during the period - Ending Gross Plant,Property and Equipment

Table 12 shows the summary statistics for the 178 firm-specific regressions. The model seems to be well specified. The coefficients κ_1 and κ_2 are expected to be opposite in sign and κ_1 is expected to be significantly less than 1 since all the additions acquired during a particular year cannot possibly be fully depreciated during that year. A similar logic suggests that κ_2 cannot be less than -1. The mean value for κ_1 is 0.065 and both the first and third quartile values are also positive. The z-statistic testing the null hypothesis of $\kappa_1=0$ across the sample has a value of 33.16. The mean value for κ_2 is -0.036 and both the first and third quartile values are also negative. The corresponding aggregate z-statistic is also very high (-23.58). The regression also has a high mean adjusted R-squared of 0.376. Since the residuals from the regression are expected to represent discretionary depreciation expenditures and since a positive value of the residual would mean that the discretionary depreciation is income decreasing, the negative of the residuals are used to measure the component of earnings that is discretionary with respect to the depreciation expense. Specifically,

DISCD = discretionary component of earnings related to depreciation

$$= (\kappa_0 + \kappa_1\, ADDN_t + \kappa_2\, DELN_t) - DDEPRN_t$$

The second model uses the accounting equation relating to the change in the balance sheet account for the allowance for uncollectibles to generate a proxy for the discretionary part of the provision for bad debts.

i.e. Allowance for uncollectible at the beginning of the year (A_{t-1}) + Provision for bad debts (P_t) - Write-offs (W_t) = Allowance at the end of the year (A_t)

If, for every firm in the sample, the inflation-adjusted sales, the customer mix in terms of their credit worthiness and the credit terms were constant during the sample period, it is the case that the provision would be exactly equal to the write-offs during every accounting period. To the extent the provision is lower or higher than the write-offs, the management is assumed to be taking either an income-increasing or income-decreasing provision for bad debts decision. Therefore, the discretionary component of the income related to the provision for bad debts is computed as the negative of the change in the balance in the allowance for uncollectibles account. i.e.

$$DISCP = A_{t-1} - A_t$$

The discretionary components DISCD and DISCP are filtered away from the reported earnings number and this leads to the generation of TREAR = EARN -DISCD - DISCP. If DISCD and DISCP account for at least some of the discretion in the reported earnings, one would expect that a regression of compensation on TREAR, DISCD and DISCP to generate significantly different regression coefficients and such a regression is expected to have substantially more explanatory power than the regression of compensation on reported earnings. Table 13 shows the summary statistics associated with the 178 firm-specific AR-1 regressions (designated as DR3) of compensation on TREAR,DISCD and DISCP.[38] A preliminary examination of the regression coefficients and associated z-statistics seems to suggest that the coefficients are significantly different from one another. However, the z-statistics and the t-statistics associated with the differences (namely ω_1-ω_2,ω_1-ω_3 and ω_2-ω_3) clearly indicate that the coefficients are not different from one another. It is possible that only a sub sample of the 178 firms is characterized by significantly different coefficients for these variables. An explanation that would then be consistent with the results in Table 13 is that some firms in the sample have efficient management compensation contracts which "see" through the accounting manipulations and some others do not. The discretionary decisions "flow" through the contract for the latter. Not surprisingly, the tests of association between the weights of the various discretionary performance measures and measures of discretion, reported in Table 14, also fail to provide evidence on the hypothesis that firms which are

[38]The regressions in levels had a cross-sectional mean first-order autocorrelation of 0.29 and a median of 0.31. The regressions were therefore run under an AR1 specification.

characterized by high measures of discretion will have low weights on DISCP and DISCD.

4.10 THE VALUATION-INFORMATIVENESS OF THE REPORTS

So far, the analysis focused on the informativeness of the various discretionary reports with respect to their conveying information about the manager's production and investment decisions and the corresponding weights given to these measures in management compensation contract. The incentive informativeness of signals may be quite different from their valuation-informativeness i.e. the way these signals are used in valuation. It is possible that the valuation of the firm is dependent not only on the agent's action and the state of nature but also on decisions taken by the principal after the signals generated by the agent's action are observed. Gjesdal (1981) argues that there could be situations where the signals are informative about the agent's action but are not used at all in decision making by the principal. In such cases, the information affects the value only through the salary function of the manager which is based on the observed signals. In a more general scenario, the way the signals are used in the contract (where the weights are specified ex-ante) and the way they are used in valuation (where the value arises from both the agent's action and ex-post decisions taken by the principal based on realized values of signals) will, in general, be different.

In continuation of the multivariate normality assumption for the production function in Chapter 3, it is assumed that the value v of the firm and the reports r_1 and r_2 are distributed trivariate normally with mean $[\mu_v, pa, qa]$ and variance-covariance matrix

$$V = \begin{bmatrix} \sigma_v^2 & V_1 & V_2 \\ V_1 & \sigma_5^2 & \rho_1\sigma_5\sigma_6 \\ V_2 & \rho_1\sigma_5\sigma_6 & \sigma_6^2 \end{bmatrix}.$$

The perceived value of the firm after the market participants observe the signals r_1 and r_2 is

$$E(v/r_1,r_2) = V_0 + (V_1 m_5 + V_2 m_{56})\, r_1 + (V_1 m_{56} + V_2 m_6)\, r_2 \quad \text{(E9)}$$

where

$$m_5 = \frac{1}{\sigma_5^2(1-\rho_1^2)}$$

$$m_6 = \frac{1}{\sigma_6^2(1-\rho_1^2)} \text{ and}$$

$$m_{56} = \frac{-\rho_1}{\sigma_5\sigma_6(1-\rho_1^2)}$$

(E9) can also be written as

$$E(v/r_1,r_2) = \beta_{0v} + \beta_{1v}\, r_1 + \beta_{2v}\, r_2 \quad . \qquad \text{(E10)}$$

Comparing (E7) and (E10), it is easy to see the mechanics of Gjesdal's assertion about differential incentive and valuation informativeness in the context of this paper. It can be shown that $\beta_1 = \beta_{1v}$ and $\beta_2 = \beta_{2v}$ if and only if $V_1 = \mu \frac{\partial E(r_1)}{\partial a}$ and $V_2 = \mu. \frac{\partial E(r_2)}{\partial a}$, where μ is the Lagrangean multiplier associated with the agent's optimal action-choice constraint in the incentive problem. Given that V_1 and V_2 are characteristics associated with the variance-covariance matrix of v, r_1 and r_2, and that μ in equilibrium typically depends on the agent's disutility for effort, his utility function and the production technology, the necessary and sufficient condition for equality of valuation and incentive informativeness will rarely hold good in practice. For example, consider the situation where both V1 and V2 are equal to zero. It is clear from (E9) that the discretionary reports will not be given any weights in valuation. But to the extent they are sensitive to the agent's action they will always be used in the incentive contract and will be attached non-trivial weights.

The empirical analysis of the link between valuation and the performance measures operationalizes (E9) in an OLS framework. The inflation-adjusted difference between the value of common stock outstanding at the end of years t and t-1 is chosen as the dependent variable ΔVAL_t.[39] Once again, TACC1 and CASO1 are chosen as the proxies for the discretionary reports. Table 15 shows the summary statistics for these firm-specific regressions. The explanatory power of the regressions, as seen by the distribution of the adjusted R-squared is very low, with a mean value of 0.047 and a median of -0.009. This is much lower than the explanatory power of the compensation-performance measures regressions. There is weak evidence to support the hypothesis that, on average, β_{1v} and β_{2v} are significantly different from zero. If all sample observations are considered independent, the associated z-statistics are 4.92 and 8.65, respectively, and the overall sample need be equivalent to a minimum of 69 and 22 independent observations for z to be significant at the 0.01 level. There is also weak evidence to the effect that, on average, the valuation-informativeness of cash flows and total accruals are different.

At the beginning of this section, it was demonstrated that, in general, the valuation-informativeness of the signals is different from their incentive-informativeness. The correlation structure shown in Panel 3 of Table 15 provides evidence for this hypothesis. This panel shows both Pearson and Spearman correlations between β_1,β_2,

[39]The single-period framework in section 4.10 is consistent with interpreting $E(v/r_1,r_2)$ - which is a function of the agent's action and the principal's decisions- as the value-added during that period. This is the reason for choosing the change in market value of equity rather than market value of equity as the dependent variable for this section.

β_{1v} and β_{2v} and their respective z-statistics (to filter the effect of the variation in standard errors across the coefficients). For the raw coefficients, the Pearson correlations (β_1,β_{1v}), (β_2,β_{2v}) and the Spearman correlation (β_1,β_{1v}) are all not significantly different from zero. The Spearman correlation (β_2,β_{2v}) is 0.198 and is significant at the 0.01 level. For the associated z-statistic pairs, all the correlations are significant at the 0.01 level, but, none of them exceeds 0.25.

