SMU ECONOMICS & STATISTICS
WORKING PAPER SERIES

SINGAPORE MANAGEMENT UNIVERSITY

# The Auditor and the Firm: A Simple Model of Corporate Cheating and Intermediation

**Brishti Guha**

September 2005

Paper No. 15-2005

**The Auditor and the Firm:**

**A Simple Model of Corporate Cheating and Intermediation**

**Brishti Guha**

**Singapore Management University**[1]

## Abstract

We apply a game-theoretic model to the analysis of the recent spate of corporate scandals in which firms have cheated their investors, often with the aid of external auditors. We characterize the different types of equilibria that obtain for different parameter ranges in an auditor's absence (the parameters we consider being "early signal accuracy" – a measure of transparency – and "withdrawal costs" – a measure of the liquidity of investments). We also analyze whether and under what conditions the presence of an informed auditor could lead to an improvement in the sense of honest behavior replacing cheating as the firms' equilibrium strategy. In doing so we take into account the auditor's incentives to collude with his clients or extort from them. We use our results to derive some policy predictions including those relating to the Sarbanes-Oxley reforms, and contrast the case of a firm-hired intermediary (like an auditor) with the situation in which an intermediary is hired by investor consortia. Interestingly, we find that mandatory disclosure of audit fees could guarantee honest behavior, in equilibrium, for much of the parameter space in which cheating would have prevailed in an auditor's absence – as investors are able to check that audit fees lie in a range which removes incentives to cheat for the auditor and his clients. Such disclosure would need to be backed by heavy penalties for false disclosure. We also find that while firm-hired intermediaries have a non-monotone reaction to improvements in public transparency, initially favoring and then opposing them, investor-hired intermediaries unambiguously dislike improvements in public

[1] School of Economics and Social Sciences, Singapore Management University, 90 Stamford Road, Singapore 178903. E-mail : bguha@smu.edu.sg This work was largely done when I was a PhD student at Princeton University. I am specially grateful to Eric Maskin for support and valuable insights. I also thank Avinash Dixit and Ashok Guha.

transparency. We argue that frequent rotation of an auditor's clients may have costs, not just benefits.

**JEL Classification :** C72, D82, L20.

**Keywords :** Corporate governance, auditing, disclosure, repeated games.

## 1. Introduction

The recent spate of corporate scandals involving fraudulent accounting by firms, often abetted by their external auditors, throws into focus a host of interesting issues. At the same time these factors and the general atmosphere of business pessimism have also resulted in some questioning of the reliability of agencies such as auditing companies or credit rating agencies which are supposed to intermediate between firms and investors. The policy implications of various measures, for instance the Sarbanes-Oxley Act, meant to prevent more such occurrences, are also a subject of much debate.

We analyze these issues by considering a framework where firms engage in long term relationships with a set of investors. The firms may be (a) always honest or (b)opportunistic**.** Firms of the first type are intrinsically honest: they do not cheat investors. They do however maximize profits subject to this constraint[2]. The second type of firms, opportunists, may either act honestly, or cheat, depending on what they view as more profitable. Thus the two actions in the opportunist firms' strategy space are "act honestly, cheat" where cheating may be interpreted as distorting internal accounts to convey an exaggerated picture of the company's profits. Standard examples of this include writing off huge amounts and using this to boost pro-forma profits, that supposedly reflect normal business activities, or not disclosing stock options as a cost (given that they are part of the managerial compensation package) in their profit statement.

[2] Other studies have also assumed some degree of "limited rationality" on the part of honest firms - see Dixit (2003).

There exist some publicly observable signals, for instance stock prices, or the profit statements published by firms, which though imperfect indicators of true value nevertheless imply a positive probability $\pi$ of investors finding out if a firm has acted dishonestly: and then they may withdraw their funds from it.

Investors optimize depending on relative payoffs and on whether they expect the firm to behave honestly or cheat. Accordingly they decide whether to invest in the firm in the first place, and in each new period, whether to reinvest or to withdraw their funds. As the story accommodates multiple periods the opportunistic firms would also be representative of firms which have been established for some time, rather than only of fresh startups floating IPOs. This seems warranted as most of the current corporate scandals involve firms with an established reputation and a large existing clientele of investors.

Using a game theoretic setup, we then model the interactions between firms and investors, and determine the nature of the equilibrium. As it turns out, equilibria can be of different types depending on parameter values. Then we introduce intermediaries into the framework. These intermediaries are one sided in the sense that they provide investors with information about the firms, but provide no information about the investors to the firms. Examples include external auditing firms and credit rating agencies. One feature which distinguishes such intermediation from many other cases of intermediation analyzed in the literature is that while these intermediaries are supposed to represent the investors' interests, they are paid by the firms, either directly in fees or through more elaborate interlocking effects if for instance their relationship with the firm extends beyond audit to the provision of other profitable services like consultancy, investment banking, etc. Keeping this in mind we check whether it is possible to sustain an equilibrium achieved through intermediation when the intermediary acts honestly. As a part of the verification of the equilibrium we examine the intermediary's incentives to collude with the firm (and the firm's to collude with the intermediary) and also the intermediary's incentive to extort exorbitant fees from the firm by threatening to falsely report that the firm has been dishonest. Examining these seems particularly relevant in view of recent instances where auditing companies have been accused of deliberately misrepresenting information to mislead investors, and given the growing skepticism among many of the accuracy of credit ratings, with some clients complaining that their claims are systematically downgraded.

Later, we also consider how the analysis might be different if the intermediaries had been paid not by firms but by a consortium of investors who sought information about the firms.

Then we interpret our findings in terms of their policy implications. In particular, we consider the impact of (a) implications for mandatory disclosure of audit fees, (b) improvements in transparency or in the informativeness of the publicly observable signals, on firms' behavior and on intermediaries' fees and incentives, (c) the implications of banning an auditing firm from the provision of non audit activities and (d) the consequences of a compulsory rotation of clients of auditing firms.

We find that mandatory disclosure of audit fees could guarantee honest behavior, in equilibrium, for much of the parameter space in which cheating would have prevailed in an auditor's absence – as investors are able to check that audit fees lie in a range which removes incentives to cheat for the auditor and his clients. Mandatory audit fee disclosure, backed by heavy penalties for false disclosure, would thus constitute an effective policy measure to rule out corporate fraud for this range of parameters. We also see that an improvement in transparency, such as requiring that the firm disclose stock options as a cost, is welcomed by firm-hired intermediaries to a certain extent, as it increases their fees, but not beyond a certain level : intuitively, if transparency is too high, firms stay honest even without intermediation so there is insufficient demand for intermediaries' services. Firms however dislike a rise in transparency as it worsens their bargaining position vis a vis intermediaries. Intermediaries hired by investor consortia also unambiguously dislike a rise in transparency, as this reduces their fees – an aspect in which they differ from firm-hired intermediaries like auditors. We also show that an intermediary's incentives to collude diminish if its expected lifespan is high. Accordingly we show that measures such as the compulsory rotation of an auditing firm's clients have costs as well as benefits. By shortening the length of its business relationship with each client it may increase its incentives to collude if information about collusive behavior does not spread quickly. Using similar logic an indirect benefit of the low level of competition among intermediaries in today's markets is that it tends to lengthen an intermediary's lifespan decreasing incentives to collude.

In a later section, we show how public observability of payoffs in our simple model would alter the picture, reducing the scope for cheating and making auditing superfluous. However, this derives from the fact that in this model observability of payoffs is a sure guide to whether cheating has taken place.

## 2. Related Themes in the Literature

This paper is related to many strands of the theoretical and empirical literature. Dixit (2003) has described a setup where both parties in an economic transaction face a moral hazard, and each represents a random draw from a large population. Anonymity prevents a cheater from being recognized as such by the new parties with whom he transacts and in this context the paper analyzes how private intermediation could help. In our model, only one party has an incentive to cheat - while Dixit considers an (asymmetric) prisoner's dilemma, the prisoner's dilemma that we consider is one-sided. Also, unlike Dixit's paper which matches firms and investors in iid random pairings each period, we allow for more persistent relationships. In our model the investor has the choice of reinvesting with the same firm next period. Only if he decides not to do so will he be randomly matched with another firm. Another difference is that in the Dixit paper intermediaries provide their clients with information about the other party, but the bulk of the focus in our paper is on the case where firms pay intermediaries, which are supposed to represent the investors' interests (so that the client is the party whose behavior is to be investigated). This makes collusion between the intermediary and the client a more likely situation than the "double-crossing" considered by Dixit (of an intermediary supplying its client with false information).

