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Does Mandatory Rotation Enhance Auditor Independence?*

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1. Introduction

The issue whether auditors should be required to be replaced at regular intervals seems to be a recurring topic in discussions about regulating the auditing industry. The debate about such a law also known as *Mandatory Rotation* has received considerable attention by professionals and in public debates. Especially in Europe the radical step of requiring the audit firm to be replaced at a regular interval has been discussed frequently.[1] Such a form of Mandatory Rotation has even been enforced in Italy and it used to be enforced in Spain and Greece until recently (Arruñada and Paz Arres (1997)). In Germany the debate about auditor rotation has been popular since many years and has gained momentum recently due to financial scandals (See Richter (1975), Leffson (1988), Herzig and Watrin (1995) and Arruñada and Paz Arres (1997)). The auditing industry has been opposed to rotation and numerous bodies and studies that have dealt with the issue took a critical view. (See Arruñada and Paz Arrez (1997), p 57 for an overview). It has also been discussed to include provisions about auditor rotation in the European Unions Fifth Directive on Company Law though a Green Paper issued by the European Comission (See European Comission (1996)) asserts that *"... the arguments in favor of such a system (i.e. mandatory rotation) are not conclusive."* Thus these differences of opinion show that there has not been reached a consensus about the rotation issue yet.

The proponents of Mandatory Rotation have been concerned that an auditor is able to earn quasi-rents from a long term audit engagement. (De Ange-

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[1] For comprehensive and exhaustive overview of all the relevant sources of this debate see Arruñada and Paz Arres 1997, especially the introduction as well as p 57, footnote 76.

lo (1981a), (1981b)). These quasi-rents are generated by a cost advantage over potential auditors that might replace him. An incumbent auditor has already incurred start-up costs at an initial audit that potential replacements have not yet incurred and has already accumulated experience that potential replacements still have to acquire. These quasi-rents-according to the conventional argument – give the client a possibility to threat the auditor in negotiations over what opinion the auditor will attest to. This undermines the auditor's independence. If the capital market understands that an auditor's statement will lack credibility financing costs will increase. Rotation is supposed to release an auditor from this form of client's pressure and thereby to enhance it's independence. It is hoped that, as a consequence, there is a beneficial effect of a rotation rule for investors via lower financing costs.

In this paper we try to analyze the idea that mandatory rotation can enhance auditor independence systematically within the framework of a stylized game theoretic model. The main result of the paper is that in a world where the public can learn whether an auditor is trustworthy or not regulation by a rotation rule may not be needed and can even impair auditor independence rather than enhancing it. By destroying quasi-rents from an ongoing relation mandatory rotation undermines the incentives for building up a reputation for independence.

1.1 An Overview of the Model

We describe the relation between auditors their clients and the capital market as an extensive form game with imperfect information. We consider a two period model with two types of audit clients: Firms with safe and firms with risky projects. Funding of any project requires external capital in the form of borrowing. If it were publicly known that a project was safe, the interest rate on the loan would be lower than were it known to be risky. But since a projects' riskiness is not public information there is a problem of adverse selection. To improve this situation there is a regime of compulsory auditing and the function of audit firms is to investigate the riskiness of projects and make the results of the investigation public. Firms thus have an incentive to persuade an auditor to assert that a project is safe to lower financing costs. Auditors are of two types. There are independent auditors who would never give in to a client's pressure whatever incentives a client might offer and there are opportunistic auditors who simply make a cost benefit analysis when deciding whether to compromise their report.

Since reports about safe projects are not in need of and are never subject to compromise by any auditor a critical situation arises only when an oppor-

tunistic auditor investigates a risky project. The report of an opportunistic auditor depends upon the following trade-off. If he agrees to issue a report that the project is safe, then the client shares some of the immediate interest savings accruing to this more favorable report but the auditor runs the risk of having the project's returns turn out badly and consequently damaging his reputation by being revealed as an opportunistic auditor. This outcome is a problem for the auditor because it forces the client to replace the auditor in the next period. He therefore forgoes whatever cost advantages he had over a potential future successor as well as possible future gains from compromising a report. The client in his replacement decisions is restricted by the capital market because the reputation of an auditor influences future costs of a loan. Furthermore the fact whether a mandate is continued or terminated might reveal further information about the financial situation of the client.

The main results derived in this framework are that if audit engagements last for both periods then all equilibria entail that opportunistic auditors report risky projects as risky with a positive probability in the first period of the engagement. If the audit mandate lasted however only for one period then all equilibria entail opportunistic auditors to report risky projects as safe in the first period. As a consequence auditors are less independent in short than in long term engagements and a rotation rule might have adverse effects on auditor independence.

This result is in contrast to the view held by the proponents of mandatory rotation. Proponents of rotation rules seem to think about financial auditing of a firm in the same way as about internal auditing in a hierarchical organization. But the crucial aspect that the rotation argument fails to take into account is a specific feature of the client-auditor-investor relationship as pointed out by Wilson: The auditor works for the client but his reputation for independence is in the capital market. This feeds back on the value the auditor has for the client (Wilson 1983). The outside capital market imposes restrictions on the auditor-client relationship. If the continued relationship creates publicly observable events that lead to a reassessment of the auditor's credibility by rational investors the existence of quasi-rents provides an incentive for independence which is damaged by mandatory rotation rules.

1.2 Related Research

If one tries to look for answers to the rotation debate in the theoretical literature on auditing there are some difficulties to find models that are suitable for the issues at stake. A large part of auditing models is set up in a Prin-