Even in the absence of any information about V_1 and V_2, it is possible to make some predictions about the ratio of the weights. Consider the following three cases :

(a) when the accruals and value are uncorrelated, i.e. $V_1 = 0$, $\frac{\beta_{1v}}{\beta_{2v}} = \frac{m_{56}}{m_5} = RAT1$

(b) when $V_1 = -V_2$, $\frac{\beta_{1v}}{\beta_{2v}} = \frac{m_5 - m_{56}}{m_{56} - m_6} = RAT2$ and

(c) when $V_1 = V_2$, $\frac{\beta_{1v}}{\beta_{2v}} = \frac{m_5 + m_{56}}{m_{56} + m_6} = RAT3$

It is possible to compare both the sign and magnitude of the estimated ratio of the slope coefficients with those of RAT1, RAT2 and RAT3 which are basically functions of the sample standard deviations and the sample correlation of TACC1 and CASO1. The sign of the ratio of the slope coefficients matches that of RAT1 in 194 out of 250 cases (77.6%), that of RAT2 in 136 (54.4%) and that of RAT3 in 195 (78%). The z-statistic, testing the null hypothesis of the signs matching by chance, is significant at the 0.01 level for both RAT1 and RAT3 but not for RAT2. However, the magnitude of the ratio of slope coefficients does not match at all with any of RAT1, RAT2 and RAT3. The corresponding Spearman and Pearson correlations are all insignificant. However, when a sub-sample is formed on the basis of the t-statistic of the denominator slope coefficient (choosing all those firms whose $|t(\beta_{2v})| > 2$) the Pearson correlation between the slope ratio and RAT3 is found to be 0.465 (Spearman correlation of 0.545). The percentage of correct matches shoots up to 96.9 with 31 out of 32 signs matching.

The low explanatory power of the regressions in Table 15 seems to suggests that the model specification leading to (E9) may not be appropriate in a valuation setting. A more appropriate way to model the use of the discretionary reports in valuation may be to interpret them as auxiliary signals that are used in conjunction with the diverse private information that market participants possess. Recent papers by Bushman and Indjejikian (1991), Kim and Suh (1991) and Paul (1991) examine the link between equilibrium market price and the incentive contract by modeling the problem in a noisy rational expectations setting. While Paul and Bushman and Indjejikian model the agent's effort as multi-dimensional and focus on the issue of use of earnings and price in contracts in the allocation of manager's effort along different dimensions, Kim and Suh restrict their analysis to uni-dimensional effort (as in the analysis in Chapter 3 of this dissertation) and focus on how risk-averse shareholders' investment decisions as investors are interrelated with their contracting decisions as the principals.

It is possible to adapt Kim and Suh's model to more completely characterize the use of the discretionary reports in market setting. Instead of a single report that is issued by the manager (which represents earnings in their analysis) it is assumed that two reports y_1 and y_2 are issued by the firm before trading takes place. It is also assumed that the contract can be expressed as $W = Nf(\alpha + \beta y_1 + \gamma y_2)$ where N represents the number of shareholders and f their average initial endowment. The final payoff per share is $v = e + u - (\alpha + \beta y_1 + \gamma y_2)$ where e is the agent's effort and u a random environmental factor. The firm announces $y_1 = e + u + \eta_1$ and $y_2 = e + u + \eta_2$, the shareholder i observes a private signal $z_i = e + u + \varepsilon_i$, the shareholders trade in a competitive market based on new information with themselves and with some non-strategic liquidity traders who have a demand of d. Finally the manager is compensated according to the contract. It is assumed that $u, \eta_1, \eta_2, \varepsilon_i$ and d are all i.i.d. normal with mean 0 and precisions h, m_1, m_2, s and t respectively. The shareholders have identical negative exponential utility for wealth characterized by risk-tolerance of r. In the above setting, it can be verified that the equilibrium stock price is given by

$$P = b_0 + b_1 y_1 + b_2 y_2 + b_3 (e + u) + b_4 d - b_5 f \qquad \text{(E11)}$$

where $b_1 = (m_1/K) - \beta$, $b_2 = (m_2/K) - \gamma$ and $K = h + m_1 + m_2 + s + t\, r^{-2} s^{-2}$.

Since K is always strictly positive, it is immediately apparent that except in rare situations where $m_1/K = 2\beta$ and $m_2/K = 2\gamma$, the valuation and incentive informativeness will not be equal. Unfortunately, it is difficult to operationalize (E9) in an empirical setting, given that u is not known in equilibrium (except by assuming that (E9) holds exactly) and that it is difficult to quantify d. (E9), nevertheless, gives one an idea about the omitted variables in Table 15 regressions.

4.11 CONTRACTS PIECE-WISE LINEAR IN ACCRUALS

The regression equivalent of the model in (E8) is linear in the outcome and the report over their entire range. In reality, many bonus plans specify lower and, in some cases, upper bounds on the performance measure (Healy (1985)). If we assume that the compensation paid to the manager is proportional to the money allotted to the bonus pool, the manager's compensation will be piece-wise linear in the performance measure, i.e., constant below the lower bound and above the upper bound and linear in between. There has been some theoretical justification for the optimality of piece-wise linear contracts. In a single-period model, where the agent takes a two-dimensional action that generates the outcome, Kantorovitz (1989) shows that, depending on the level of variance-reducing effort the principal may want to motivate, a piece-wise contract with a lower bound or an upper bound may be optimal. Verrecchia (1986) shows that when the principal is skeptical of a high report from the manager, the optimal contract may be a constant beyond an upper bound on the report. In case of the two-signal model developed in Chapter 3 also, it is possible that the optimal contract may actually be piece-wise linear in one or both of the agent's reports. The analysis in this section assumes that the compensation is piece-wise linear in the more discretionary report, i.e., accruals, and fully linear in cash flows. This means that, for a given value of cash flows, the observed relationship between compensation and extremely high/low values of total accruals may be substantially different from that of compensation and intermediate values of total accruals.

I check for the above possibility in the following way. For each firm, regressions of the type R1 are carried out after deleting observations corresponding to the lowest and highest values of the total accruals.[40] The following prediction errors are then computed for each firm in the sample.[41]

$$PE_{1L} = [COMP_L - \beta_0 - \beta_1\ TACC1_L - \beta_2\ CASO1_L]$$

$$PE_{1H} = [COMP_H - \beta_0 - \beta_1\ TACC1_H - \beta_2\ CASO1_H]$$

where the subscripts "L" and "H" stand for the observations corresponding to the lowest and highest total accrual values. If β_1 is positive (negative) and if the contracts are piece-wise linear in total accruals (i.e. for a given cash flow the compensation is independent of total accruals when they are very high or very low) one would expect to see a large

[40]The number of observations for each firm gets reduced by 2 when compared to R1 and R2. As a result, the number of observations used in the estimation of the firm-specific regression coefficients varies from a minimum of 12 to a maximum of 16.

[41]The prediction errors are described in terms of TACC1 and CASO1 measures. The computation is similar for TACC2 and CASO2.

proportion of PE_{1L}s positive (negative) and a large proportion of PE_{1H}s negative (positive). Denoting $IND(\beta_1)$ as the indicator variable whose value is 1 if β_1 is positive and -1 if it is negative, the following hypotheses are tested.

H5 : $IND(\beta_1)*PE_{1L} = 0$ versus $IND(\beta_1)*PE_{1L} > 0$

H6 : $IND(\beta_1)*PE_{1H} = 0$ versus $IND(\beta_1)*PE_{1H} < 0$

The average value of $IND(\beta_1)*PE_{1L}$ ($IND(\beta_1)*PE_{1H}$) is 25.04(-4.69) with a standard deviation of 112.99(87.44). 143(120) out of 250 $IND(\beta_1)*PE_{1L}$s ($IND(\beta_1)*PE_{1H}$s) are positive. The t-statistic testing H5 and the non-parametric tests reject the null hypothesis at 0.05 level. However, the t-statistic testing H6 and the non-parametric tests do not reject the null hypothesis. On average, there seems to be weak evidence that the contracts are piece-wise linear with a lower bound but with no upper bound.

The choice of the "high" and "low" accrual values was done arbitrarily in the preceding analysis. The following regression model endogenizes the choice of these values in order to gain further insight into the compensation-accrual relationship.

NL1:

$$COMP_t = \begin{cases} \beta_0 + \beta_1 X_1 + \beta_2 CASO1_t + \varepsilon_t & \text{if} \quad TACC1_t < X_1 \\ \beta_0 + \beta_1 X_2 + \beta_2 CASO1_t + \varepsilon_t & \text{if} \quad TACC1_t > X_2 \\ \beta_0 + \beta_1 TACC1_t + \beta_2 CASO1_t + \varepsilon_t & \text{otherwise} \end{cases}$$

In this model, $\beta_0, \beta_1, \beta_2, X_1$ and X_2 are jointly estimated so as to minimize the residual sum of squares. Though it is reasonable to expect that the values of $\beta_0, \beta_1, \beta_2, X_1$ and X_2 vary from firm to firm, the analysis could not be carried out for each firm separately because of the considerable computation involved. To control for this problem, the performance measures TACC1 and CASO1 were standardized in the following way:

$$STACC1 = \frac{TACC1 - \mu(TACC1)}{\sigma(TACC1)} \text{ and}$$

$$SCASO1 = \frac{CASO1 - \mu(CASO1)}{\sigma(CASO1)}$$

where $\mu(.)$ and $\sigma(.)$ refer to the firm-specific sample mean and standard deviation of the relevant performance measure.