Other papers relating to the cheating literature include Greif's (1993,1996) theoretical models and case studies of the control of cheating among traders in the Mediterranean. Our paper is also related to the corporate finance literature dealing with firm-investor interactions (eg Diamond (1991)). As in our paper, Diamond considers firms of heterogeneous types, however he focuses on adverse selection rather than moral hazard. Also, his model is not a prisoner's dilemma, but considers different types of projects the borrower could invest in, and shows that if adverse selection is strong, reputation effects are insufficient to lead to choice of good projects. Unlike in our model, investors are dying every period, to be replaced by a new set, so that "credit history" forms the only constraint on future behavior. Luck plays an important role in the Diamond model. He shows that while for the worst borrowers neither reputation nor intermediation (in the form of banks) can ensure good project selection, and for the top borrowers reputation alone suffices, intermediation is useful for the middle range borrowers. In our model however, once there is intermediation, all firms benefit from becoming the intermediary's clients, because no one wants to invest in them otherwise. Thus even honest types can benefit from becoming clients.

Campbell and Kracaw (1980) make intermediation endogenous - an intermediary is an investor with sufficient initial wealth to credibly invest in information production. Our model however does not explicitly model intermediary formation. A major difference in results is that while their paper stresses that competition between intermediaries makes collusion between overvalued firms and intermediaries less likely [as in their setup such firms have to pay each intermediary to suppress damaging information about their prospects] in our model collusion is negatively related to the expected lifespan of the intermediary which is arguably the higher, the lower the extent of competition in the intermediation market.

In the empirical literature, studies of the effect of the provision of non audit services on auditing firms' tendency to qualify a report have yielded mixed results. Wines (1994) finds a negative association, suggestive of the collusive mechanisms modeled in our paper and suggested by the anecdotal evidence surrounding the recent corporate scandals, in which non-separation of audit and non audit services like consultancy, or between investment banking and research, created conflicts of interest. However other studies [eg Barkess and Simnett (1994)] find no association between the tendency to qualify a report and non audit services. We note that Barkess and Simnett's sample was from the top auditing firms for whom life expectancy as well as reputational concerns were presumably higher and this in the context of our model would reduce tendencies to collude. Craswell, Stokes and Laughton (2002) find that having controlled for non audit services, the proportion of total fees contributed by the auditing fees of the client have no effect. However, it is to be noted that in many of these studies the non audit fee component may be mismeasured, leaving out (for example) such non monetary effects such as the dependence of research analysts' fees on the number of investment banking mandates they brought in. This measurement error would tend to bias the coefficients on non audit services towards zero. Also, the dependent variable in such studies should be the number of reports where auditors detect an error, but do not report it (rather than the number of reports they qualify) - but unfortunately it is not possible to observe this.

## 3. The Assumptions of the Model

We call player 1 the firm[3], and player 2 the investors with whom it is engaged in a relationship. Players are of the types specified in the introduction. We assume that α and 1-α represent the proportions of firms of honest and opportunistic types. Firms live on indefinitely unless investors withdraw their

[3] We can think of the "firm" as denoting insiders who play decisive roles in the operation of the business. "Investors" refers to outside financiers who may be shareholders or lenders. For simplicity we treat the insiders as a single decision-making unit – alternatively we can think of the insiders as merely comprising of a "manager" who takes all the decisions including whether or not to cheat the outsiders.

funds from them. To keep the proportions of different firm types constant we assume that whenever a firm dies out it is replaced by another firm of the same type. Investors are assumed to be infinitely lived. In the initial period investors, based on their future expected payoff from investing, decide whether or not to invest. If they never invest to start with, they get 0. If they do invest initially, they may choose to withdraw or not at an intermediate stage in response to an early warning signal which warns of cheating, though with imperfect accuracy. They then choose at the beginning of each subsequent period between withdrawing and staying with their original choices. Meanwhile, at the outset of each period, opportunistic firms decide whether to play honest or to cheat.

The payoff matrix in the stage game is as follows:

| | Player 2 (investors) | | |
|---|---|---|---|
| | Invest/buy (B) | Withdraw/sell (S) at intermediate stage | Withdraw only at the end |
| Player 1 (firm) Honest (H) | $H_1, H_2$ | $L_1, -Z$ | $H_1, H_2 - Z$ |
| Cheat (C) | $W_1, L_2$ | $0, -Z$ | $W_1, -Z + L_2$ |

given

$$W_1 > H_1 > 0 > L_1 \text{ and } H_2 > 0 > -Z .$$

Payoffs are realized at the end of each period when they become known (to the firm of course) and to its investors, but not to the public at large (unless auditors are in action – a possibility that we consider in a later section). The case where payoffs are observable by the general public and not just by the concerned investors is also analyzed in a later section.

All investors get to know whether they have been cheated after the realization of their payoffs. However, there is an early warning signal that is observable at an intermediate stage by the investors in any firm. If the signal warns of cheating, the investors have the choice of withdrawing early, incurring the withdrawal cost of $Z$ but avoiding the final (negative) payoff of $L_2$. We assume that these are imperfect signals. Accordingly, if firms cheat, this is revealed to investors via these signals with a probability $\pi < 1$, while with probability $1-\pi$ cheats go undetected.

The interpretation of the payoffs is as follows. If the firm acts honestly, and investors also invest, the firm gets a positive payoff $H_1$ while the investor also gets a positive amount where we can think of $H_2$ as an expectation taken over all the possible states (where states are exogenous, a function of luck) the firm could be in (but provided it was acting honestly). The firm however has an incentive to deviate and cheat, because $W_1 > H_1$, but in this case the investor makes losses: $L_2$ is negative which means that the investor does worse than if he had never invested. If the investor withdraws, he gets a stage payoff of $-Z$ irrespective of whether the firm is acting honestly or not. Here we assume that $Z$ is the cost of withdrawing funds. It captures the transaction or illiquidity associated costs of selling out. We characterize $Z$ as being fixed which may represent some sort of lock in effect such as the Tobin taxes on portfolio investments. Finally $L_1<0$ can be interpreted as a loss the firm suffers if it is liquidated (because the investors have withdrawn) despite having acted honestly. We assume that the firm gets a higher payoff of 0 if it cheats and the investors withdraw, because while cheating it can consume some gains and it is not possible to deprive it of these even if it is liquidated (the figure 0 is just chosen for convenience, but the point is really that the firm can do a little better if it cheated, even if the investors withdraw).

The first set of inequalities - $W_1 > H_1 > 0 > L_1$ - implies that in the one stage game cheating is always a strictly dominant strategy for the opportunistic firm. The investor prefers not to sell if the firm is acting honestly, but if the firm is cheating, selling out early (a possible action in response to an early warning signal, which we will discuss shortly) may be worthwhile in the stage game depending on the relative magnitudes of $Z$ and $L_2$. In particular withdrawing in response to an early signal dominates the third strategy of withdrawing only after the end of the period – as in that case investors would incur both the withdrawal cost $Z$ and the loss $L_2$. We note that the prisoners' dilemma here may be one sided as $H_2 > 0 > -Z$ but it is possible that $-Z > L_2$ : in this case the investor does not have a strictly dominant strategy - but the firm will always wish to deviate from playing H. In this event the Nash equilibrium of the stage game is C,S.

## 4.Equilibria without Intermediation

We now investigate the types of sustainable equilibria. Opportunistic firms must decide between playing Honest and Cheat given investors' play. Investors must decide between playing B and S - returns to doing so differ depending on whether firms are playing H or C in equilibrium.

An *honest equilibrium* is one in which investors expect all firms to play H and firms find it optimal to do so as long as investors act on this premise.

A *cheating equilibrium* is one in which (1) all opportunistic firms cheat, (2) investors have rational expectations, therefore they expect a fraction $1-\alpha$ of all firms to play C. There will be sub-cases of cheating equilibria depending on whether investors find it optimal to withdraw upon receipt of a bad early signal.

The sequential structure of the *equilibrium line of play* in a cheating equilibrium is as follows. Investors decide to invest or not, according to whether they expect non-negative returns or not. If investors do invest, a fraction $\alpha$ of all firms plays H while the rest find it profitable to play C. A fraction $\pi$ of the $(1-\alpha)$N cheating firms (where N denotes the total number of firms) is identified by an early signal before realization of payoffs. Investors then have an opportunity of withdrawing from these $\pi(1-\alpha)$N detected cheating firms at a loss of $Z$ but without incurring the negative pay-off $L_2$. At the end of the period, outcomes are realized. Honest firms and their investors receive payoffs ($H_1, H_2$). Investors in cheating firms receive a penalty of $L_2$. They also have a choice of withdrawing (S) or continuing in the same firm (B). Withdrawal results in an additional loss of $Z$; however, all investors who withdraw, at this stage or the earlier one, now have the opportunity of reinvesting in another firm with the same profit expectations as in the phase described above (as this is an indefinitely repeated game).