cipal-Agent framework that is designed mainly to address the role played by auditors in the process of enforcement and internal control in organizations. Prominent papers in this literature are, among others, Baron and Besanko (1984), Border and Sobel (1987), Mookherjee and Png (1989) in the context of regulation and tax enforcement, or Antle (1982, 1984), Baiman, Evans and Noel (1987) in the context of accounting. These models are not directly suitable to address the mandatory rotation issue because this problem requires a framework describing the interaction of an external auditor and his client with an outside capital market. There are several papers discussing such market models of auditing. Two important papers by DeAngelo (1981a, 1981b) have stimulated the academic debate about auditor markets. The focus of DeAngelos work was an analysis of the practice to offer initial audits at a price below marginal costs (low balling) on auditor independence. In DeAngelo (1981b) the relation between audit firm size and audit quality is discussed. This paper contains arguments on reputational influences on audit quality, which are similar to the basic elements of the model presented in this paper. Wilson (1983) also outlined some important ideas about how one could think fruitfully about auditor markets by modelling the interaction between audit firms, clients and the capital market focussing on reputations. However, neither the papers by DeAngelo (1981a, 1981b), nor the paper by Wilson (1983) provide an explicit model of reputation formation in an auditor-client-capital market context. An important market model of auditing is Melumad and Thoman (1990), who investigate auditor markets in a world of adverse selection. Their model does not describe reputation formation and excludes the possibility of collusive manipulation of financial statements, which is needed to discuss the mandatory rotation debate. Our model builds on these contributions by Melumad and Thoman (1990) as well as DeAngelo (1981b) and Wilson (1983). There are two papers by Dye (1991) and Theo (1992), which are directly relevant for the rotation issue because they provide detailed and rigorous models of market reactions to a client's decisions of replacing an auditor. This allows to analyze a crucial aspect of the debate. However, their models do not directly discuss the issues of reputation for independence and collusion that are the focus of our paper. Since these papers have a richer analysis of market reactions to auditor replacement decisions, they provide complementary and important additional aspects to the arguments put forward here. Reputation formation in our paper is modelled in the traditional approach of the game theoretic literature (Kreps and Wilson (1982), Milgrom and Roberts (1982)). We also borrow from models of credibility, in particular from Sobel (1985), Benabou and Laroque (1992) as well as Diamond (1989). The formal analysis of reputation formation used in our model borrows mainly from the paper by Benabou and Laroque (1992). Our model is also related to a paper from the litera-

ture on Investment Banking by Chemmanur and Fulghieri (1994) who apply a reputation story to the evaluation of firms by investment banks.

There are some recent papers directly contributing to the academic debate about mandatory rotation. The most comprehensive discussion of the rotation issue is Arruñada and Paz-Ares (1997). These authors provide a detailed overview of the debate and analyze the various aspects of auditor rotation partly using a formal model of an auditor's decision. In particular they discuss the costs of rotation, the impact on the competitive structure of the auditing industry, the effects on audit quality and auditor independence. In their discussion of the effects on independence they are making a point related to the main results or this paper. The reduction of quasi-rents induced by a rotation rule impairs auditor independence. (See Arruñada and Paz-Ares (1997)). The main result of this paper is in line with this view. A similar argument is made by Sen and Geitzman (1997) in a game-theoretic framework. These authors stress possible adverse effects of a rotation rule on auditor independence via the effects on reputation. In contrast to the present paper, they don't provide a full model of reputation formation but refer to reputation effects only indirectly. They also relate the effectiveness of such a rule to the competitiveness of the auditor market.

The first game theoretic model of mandatory rotation (and also the paper most closely related to ours) is De Palma and Deneckere (1995). In this paper the authors demonstrate that mandatory rotation can have a detrimental impact on an auditor's ability to resist client pressure by lowering the auditor's future profits and thereby his incentive to build up and maintain a reputation for independence. They analyze an auditor's trade off between gains of collusion from a compromised report and the loss of reputation for independence among investors. Auditor rotation creates additional switching costs, making reputation less valuable, and therefore possibly compromising independence. This result is similar to the main result emphasized in this paper. However in the details of their model DePalma and Deneckere (1995) relate their analysis mainly to collusion gains, audit firm size and switching costs. In contrast our paper puts the incentive effects of quasi-rents earned by an incumbent auditor to the center of the debate. So both papers – though coming to a similar conclusion – suggest different details to look at in deciding the practical question whether a rotation rule is a good or bad idea for enhancing auditor independence.[2]

[2] I did not become aware of De Palma and Deneckere's (1995) paper until after the research for my paper had been completed. However, during formatory stages of my research, I had the opportunity of reading the NSF research proposal by Deneckere (1996). This proposal verbally describes a model along the lines of De Palma and Deneckere (1995), and contains the conjecture that mandatory rotation can have a detrimental impact on auditor independence via its effect on the incentives for building up a reputation for independence in an outside capital market.

Finally Herzig and Watrin (1995) give a general discussion of auditor rotation with a special focus on the debate in Germany where the idea of introducing a rotation rule has been quite popular. Using arguments based on Agency-Theory these authors oppose mandatory rotation as a regulatory policy for the auditing industry.[3]

It should be pointed out that the main argument of our paper is in line with a different literature on the role of markets in enforcing contractual performance (Klein and Leffler (1981)). The idea of reputations providing incentives for contract performance without any third party enforcer goes at least back to Hayek (1948)[4] and Marshall (1949) and appears also in the more recent literature. Klein and Leffler (1981) examine the conditions under which a repeated purchase mechanism together with persisting rents can guarantee contractual performance without any third party enforcement. In the light of this literature the central idea of the paper can also be interpreted as an application of this kind of reasoning to the recent debate about the question whether mandatory rotation is a good or a bad idea to enhance auditor independence.

The paper is organized as follows. Section 2 describes the model and discusses the various assumptions underlying it. Section 3 analyzes sequential equilibria of the game when it is played only once. This analysis generates some important results relevant to the problem of repeated interaction and gives us some insights how a continued relation changes the interaction between the players. Section 4 analyzes sequential equilibria of the game when it is repeated. This section contains the basic argument how reputation for independence works. Section 5 analyzes the effects of mandatory rotation on auditor independence and discusses implications for the regulatory debate. Section 6 concludes. Proofs are in the appendix.

2. The Model

2.1 Borrowers, Auditors and the Capital Market

We consider an extensive form game between borrowers, auditors and a capital market. The game has an intertemporal structure. The details of this

[3] In Germany the rotation debate is also taken up in a popular textbook on Auditing. See Leffson (1988).

[4] In Chapter V, p. 97 Hayek writes: "... In actual life the fact that our inadequate knowledge of the available commodities or services is made up for by our experience with the persons and firms supplying them – that competition is in a large measure competition for reputation and good will – is one of the most important facts to solve our daily problems. The function of competition is here precisely to tell us who will serve us well ..." See also Klein and Leffler (1981), Williamson (1979), Klein (1980).

structure are described after we have explained how the players are characterized by preferences, endowments and technologies they can use.