Table 16 reports the results of the analysis. For comparative purposes, the OLS cross-sectional regression results are also shown. When the actual values of the performance measures are used, the piece-wise contract seems to be a better specification than its OLS equivalent (as can be seen from the increase in R-Squared). The more interesting point though is the fact that the sign of β_1 (the coefficient on accruals) is reversed and its absolute value is substantially higher than the coefficient on the cash flows (which is still positive and significant). Once the bounds are imposed, it seems to be the case that the principal finds the accruals report to contain practically all the information about the agent's productive action despite the fact that it is more discretionary. When the accruals report is within the bounds, it seems to be sufficient for the cash flows. The non-linear model which uses the standardized measures, however, is only marginally better than its OLS equivalent. It may be interesting to check whether piece-wise contracts provide a substantial improvement over the OLS specification at the individual firm level.

CHAPTER 5

CONCLUSION

This study provides theoretical and empirical evidence on the use of cash flows and accruals in management compensation contracts. The analytical model developed in this paper demonstrates that discretionary reports can be used as performance measures in compensating managers. It is shown that, in a setting where the compensation contracts arise as a result of strategic interaction between the shareholders and the management and cash flows and accruals are publicly observed, it may be rational for the shareholders to allow discretionary reporting of cash flows and accruals and use them as two distinct performance measures. It is also shown that cash flows and total accruals are given different weights in the contracts, which is consistent with the hypothesis that the shareholders view the additional information contained in the primary components of the earnings useful, at least for the purposes of compensating the managers.

It is also checked whether the contracts designed by the shareholders are sophisticated enough in filtering away the discretionary component from accruals and cash flows. This is done by developing proxies for discretionary accruals. The results seem to suggest that either the proxies for discretionary accruals are not accurate enough or the shareholders seem to filter away the discretionary element in only a sub-sample of the firms analyzed. A cross-sectional analysis of the weights on discretionary measures also fails to provide any conclusive evidence on the relation between the weights and company-specific ratios used as proxies for discretion. The reason for this weak result seems to be due to some firms in the sample letting the discretionary accruals flow through and some others filtering them from the informative component of earnings. An interesting extension of this study may be to develop and test theories that provide more insight into the different ways discretionary reports are used by companies.

This study also provides evidence on the difference between the valuation-informativeness and incentive-informativeness of cash flows and accruals. The relationship between the change in firm value and the cash flows and accruals numbers is found to be weak. Finally, instead of an all-linear specification, it is checked whether a piece-wise linear specification in the report with higher discretion explains the statistical relationship between compensation and the cash flows and accruals. There is weak evidence that the contracts are piece-wise linear rather than all-linear.

The analysis in this study has the following limitations. To develop testable hypotheses, a number of assumptions have to be made about the production function, the feasible reporting set, the preference structures of the contracting parties and the choice of performance measures. To this extent, the empirical tests that are conducted in this paper are joint tests of the assumptions underlying the model and the assumed rational behavior of shareholders and the managers. Also, the measure of management compensation that is used in the analysis ignores the components of a manager's total earnings other than salary and bonus. Despite these restrictions, the results indicate that the discretion in the accrual reporting process is built into the compensation scheme and the information in a discretionary accounting report is typically adjusted for its noisiness when the report is used as a performance measure.

In a rational world it is also possible that shareholders take actions that reduce the noisiness of the reporting set. Shareholders may lobby with the regulatory institutions to reduce the flexibility afforded by the accounting rules in the reporting process or change auditors and thereby reduce managerial discretion. This aspect was not considered in this study. A more detailed analysis may include this as part of the shareholders' problem.

APPENDIX

A1. PROOF OF PROPOSITION 1

The proof is in two parts. In the first part, I show that the conditions given in the proposition are sufficient to make sure that at least one of the reporting strategies $\{ (l_1,l_2),(l_1,h_2),(h_1,l_2),(h_1,h_2) \}$ is a feasible reporting rule implementable by the optimal contract.[42] In the second part, I show that this guarantees that the solution to problem P1 will always result in an expected utility to the principal that is strictly higher than $EU(a_l)$ (the lowest expected utility achieved by the principal when he pays a constant wage and the agent implements the lowest action a_l).

We note that if $\{r_1=l_1, r_2=l_2\}$ is to be a feasible reporting rule then it must be the case that given $s_{ll}(l_1,l_2)$, the agent's report choice satisfying C3, should be $l_1(.)$ and $l_2(.)$ respectively. Now suppose the contract is such that, for all realizations of l_1 and l_2, the agent's utility $U(s_{ll}(l_1,l_2))$ is decreasing in each of the reports. It is clear that the agent will always report the lowest possible value for l_1 and l_2, within the constraints of the reporting set, since that maximizes his utility. Differentiating (E2) once with respect to l_1 and l_2, respectively, we see that $\frac{\partial}{\partial l_1} s_{ll}(l_1,l_2) = -\frac{(U')^2}{U''}\mu_1 \frac{\partial}{\partial l_1}\frac{f_a(l_1,l_2;a_{ll})}{f(l_1,l_2;a_{ll})}$ and $\frac{\partial}{\partial l_2} s_{ll}(l_1,l_2) = -\frac{(U')^2}{U''}\mu_1 \frac{\partial}{\partial l_2}\frac{f_a(l_1,l_2;a_{ll})}{f(l_1,l_2;a_{ll})}$ are strictly negative whenever $\frac{\partial}{\partial l_1}\frac{f_a(l_1,l_2;a_{ll})}{f(l_1,l_2;a_{ll})}$ and $\frac{\partial}{\partial l_2}\frac{f_a(l_1,l_2;a_{ll})}{f(l_1,l_2;a_{ll})}$ are strictly negative. This is guaranteed by condition (1) in the proposition. Since $\frac{\partial U}{\partial l_1} = U' \frac{\partial}{\partial l_1} s_{ll}(l_1,l_2)$ and $\frac{\partial U}{\partial l_2} = U' \frac{\partial}{\partial l_2} s_{ll}(l_1,l_2)$ the agent's utility is

[42]The term "feasible reporting rule" will be used to denote "feasible reporting rule implementable by the optimal contract" for the rest of the proof.

indeed decreasing in the reports whenever $\frac{\partial}{\partial l_1}s_{ll}(l_1,l_2) < 0$ and $\frac{\partial}{\partial l_2}s_{ll}(l_1,l_2) < 0$. Therefore, $r = \{r_1=l_1, r_2=l_2\}$ is a feasible reporting rule whenever condition (a) of Proposition 1 is satisfied. Similarly, $r = \{r_1=l_1, r_2=h_2\}$ or $\{r_1=h_1, r_2=l_2\}$ or $\{r_1=h_1, r_2=h_2\}$ is a feasible reporting rule whenever conditions (b),(c) or (d), respectively, are satisfied.

Let $r = \{r_1=l_1, r_2=l_2\}$ be a feasible reporting rule. If we denote EP(P1) as the expected utility derived by the principal in the solution to P1, clearly EP(P1) ≥ $EP(a^{ll})$. But from (A7), we know that $EP(a_{ll}) > EP(a_l)$. This means $EP(P1) > EP(a_l)$ and hence the principal will always prefer to base the contract on both the discretionary reports. When each of the other reporting strategies are feasible, a similar logic holds. Finally, when all the four reporting strategies is feasible, it is the case that EP(P1) ≥ $Max\{EP(a_{ll}),EP(a_{lh}),EP(a_{hl}),EP(a_{hh})\} > EP(a_l)$ and the principal once again chooses a contract based on both the reports, thus completing the proof.

Q.E.D

Some examples of production functions and reporting sets that satisfy some or all of the sufficient conditions in Proposition 1 are given below:

Example 1 : Let $l_1(x,y,m,n,a) = x+ma$, $h_1(x,y,m,n,a) = x$, $l_2(x,y,m,n,a) = y+na$ and $h_2(x,y,m,n,a) = y$ and x,y,m and n be independently distributed of each other with the following p.d.fs.

$f(x) = exp(x/a)/a$ $\quad -\infty \le x \le 0$

$f(y) = exp(y/a)/a$ $\quad -\infty \le y \le 0$

$f(m) = exp(m)$ $\quad -\infty \le m \le 0$

and $f(n) = exp(n)$ $\quad -\infty \le n \le 0$.

For all the p.d.fs, a is strictly positive. It can be shown that for any a, the partial derivatives of L_1,L_2,L_3 and L_4 with respect to the respective reports are identically equal to $-1/a^2$ and hence condition (a) alone will be satisfied.

Example 2 : Let $l_1(x,y,m,n,a) = x$, $h_1(x,y,m,n,a) = x+ma$, $l_2(x,y,m,n,a) = y$ and $h_2(x,y,m,n,a) = y+na$ and x,y,m and n be independently distributed of each other with the following p.d.fs.

$$f(x) = \frac{1}{2a^3} x^2 exp(- \frac{x}{a}) \qquad 0 \leq x \leq \infty$$

$$f(y) = \frac{1}{2a^3} y^2 exp(- \frac{y}{a}) \qquad 0 \leq y \leq \infty$$

$$f(m) = \frac{1}{2} m^2 exp(- m) \qquad 0 \leq m \leq \infty$$

and $$f(n) = \frac{1}{2} n^2 exp(- n) \qquad 0 \leq n \leq \infty$$

For all the p.d.fs, a is strictly positive. It can be shown that the sufficient condition (d) alone will be satisfied in this case.