We now discuss when a cheating equilibrium is possible.

*Proposition 1*: If $\alpha H_2 + (1 - \alpha)L_2 > 0$, there exists a cheating equilibrium in which the habitually honest firms play H and their investors respond to this by playing B every period. So the honest firms' and their investors' respective long run payoffs are $\frac{H_1}{1-\delta}$ and $\frac{H_2}{1-\delta}$ .

*Proof*: Habitually honest firms are not optimizers, and play H by definition. To start with, an investor cannot distinguish an intrinsically honest type from an opportunist. However as long as $\alpha H_2 + (1 - \alpha)L_2 > 0$, the investor's expected payoff is positive and he chooses to invest. The investor has no cause to withdraw from a habitually honest firm, because (a) he will never receive an early signal about cheating on the part of such a firm, and (b) after observing $H_2$, his realized payoff at the end of the period, he will not want to withdraw either, as he realizes that the firm has not cheated. Thus he stays with the same firm and plays B each period. The payoffs, for the honest firm and the investor, are $H_1$ and $H_2$ per period for ever. **Q. E. D.**

For the $\pi(1-\alpha)$N firms who are caught early, investors have a choice of playing S or B. If investors withdraw, they incur the early withdrawal cost $Z$ but are free to invest elsewhere from the next period. If they play B however they keep getting the same loss $L_2$ for all time.

The remaining $(1-\alpha)(1-\pi)$N firms are discovered by their investors to be cheating only when the latter get their payoffs. These investors, again, choose between S and B, with the difference that if they withdraw they cannot avoid realizing the one time loss $L_2$ in addition to having to pay $Z$ - as in the previous case, they are free to invest elsewhere from the next period.

This situation where opportunistic firms are cheating is compatible with two distinct kinds of investor behavior (that we label strategies 1 and 2), depending on the parameter values.

1. The investor invests in a firm and doesn't withdraw, even if alerted by an early signal that the firm is cheating – essentially because the high cost of withdrawal exceeds the present value of his anticipated losses due to his firm's cheating. Then he won't withdraw from a firm that is revealed to be cheating only after the declaration of outcomes. Here

$$V_2^1 = \frac{\alpha H_2 + (1-\alpha)L_2}{1-\delta} > 0 \qquad (1)$$

where the subscript on V denotes the player and the superscript the strategy. The function $V_i^j$ denotes player i's lifetime present value from playing strategy j. In the text of this paper, though not in the appendix, we assume that (1) holds, it is always profitable ex-ante to invest, either because the payoff in case the firm acts honestly is large or because the proportion of intrinsically honest firms is high enough to ensure a positive expected value from investment.

2. The investor invests, but will withdraw if the declaration of outcomes reveals that the firm was cheating. In that case, he would certainly have withdrawn if he received an early signal to the same effect. Here the payoff to this strategy is

$$V_2^2 = \frac{\alpha H_2}{1-\delta} + (1-\alpha)(-Z + \delta V_2^2) + (1-\alpha)(1-\pi)L_2$$

$$\text{or } V_2^2 = \frac{1}{1-\delta(1-\alpha)}\left[\frac{\alpha H_2}{1-\delta} - (1-\alpha)Z + (1-\alpha)(1-\pi)L_2\right] \qquad (2)$$

At this point we can ask : can there be in equilibrium a strategy where the investor invests, withdraws if alerted by an early signal that the firm is cheating, but does not do so if he learns of this only after results are declared? The answer is negative. The declaration of outcomes at the end of the first period reveals that the firm is cheating - the investor who stays with the firm is assured of a perpetual loss of $L_2$ per period - a loss the present value of which outweighs the withdrawal cost $Z$ (as indicated by the assumption that he would have divested if he received an early warning of cheating). In a subgame-perfect equilibrium, therefore, this strategy is dominated by strategy 2.

To find the conditions under which each of these strategies is optimal, we need to compare the relative payoffs.

Comparing strategies (1) and (2),

$$V_2^2 \geq V_2^1$$

if and only if

$$Z \leq \frac{\alpha\delta}{1-\delta}[H_2 - L_2] - \pi L_2 = Z^* \tag{3}$$

where the cutoff $Z^*$ is an increasing function of $\pi$. [Differentiation instantly tells us that the derivative of $Z^*$ with respect to $\pi$ is -$L_2$>0 as $L_2$<0.]

From Figure 1, we can define two zones in ($\pi$, $Z$) space. Zone 1 lies to the right of $Z^*$. In this region we have $V_2^1 > V_2^2$ [from (3)], and of course from (1) we know that strategy 1 is a profitable strategy. Therefore in Zone 1, investors follow strategy 1.

The line forming the boundary between Zones 1 and 2 is upward sloping indicating that $Z^*$ is increasing in $\pi$. To the left of this line, in Zone 2, we have $Z$ less than $Z^*$ and (3) and (1) tell us that in this region,

$$V_2^2 > V_2^1 > 0$$

hence in this region investors follow strategy 2 which is also a profitable strategy.

We note that assuming (1), that strategy 1 is always a profitable one, means that we do not need to use a separate profitability condition for strategy 2. This changes if we drop (1), that is, assume that it may not always be ex ante profitable to invest. We deal with this case in the appendix.

The equations and inequalities above define the regions of the parameter space in which the specified investor behavior is compatible with equilibrium, given that opportunistic firms are cheating. But when would firms find it worthwhile to cheat? The two zones defined above provide very different incentives for the opportunistic firm.

1. In Zone 1, the firm's anticipated profits are

$$V_1 = \max[H_1 + \delta V_1, W_1 + \delta V_1] \tag{4}$$
$$= W_1 + \delta V_1$$

or

$$V_1 = \frac{W_1}{1-\delta} \tag{5}$$

so that the firm always cheats and a cheating equilibrium is sustainable. The firm knows that if it cheats, investors will not withdraw being locked in by high withdrawal costs. On the other hand, investors find it optimal to invest in the first place even if they expect all opportunistic firms to cheat, as by (1) the high proportion of habitually honest firms in the population ensures a positive expected payoff for them .

2. In Zone 2,

$$V_1 = \max[H_1 + \delta V_1, (1-\pi)W_1 + \delta V_1] \tag{6}$$

The first term in brackets shows the firm's payoff if it is honest, while the second shows that if the firm cheats, it gets $W_1$ with a probability of $1-\pi$, the probability of its escaping detection. We note that even though investors withdraw after their payoffs reveal cheating, by then the firm has already obtained its one period cheating gains - in the next period it simply gets continuation payoffs from a fresh set of investors. With probability $\pi$ its cheating is detected early and it gets 0 in the current period as investors withdraw in response to the early signal - in which case withdrawal is too early for the firm to realize its gains from cheating.

The firm will then cheat if

$$(1-\pi)W_1 > H_1$$

or if

$$\pi < \frac{W_1 - H_1}{W_1} = \pi^* \tag{7}$$

and will be honest otherwise in this region. A cheating equilibrium is possible only for a low enough probability of detection. Thus the investors' equilibrium strategy here is to withdraw only if they receive a bad early signal, while the opportunistic firms' is to be honest for a sufficiently high probability of detection, and otherwise to cheat.

As Figure 1 shows, there are several possible types of steady states depending on parameter values. Zone 1 is a region where firms always cheat. Zone 2 is itself split into two regions depending on values of $\pi$ - firms are honest for $\pi$ above or equal to $\pi^*$ and cheat otherwise.

The fact that the line separating zones 1 and 2 is upward sloping implies that while opportunistic firms are sometimes honest for low withdrawal costs, the range of such honest equilibria increases with improvements in transparency (ie in the accuracy of the public signal). For a highly accurate public signal, firms will be always honest for a greater range of values of $Z$ .

The regions in which one sided intermediation by agencies such as external auditors and credit rating agencies could have a role are in the lower part of Zone 2 (where $\pi < \pi^*$ ) and in Zone 1. Is it conceivable that employing an intermediary of this kind (who, to reiterate a point made in the introduction, is paid by the firm but supposed to serve the investors' interest) might influence the type of steady state the economy ends up in? We examine this question in the next section.