2.1.1 *The Capital Market*

The capital market is modelled as an infinite number of potential investors who receive an endowment of inputs in each period. Lenders are risk neutral. They have access to a constant returns to scale technology that enables them to store the endowment within a period to convert it into one unit of a consumption good per unit of endowment input at the period's end. Within a period the endowment can also be used as an input to an investment project described below. Lenders must either store or invest their endowment and we assume that the aggregate endowment exceeds in each period the total amount of inputs that can be utilized by all available projects. Lenders in this model are assumed to represent an anonymous capital market rather than a bank or a financial institution.[5]

2.1.2 *Borrowers*

There is a finite number of risk neutral borrowers or entrepreneurs who neither receive an endowment nor do they have access to the storage technology. They have access to an investment project in each period p. An investment project requires one unit of the input to yield a random payoff $\widetilde{X_p}$ at the end of the period. We assume that there are two states of the world and two possible types of projects. A project can be either risky or safe. The project's risk status is private information of the borrowers and a project is risky with probability 1/2 in each period.[6] If the project is risky it yields in one state a cash flow that is just sufficient to pay the auditor but not to pay back the loan. This state occurs for a risky project with a known probability $b \in (0,1)$ in each period. If the project is safe the cash flow is in both states of the world high enough to meet all obligations.[7] Borrowers can acquire

[5] This modelling approach is common in the literature and in the version here follows Diamond (1989).

[6] This probability need not be one half and our results do not depend on this particular prior. Assuming 1/2 puts a bit of symmetry into the model that makes formulas nicer and the paper more readable.

[7] This assumption is not necessary but should be thought of as a simplification of the model because it avoids a proliferation of different cases that are not crucial to the argument. It specifies the default state in a very simple and convenient way. In case of a default the auditor has priority and can always be repaid, so we don't have to worry about cases where the auditor can not be paid. The decisive point here is that there is a project with a risky payoff for the lenders. For convenience we choose a very simple stylized stochastic setup that is able to describe this aspect.

the necessary funds from lenders by issuing standard debt contracts in each period.[8] A debt contract specifies an obligation to repay the borrowed amount plus interest, here denoted as $R_p(.)$, with the provision that the borrower defaults if his cash flow is not high enough to meet this obligation. We are considering a world with compulsory auditing.[9] Borrowers can not issue a debt contract if their financial statements are not approved by an external auditor. If lenders knew a project's risk, it would be straightforward to determine a competitive interest factor and risky projects would have higher financing costs. But due to imperfect information the interest factor is a function of the beliefs of lenders about the credibility of their available information. These beliefs will be described in detail below. For the moment let the belief in period p that a project is indeed risky after the auditor has declared it as risky be denoted by $\pi_p(.)$. Denote the belief that the project is actually safe after a safe report by $\mu_p(.)$. Then $R_p(\pi_p(.))$ is the interest factor charged if the market gets the message that the project is risky and $R_p(\mu_p(.))$ is the interest factor if the market believes that the project is safe.

It should be noted how describing the auditor's message as *"declaring a project as risky (safe)"* in the model is related to the practice of auditing. A real life situation is of course considerably more complex. In practice an auditor can issue a *qualification* stating clearly all the factors giving rise to a disagreement with a clients version of financial statements. When the auditor believes that the financial statements as a whole are misleading he is required to issue an *adverse opinion*. In the binary world of our model a qualification is the same as an adverse opinion and it is equivalent to directly declaring the risk status of the project.

To summarize, borrowers issue a standard debt contract to investors and ask the auditor to confirm that their project is actually safe. Auditors have to be hired on a market for auditors, which determines the fee for an audit, denoted by z_p. Though auditing is compulsory borrowers can decide in each period whether to maintain or replace the auditor by a new one from the auditor market. We adopt the assumption that clients can sign contracts with auditors for only one period because long term commitments are rarely observed in practice. One reason might be the fact that contracts that are contingent on the content of an audit report are prohibited (see Arens and

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[8] In practice of course firms are usually financed by debt and equity and not only the interests of creditors are affected by the auditor's statements and his credibility. There is, however, an argument in favor of modelling the rotation issues in a world with debt finance. One could argue that shareholders as a party holding property and decision rights in the firm are in principle always in the position to write contracts with the auditor that resolve some conflicts of interest which lenders can not (For the issue of incentive contracts with auditors, see Baiman et. al. (1989)).

[9] Most countries do have a regime of obligatory auditing for all firms beyond a certain scale.

Loebbecke 1991) and collusive side arrangements are not enforceable. With the lack of intertemporal commitment the option to replace the auditor is an important disciplinary device for the client.

The payoff of a borrower in each period p is either 0 in the case of a default or $Y_p \equiv X_p - R_p(.) - z_p$ otherwise, where $R_p(.)$ is the interest factor (face value plus interest) charged by the capital market and z_p is the auditor's fee.

Note that we have assumed that the expected return on any project, risky or safe, is positive independent of the interest rate charged. Besides considerations of simplifying the model this assumption is in line with the observation that in reality a firm is very rarely either driven out of business or denied credit because of an audit opinion. Transaction terms however are frequently affected by the auditor's report (see Melumad and Thoman 1990).[10]

2.1.3 Auditors

Auditors receive no endowment and their reservation utility is 0. There are always more auditors than clients so the auditor market is competitive. Each auditor has access to an audit technology. The technology gives a perfect signal about the true risk status of a project. Thus an audit always yields a correct result.[11]

We want to model a situation where the capital market is uncertain about the auditor's independence. The market has a prior probability t_0 that the auditor is independent. An independent auditor has preferences such that he will always report in accordance with his findings. He will never give in to any form of a client's pressure to accept another version of accounts than indicated by the results of the audit. With $(1 - t_0)$ the auditor is opportunistic and would be willing to give in to clients pressure if he has some advan-

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10 The assumption implies that in this model there is not really a welfare issue because from a social point of view all projects should be undertaken. The regulatory policy discussed here addresses the protection of creditors from manipulated audit opinions. At the cost of a more complex model the analysis could be extended to a case where either manipulated auditor statements lead to the realization of projects that are socially undesirable or lead to a situation where desirable projects are denied credit. In this case the lack of auditor independence would become a general welfare issue and not only a question of creditor protection.

11 This specification might seem rather extreme because in reality the signal received by an auditor is in general not perfect. The results of the model do, however, not depend on this specification but it leads to sharper predictions. For the purpose of the following discussion this assumption accentuates the learning possibilities of the market. An earlier version of the model worked with an imperfect technology. The analysis can be conducted along the same lines.

tage from manipulating a report. This approach of modelling reputation is standard in the literature since the seminal papers of Kreps and Wilson (1982) and Milgrom and Roberts (1982). We assume that the distribution of tough and opportunistic auditors in the auditor market is stationary in the sense that the distribution of types in the outside pool of potential auditors is in each period given by t_0 and $(1 - t_0)$.