Example 3 : Let $l_1(x,y,m,n,a) = x(m-1)$, $h_1(x,y,m,n,a) = mx$, $l_2(x,y,m,n,a) = y\,(n-1)$ and $h_2(x,y,m,n,a) = ny$ and x,y,m and n be independently distributed of each other with the following p.d.fs.

$$f(x) = exp(-x/a)/a \qquad 0 \leq x \leq \infty$$

$$f(y) = \frac{1}{a} exp(- \frac{y}{a}) \qquad 0 \leq y \leq \infty$$

$$f(m) = 1 \qquad 0 \leq m \leq 1$$

and $$f(n) = 1 \qquad 0 \leq n \leq 1$$

Once again, a is strictly positive. It can be verified that all the four conditions listed in Proposition 1 will be satisfied by the above functions and reporting sets.

A2. COMPUTATION OF VARIOUS PERFORMANCE MEASURES

This appendix describes the computation of the various performance measures from the Annual Industrial Compustat. The basic objective is to compute total accruals and cash flows from operations. These are computed in two different ways based on previous empirical work on the information content of earnings components.

Under the first approach, the measures are computed using income statement and comparative balance sheet data. The computation is identical to that of Rayburn (1986). Total accruals are first estimated and cash flows from operations are then estimated as the difference between accounting earnings before extraordinary items and total accruals. Partially following Rayburn's notation, the following sequence describes the computation of TACC1 and CASO1. The reference number for each data item is given in the parentheses.

CA_t = Current assets other than cash and short-term investments at end of year t (4 -1).

CL_t = Current liabilities other than current maturities of long-term liabilities at end of year t (5 - 44).

$DEPR_t$ = Depreciation,amortization and depletion for year t (14).

TAX_t = Deferred taxes at end of year t (35).

$DTAX_t$ = Change in deferred taxes from t-1 to t (TAX_t - TAX_{t-1}).

DWC_t = Change in working capital from t-1 to t [(CA_t - CA_{t-1}) - (CL_t - CL_{t-1})]

$TACC1_t$ = Total accruals for year t [DWC_t - $DEPR_t$ - $DTAX_t$]

$CASO1_t$ = $EARN1_t$ - $TACC1_t$.

$EARN1_t$ = Income before extraordinary items in year t (18).

The main difference between $TACC1_t$ and Rayburn's accrual measure AA_t is that they are of the same magnitude but different sign.

Under the second approach, cash flows from operations are estimated from income statement and balance sheet data and total accruals are then estimated by subtracting cash flows from earnings. Cash from operations is calculated as the sum of five components estimated as in Livnat and Zarowin (1990). These are

1. Cash from customers = Sales - change in accounts receivable (12 - Δ2)
2. Payments to suppliers,employees etc. = COG (excluding depreciation) + change in inventory - change in accounts payable + change in other assets - change in other current liabilities - change in other liabilities. [(12-13) + Δ3 – Δ70 + Δ69 + Δ68 –Δ72 – Δ75 – (Δ34 – Δ44)].
3. Taxes paid = Tax expense - change in deferred taxes - change in taxes payable [16 - Δ35 – Δ71].
4. Interest paid, net = interest expense - interest income = [15-62].
5. Other operating cash flows = Special items + non-operating income (excluding interest income) - extraordinary expenses. [17+61-62+48]

CASO2 = (1) + (5) - (2) - (3) - (4)

TACC2 = EARN2 - CASO2

EARN2 = Net Income [172].

A3. OPTIMAL CONTRACT WHEN THE PRODUCTION FUNCTION IS NORMAL AND THE AGENT'S UTILITY IS LOGARITHMIC

To derive testable hypotheses it was assumed that the agent's utility function is logarithmic and the production function is bivariate normal in the signals x and y. These assumptions led to the optimal contract being linear in the two signals when the first-order approach was used to solve the principal's problem. It is however not clear whether such a contract always results in the argument of the logarithmic utility function being always strictly positive even for large negative values of x and y. This appendix provides some numerical evidence about the appropriateness of the first order approach for the specific case of normal production function and logarithmic utility function.

Consider the following principal-agent problem. The outcome x resulting from the agent's action a, is generated from n(a,1) i.e. the agent's effort is the mean of the distribution. The agent can choose any action from the action space $\{a_1,.....,a_n\}$ where a_1 refers to the lowest possible action and a_n the highest. The agent's utility from the compensation s is log(s) and his work aversion characteristics are captured by $V(a_i) = 0.1a_i$. The reservation utility θ is 0.1. The optimal contract that implements any a_t (other than the lowest a_1) can be approximated by the optimal contract corresponding to the discrete approximation of the production environment. Grossman and Hart (1984) demonstrate that when the outcomes are discrete, such a contract can be exactly solved by using convex programming techniques.

The discrete approximation is generated by choosing 69 values of x_i, the lowest being -2.9 and the highest 3.9 with the intermediate values at 0.1 intervals. Probability masses are attached to each of the x values such that the resulting pdf approximates the underlying normal pdf.[43] Since the underlying normal pdf's mean is the agent's effort the probability attached to any x_i (denoted as $p_i(.)$) also changes with the effort levels. Defining s_i as the compensation paid to the agent when outcome x_i results and denoting $\log(s_i)$ as k_i, the principal's problem (when the implementation of a particular a_t other than a_1 is desired) is :

$$\underset{\{k_i\}}{\text{Min}} \sum_i p_i(a_t) \exp(k_i)$$

subject to

$$\sum_i p_i(a_t)\, k_i - V(a_t) \geq \theta \quad \text{and}$$

$$\sum_i p_i(a_t)\, k_i - V(a_t) \geq \sum_i p_i(a_j)\, k_i - V(a_j) \quad \text{for all } j \neq t.$$

This above program was exactly solved for optimal values of $\{k_i\}$ that implement the action a_t. The optimal compensation contract $\{s_i\}$ was computed as $\{\exp(k_i)\}$ and the functional relationship between s_i and x_i was examined by OLS regression. The results are reported for the implementation of the highest possible action when three different action spaces are considered.

Case 1 :

Action space = $\{a_1, a_2\} = \{0,1\}$

First best contract to implement a_2 : expected compensation = Exp(0.2) = 1.2214

Second best contract to implement a_2 : expected compensation = 1.224284

$$\underset{(44.28)}{s_i = 1.018499} + \underset{(10.44)}{0.11697\, x_i}$$

[43]The probability masses are computed in the following way. For example, let $a_t = 0$. In the first step, $q_i(a_t) = 0.5\,(N(x_i+0.1) - N(x_i - 0.1))$ is computed from the CDF for the standard normal distribution. In the second step, the $q_i(a_t)$ are normalized to compute $p_i(a_t) = \dfrac{q_i(a_t)}{\sum q_i(a_t)}$ for all the 69 values of x_i.

Adjusted R-squared = 0.6137

Case 2 :

Action space = $\{a_1,a_2,a_3\} = \{0,0.5,1\}$

First best contract to implement a_3 : expected compensation = Exp(0.2) = 1.2214

Second best contract to implement a_3 : expected compensation = 1.226534

$$s_i = \underset{(62.45)}{0.998023} + \underset{(19.09)}{0.14861}\, x_i$$

Adjusted R-squared = 0.8425

Case 3 :

Action space = $\{a_1,a_2,a_3,a_4\} = \{0,0.5,0.7,1\}$

First best contract to implement a_4 : expected compensation = Exp(0.2) = 1.2214

Second best contract to implement a_4 : expected compensation = 1.227114

$$s_i = \underset{(115.47)}{1.04048} + \underset{(31.28)}{0.13727}\, x_i$$

Adjusted R-squared = 0.9350

The above evidence suggests that as the action space expands, the functional relationship between the outcome and the optimal compensation approaches linearity. The evidence is therefore supportive of the use of the first order approach when the production function is normal and the agent's utility is logarithmic.

Table 1

Descriptive Statistics of Firms in S1

1. Industry Composition of firms in the sample :

SIC	Industry	Number of Firms
1000 - 1999	Mining,Oil and Construction	12
2000 - 2999	Light Industry	100
3000 - 3999	Manufacturing	87
4000 - 4999	Railroads, Air Transport & Telephone	22
5000 - 5999	Merchandising	21
6000 - 6999	Financial Services & Insurance	2
7000 -	Other Services	6
	Total Number of Firms in S1	250

2. Summary Statistics of Compensation, Earnings, Total Accruals and Cash flows from operations[1]:

Variable	Mean	Std.Dev	Q1	Median	Q3
COMP	228.64	76.51	179.20	218.57	277.87
EARN1	109.90	241.13	27.43	47.65	88.49
TACC1	-106.12	275.20	-85.06	-35.22	-13.01
CASO1	216.02	505.58	42.70	88.70	176.63
$\rho_{EARN1,TACC1}$	-0.0411	0.3932	-0.3115	-0.0655	0.2723
$\rho_{EARN1,CASO1}$	0.5488	0.3031	0.3619	0.6193	0.7924
$\rho_{TACC1,CASO1}$	-0.8025	0.1987	-0.9404	-0.8680	-0.7373

[1]These results are for the cross-sectional distribution of time-series averages and sample correlations of the relevant variables. Each time series contains between 14 and 18 observations. COMP which refers to executive salary and bonus is in thousands and all other variables are in millions of CPI-deflated (1970=100) constant dollars. Q1 and Q3 refer to the first and third quartile respectively.