## 5. Equilibrium with Intermediaries

An intermediary of the sort described above is assumed to have a survival probability of $\lambda \leq 1$. Here $\lambda$ is treated as an exogenous parameter though if we were to model the form of competition in the intermediation market there would be scope for endogenizing it. Intermediaries die off at a random rate $(1 - \lambda)$ per period.

The auditor receives his fee at the outset of each period, investigates the activities of the firm and reports to the public at large at the outset of the next period. Meanwhile, if he is not committed to honesty, he can try to increase his earnings from his client firm by demanding a bribe to be paid on delivery of a clean report or by threatening a false report of cheating unless paid extortion money. These negotiations could occur either at the outset of the audit period or later after the cheating and perhaps the investigation have occurred; however, agreement, if any, would specify that extra payments would be synchronized with the delivery of a good report.

When cheating occurs, the intermediary can detect this with probability 1, in contrast to the probability $\pi$ of detection using the early warning signal. However detection for the intermediary occurs with a one period lag. On the one hand this assumption allows the early signal to maintain a special role in enabling investors to withdraw early and avoid loss in the current period - instantaneous detection of cheating with probability 1 by the intermediary would render the early signal superfluous. On the other hand, this assumption highlights the point that the basic role of the intermediary is to provide information about a firm's cheating to all investors. Without intermediation, individual investors could infer from their payoffs that they had been cheated, and could choose to withdraw, but as this would not become public information the firm would still get a payoff next period from fresh investors. By becoming the client of an intermediary a firm can seek to signal its honesty and we derive conditions for an equilibrium where the client firms are indeed honest while no investors patronize the non client firms.

We first postulate an equilibrium where the intermediary is honest, ie where it correctly identifies and signals honesty and cheating by firms without attempting collusion or extortion, and examine how its presence affects the scenario described in the previous section. (Later in this section we examine (a) conditions under which opportunistic intermediaries will act honestly, and (b) whether the cheating equilibria discussed earlier will in fact be replaced by honest equilibria). Assuming that all firms are customers of the intermediary, we calculate their relative gains to being customers over not being customers. To do this we consider a situation where investors do not invest in any firms which are not the intermediary's clients. This does not seem to be an unrealistic assumption as most uninformed investors prefer not to invest in a firm whose claims are not rated or which is not certified by agencies of this kind. As we proceed, it will also become evident that where other investors withdraw from firms that do not hire auditors, the best policy for an individual investor is to do likewise**.** So from the point of view of the individual investor, avoiding firms that do not become the intermediary's clients will be shown to be an optimal strategy.

The relative payoffs to being a customer versus being a non customer of the intermediary are $H_1$ for both honest and opportunistic types. Both types of firms will get $H_1$ if they become the auditor's customers, but if they do not, they will not get any investment and hence will get zero. If they already have existing investors at the time the auditor enters the picture, the honest types know that if they do not become customers, their investors will respond by playing S while the honest firms, because of their type, will be constrained to play H and get the payoff $L_1 < 0$. Since they aim at profit maximization, subject to the honesty constraint**,** they exit and play their outside option which gives payoff 0, irrespective of investor type. A similar assumption – that intrinsically honest types are rational enough to choose an outside option which is more profitable than placing themselves in a situation where their nature will constrain them to act honestly – is made in Dixit (2003). For opportunistic firms with investor already in place at the time of entry of the auditor, the gain of becoming a customer is exactly the same as that of an honest type while if it is not a customer it gets 0 due to the investors' play of S to which it can respond by cheating. The gain of both types of firms and accordingly their maximum willingness to pay the intermediary is therefore $H_1$ . We can show however that the intermediary's fee F must be less than the opportunist's and the honest types' gain .

If an opportunistic firm is not a customer of the intermediary, it will never play honest. Given investors' strategies, one of two things can happen. The first is that investors will not invest in any such firm (in which case the opportunist would never have a chance to either play honest or cheat, and would get a payoff of zero). The second possibility is that if the firm already has investors when the auditor comes into being, investors will withdraw their funds and the opportunist will receive no future investment (in which case the opportunist will get a one-time payoff of 0 if he cheats and $L_1 < 0$ if he is honest – thus he will choose to cheat)[4]. The implication of this is that the firm is paying the intermediary to signal its honesty. Any investor who deviates by staying with a firm that does not hire an auditor will be cheated; it is therefore optimal for him to withdraw from such firms.

*Proposition 2*: When we restrict our attention to the part of Zone 2 where there would have been cheating in the intermediary's absence, the intermediary's fee F must be less than the opportunistic firms' gain from being its customer, (ie $F < H_1$) and the extent of the shortfall depends on the accuracy of the public signal $\pi$.

*Proof*: We examine the conditions for an opportunistic firm to be honest and to be a customer of the intermediary. Now, we can define $V_1$, the long-term payoff of the firm, as the maximum of three alternatives – hiring an auditor and being honest, hiring an auditor but cheating nevertheless, and not hiring an auditor. Thus we have

$$V_1 = \max[H_1 - F + \delta V_1, W_1 - F + \delta \overline{V_1}, 0]$$

where $\overline{V}_1$ is the continuation payoff a cheat gets and is given by

[4] This argument is only valid for Zone 2, as in Zone 1 investors are "locked in" by high withdrawal costs. But we will show soon that in any case intermediation does not have a role to play in Zone 1. Therefore, our argument is valid for the domain where intermediation can potentially be effective.

$$\overline{V}_1 = \lambda(0+\delta\overline{V}_1)+(1-\lambda)V_1 \tag{8}$$

Here the first term on the right hand side of (8) shows that if the intermediary detects cheating, the cheat receives the one time payoff 0 - in the next period he begins afresh and receives the continuation payoff of a cheat. The second term shows that if the intermediary does not survive into the next period, the firm can get away with cheating. As the information about its cheating does not become common knowledge it can get a payoff from fresh investors even if the old ones were to withdraw subsequently.

Now for an opportunistic firm to hire an auditor and be honest, we must have

$$V_1 = H_1 - F + \delta V_1 \tag{9}$$

This must yield more than the second and third options. By comparison with the third option, we must have

$$V_1 > 0$$

or

$$F < H_1 \tag{10}$$

Moreover, by comparison with the second option,

$$(1-\pi)W_1 - H_1 \le \delta(V_1 - \overline{V}_1) \tag{11}$$

Now to relate the extent of the shortfall of F from $H_1$ to $\pi$, (8) and (9) give us

$$V_1 - \overline{V}_1 = \lambda[H_1 - F] + \lambda\delta[V_1 - \overline{V}_1]$$

$$= \frac{\lambda[H_1 - F]}{1-\delta\lambda} \qquad \text{[using (9)]}$$

Substituting this in (11) and rearranging,

$$F \le H_1 - ((1-\pi)W_1 - H_1)\frac{1-\delta\lambda}{\delta\lambda} \tag{12}$$

Now it is evident that the second term on the RHS of (12), is decreasing in $\pi$, more so for $\lambda$ <1. The interpretation of this is that as the warning signal becomes more accurate the shortfall of F from the opportunistic firms' gains diminishes, that is F increases while the opportunistic firms' bargaining power falls. This reflects the fact that as the accuracy of the signal increases**,** the opportunistic firm has no good alternatives to not being the intermediary's customer, as it becomes increasingly difficult for it to cheat (and the only benefit from not being a customer is if one can cheat)[5]. Of course if $\pi$ is so high that it exceeds $\pi^*$ then the firm is always honest even without intermediation and the intermediary's services are not needed. The impact of the signal would be similar for an infinitely lived intermediary, though weaker : if the intermediary were infinitely lived, a cheating firm might be able to get away with cheating this period, but would be sure to be penalized from the next period as the intermediary could pass on information about its cheating with probability 1. In Zone 2, the early signal would still retain a role by reducing the expected payoff to firms from cheating by enabling investors to withdraw at an intermediate stage. **Q.E.D**

We also note that the investors' equilibrium strategy of not investing in any firms that are not the intermediary's clients, makes sense, as the only reason for not being a client is if the firm wants to cheat. Though for some parameter values investors do not refrain from investing in a cheat in the absence of intermediation, this reflects their inability to distinguish ex ante between cheats and honest firms and the probability of the firm being honest is high enough to ensure them a positive expected payoff. Once they know however that a firm will be a cheat they have no incentive to invest in it.