The interpretation of independence can be behavioral. Independent auditors always would for some unspecified, not explicitly modelled reason comply with a certain standard of behavior, in this case to the standard of never giving in to client's pressure.[12] Another possibility is to interpret t_0 in terms of payoff uncertainty. Under most legal systems auditors face a threat of legal liability to third parties including creditors.[13] In this model we can imagine that creditors can sue an auditor for the failed detection of manipulated reports. Assume that only the auditor knows the probability with which he will escape a discovery. Then the market can not be sure whether the penalty is sufficient to deter manipulations. So this model can be interpreted as a situation allowing for legal liability of auditors but discovery probabilities are private information. With probability t_0 the detection risk will be high enough that the penalty deters misrepresentation and with $(1 - t_0)$ this will not be the case.

Initially auditors are hired at a flat fee z_0. Given the competitiveness of the market an initial audit is just priced at the marginal cost of an initial audit which for all auditors are equal to c so $z_0 = c$.[14]

We assume that an incumbent has cost savings in a follow up audit. So an incumbent's costs are $s < c$ and this fact is common knowledge. The assumption of decreased costs of a follow-up audit of the same client is based on the

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12 In reality the definition and scope of the notion of independence is more complex than modelled here. The approach taken does, however, describe in a stylized way the main aspects. The rules of professional conduct in the U.S., for instance, are written down in the AICPA. Rule 101 of AICPA describes independence. (A member in public practice shall be independent in the performance of professional services as required by standards promulgated by bodies designated by the council. Arens and Loebbecke 1991, p. 80). The Auditing Standards Board requires that rule 101 is applied to attestations and therefore applies to audits. In our model one can interpret auditors of type t as players always acting in accordance with the codes of professional conduct.

13 For discussion of liability issues including some significant cases, see Arens and Loebbecke (1991) p 116 fl.

14 In principle it is straightforward to derive such a uniform fee endogenously by assuming that the client has all the bargaining power in the market for initial audits and can make a take-it-or-leave-it offer to the auditor. What makes the argument however lengthy and more complicated here is that clients have private information and there are possibilities of signalling project risks via audit fee offers. In an earlier version of the paper we have shown with such a specification that *in equilibrium* initial audits will indeed be uniformly priced if we model the fee determination as a bargaining process where the client has all the bargaining power.

fact that the design of an efficient audit in accordance with GAAS[15] requires a lot of client-specific information that constitute higher costs in an initial audit. In practice initial auditors also have a considerable amount of fixed costs.[16] For simplicity this fixed cost component is assumed away here.[17] The cost savings of an incumbent create a gain that can be shared between the auditor and the client. How these gains will be shared is depending on the bargaining power of the participants. The model therefore shows the feature that incumbent auditors can acquire higher fees related to their reputation via sharing some of the gains from cost savings of a follow up audit. In the literature following DeAngelo 1981a it has often been pointed out that in equilibrium audit fees would be offered below marginal costs in the initial period. Note that in principle "low balling" could occur here but is not model by setting the initial fee equal to the marginal costs of an audit. As can be easily seen below given the linear payoff structure of the model, whether of not low balling occurs is not instrumental for our arguments and we can leave this aspect of pricing initial audits out for simplicity.

Some auditing models dealing with gains from incumbency assume that the incumbent auditor has *all* the bargaining power and can acquire these gains (De Angelo (1981) or Magee and Tseng (1990)). This assumption has been criticized as arbitrary (Dye (1991)). If the client had all the bargaining power an auditor would not be able to acquire these gains from incumbency. Kanodia and Mukherji (1994) have shown that even if *all* the bargaining power stays with the client the incumbent auditor is able to earn some rents provided there is asymmetric information about the true costs of the follow up audit. If the learning story is taken seriously this information asymmetry is a natural assumption.

For the purpose of the problem under discussion here we do not want to go into the bargaining, contracting and informational details that can leave some gains from incumbency with the auditor. We adopt a stylized and strongly simplified approach to model two aspects. First, the auditor market is competitive – i.e., the client is in a position to acquire at least some gains from a continued relation – and second, the strength of the auditor's position in sharing the benefits from an ongoing relation is tied to his reputation for independence in the capital market. An easy way to incorporate this idea into the model is the following. If the auditor's reputation for independence increases in the market and the client hires him again he can acquire some of the gains from incumbency. He can not acquire all of the gains but if his

15 Generally accepted auditing standards.

16 See Arruñada and Paz-Ares (1997) for some estimates.

17 A traditional argument against rotation has been that it is wasteful because fixed costs have to be incurred for every new audit. Our simplification implies that this argument can not occur in the model.

reputation is high his share will be higher. If his reputation stays constant or declines and the client does not replace him the client is able to acquire all of the gains from incumbency. Let us denote the share an auditor can have from the gains of incumbency by $\alpha(t)$, where $\alpha(t)$ is continuous and strictly increasing in t and

$$(1)\quad \alpha(t) = \begin{cases} 0 & \text{if auditor starts period 1 with non increased reputation} \\ 0 < a(t) < 1 & \text{if auditor starts period 1 with a strictly higher reputation} \end{cases}$$

For the description of auditors and their goals it remains to specify the advantages an opportunist can have from giving in to a client's pressure. We want to capture the idea that market manipulations by auditors can be described by some form of collusive behavior. This idea comes from the fact that, given the competitive capital market described above, gains from cheaper finance go entirely to the auditor and the client who can share this profit from manipulations. The auditor who gives in to a client's pressure, i.e., to the version that a risky project is safe, has an extra gain. We assume that this gain is proportional to what he actually achieves for a client. As with the gains from incumbency we model the gains from collusion in a simplifying, stylized way by assuming that the auditor can acquire a fixed share $0 < \gamma < 1$ of the gains a client has if he doesn't have to pay the higher financing costs for a risky project. The gain from collusion for an opportunistic auditor can be written as $\gamma(R_p(\pi_p(.)) - R_p(\mu_p(.))$. It is assumed that γ is agreed upon ex ante, i.e., before the state of the world occurs. So an auditor is able to realize the collusive gain only if the project does not default. Hence the client can always fulfill his budget constraint.