Table 2

Descriptive Statistics of Firms in S2

1. Industry Composition of firms in the sample :

SIC	Industry	Number of Firms
1000 - 1999	Mining,Oil and Construction	9
2000 - 2999	Light Industry	83
3000 - 3999	Manufacturing	80
4000 - 4999	Railroads, Air Transport & Telephone	20
5000 - 5999	Merchandising	19
6000 - 6999	Financial Services & Insurance	2
7000 -	Other Services	4
	Total Number of Firms in S2	217

2. Summary Statistics of Compensation, Earnings, Total Accruals and Cash flows from operations[1]:

Variable	Mean	Std.Dev	Q1	Median	Q3
COMP	228.883	75.543	180.364	217.482	271.006
EARN2	110.591	255.312	27.762	49.131	92.411
TACC2	-109.719	298.450	-94.346	-36.395	-13.919
CASO2	220.310	540.067	43.771	96.273	168.571
$\rho_{EARN2,TACC2}$	-0.0514	0.4079	-0.356	-0.0974	0.2548
$\rho_{EARN2,CASO2}$	0.5585	0.3125	0.4004	0.6287	0.7756
$\rho_{TACC2,CASO2}$	-0.8004	0.1955	-0.9359	-0.8719	-0.7212

[1]These results are for the cross-sectional distribution of time-series averages and sample correlations of the relevant variables. Each time series contains between 14 and 18 observations. COMP which refers to executive salary and bonus is in thousands and all other variables are in millions of CPI-deflated (1970=100) constant dollars. Q1 and Q3 refer to the first and third quartile respectively.

Table 3

Cross-sectional means of firm-specific sample correlations

Number of firms common to S1 and S2 = 217

VAR	EARN1	EARN2	TACC1	TACC2	CASO1	CASO2	COMP
EARN1	1.00	0.93063	-0.0535*	-0.0272*	0.57383	0.52282	0.44516
EARN2		1.00	-0.0550*	-0.0494*	0.54629	0.56821	0.44352
TACC1			1.00	0.89519	-0.7899	-0.71904	-0.1464
TACC2				1.00	-0.69642	-0.79430	-0.1311
CASO1					1.00	0.90485	0.36117
CASO2						1.00	0.35093
COMP							1.00

All the correlations (except those marked with an *) are significant at the 0.0001 level in the two-tailed test of the hypothesis, $\rho = 0$ vs $\rho \neq 0$.

Table 4

1. Summary statistics for firm-specific regressions R1 (N = 250)

$$COMP_t = \beta_0 + \beta_1 TACC1_t + \beta_2 CASO1_t + \varepsilon_t$$

	Mean	Std.Dev	Q1	Median	Q3
β_0	152.354	103.981	89.780	147.872	206.565
β_0 (t-statistic)	6.047	4.608	2.536	5.462	8.291
β_1	1.416	2.704	0.071	0.720	2.043
β_1 (t-statistic)	1.833	2.483	0.220	1.704	3.258
β_2	1.646	2.812	0.225	0.860	2.284
β_2 (t-statistic)	2.734	3.337	0.654	2.401	4.111
Adjusted R-Sqrd	0.345	0.296	0.094	0.335	0.591
1st order Auto.Corr	0.301	0.253	0.134	0.334	0.484
Cond.No.[1]	11.501	6.723	7.236	9.681	14.381
Vari1[2]	0.754	0.240	0.624	0.844	0.935
Vari2[3]	0.942	0.162	0.974	0.989	0.995
γ_1	0.034	0.077	0.001	0.011	0.034
γ_2	0.054	0.115	0.007	0.021	0.047
γ_1/γ_2	0.231	2.668	0.241	0.771	0.998
β_1/β_2	1.023	10.660	0.627	0.940	1.155
$\beta_2 - \beta_1$	0.230	0.944	-0.101	0.065	0.403
ProbF ($\beta_2 = \beta_1$) [4]	0.409	0.322	0.113	0.320	0.703

[1]Refers to the ratio of the square root of the largest eigen value to the lowest of the X'X matrix.

[2]Refers to the proportion of the variance of β_1 explained by the largest eigen value.

[3]Refers to the proportion of the variance of β_2 explained by the largest eigen value.

[4]Probability that $F(1,k_j)$ is greater than the F statistic defined as k_j (RSS-URSS)/URSS where k_j is the degrees of freedom of firm j in R1, URSS is the sum of squared residuals of R1 and RSS the sum of squared residuals of R1 with the restriction $\beta_1=\beta_2$.

2. Aggregate test-statistics for the firm-specific regressions[5] :

Test	T (mean=0)	Z	χ^2	M	S
1a) $\beta_1 = 0$ vs $\beta_1 \neq 0$	8.28*	26.8*(3)	-	69*	11114*
1b) $\beta_2 = 0$ vs $\beta_2 \neq 0$	9.25*	40.0*(2)	--	88*	13484*
2) $\beta_2 - \beta_1 = 0$ vs $\beta_2 - \beta_1 \neq 0$	3.85*	6.98*(35)	767.1*	32*	5024*
3) $\text{sign}(\frac{\beta_1}{\beta_2}) = \text{sign}(\frac{\gamma_1}{\gamma_2})$			15.37*	--	--
a) p= 0.5 vs p > 0.5	--	9.36*		--	--
b) p= 0.7 vs p > 0.7	--	3.31*		--	--
4) $\frac{\beta_1}{\beta_2} - \frac{\gamma_1}{\gamma_2} = \xi = 0$ vs $\neq 0$	1.15	1.9^{+}	--	26*	4324*

*,** and $^{+}$ refer to significance at 0.01,0.05 and 0.1 levels respectively.

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[5](1) The Z statistics for tests 1a,1b,2 and 4 are computed by aggregating the relevant standardized firm-specific t-statistics assuming cross-sectional independence. Since the firm-specific regressions are conducted over the same time-period (1971-88) it is unlikely that the slope coefficients are independent across firms. The number shown in brackets refers to the minimum number of independent observations needed to have the Z statistic significant at the 1% level. For test 4, the t-statistic corresponding to $(\beta_1 - \frac{\beta_2\gamma_1}{\gamma_2})$ is aggregated assuming that the ratio $\frac{\gamma_1}{\gamma_2}$ has very low standard error.

(2) The Z-statistic for test 3 is the large-sample approximation for the binomial test-statistic. It is computed as $(B - np) / \sqrt{np(1-p)}$ where B is the number of times the signs of the two ratios match in the sample. The Bernoulli trials are assumed to be independent.

(3) The χ^2 statistic for test 2, is computed as $\sum -2 \ln(\text{Prob}F_j)$. This has 2N degrees of freedom. The χ^2 statistic for test 3 checks whether the signs of the ratios are independent and has 1 degree of freedom.

(4) The non-parametric tests are carried out the following way. For the sign test, $M = p - (n/2)$ where p is the number of values greater than zero and n the number of non-zero values. The probability (Prob > |M|) is computed as $|M|\ 2 \sum_{i=0}^{\min(p,n-p)} 0.5^n \binom{n}{i}$. For the sign-rank test, $S = \sum r_i^+ - n(n+1)/4$ where r_i^+ is the rank of $|x_i|$ after discarding values of $x_i = 0$, n is the number of non-zero values and the sum is over all x_i values greater than zero. (Prob > S) is computed by treating $S\sqrt{n-1} / \sqrt{nV - S^2}$ as a Student's t variate with (n-1) degrees of freedom. V is computed as $n(n+1)(2n+1)/24$.