What are the policy implications of all this? Measures to improve the accuracy of the publicly observable signals, such as transparency measures like requiring the firm to disclose stock options as costs, are welcomed by intermediaries to a certain extent, insofar as it increases their fees. However, intermediaries dislike too much transparency. Their expected payoff decreases if markets are too efficient or internal accounting very transparent because this may

[5] This dependence on early signal accuracy is valid only for Zone 2, because in Zone 1 investors are locked in by high withdrawal costs and cannot respond to the early signal. However, as mentioned in footnote 4, we will show later that in any case intermediation is not effective in ensuring honesty in Zone 1. Thus we can say that in the domain where intermediation can be effective, intermediaries have this sort of non-monotone preference over early signal accuracy.

mean that firms stay honest even without intermediation. Investors, too, know this, therefore basically firms have no need to engage intermediaries. Firms unambiguously dislike greater transparency, as it worsens their bargaining position vis a vis intermediaries. Of course another obvious policy implication that is evident from Figure 1 is that a decrease in the cost of withdrawal increases the likelihood of honest behavior among firms.

Now we consider, first, the conditions needed to ensure honesty on the part of the intermediary. Next we analyze in what zones of Figure 1 intermediation (subject to the necessary conditions) can help in replacing cheating by an honest equilibrium, and summarize the properties of this equilibrium in a proposition.

*Collusion*

To analyze the conditions needed for honest behavior by the intermediary, we first consider the intermediary's incentives to "collude" with a client firm by failing to report cheating behavior in exchange for a bribe. It is possible that the intermediary may collude with its client firms to falsely furnish a report of honesty. This possibility is particularly relevant in view of the fact that auditing firms for instance tended to perform profitable non audit services like consultancy or investment banking for their audit clients, and generous remuneration in one service may be linked to collusion in the other. To introduce a cost of collusion into this framework we assume that there is some positive probability q that investors can, in the next period, detect that the intermediary has cheated them. This can for instance be because as intermediaries are relatively few in number, news about cheating behavior on their part is more likely to become public knowledge. Here we consider q = 1 for simplicity[6]. Therefore, the investors lose faith in the intermediary. In this event the firm too stops using the

[6] Note that investors can tell from their payoffs at the end of the period that they have been cheated.

intermediary's services for all time to come - as the investors have lost faith in it it is worthless to go on paying the intermediary. This constitutes a loss for the intermediary. Moreover, if the intermediary services n client firms, all n firms will find it worthless to go on paying an intermediary in which investors have lost faith.

We have already described the timing of the negotiations between the firm and the intermediary on collusion and extortion. What are the feasible strategies open to each of the agents in this game?

*Firms* may or may not hire auditors for an agreed fee to start with. In either case, they may or may not cheat. If they have hired an auditor and cheated, they may or may not choose to bribe him by a secret extra payment simultaneous with a favorable audit report. If they have hired an auditor and not cheated, and the auditor demands a bribe for certifying to the fact, they may or may not pay.

The *auditor* accepts a fee at the outset and investigates. If there has been cheating, he may report as much or suppress the facts for a bribe. If there has been none, he could report this with or without additional demands. He could of course negotiate about this in advance, rather than after the fact, though actual payments of course would only be made on delivery of the report.

*Investors* watch whether firms hire auditors or not. They may or may not get to know the auditor's fees. They then decide whether or not to invest in a firm. At the commencement of the next period, they may withdraw or reinvest. The information available to them at this point includes the return they have received in the last period, the auditor's report and the warning signal.

Now we first examine the intermediary's non collusion condition. Now we first examine the intermediary's non collusion condition**.** It makes no sense for the intermediary to collude with just one (or a few) firms since its one-period cheating gains would be limited by one (or a few) firms' one period cheating gains, while exposure would lead to the loss of its entire clientele. Therefore, the intermediary will make the collusion offer to all its n clients – and, if collusion is at all worthwhile for any firm, the intermediary can hope for a positive response from all the $(1 - \alpha)n$ that are opportunistic. The maximum it can gain by collusion are these (1 – α)n firms' gains (1 – α)n $(W_1 - H_1)$, from deviating and playing Cheat[7], while its loss is the discounted value of n times its future fee, beginning next period, times the probability q (here, equal to one) that its collusion is detected by the investors. So the condition is:

$$(1-\alpha)n(W_1 - H_1) < nF\,\frac{\delta\lambda}{1-\delta\lambda}$$

or

$$F > (1-\alpha)\frac{1-\delta\lambda}{\delta\lambda}[W_1 - H_1] \qquad (13)$$

What of an opportunist firm's incentive to initiate collusion with its intermediary by making an all-or-nothing offer where the firm keeps almost all of the one-time gain $W_1 - H_1$? The firm's maximum one time gains from collusion are $W_1 - H_1$. From the next period, with probability q (=1) it is punished and loses its non deviation payoff $H_1$, but in this case it terminates its relationship with the intermediary and so avoids paying F. Thus the firm's no collusion condition is

$$W_1 - H_1 < \frac{\delta\lambda}{1-\delta\lambda}\,[H_1 - F]$$

$$\text{or } F < \frac{H_1 - (1-\delta\lambda)W_1}{\delta\lambda} \qquad (14)$$

For both the firm and the intermediary to have no incentive to collude we require

$$(1-\alpha)(1-\delta\lambda)(W_1 - H_1) < H_1 - (1-\delta\lambda)W_1$$

$$\text{or } W_1 < H_1\frac{1+(1-\alpha)(1-\delta\lambda)}{(2-\alpha)(1-\delta\lambda)} \qquad (15)$$

[7] This presumes that they are not caught by the warning signal, at least in Zone 2. If collusion takes place ex-post, only firms which have successfully cheated, eluding damage from the early signal, can collude.

Noting that the coefficient of $H_1$ in (15) exceeds 1, we can see that it is possible to satisfy (15) even though $H_1 < W_1$. Moreover the factor is increasing in $\delta$, in $\lambda$ and in α which implies that the higher the discount rate and the longer lived the intermediary, and the higher the proportion of honest firms**,** the more likely is it that neither party has an incentive to collude. However, we note that collusion will not take place unless *both* parties are willing.

*Extortion*

We next consider the intermediary's propensity for "extortion". Can the intermediary threaten to falsely blacklist a client firm, extorting exorbitant fees not to do so? Such a threat lacks credibility. Should the client refuse to pay, it will not be in the interest of the auditor to implement his threat: if he does, he gains nothing, but loses the patronage of his client for the rest of his life. He may also acquire a bad reputation and lose other clients in consequence; and he runs the risk of being so exposed that he loses the trust of investors and, consequently, his entire clientele. Since the client firm knows that the auditor's threat is hollow, it would ignore the threat if it is made. Therefore, it will not be made. Extortion has no role in a subgame-perfect equilibrium[8].

Whether the auditor attempts to extort from a single client, or *collectively* from his entire clientele, one might argue that he has an incentive to implement his threat : if he does, he can establish a reputation as an extortionist who means business. However, such a reputation can affect the firms' decisions only in the next period, and since firms have a choice at the commencement of the next period of dismissing him, they will do so – especially because such a reputation deters not only firms but also investors from reposing their confidence in him. In this sense the possibilities of extortion by auditors are far more limited than those

[8] This assumes that the intermediary has no power to extract payment by force, or to make credible threats to do so.

of extortion by the mafia, who do not permit their clients the luxury of withdrawal from the relationship.

*Intermediation and the Domain of Honesty*

Now we ask in what zones of Figure 2, intermediation, subject to condition (13) – the conditions needed to rule out the intermediary's propensities to engage in collusion – would result in cheating being replaced by honest equilibria. In Zone 1, opportunistic firms find that if they do not hire an intermediary, investors believe that they are cheats and avoid them, so they get a payoff of 0. However, such a firm can hire an intermediary for one period, cheat and then dismiss the intermediary. This is because its old investors are locked in for eternity by high withdrawal costs (in this region) and in later periods the firm retains these investors and can save on the intermediary's fee by dismissing the intermediary. Note that these investors cannot withdraw in response to an early signal either. Thus, in this region the firm's payoff to hiring an intermediary and then cheating, is $\frac{W_1}{1-\delta}$-F. This is greater than its payoff from hiring an intermediary and playing honest, $\frac{H_1-F}{1-\delta}$, as $W_1 > H_1$ and $\delta < 1$. Thus the firm would cheat and no honest Nash equilibrium can be sustained in Zone 1. Investors also know this and in this range of parameters would attach no importance to the hiring of an auditor. The firms, knowing this, will not hire an auditor. A cheating equilibrium does not of course require intermediation.