Gains from collusion can be interpreted in two ways. Either they describe a direct side payment, where γ is a sharing rule from the extra profit from cheaper finance. Another interpretation is suggested by the changed role of big auditing firms that are in many cases also in business as consulting firms (Stevens (1991)). In this case the gains from collusion to an auditor may be interpreted as the present value of a consultancy contract allocated to the auditor in exchange for a favorable audit opinion. The consulting contract is the more attractive the better the auditor performs as a market manipulator.

This modelling approach is a shortcut in the sense that collusion is not modelled in a strictly non-cooperative way. It just says that if there are gains from collusion there is a feasible way to make the opportunistic auditor participate in them.[18]

[18] The correct way of modelling collusion is in fact an open issue that is a topic of active research since a seminal paper by Tirole (1986). See Laffont and Martimort (1997) for a recent contribution to the theory of collusion.

The reporting behavior of an opportunistic auditor is described by his behavior strategy that specifies a probability distribution on his possible moves after he found out that a project is risky. We denote by σ_p the probability that an opportunistic auditor will actually choose to report that a project is risky rather than give in to a client's pressure and to declare it as safe. To incorporate some realistic features of auditing we assume that if an auditor observed that the project is safe it can not be qualified, i.e., it will always be declared as safe.

To summarize: Clients hire an auditor and ask him to confirm that their project is actually safe. All auditors, except the opportunistic type, who finds out that the project is risky, observe what the audit technology yields and either agree (issue an unqualified statement) or issue a qualification mechanically. An opportunist with a possible gain from collusion will issue a qualification with probability σ_p. So an opportunistic auditor has either payoff

$$z_p - c + \gamma\Big[R_p(\pi_p(.)) - R_p(\mu_p(.))\Big](1-\sigma_p)(1-b)$$

or, if the relation continues, he has a payoff of

$$z_p - s + \gamma\Big[R_p(\pi_p(.)) - R_p(\mu_p(.))\Big](1-\sigma_p)(1-b)$$

in period one.

2.2 The Game

To keep the analysis simple we assume that there are only two periods. This gives us a minimal intertemporal structure so that learning can take place. The following steps describe the extensive form of the game and how auditors, clients and the capital market interact.

In Period 0 a move by nature selects borrower types, i.e., project risks (learned by borrowers) and auditor types (learned by auditors). In the next step clients hire an auditor from the market at a flat fee z_0. Clients then ask auditors to confirm that their projects are ultimately safe and auditors in their duty observe a result which they report to the market. If the auditor is opportunistic and his result yields that a project is risky there arises a possibility for collusion. Now an opportunistic auditor chooses a reporting strategy σ_0.

Remember that σ_0 describes the probability that an opportunistic auditor, who has a possibility to collude in the initial period, will tell the truth. A

value of $\sigma_0 = 0$ means that he is always lying in period 0. When $\sigma_0 = 1$ he is always telling the truth whereas a value of $0 < \sigma_0 < 1$ says that he is randomizing between lying and truthtelling. Since there are only two periods, in the analysis of the game we are ultimately interested in the equilibrium value of σ_0. The reason is that analytically the question whether mandatory rotation enhances auditor independence or not boils down to determine whether the equilibrium value of σ_0 is higher or lower in a regime with than in a regime without rotation.

After observing the auditor's message lenders determine $R_0(.)$ given their beliefs about the project's risk status. Then the project either defaults or not. Period 0 payoffs are made.

In period 1 lenders and clients update beliefs about the auditor's type. The client learns the risk status of his second period project and decides whether to retain or to replace an auditor. He knows the costs of hiring an outsider and that the costs he has to pay to an insider are strictly smaller. The market, knowing the client's incentives, readjusts beliefs contingent on the clients replacement decision. If the client decides to keep the incumbent, depending on the auditor's reputation, he is able to seize all or a part of the gains from incumbency. If the client does replace the auditor he can hire a new one from the outside pool in the same way he did in period 0. The auditor conducts an audit. If the observation yields that the project is risky there is again a possibility to collude. The opportunistic auditor chooses σ_1, in the same way as he chose σ_0 in the previous period. Lenders determine $R_1(.)$ given their beliefs. The project fails or not. Period one payoffs are made and the game ends. The total payoff of a player is the sum of his period 0 plus his undiscounted period 1 payoff.

2.3 The Game When the Law Prescribes Mandatory Rotation

Period 0 is identical to the game as described above. Period 1 differs in the following way. Now clients can't decide whether to retain an auditor or not. They *have* to hire some new one in period 1. No auditor has cost savings in period 1.

3. The Short Run

It is helpful for the analysis of the game to study first the case where the game is played only once, that is, where it is in fact terminated after period 0.

3.1 Inference and Beliefs

The beliefs of lenders depend on the parameters of the model, in particular the prior about the independence of the auditor. Furthermore the probabilities of projects being risky or safe influence these beliefs. These probabilities cancel out here by symmetry. (In this sense assuming a prior of 1/2 is a simplification.) Market beliefs are clearly depending on the conjecture of lenders about the equilibrium reporting strategy of an opportunistic auditor.

Given an audit fee of z_0, lenders who observe a qualification (which means that they receive the message that the project is risky) form beliefs according to Bayes' rule. Assume first that the auditor issues a qualification, which is in the model equivalent to declaring the project as risky. It is clear that for all σ_0 the belief that the model is indeed risky must be:

$$\pi_0(\sigma_0|t_0) = 1 \tag{2}$$

The reason is that an auditor who observes a safe project will always give an unqualified opinion. Because the auditing technology is perfect and there are two types of projects this implies that a project that has not been declared as safe must be risky. Now assume the market hears the message that the project is safe. The belief that this message is true will then be:

$$\mu_0(\sigma_0|t_0) = \frac{1}{1 + (1 - \sigma_0)(1 - t_0)} \tag{3}$$

Now the situation is not quite so simple because this belief depends on σ_0. The intuition behind this formula is straightforward. If the market hears the message that a project is safe this can be correct but there could also be an intentional manipulation by collusive behavior. This belief therefore depends on the conjecture of the equilibrium behavior of an opportunist and can clearly not be independent of σ_0. If σ_0 is 1, i.e., if the auditor is completely honest, $\mu_0(.)$ does not depend on t_0. For all $\sigma_0 \in [0, 1)$ it is increasing in the markets' beliefs t_0 that the auditor is tough.