Table 4A

Results for tests on subsample for which $t(\beta_2)$ is significant at the 0.05 level: (N=139)

Test	T (mean=0)	Z	χ^2	M	S
1a) $\beta_1 = 0$ vs $\beta_2 \neq 0$	9.64*	33.7*(1)	-	61*	4479*
1b) $\beta_2 = 0$ vs $\beta_2 \neq 0$	10.19*	48.4*(1)	--	63*	4656*
2) $\beta_2 - \beta_1 = 0$ vs $\beta_2 - \beta_1 \neq 0$	2.59*	4.92*(38)	414.1*	14**	1294*
3) $\text{sign}(\frac{\beta_1}{\beta_2}) = \text{sign}(\frac{\gamma_1}{\gamma_2})$			11.5*	--	--
a) p= 0.5 vs p > 0.5	--	8.57*		--	--
b) p= 0.7 vs p > 0.7	--	4.2*		--	--
4) $\frac{\beta_1}{\beta_2} - \frac{\gamma_1}{\gamma_2} = \xi = 0$ vs $\neq 0$	3.72*	4.74*(19)	--	19*	2158*

Table 5

1. Summary statistics for firm-specific regressions AR1 (N = 250) :

$$COMP_t = \beta_{0a} + \beta_{1a} TACC1_t + \beta_{2a} CASO1_t + v_t$$
$$v_t = \varepsilon_t - \alpha v_{t-1}$$

	Mean	Std.Dev	Q1	Median	Q3
β_{0a}	158.86	98.282	94.757	154.870	206.303
β_{0a} (t-statistic)	5.769	4.194	2.588	5.047	7.893
β_{1a}	1.391	2.265	0.123	0.698	2.004
β_{1a} (t-statistic)	1.896	2.316	0.384	1.617	3.167
β_{2a}	1.539	2.397	0.229	0.814	2.225
β_{2a} (t-statistic)	2.536	2.925	0.794	2.311	3.722
α	-0.301	0.253	-0.484	-0.334	-0.134
$\beta_{2a} - \beta_{1a}$	0.149	0.770	-0.105	0.039	0.270
ρ[1]	0.171	0.138	0.057	0.152	0.241
Adj. Reg. R Sqrd[2]	0.298	0.289	0.034	0.274	0.523
Adj. Total R Sqrd[3]	0.488	0.259	0.311	0.494	0.683
γ_1	0.034	0.077	0.001	0.011	0.034
γ_2	0.054	0.115	0.007	0.021	0.047
γ_1/γ_2	0.231	2.668	0.241	0.771	0.998
β_{1a}/β_{2a}	1.991	9.544	0.711	0.991	1.169

[1]Refers to the first-order autocorrelation of the residuals in the transformed model.
[2]Refers to the adjusted R squared for the transformed model in the two-step full transform method.
[3]Refers to the adjusted R squared for the primary regression equation using the parameter estimates of the two-step full transform method.

2. Aggregate test-statistics for the firm-specific regressions:

Test	T (mean=0)	Z	χ^2	M	S
1a) $\beta_{1a} = 0$ vs $\beta_{1a} \neq 0$	9.71*	27.6*(3)	--	81*	12197*
1b) $\beta_{2a} = 0$ vs $\beta_{2a} \neq 0$	10.2*	36.9*(2)	--	92*	13897*
2) $\beta_{2a} - \beta_{1a} = 0$ vs $\beta_{2a} - \beta_{1a} \neq 0$	3.05*	4.0*(104)	--	16**	3713*
3) $\text{sign}(\frac{\beta_{1a}}{\beta_{2a}}) = \text{sign}(\frac{\gamma_1}{\gamma_2})$			19.85*	--	--
a) p= 0.5 vs p > 0.5	--	10.1*		--	--
b) p= 0.7 vs p > 0.7	--	4.14*		--	--
4) $\frac{\beta_{1a}}{\beta_{2a}} - \frac{\gamma_1}{\gamma_2} = \xi = 0$ vs $\neq 0$	2.81*	4.01*	--	34*	6111*

Table 5A

Results for tests on subsample for which $t(\beta_{2a})$ is significant at the 0.05 level: (N=131)

Test	T (mean=0)	Z	χ^2	M	S
1a) $\beta_{1a} = 0$ vs $\beta_{1a} \neq 0$	10.5*	34.2*(1)	--	61*	4149*
1b) $\beta_{2a} = 0$ vs $\beta_{2a} \neq 0$	10.9*	45.4*(2)	--	64*	4294*
2) $\beta_{2a} - \beta_{1a} = 0$ vs $\beta_{2a} - \beta_{1a} \neq 0$	2.10**	3.15*(86)	--	9	962**
3) $\mathrm{sign}(\frac{\beta_{1a}}{\beta_{2a}}) = \mathrm{sign}(\frac{\gamma_1}{\gamma_2})$			5.53**	--	--
a) p= 0.5 vs p > 0.5	--	7.78*		--	--
b) p= 0.7 vs p > 0.7	--	3.49*		--	--
4) $\frac{\beta_{1a}}{\beta_{2a}} - \frac{\gamma_1}{\gamma_2} = \xi = 0$ vs $\neq 0$	3.33*	5.19*	--	16*	1241*

Table 6

1. Summary statistics for firm-specific regressions (N=190, Estimation period = 1950-1969)

ER1: $TACC1_t = \delta_0 + \delta_1 \, DREV + \delta_2 \, GPPE + \varepsilon_t$

	Mean	Std.Dev	Q1	Median	Q3
δ_0	-3.4145	36.407	-6.0588	-1.4645	1.5592
δ_0 (t-statistic)	-0.4422	1.1273	-1.099	-0.353	0.293
δ_1	0.0419	0.1827	-0.0493	0.036	0.1222
δ_1 (t-statistic)	0.6580	2.0079	-0.625	0.4435	1.809
δ_2	-0.0384	0.0821	-0.0736	-0.046	-.0097
δ_2 (t-statistic)	-1.8601	2.6223	-3.171	-1.351	-0.178
Adjusted R-Sqrd	0.2912	0.3081	0.0221	0.261	0.5321
1st order Auto.Corr	-0.1729	0.2208	-0.315	-0.185	-0.018
Cond.No.	5.5145	2.5332	3.907	4.9321	6.3393
Vari1	0.2566	0.3044	0.0172	0.1058	0.4073
Vari2	0.8962	0.1485	0.8875	0.9401	0.9647
ProbF ($\delta_2 = \delta_1$)	0.3414	0.2945	0.0702	0.2813	0.5629

2. Summary statistics for firm-specific regressions (N=190, Estimation period = 1950-1969)

ER2: $CASO1_t = \upsilon_0 + \upsilon_1 \, DREV + \upsilon_2 \, GPPE + \varepsilon_t$

	Mean	Std.Dev	Q1	Median	Q3
υ_0	33.084	98.765	1.550	7.847	25.397
υ_0 (t-statistic)	1.734	2.015	0.470	1.383	2.738
υ_1	0.021	0.205	-0.062	0.016	0.123
υ_1 (t-statistic)	0.073	2.091	-1.097	0.253	1.224
υ_2	0.139	0.107	0.076	0.117	0.190
υ_2 (t-statistic)	4.666	4.170	1.950	3.652	6.374
Adjusted R-Sqrd	0.5059	0.3178	0.2757	0.5351	0.7872
1st order Auto.Corr	-0.108	0.276	-0.295	-0.135	0.111
Cond.No.	5.514	2.533	3.907	4.932	6.339
Vari1	0.257	0.304	0.017	0.106	0.407
Vari2	0.896	0.149	0.888	0.940	0.965
ProbF ($\upsilon_2 = \upsilon_1$)	0.292	0.307	0.016	0.170	0.540

Table 7

1. Descriptive statistics for the DR1 regression variables :

	Mean	Std.Dev	Q1	Median	Q3
COMP	242.41	75.052	187.91	231.68	289.92
NDACC1	-237.50	608.09	-179.08	-63.56	-8.14
CASO1	269.72	504.65	50.27	104.09	202.75
DACC1	97.39	320.67	-12.18	24.65	86.83
$\rho_{COMP,NDACC1}$	-0.1496	0.5520	-0.6063	-0.2533	0.2655
$\rho_{COMP,CASO1}$	0.3415	0.3236	0.1357	0.3571	0.5985
$\rho_{COMP,DACC1}$	0.0826	0.4236	-0.2033	0.1186	0.3817
$\rho_{NDACC1,CASO1}$	-0.1632	0.4576	-0.5162	-0.271	0.0952
$\rho_{NDACC1,DACC1}$	-0.5784	0.3627	-0.8828	-0.6915	-0.3772
$\rho_{CASO1,DACC1}$	-0.4146	0.4700	-0.8012	-0.5487	-0.1195

2. Descriptive statistics for the DR2 regression variables :

	Mean	Std.Dev	Q1	Median	Q3
NDCASO1	522.86	1172.53	91.22	179.48	411.81
DISCRT	-155.75	386.71	-133.09	-57.28	-28.12
$\rho_{COMP,NDCASO1}$	0.4086	0.4518	0.1745	0.5182	0.7585
$\rho_{COMP,DISCRT}$	-0.1572	0.5267	-0.6280	-0.1567	0.2481
$\rho_{NDACC1,NDCASO1}$	-0.6517	0.6497	-0.9972	-0.9761	-0.7967
$\rho_{NDACC1,DISCRT}$	0.3167	0.6902	-0.2079	0.6503	0.9009
$\rho_{NDCASO1,DISCRT}$	-0.6701	0.4752	-0.9683	-0.8963	-0.6407

Table 8

1. Summary statistics for firm-specific regressions DR1 (N=189) :

$$COMP_t = \tau_0 + \tau_1 \, NDACC1_t + \tau_2 \, CASO1_t + \tau_3 \, DACC1_t + \varepsilon_t$$