In contrast, in the lower part of Zone 2, the introduction of intermediaries (who behave honestly given condition (13) ) can result in cheating being replaced by an honest equilibrium. As old investors are not locked in in this region, we merely require that the option of hiring an intermediary, then cheating and receiving the continuation payoff of a cheat, be less profitable than being honest and paying the intermediary. We can easily verify that this corresponds to condition (12) (in the proof of Proposition 3) holding. The option of not hiring an intermediary gives a payoff of zero, as before, and so is not adopted either.

All this leads to the following proposition[9] :

*Proposition 3* : Subject to conditions (12) and (13), the introduction of intermediation can lead to the replacement of cheating equilibrium in the lower part of Zone 2 (the region defined by inequalities (3) and (7)) by an honest equilibrium in which (a) all firms act honestly and engage the intermediary, (b) investors know this, always invest and reinvest each period, (c) there is no collusion or extortion.

*The Determination of Audit Fees*

How is the audit fee F determined? Inequalities (13) and (14) set lower and upper limits to F, outside which collusion is profitable[10]. Since these limits are defined in terms of the parameters of the system, the investor can figure out – if he knows the actual fee – whether the integrity of the audit can be relied upon. If the investor does not trust the intermediary, the firm has no incentive to hire him. It follows that outside the limits set by (13) and (14), there is no demand for the intermediary's services. F must lie within these limits, whatever the structure of the market in the audit industry. If there is intense competition among intermediaries, F will be driven down to the floor (13) while a monopolistic auditor (who can somehow rule out new entry) may be able to raise the fee to the ceiling (14).

*Some Implications*

We turn to a discussion of some implications. One major policy prescription which this work suggests is mandatory disclosure of audit fees, backed by heavy penalties for false disclosure. As explained in the previous

[9] As this proposition summarizes results we have argued through already, we do not offer a separate proof to avoid repetition.

paragraph, with mandatory disclosure investors can actually check whether the conditions for credible and effective auditing hold. This is because, for parameter ranges in the lower part of Zone 2 (with low accuracy of the warning signal, but also relatively low values of withdrawal costs), auditing will be credible if audit fees lie in a certain range (defined by (13) and (14)). So mandatory disclosure will guarantee the achievement of an honest equilibrium with auditing, which is a much stronger statement than saying that such an equilibrium *could* be supported given conditions (13) and (14). Heavy penalties for false disclosure are however necessary to rule out misrepresentation of the audit fee.

We have already discussed the intermediary's non-monotone reaction to improvements in transparency, favoring these at first and then opposing them. Now we consider measures to some extent incorporated in the Sarbanes-Oxley recommendations, such as the separation of audit from non audit activities, and the rotation of the clients of an auditor. By limiting the scope of bribing auditors, the separation of audit and non-audit activities has the effect of ensuring that even if the conditions for no collusion are not satisfied, a wealth constraint prevents the firm from colluding with the intermediary. That is, the two parties may be unable to collude, even if they wish to.

Another policy measure of interest is the stipulation that an intermediary must rotate its clients. Proponents of this measure argue that this will ensure that intermediaries and firms do not have enough time to build up networks which could make collusion easy. Opponents may argue that if the length of the intermediary's business relationship with a particular firm is shortened, it has more incentive to extort from that firm (as it in any case it knows that the firm cannot patronize it far into the future). Our analysis shows that the latter argument is not valid. Extortion by intermediaries is not sustainable. Nonetheless, a short length of business relationship would also tend to increase the intermediary's incentives to collude, particularly if information about such behavior spread relatively slowly (that is, if q – which we have taken to be 1, for simplicity – were small) as in this case a colluding auditor would have less to lose.[11]

## 6. Intermediaries hired by Investors

What if the intermediary were paid, not by firms, but by a consortium of investors in exchange for supplying information about firms? Indeed credit rating agencies, prior to their current system of publicly releasing ratings of firms listed with them, used to charge investors for privately revealing information about specific firms these investors were interested in. One problem with this that many have pointed out concerns appropriability. It is easy for an individual investor who obtains the information from the intermediary, to pass it on to many others who do not have to pay the intermediary, therefore the intermediary is in effect able to appropriate only a small fraction of the total gains generated by the information it has supplied. This is owing to the public good character of information. Of course free rider problems are associated with this situation as no one investor may be willing to internalize the externalities of bearing the entire cost of paying the full value of the information. To circumvent these issues to some extent, we do not assume that individual investors seek and pay for information, but rather that the intermediary sells information to a consortium of investors, who are all interested in the same firm.

Assuming (we will check the conditions for this to hold later) that if investors are customers of the intermediary, this induces honesty among firms, the investors get $\frac{H_2}{1-\delta}$ if they become customers of the intermediary, regardless of whether they deal with firms of honest or opportunistic type. On the other hand if they do not become customers, their payoffs are the following:

(a)In Zone 1,

[11] These possible adverse effects of frequent rotation of an auditor's clients may help explain the results of some empirical studies on auditor tenure – for example, Iyer and Rama (2004) find that short auditor tenures adversely affect audit quality, while Lee (2003) finds that short tenures have an adverse impact by increasing the manager's accounting discretion.

$$V_2^1 = \frac{\alpha H_2 + (1-\alpha)L_2}{1-\delta}$$

so investors are willing to pay up to the limit

$$F^* = \frac{(1-\alpha)(H_2 - L_2)}{1-\delta}$$

(b)In Zone 2, for $\pi < \pi^*$,

they get (without intermediation) a payoff of

$$V_2^2 = \frac{1}{1-\delta(1-\alpha)}[\frac{\alpha H_2}{1-\delta} - (1-\alpha)Z + (1-\alpha)(1-\pi)L_2],$$

so investors are willing to pay up to

$$F^{**} = \frac{(1-\alpha)}{1-\delta(1-\alpha)}[H_2 + Z - (1-\pi)L_2]$$

Here

$$\frac{\partial F^{**}}{\partial \pi} = \frac{(1-\alpha)}{1-\delta(1-\alpha)} L_2 < 0$$

so F** is decreasing in $\pi$.

Here the intermediaries dislike transparency. Not only is it the case that for high levels of transparency ($\pi > \pi^*$) their services are not needed, but even for lower levels of $\pi$, in Zone 2, the ceiling on their fee is decreasing in transparency . The intuition is that for an informative warning signal the investors' outside option to not hiring intermediaries pays better and so the investors' bargaining position vis a vis the intermediaries is strong for high levels of transparency. We may also note that similar to the case of firm-hired intermediaries, these intermediaries will also be ineffective in Zone 1, as by the time they detect cheating, the old investors will already be “locked in” by high withdrawal costs. Therefore intermediaries are in demand only when parameters correspond to the cheating zone in Zone 2. Hence these intermediaries' preferences over withdrawal costs as well as transparency are decreasing.

This is illustrated in Figure 2 which shows how F** varies with $\pi$ for a given level of Z. The downward sloping curve shows how the cap on the fee diminishes with transparency for a given Z in Zone 2. Beyond $\pi^*$ the fee is zero as the intermediary is not needed.

It remains to check under what conditions the firms will act honest, once they know that investors are paying the intermediary. We have already pointed out that this will not happen in Zone 1. In the lower part of Zone 2, the maximum one shot gains they could get by cheating are $W_1 - H_1$. On the other hand, as the intermediary will provide information about its cheating to investors, it will get 0 in the future and will lose its payoff of $H_1$ every period which it would have got if it had acted honestly – except in the event that the intermediary does not survive to tell the tale. Therefore the no deviation condition is

$$W_1 - H_1 < \frac{\delta\lambda}{1-\delta\lambda} H_1$$

$$\Leftrightarrow (1-\delta\lambda)W_1 < H_1 \tag{16}$$

So intermediation will be effective for a sufficiently high discount factor( if the firm cares sufficiently about the future), or for a sufficiently long-lived intermediary.

Can the intermediary double cross its customers (the investors) by accepting a side payment from firms in return for which it supplies its customers with false information about the firm? The intermediary, after being hired by the investors, investigates the firm's past performance and reports to its clients in time for them to decide on their next period's investments. Double-crossing is feasible if the intermediary and the firm can negotiate secretly between the hiring and the submission of the report on a side payment to be synchronized with this submission. Should they choose to do so, investors act on this report (presumably favorable) and invest. At the end of the period, they observe the outcome and decide whether or not to renew their contract with the intermediary and their investment in the firm.