3.2 Equilibrium Interest Factors

We have already stated the assumption that in each period the total amount of inputs that can be utilized is less than the aggregate endowment of the capital good. Therefore the storage technology is in use in any equilibrium. This implies that competition for debt contracts will allow bor-

rowers to borrow by writing contracts that provide an expected return of 1. This observation gives us an easy way to determine equilibrium interest factors.

If the market receives a report that the project is risky, it charges an interest factor based on beliefs about the project's actual risk status. Beliefs are inferences based on the prior probabilities known to the market and the conjectures of investors' equilibrium behavior. Therefore the interest factor charged for a risky project must be in any sequential equilibrium of the short run game:

$$R_0(\pi_0(\sigma_0|t_0))(1-b)\pi_0(\sigma_0|t_0) + R_0(\pi_0(\sigma_0|t_0))(1-\pi_0(\sigma_0|t_0)) = 1$$

Given the competitive capital market the expected return on the risky project must be equal to the opportunity costs determined by the return on the storage technology. Therefore the equilibrium interest factor is:

$$R_0\big(\pi_0(\sigma_0|t_0)\big) = \frac{1}{1-b\pi_0(\sigma_0|t_0)} \tag{4}$$

To simplify notation we will from now on only write $R(\pi_0(.))$ when actually $R(\pi_0(\sigma_0|t_0))$ is meant. And we will also use this convention in the case of the interest rate charged after a report that the project is safe.

After a report that the project is safe, the market charges:

$$R_0\big(\mu_0(\sigma_0|t_0)\big)\mu_0(\sigma_0|t_0) + \big(1-\mu_0(\sigma_0|t_0)\big)R_0\big(\mu_0(\sigma_0|t_0)\big)(1-b) = 1$$

Therefore:

$$R_0\big(\mu_0(\sigma_0|t_0)\big) = \frac{1}{1-b\big(1-\mu_0(\sigma_0|t_0)\big)} \tag{5}$$

The following result is useful and easy to establish.

Lemma 1: In any sequential equilibrium of the short run game

- the equilibrium interest factors are determined by (4) and (5).
- For all $t_0 > 0$ the signal that a project is safe is always informative, i.e., $\mu_0(\sigma_0|t_0) > 1/2$.
- If $\mu_0(\sigma_0|t_0) + \pi_0(\sigma_0|t) > 1$ then $R_0(\pi_0(.)) > R_0(\mu_0(.))$.

Proof: Appendix. □

The result of Lemma 1 shows that the existence of a small but positive amount of tough auditors is enough to make the signal received by the mar-

ket informative. So the existence of a positive however small fraction of honest auditors makes auditing valuable here. This situation might appear as rather extreme. It has to do with the structure of the model and can be best looked at as a boundary case. In other models of reputation and credibility it is usually required that the probability of the tough type exceeds some critical positive threshold.[19]

3.3 Best Reply of an Opportunistic Auditor

We know that all auditors – except the opportunist – act basically in a mechanistic way. For analyzing a sequential equilibrium of the game, we therefore have to pin down the best reply σ_0 of an opportunist.

Given an equilibrium fee z_0 the opportunistic auditor with a possibility to collude gets in any sequential equilibrium:

$$z_0 - c + \gamma\Big[R_0\big(\pi_0(.)\big) - R_0\big(\mu_0(.)\big)\Big](1-\sigma_0)(1-b) \tag{6}$$

His net revenue is given by $z_0 - c$. The term $\gamma[R_0(\pi_0(.)) - R_0(\mu_0(.)]$ is his possible gain from collusion: the share he gets from the cheaper financing costs that can be realized if the market attaches some credibility to the message that the project is safe. Finally the gains from collusion are multiplied by $(1-b)$. They can only be realized when the project turns out to be a success. An opportunist will choose σ_0 as to maximize this expression.

3.4 Equilibrium of the Short Run Game

In a sequential equilibrium of the short run game each player must choose a best reply given the best reply of any other player, his strategies must be sequentially rational given his beliefs, and the beliefs must be consistent with equilibrium play. The sequential equilibrium of the short run game can be summarized in the following

Proposition: For all $t_0 > 0$, in a sequential equilibrium of the short run game we have

- $\pi_0(0|t_0) = 1$, the report that a project is risky has maximal credibility.
- $\mu_0(0|t_0) = \frac{1}{2-t_0}$, denoting the credibility that a project declared as safe is indeed safe.

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[19] See for instance Kreps and Wilson (1982), Sobel (1985), Benabou and Laroque (1992).

- $\sigma_0 = 0$, i.e., an opportunistic auditor with a possibility to collude always manipulates his report.
- $R_0(\pi_0(.)) = \frac{1}{1-b\pi_0(0|t)} = \frac{1}{1-b,}$ denoting the interest factor of a project declared as risky.
- $R_0(\mu_0(.)) = \frac{1}{1-b(1-\mu_0(0|t))}$, denoting the interest factor of a project declared as safe.

Proof: See Appendix. □

Though the market anticipates that in fact *all* opportunists will try to manipulate the market, the existence of tough auditors is enough to make the signal about a safe project informative, this in turn leads to a lower interest factor for projects declared as safe than projects declared as risky.

4. The "Long Run"

Consider now a dynamic world, where the capital market has an opportunity to learn something about an auditor across periods. In our model this "long run" perspective is described by including a second period. In this case the market learns something about the auditor comparing his predictions with what has actually happened. Note that also the client can learn about the auditor he is dealing with, since initially it is also not clear whether he is facing a tough or an opportunistic auditor. Only when collusion has actually occurred – i.e., when the auditor has declared a risky project as safe – he will know definitely that his auditor is an opportunist.

4.1 Inference Across and Within Periods

4.1.1 The Market

The inference of the market *within* a period is analogous to the first period. In period 1, the market will again form beliefs about the risk status of a project after having received the auditor's messages taking account of the updated beliefs about the auditor's independence. If a client receives the report that a project is risky in period one then: For all σ_1

$$\pi_1(\sigma_1|t_1) = 1 \tag{7}$$

The interpretation of this formula was already given in the previous section. The message that a project is risky has maximal credibility.