	Mean	Std.Dev	Q1	Median	Q3
τ_0	142.520	101.334	81.069	135.803	191.478
τ_0 (t-statistic)	4.713	3.907	2.092	4.031	6.282
τ_1	0.9398	3.029	-0.2434	0.4175	1.8783
τ_1 (t-statistic)	1.109	2.349	-0.533	1.001	2.683
τ_2	1.185	2.278	0.157	0.715	1.763
τ_2 (t-statistic)	2.039	2.138	0.794	1.847	3.434
τ_3	1.095	2.187	0.115	0.691	1.549
τ_3 (t-statistic)	1.633	1.906	0.397	1.564	2.916
Adjusted R-Sqrd	0.468	0.280	0.266	0.481	0.679
1st order Auto.Corr	0.190	0.240	0.033	0.221	0.382
Cond.No.	24.078	20.735	11.899	18.402	28.859
Vari1	0.757	0.319	0.659	0.924	0.981
Vari2	0.817	0.265	0.796	0.932	0.987
Vari3	0.802	0.260	0.731	0.928	0.973

2. Aggregate test statistics for the firm-specific regressions :

Test	Z statistic	χ^2
$\tau_0 = 0$ (N=189)	59.67*(1)	
$\tau_1 = 0$ (N=189)	14.03*(7)	
$\tau_2 = 0$ (N=189)	25.85*(2)	
$\tau_3 = 0$ (N=189)	20.70*(3)	
$\tau_1 - \tau_2 = 0$ (N=146)	-8.76*(13)	779.97*
$\tau_1 - \tau_3 = 0$ (N=146)	-8.88*(13)	854.93*
$\tau_2 - \tau_3 = 0$ (N=146)	0.77	338.83*
$\tau_1 = \tau_2 = \tau_3$ (N=146)		859.14*

Table 9

Summary statistics for firm-specific regressions DR2 (N=189) :

$$COMP_t = \psi_0 + \psi_1 NDACC1_t + \psi_2 NDCASO1_t + \psi_3 DISCRT_t + \varepsilon_t$$

	Mean	Std.Dev	Q1	Median	Q3
ψ_0	100.689	501.179	70.189	134.906	189.683
ψ_0 (t-statistic)	3.854	3.570	1.301	3.382	5.913
ψ_1	5.005	25.1903	-0.298	0.820	2.910
ψ_1 (t-statistic)	1.013	1.922	-0.199	0.860	2.056
ψ_2	3.159	20.727	-0.041	0.863	2.177
ψ_2 (t-statistic)	1.357	2.103	-0.115	1.207	2.516
ψ_3	1.092	2.572	0.065	0.586	1.478
ψ_3 (t-statistic)	1.609	2.016	0.409	1.489	2.882
Adjusted R-Sqrd	0.5112	0.2833	0.3348	0.5205	0.7394
1st order Auto.Corr	0.130	0.251	-0.046	0.141	0.318
Cond.No.	92.148	109.356	26.816	50.222	107.110
Vari1	0.815	0.283	0.757	0.957	0.995
Vari2	0.969	0.126	0.986	0.996	0.999
Vari3	0.406	0.359	0.073	0.268	0.774

2. Aggregate test statistics for the firm-specific regressions :

Test	Z statistic	χ^2
$\psi_0 = 0$ (N=189)	48.79*(1)	
$\psi_1 = 0$ (N=189)	12.84*(8)	
$\psi_2 = 0$ (N=189)	17.21*(5)	
$\psi_3 = 0$ (N=189)	20.39*(4)	
$\psi_1 - \psi_2 = 0$ (N=62)	-1.57	219.41*
$\psi_1 - \psi_3 = 0$ (N=62)	2.29**	247.69*
$\psi_2 - \psi_3 = 0$ (N=62)	6.41*	298.31*
$\psi_1 = \psi_2 = \psi_3$ (N=62)		464.18*

Table 10

1. Descriptive statistics for the various proxies for managerial discretion :

	Mean	Std.Dev	Q1	Median	Q3
PLTA	0.4190	0.1681	0.2914	0.3888	0.5355
RECSAL	0.1465	0.0604	0.1086	0.1442	0.1750
LEVER	0.5040	0.6805	0.1482	0.3195	0.6298
EARNADJ	0.3123	1.5999	0.0001	0.0268	0.1485
IFTNT	0.1006	0.0592	0.05	0.10	0.15
MABSERR	0.0102	0.0252	0.0028	0.0053	0.0093

2. Correlation structure of the various proxies for discretion :

	RECSAL	LEVER	EARNAD	IFTNT	MABSER
PLTA	-0.2912*	0.2043*	-0.0982	0.0552	0.0860
RECSAL		-0.0948	0.0475	0.2169*	-0.0905
LEVER			0.0924	0.0260	0.7573*
EARNADJ				-0.0798	0.0200
IFTNT					-0.0422

Table 11

1. Non-parametric tests of association between proxies for discretion and the weights of accrual measures in compensation contracts :

Partitioning Variable	Ranking Variable β_{1a}	$t(\beta_{1a})$	τ_3	$t(\tau_3)$
PLTA	-3.63*(125,125)	-3.62*(125,125)	-1.56+(95,94)	-1.57+(95,94)
RECSAL	-0.42(125,125)	0.60(125,125)	0.12(95,94)	1.04(95,94)
LEVER	-2.34*(125,125)	-2.29**(125,125)	-0.33(95,94)	0.21(95,94)
EARNADJ	-0.13(125,124)	-0.35(125,124)	0.63(95,94)	0.54(95,94)
IFTNT	-2.03**(125,125)	-1.12(125,124)	-1.35+(95,94)	0.27(95,94)
MABSERR	-4.35*(109,108)	-3.62*(125,125)	-1.67**(87,87)	-0.03(87,87)

2. Cross-sectional regression results of weights of accrual measures on various measures of discretion :

$$\text{DEP.VAR.} = \lambda_0 + \lambda_1\text{PLTA} + \lambda_2\text{RECSAL} + \lambda_3\text{LEVER} + \lambda_4\text{EARNADJ} + \lambda_5\text{IFTNT} + \lambda_6\text{MABSERR}$$

	Dependent Variable β_{1a} (n=217)	$t(\beta_{1a})$	τ_3 (n=174)	$t(\tau_3)$
λ_0	4.43(7.09)*	3.196(4.55)*	2.675(3.85)*	1.145(1.756)
λ_1	-3.58(-3.79)*	-2.294(-2.162)**	-1.625(-1.527)++	-0.208(-0.208)
λ_2	-8.012(-3.23)*	0.591(0.212)	-4.086(-1.524)++	3.451(1.37)
λ_3	-0.047(-0.15)	0.112(0.309)	0.057(0.138)	0.288(0.749)
λ_4	-0.119(-0.96)	-0.021(-0.148)	-0.045(-0.37)	0.072(0.617)
λ_5	-2.641(-1.12)	-2.589(-0.974)	-2.647(-1.02)	0.823(0.338)
λ_6	-10.827(-1.29)	-15.071(-1.603)++	-8.161(-0.596)	-7.929(-0.617)
adj. R^2	0.0949	0.0265	0.0029	-0.0145

*,**,+ and ++ refer to significance at 0.01,0.05,0.1 and 0.2 levels respectively.

3. Linear discriminant function analysis of the regression statistics :

	Ranking Variable			
	β_{1a}	$t(\beta_{1a})$	τ_3	$t(\tau_3)$
L-L	66	62	58	52
L-H	43	47	29	35
H-L	41	36	40	44
H-H	67	72	47	43
p	0.3871	0.3823	0.3966	0.4540

The cell entries in the first four rows correspond to the number of observations classified. The entries in the fifth row correspond to the mis-classification probabilities.

Table 12

1. Summary statistics for firm-specific regressions (N=178, Estimation period = 1970-1988)

ER3: $DDEPRN_t = \kappa_0 + \kappa_1 \, ADDN_t + \kappa_2 \, DELN_t + \varepsilon_t$

	Mean	Std.Dev	Q1	Median	Q3
κ_0	-0.0794	61.729	-1.589	0.052	1.194
κ_0 (t-statistic)	0.151	1.354	-0.674	0.037	0.873
κ_1	0.0648	0.057	0.035	0.059	0.086
κ_1 (t-statistic)	2.685	2.291	1.280	2.258	3.567
κ_2	-0.036	0.075	-0.065	-0.039	-0.010
κ_2 (t-statistic)	-1.906	2.782	-2.866	-1.459	-0.333
Adjusted R-Sqrd	0.376	0.295	0.120	0.369	0.636
1st order Auto.Corr	0.017	0.001	0.017	0.018	0.018

2. Descriptive statistics for the regression variables :

	Mean	Std.Dev	Q1	Median	Q3
DDEPRN	9.668	22.708	1.302	3.356	8.173
ADDN	218.370	560.584	33.565	68.594	178.200
DELN	94.670	380.902	7.637	22.524	61.550
$\rho_{DDEPRN,ADDN}$	0.454	0.261	0.279	0.483	0.657
$\rho_{DDEPRN,DELN}$	-0.225	0.395	-0.507	-0.250	0.009
$\rho_{ADDN,DELN}$	0.075	0.332	-0.184	0.050	0.300

Table 13

1. Summary statistics for firm-specific regressions DR3 (N=178) :

$$COMP_t = \omega_0 + \omega_1\, TREAR_t + \omega_2\, DISCP_t + \omega_3\, DISCD_t + \nu_t$$
$$\nu_t \quad = \varepsilon_t - \alpha \nu_{t-1}$$