If there has been double-crossing, the investors find out in the next period with probability q (here assumed to be 1 as in the previous section) that they have been cheated, and in all future periods they refrain from patronizing the intermediary. The intermediary can extract a maximum bribe of $W_1 - H_1$ from the cheating firms (this is the case in which it extorts their entire cheating gains as a bribe). However for all future periods it loses its fee F with probability q (=1). Therefore the no double crossing condition is:

$$W_1 - H_1 < \frac{\delta\lambda}{1-\delta\lambda} F$$

$$\text{or } F > \frac{1-\delta\lambda}{\delta\lambda}(W_1 - H_1) \qquad (17)$$

This is very similar to the intermediary's no collusion condition (13) in the case when intermediaries are paid by firms, except for the honesty parameter in (13) and the fact that the fee F represents different things in the two constraints. (17) should have a term indicating the size of the consortium employing the intermediary (to show that it stands to lose fees from its entire clientele). Purely to economize on the use of symbols we treat this here as having a unit measure. Condition (17) is easier to satisfy for a long lived intermediary, and for low levels of public transparency (as the intermediary's fee is decreasing in $\pi$). In the setup considered here, however, while analyzing the implications of policy measures such as the separation of audit and non audit activities and the compulsory rotation of clients, one has to remember that the clients are now investors. Therefore, these measures cannot be considered relevant to this setup, for where the intermediary performs services (auditing or other) for firms, the firms are its customers. On the other hand policies which could have restricted the firms' ability to bribe the intermediaries would still have worked but would be more difficult to enforce as the firms were not the intermediary's customers. Another interesting issue is the benefits of greater public transparency, to which intermediaries exhibit a different attitude than in the case where they were paid by firms. We also notice that in this case investors face a tradeoff - initially better transparency translates into a lower fee to be paid to intermediaries, but on the other hand, sufficiently low fees in turn may create an incentive for the intermediary to double cross the investors (unless the intermediaries operate in a very sheltered market and hence have a long lifespan). Of course, if transparency improves to the extent that $\pi > \pi^*$ investors no longer have to hire intermediaries.

**7. Public Observability of Payoffs**

Up to this point, we have assumed that the fact of cheating by any firm is private information for the investors in that particular firm. How does the analysis change if cheating becomes publicly known, whether because of the early warning signal or because outcomes are common knowledge?

In Zone 1, where investors are locked in by high withdrawal costs, there will be no change. The firm will acquire a bad reputation after cheating for one period and will not be able to attract fresh investors. But since its old investors cannot withdraw, it does not need fresh investment.

In Zone 2, however, the picture changes. Investors can depart the cheating firm, possibly after being warned by the early signal, most certainly after the announcement of outcomes; and there will be no fresh investment. The continuation payoff of the cheat after the first period is 0. Cheating is therefore a transient indulgence. Its single-period reward is $(1-\pi)W_1$ (taking into account that the cheat is not prematurely exposed by the early warning signal). The opportunist firm compares this with the payoff from being honest for ever $\frac{H_1}{1-\delta}$.

It cheats if and only if

$$\pi < \pi^{**} = 1 - \frac{H_1}{(1-\delta)W_1}.$$

Since $\pi^{**} < \pi^*$, cheating will occur for a narrower range of parameters when it gets to be publicly known. If $\pi^{**}<0$, cheating will not occur at all. We note that $\pi^{**}<0$ is equivalent to

$$(1-\delta)W_1 < H_1 \qquad (18)$$

Comparing (18) with (16), we see that (18) will always hold if (16) does. Thus if an investor-hired intermediary (irrespective of its lifespan) were to be effective in deterring cheating in a situation where payoffs were not common knowledge, then there would never be any cheating if payoffs *were* common knowledge.

Common knowledge of cheating eliminates any role for the auditor. The auditor's only function was to convey to the public at large the fact of cheating with a one period lag – this too with limited reliability because of the possibility of collusion and the limited lifespan of the auditor. This function is now rendered superfluous. We should note that this strong result is obtained only because in this simple model, being able to observe payoffs can indicate to the investors for certain whether cheating has taken place.

## 8. Conclusion

This paper has shown how a one sided prisoners' dilemma between firms and investors could lead to different steady states depending on the accuracy of publicly observable signals and the costs of withdrawing funds. It has shown conditions under which one sided intermediation could lead to equilibria where the firms act honestly. It has also examined incentives for the firm and the intermediary to collude. It turns out that in the current setup where firms pay intermediaries, credible intermediation can be achieved in some parameter ranges where cheating equilibria would have prevailed in an intermediary's absence - provided audit fees lie within a certain range. Moreover, this would be guaranteed if audit fee disclosure were made mandatory, with heavy penalties for false disclosure. We find that firm-hired intermediaries like greater transparency (more informative public signals) but only to a certain extent, and firms tend to dislike transparency, as do intermediaries hired by investor consortia. It also appears that longer lived intermediaries are less prone to collude, which is an indirect benefit of the low level of competition among intermediaries in today's markets. We discuss the implications of measures designed to prevent collusion, such as the separation of audit and non audit activities and compulsory rotation of auditing companies' clients. We explain why the latter measure may entail costs, not just benefits. For investors hiring an intermediary, improvements in transparency constitute a mixed blessing, as long as intermediaries still have to be hired. While the improvements reduce the fees investors have to pay, they also increase the risk of being double-crossed.

Closely related issues include the analysis of the effects of requiring top level managers to sign statements certifying that they have verified the internal accounting of their firms. Will this have the desired effect? If the managers discount the future heavily they may prefer to collude with others inside the firm and reap large one time gains, despite the threat to their career in the future. Again reputation effects, this time with regard to the reputation of the manager, would play an important role. Other ways in which the model could be extended to incorporate intra firm interactions include the fact that while we have modeled the benefits to collusion as monetary, they could be power related. For instance, interlocking directorships between firms and auditors or investment bankers could mean that an auditor might furnish a false good report on a firm in exchange for the firm executives' influence on making top level hiring or promotional decisions as part of the auditing firm's board of directors. Rigorously modeling these intra firm interactions are however beyond the scope of this present paper.

## Appendix

We now consider the case where (1) does not hold, ie it is better not to invest than to invest and never withdraw even when one receives proof of cheating either by an early signal or by observation of the outcome. This could be so either because the proportion of intrinsically honest types is low or because the payoff even in times of honesty is not high enough to result in an ex ante positive expected value. Now strategy 1 is no longer a profitable strategy. As for strategy 2, we need the following profitability condition:

$$V_2^2 > 0$$

$$\Rightarrow Z < \frac{\alpha H_2}{(1-\delta)(1-\alpha)} + (1-\pi)L_2 \qquad \text{(A1)}$$

In Appendix Figure 1 strategy 2 is the preferred strategy to the left of the non-negativity condition (A1) as it is the only profitable strategy : to the right of (A1), strategy 2 is no longer profitable, therefore there is no investment. Thus in this case investors either follow strategy 2 (of withdrawing after realization of a bad outcome, even if the public signal had not detected cheating) for very low withdrawal costs while otherwise they do not invest.

The analysis of the firms' responses is the same as in the text though now as strategy 1 is eliminated, there is no zone where (opportunistic) firms always cheat, irrespective of $\pi$. For areas where strategy 2 is played, firms are honest only if $\pi$ lies above $\pi^*$, otherwise they cheat. As in the text intermediation could result in an honest equilibrium in this region if (12) and (13) hold.

**References**:


Barkess, L and R. Simnett (1994) : " The pricing of other services by auditors : independence and pricing issues", *Accounting and Business Research*, 24 : 91-108.

Campbell, Tim S. and William A. Kracaw (1980):"Information Production, Market Signaling and the Theory of Financial Intermediation", *Journal of Finance*, 35: 863-882.

Craswell, A, D Stokes and J Laughton (2002) : "Auditor Independence and Fee Dependence", *Journal of Accounting and Economics*, 33(2) : 253-275.

Diamond, Douglas (1991):"Monitoring and Reputation: the Choice Between Bank Loans and Directly Placed Debt" *Journal of Political Economy*, 99: 689-721.

Diamond, Douglas and Raghuram Rajan (2001):"Liquidity risk, liquidity creation and financial fragility", *Journal of Political Economy*, 109: 287-328.

Dixit, Avinash (2003):" On Modes of Economic Governance" , *Econometrica*, 71: 449-481.

Greif, A.(1996): "Contracting, Enforcement and Efficiency: Economics Beyond the Law", *Annual World Bank Conference on Development Economics*, 239-265.

Greif, A. (1991), "Contract Enforceability and Economic Institutions in Early Trade: the Maghribi Traders' Coalition", *American Economic Review*, 83(3) :525-48.

Iyer, V.M and Rama, D.V (2004) : "Clients' Expectations on Audit Judgments : A Note", *Behavioral Research in Accounting*, 16: 63-74.