Assume now the market hears the message that the project is safe. The appropriate belief will then be

$$\mu_1(\sigma_1|t_1) = \frac{1}{1+(1-\sigma_1)(1-t_1)}$$

Across periods – i.e., from period 0 to period 1 – the market can observe what the message was and whether a default occurred or not. Several situations can be distinguished by the market. Either the audit opinion indicated that the project is risky and a default occurred or not. In both cases it is easy to see that the market will update his beliefs that the auditor is tough to

$$t_1^r = \frac{t_0}{t_0+(1-t_0)\sigma_0} \geq t_0 \tag{9}$$

As long as there is some probability of market manipulations by an opportunistic auditor – i.e. $\sigma_0 > 0$ – the issue of a qualification will increase the auditor's reputation for trustworthiness in the market and his statements gain credibility for investors.

Now assume the auditor has issued an unqualified report (declared that project as safe) and there was a default. It is clear that in this case it is revealed to the capital market that he is an opportunist and his reputation for independence collapses, so:

$$t_1 = 0 \tag{10}$$

Finally it can be that the report was safe but there was no default. If there was no default the market can not distinguish whether the auditor's claim was right or wrong, both cases are possible. The revision of beliefs after this event will therefore be :

$$t_1^s = \frac{t_0}{1+(1-t_0)(1-\sigma_0)} \leq t_0 \tag{11}$$

The market's belief is decreasing as long as there is some conjecture that there is market manipulation by opportunists in period 0. The market takes into account that the event of no bankruptcy after a safe report could mean that the project was indeed risky but he has just failed to realize a manipulation of results by chance.

4.1.2 The Clients

If the auditor didn't give in, the client updates his belief according to Bayes' Formula. This yields an update to $\frac{t_0}{t_0+(1-t_0)\sigma_0}$ that he must be tough, which is equal to the market's new belief. If the client has a safe project, he can learn nothing from the auditor's report. If the auditor did manipulate his opinion, the client knows that he is an opportunist. This also means that a client with a safe project has no possibility to learn something about the type of his auditor. He carries his initial beliefs on to the next period.

4.2 Optimal Reporting Strategy of an Opportunist in Period 1

One observation about the equilibrium of the two period game can be easily established. Given an opportunist is still in the market in period one and his type is not revealed, his optimal reporting strategy follows directly from Proposition 1. An opportunist will manipulate the market in any case. The reason is again easy to explain. Given the signal is informative (which will always be the case as long as there are some independent auditors in the market) there is a potential gain from manipulating the capital market. This gain can be reaped as a share in the gains from collusion at no further costs, since the world ends. The auditor has not to be concerned about his reputation for independence after the final period. So it is clear that in any equilibrium of the two period game an auditor with the possibility to collude will do so and choose $\sigma_1 = 0$. We have therefore shown:

Lemma 2: In any sequential equilibrium of the two period game, an opportunistic auditor with the possibility to collude, will always do so, i.e., choose $\sigma_1 = 0$.

Proof: By the fact that period one is the last period, the proof follows from Proposition 1. □

4.3 The Client's Replacement Decision

After period 0 the client knows what the auditor's reputation is in the market and how much the incumbent will therefore cost him as opposed to a new auditor from the pool of outsiders. Furthermore he has possibly revised beliefs about the auditor he is dealing with.

Assume first that the auditor's reputation has increased in the market. As we have seen this is only possible if he issued a qualification in the initial period. If the client has a safe project in period one, it is clear that he

has a dominant strategy to retain the auditor because he anticipates that he will cost him less than an outsider and bring him cheaper finance via his increased credibility in the market. If the auditor has in his eyes a higher probability of being tough it does not matter for him. The reason is that, given he has a safe project, he can be sure that the auditor will find out and report the result to the market. By this argument the possibilities of a client with a risky project are restricted. Even if he would consider a replacement, he would not do so. Why? Replacing an auditor with an increased reputation – given the dominant strategy of a client with a safe project – the market would then *know* that his project must be risky and charge the highest possible interest rate for him. By this argument we get the following

Lemma 3: In any sequential equilibrium of the two period game an auditor with an increased reputation will never be replaced.

Proof: The argument given above essentially proves Lemma 3. □

This result shows that in a world where the market can learn about the auditor's abilities a client can not retain and replace an auditor at will. So even if the client exerts pressure on an auditor to compromise a report an auditor has the possibility to resist even from a pure cost-benefit viewpoint. In this example it would for instance be an "incredible threat" to cut the auditor off a future stream of income if he doesn't declare a risky project as safe.[20]

Now assume the type of an opportunistic auditor is revealed by a default. In this case he entirely loses his reputation in the market. If the market receives a message from such an auditor it will be completely uninformative and the interest factor charged in the market will be based only on the prior information about project risks. Such an auditor still has the cost savings of an incumbent when he stays with the client. The client is also able to acquire all the gains from incumbency since the auditor has lost his reputation for independence in the market. However the client's financing costs rise if he keeps an auditor with a damaged reputation. It is clear that in general when the incremental costs of hiring a new auditor would be very large it

[20] In general, the problem what investors can learn from a client's auditor replacement decision can be rather complicated and quite subtle. A detailed analysis of this problem is given by Dye (1991). For a situation where outsiders can draw conclusions about the financial condition of the firm from the replacement decision, the paper finds that the success of a client's pressure depends on whether the client has relatively superior information about the financial situation of the firm than the auditor or not. Dye also finds that when the firm and the auditor have the same information about the financial condition of the firm and this information can be communicated via financial statements, then an auditor will never be replaced. Though our model describes replacement decisions in a much more simplified way our results are consistent with these findings.

could pay to keep the auditor even if his reputation is completely damaged. To exclude such a case we make the following:

Assumption 1: Denote the incremental costs of replacing the incumbent by Δ and denote the interest rate that is based only on the prior beliefs about project risks by R^*. For any client with a safe project it holds that $R^* - R(\mu(t_0)) > \Delta$, i.e., the gain from hiring an outsider exceeds the loss from incurring the incremental costs caused by a new initial audit.

By the same argument we gave for Lemma 3 it follows that Assumption 1 implies that a client with a risky project would also find it beneficial to replace the auditor. Why? If he keeps him he would immediately signal his risky project to the market and incur the largest possible interest factor.

Lemma 4: Given Assumption 1 an auditor who has lost his reputation will be replaced in any sequential equilibrium of the two period game.

Proof: See argument given above. □

The case of an auditor with a declined but not completely damaged reputation can clearly not be determined from the outset because it will depend on the conjecture of the client about the auditor's equilibrium strategy of reporting in period 0. Depending on the parameters of the model there can be sequential equilibria of the model where it pays to replace such an auditor and others where it pays to keep him.