	Mean	Std.Dev	Q1	Median	Q3
ω_0	158.05	101.47	96.784	159.044	213.755
ω_0 (t-statistic)	6.561	4.916	2.978	5.753	8.941
ω_1	1.484	2.842	0.190	0.771	2.120
ω_1 (t-statistic)	2.601	2.837	0.717	2.035	4.026
ω_2	0.716	28.949	-5.879	1.304	9.994
ω_2 (t-statistic)	0.191	1.299	-0.423	0.210	0.914
ω_3	1.525	11.755	-0.907	0.542	3.767
ω_3 (t-statistic)	0.341	1.275	-0.476	0.237	1.008
Adj. Reg. R Sqrd	0.338	0.304	0.096	0.288	0.576
Adj. Total R Sqrd	0.506	0.264	0.314	0.517	0.712
$\omega_2 - \omega_3$	-0.809	36.346	-8.923	-0.203	7.216

2. Aggregate test statistics for the firm-specific regressions :

Test	Z statistic	T statistic
$\omega_0 = 0$ (N=178)	79.48*(1)	20.776*
$\omega_1 = 0$ (N=178)	31.54*(2)	6.965*
$\omega_2 = 0$ (N=178)	2.32**	0.330
$\omega_3 = 0$ (N=178)	4.12*(68)	1.731+
$\omega_1 - \omega_2 = 0$ (N=178)	-0.614	0.366
$\omega_1 - \omega_3 = 0$ (N=178)	0.600	-0.042
$\omega_2 - \omega_3 = 0$ (N=178)	1.508	-0.297

Table 14

1. Non-parametric tests of association between proxies for discretion and the weights of discretionary depreciation and bad debt provision in compensation contracts :

Partitioning Variable	Ranking Variable			
	ω_2	$t(\omega_2)$	ω_3	$t(\omega_3)$
PLTA	-0.22(89,89)	0.12(89,89)	0.57(89,88)	0.59(89,89)
RECSAL	-0.61(89,89)	-0.73(89,89)	0.62(89,89)	0.99(89,89)
LEVER	-0.43(89,89)	-0.88(89,89)	-1.10(89,88)	-0.58(89,88)
EARNADJ	0.62(89,88)	0.39(89,88)	-1.08(89,88)	-0.58(89,88)
IFTNT	-0.45(89,89)	-0.35(89,89)	-0.98(89,89)	-0.41(89,89)
MABSERR	-1.16(77,77)	-1.52(77,77)	-0.06(77,77)	-0.15(89,89)

2. Cross-sectional regression results of weights of accrual measures on various measures of discretion : (N=154)

$$DEP.VAR. = \lambda_0 + \lambda_1 PLTA + \lambda_2 RECSAL + \lambda_3 LEVER + \lambda_4 EARNADJ + \lambda_5 IFTNT + \lambda_6 MABSERR$$

	Dependent Variable			
	ω_2	$t(\omega_2)$	ω_3	$t(\omega_3)$
λ_0	-3.597(-0.438)	0.367(0.736)	-7.834(-2.265)**	-0.494(-0.959)
λ_1	19.443(1.696)++	0.695(0.998)	6.537(1.354)++	0.751(1.045)
λ_2	-3.375(-0.100)	-1.577(-0.769)	41.614(2.925)*	3.294(1.555)++
λ_3	0.728(0.203)	-0.088(-0.402)	-0.276(-0.183)	-0.026(-0.116)
λ_4	0.448(0.352)	0.151(1.956)+	0.853(1.594)++	0.167(2.091)**
λ_5	1,283(0.047)	-0.718(-0.433)	-6.133(-0.532)	-0.134(-0.078)
λ_6	-113.256(-1.275)	-5.491(-1.018)	26.113(0.698)	-0.349(-0.063)
adj. R^2	0.0022	0.0256	0.0324	0.0045

*,**,+ and ++ refer to significance at 0.01,0.05,0.1 and 0.2 levels respectively.

3. Linear discriminant function analysis of the regression statistics :

	Ranking Variable			
	ω_2	$t(\omega_2)$	ω_3	$t(\omega_3)$
L-L	48	40	47	44
L-H	26	34	31	35
H-L	32	33	33	34
H-H	48	47	43	41
p	0.3757	0.4360	0.4158	0.4482

The cell entries in the first four rows correspond to the number of observations classified. The entries in the fifth row correspond to the mis-classification probabilities.

Table 15

1. Summary statistics for firm-specific regressions (N = 250)

V1: $\Delta VAL_t = \beta_{0v} + \beta_{1v} TACC1_t + \beta_{2v} CASO1_t + \varepsilon_t$

	Mean	Std.Dev	Q1	Median	Q3
β_{0v}	-47.256	914.798	-58.715	0.187	63.482
β_{0v} (t-statistic)	-0.041	1.151	-0.632	0.008	0.604
β_{1v}	0.380	3.546	-1.077	0.379	1.906
β_{1v} (t-statistic)	0.333	1.331	-0.489	0.208	1.139
β_{2v}	0.889	2.859	-0.367	0.603	1.856
β_{2v} (t-statistic)	0.586	1.313	-0.166	0.503	1.254
Adjusted R-Sqrd	0.047	0.175	-0.074	-0.009	0.113
1st order Auto.Corr	-0.039	0.181	-0.163	-0.039	0.085
Cond.No.	10.729	6.172	6.799	9.176	13.379
Vari1	0.747	0.243	0.643	0.831	0.935
Vari2	0.937	0.167	0.969	0.988	0.994
β_{1v}/β_{2v}	0.676	6.426	0.157	0.964	1.624
$\beta_{2v} - \beta_{1v}$	0.509	2.355	-0.518	0.282	1.124
ProbF ($\beta_{2v} = \beta_{1v}$)	0.451	0.281	0.193	0.461	0.668

2. Aggregate test-statistics for the firm-specific regressions:

Test	T (mean=0)	Z	χ^2	M	S
1a) $\beta_{1v} = 0$ vs $\beta_{1v} \neq 0$	1.69+	4.9*(69)	--	19**	2982*
1b) $\beta_{2v} = 0$ vs $\beta_{2v} \neq 0$	4.91*	8.7*(22)	--	44*	6563*
2) $\beta_{2v} - \beta_{1v} = 0$ vs $\beta_{2v} - \beta_{1v} \neq 0$	3.42*	4.6*(81)	614*	24**	3946*

3. Correlation Structure of (a) the compensation and valuation regression coefficients (Pearson and Spearman correlations, N=250)[1] :

	β_1	β_2	β_{1v}	β_{2v}
β_1		*0.942**	*0.062*	*0.087*
β_2	0.889*		*0.060*	*0.101*
β_{1v}	0.075	0.081		*0.750**
β_{2v}	0.168*	0.198*	0.755*	

(b) z statistics of compensation and valuation regression coefficients :

	β_1	β_2	β_{1v}	β_{2v}
β_1		*0.883**	*0.139***	*0.184**
β_2	0.869*		*0.087*	*0.177**
β_{1v}	0.151**	0.149**		*0.832**
β_{2v}	0.175*	0.224*	0.798*	

* significant at 0.01 level in a two-tail test of $\rho = 0$

** significant at 0.05 level in a two-tail test of $\rho = 0$

[1]The Pearson correlations are in italics.

Table 16

Comparison of results of cross-sectional OLS and non-linear regression (NL1) models (Sample=S1, N=4280) :

OLS : $COMP_t = \beta_0 + \beta_1 \, TACC1_t + \beta_2 \, CASO1_t + \varepsilon_t$

Non-Linear model : $COMP_t = \beta_0 + \beta_1 \, X_1 + \beta_2 \, CASO1_t + \varepsilon_t$ $\quad TACC1_t < X_1$

$= \beta_0 + \beta_1 \, X_2 + \beta_2 \, CASO1_t + \varepsilon_t$ $\quad TACC1_t > X_2$

$= \beta_0 + \beta_1 \, TACC1_t + \beta_2 \, CASO1_t + \varepsilon_t$ $\quad$ otherwise

	Actual		Standardized[1]	
	OLS	Non-Linear	OLS	Non-Linear
β_0	213.531	194.811	230.141	228.77
β_0 (t-statistic)	136.71	74.89	152.18	141.34
β_1	0.156	-0.443	25.222	27.619
β_1 (t-statistic)	13.181	-14.46	9.609	9.672
β_2	0.153	0.0255	44.535	43.539
β_2 (t-statistic)	20.489	8.181	16.967	17.126
R-Sqrd	0.1542	0.2015	0.0725	0.0736
X_1	-	-263.73	-	-1.348
X_2	-	-5.485	-	-

The t-statistics of the regression coefficients reported under the non-linear model are computed using asymptotic standard errors.

[1]This pertains to the case where the actual values of TACC1 and CASO1 are standardized in the following way for every firm-year in the sample : $STACC1 = \frac{TACC1 - \mu(TACC1)}{\sigma(TACC1)}$ and $SCASO1 = \frac{CASO1 - \mu(CASO1)}{\sigma(CASO1)}$ where $\mu(.)$ and $\sigma(.)$ correspond to the firm-specific sample mean and standard deviation of the respective performance measure.

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