Lee, Ho Young (2003) : "The Role of Audit Committee Independence, Auditor Tenure and their Interaction on Managers' Accounting Discretion", *Journal of Applied Business Research*, 19(4) : 1-13.

Ramey, Garey and Joel Watson(2002):"Contractual Intermediaries", *Journal of Law, Economics and Organization*, 18: 362-384.

Wines, G (1994) : "Auditor Independence, audit qualifications and the provision of non-audit services : A Note", *Accounting and Finance*, 34(1) : 75-86.

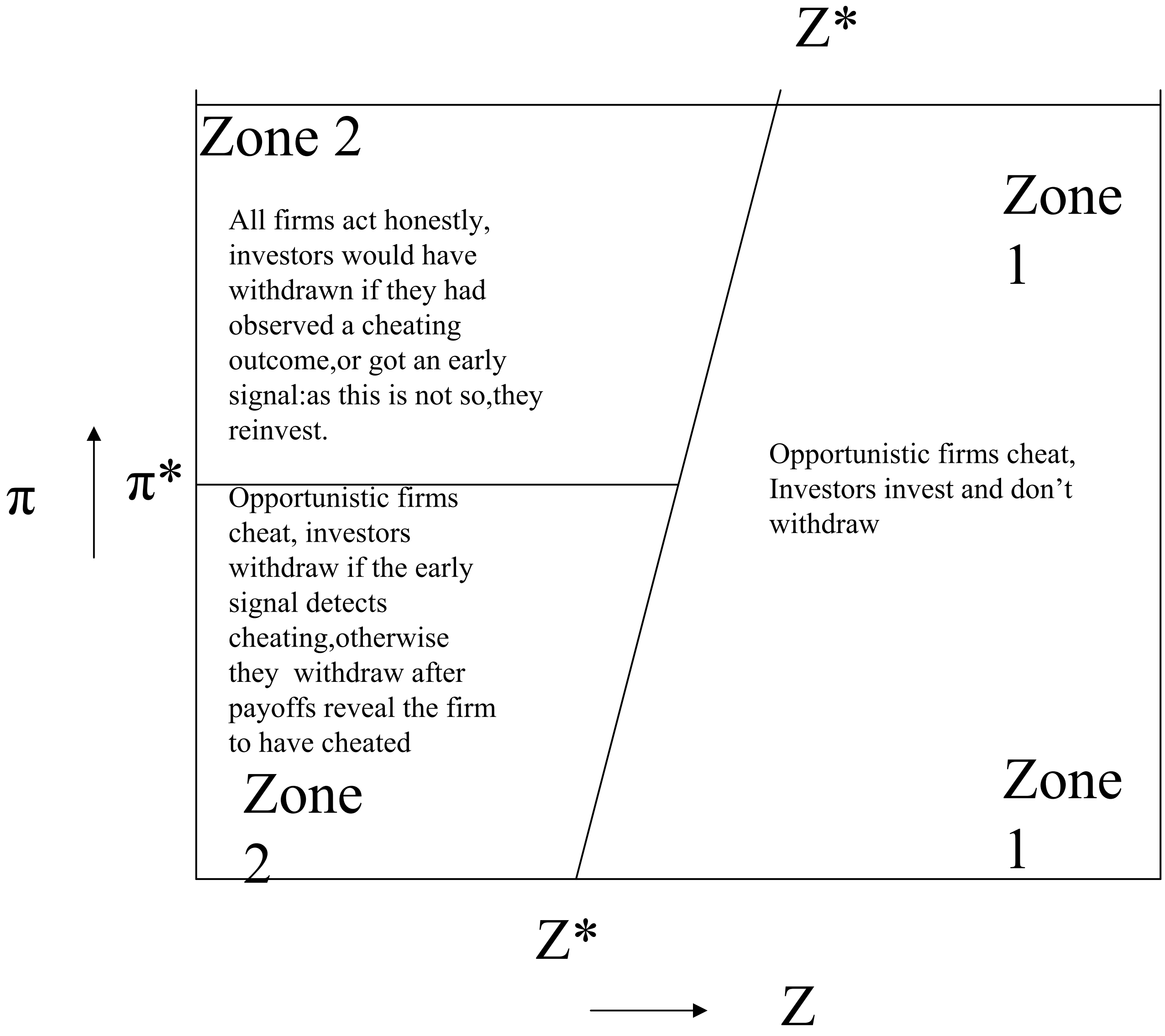
Z*
Zone 2
All firms act honestly, investors would have withdrawn if they had observed a cheating outcome,or got an early signal:as this is not so,they reinvest.
Zone 1
π
π*
Opportunistic firms cheat, Investors invest and don't withdraw
Opportunistic firms cheat, investors withdraw if the early signal detects cheating,otherwise they withdraw after payoffs reveal the firm to have cheated
Zone 2
Zone 1
Z*
Z

**Figure 1**

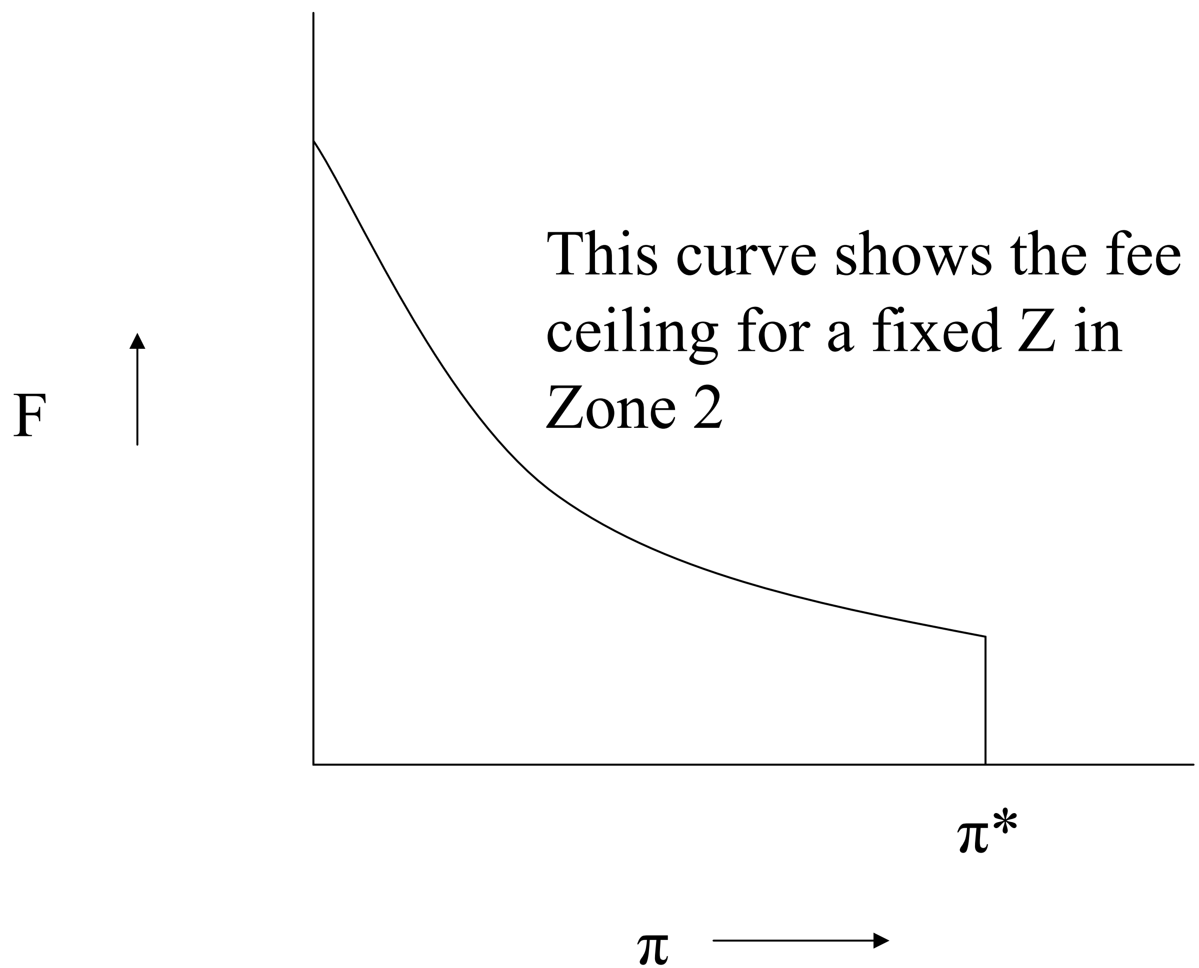


Figure 2