4.4 The Reporting Decision of an Opportunist in period 0: Reputation Effects

For the problem we are discussing here it is of particular interest which reporting strategy an opportunist will choose in a sequential equilibrium of the two period game. The behavior of other types is determined. For the purpose of determining σ_0 we will work indirectly with the auditor's credibility $\mu_0(t_0)$ (see Benabou and Laroque 1992).

We already found out that in the short run game he will never tell the truth in such a situation. So the interesting question is, if the intertemporal structure can change this result. The problem of an opportunistic auditor changes in the following way:

By choosing σ_0 an opportunist has to take into account the effect on his reputation and he has to balance this effect against short term gains he can have from collusive behavior.

If he observes a risky project and reports this observation truthfully to the market, the market will attach a credibility of $\pi_0(\sigma_0|t_0)$ to his message. His credibility can not decrease in the market no matter whether the project de-

faults or not. In this case, by Lemma 3, he will not be replaced and can possibly gain a future rent from lower auditing costs plus, if he happens to audit a risky project, collusion benefits. If he manipulates a report either there is a default and he will be replaced according to Lemma 4. If there is no default he is either retained or also replaced. Which of the two cases finally occurs depends on the equilibrium of the game. Assume first we are looking at an equilibrium in which the auditor with a declined reputation will not be replaced.

By Lemma 2 we already know that in any sequential equilibrium $\sigma_1 = 0$. By taking a dynamic programming approach we can therefore write down the *maximal value* of an auditor's expected future utility. Let us denote the value function by W. (Subscripts 1 is for period 1 and subscripts T and L are for truth and lie in period 0). Denote the net gains from incumbency by G. Then telling the truth leads to an expected maximal value of

$$W_{1T}^{*} = \alpha(t_1^r)G + 0.5\left[\gamma\left(R_1(\pi(.)) - R_1\left(\mu_1(t_1^r)\right)(1-b)\right]\right. \tag{12}$$

The interpretation of this expression is straightforward. If he tells the truth with probability one he can seize some of the gains from incumbency plus a possible expected future gain from collusion.

If he lies, he can be detected or not, because there is a probability of bankruptcy b. So in case of a default he loses his reputation. According to Lemma 4 he is replaced by a new auditor. With $(1-b)$ his lie stays undetected. In both cases his reputation declines. Under the assumption that he will not be replaced. His expected future maximal value can be written as

$$W_{1L}^{*} = (1-b)\left(\alpha(t_1^s)G + 0.5\left[\gamma(R_1(\pi_1) - R_1(t_1^s))(1-b)\right]\right) \tag{13}$$

An opportunistic auditor with a possibility to collude in the initial period who tells the truth gets a utility of

$$U_T(t_0) = z_0 - c = 0 \tag{14}$$

Lying in the initial period leads to a utility of:

$$U_L(t_0) = z_0 - c + \gamma[R_0(\pi_0) - R(\mu_0)](1-b) = \gamma[R(\pi_0) - R(\mu_0)](1-b) \tag{15}$$

What the auditor has to consider in his optimal decision is to weight the *gain from colluding today*

$$U_L(t_0) - U_T(t_0) \tag{16}$$

against his *incentive to maintain his reputation:*

$$W_{1T}^* - W_{1L}^* \,. \tag{17}$$

If we denote the auditor's *life time utility,* given his reputation today is t_0, by $V(t_0)$ then we have

$$V_T(t_0) = z_0 - c + \alpha(t_1^r)G + 0.5\Big[\gamma\big(R_1(\pi) - R_1\big(\mu_0(t_1^r)\big)(1-b)\Big] \tag{18}$$

and

$$V_L(t_0) = z_0 - c + \gamma\Big[R_0(\pi_0) - R_0(\mu_0(t_0)\Big](1-b) + (1-b)(\alpha(t_1^s)G + 0.5\Big[\gamma\big(R_1(\pi) - R_1(t_1^s)\big)(1-b)\Big]) \tag{19}$$

Now from the point of view of an opportunist we get that

$$\begin{aligned} &\text{If } V_T(t_0) > V_L(t_0) \text{ then } \sigma_0 = 1 \\ &\text{If } V_T(t_0) = V_L(t_0) \text{ then } \sigma_0 \in [0,1] \\ &\text{If } V_T(t_0) < V_L(t_0) \text{ then } \sigma_0 = 0 \end{aligned}$$

Denote the minimal credibility an auditor can have $\mu(0|t_0) = \frac{1}{2-t_0}$ by $\underline{\mu}$. Note that $\sigma_0 \in [0,1]$ means equivalently that μ_0 takes a value in $[\underline{\mu}, 1]$ from which we can deduce σ_0 by (3).

Therefore we have:

Proposition 2: An equilibrium of the two period game corresponds to an auditor's credibility as a function $\mu : [0,1] \to [\underline{\mu}, 1]$ of his reputation and an associated value function $W : [0,1] \to R$ such that for all t

$$\begin{aligned} &\text{If } V_T(t_0) > V_L(t_0) \text{ then } \mu_0 = 1 \\ &\text{If } V_T(t_0) = V_L(t_0) \text{ then } \underline{\mu} < \mu_0 < 1 \\ &\text{If } V_T(t_0) < V_L(t_0) \text{ then } \mu_0 = \underline{\mu} \end{aligned} \tag{20}$$

and $W_0^* = \max[V_T(t_0), V_L(t_0)]$.

By (18) and (19) it is clear that the relation between possible rents and collusion gains will play the decisive role to determine an equilibrium. We therefore need an additional restriction. Denote by $D(\mu|t_0, W_1^*) \equiv V_T(t_0) - V_L(t_0)$ the difference between life time utilities of an opportunist when he tells the truth with probability one in period 0 and when he lies with probability 1 in period 0

Assumption 2: For any t_0 and W_1^* it holds that $D(\underline{\mu}|t_0, W_1^*) \geq 0$.

Assumption 2 says that at the lowest possible credibility of the auditor the payoff from truth-telling is weakly better than the payoff from lying. If Assumption 2 does not hold the incentives for an auditor to built up a reputation for independence could never be large enough, i.e., an opportunistic auditor will always lie with probability one in period 0.

The reader who is interested in the construction of the equilibrium value for σ_0 is referred to the appendix for the detailed argument. We state the result of the argument in the following.

Proposition 3: Given Assumptions 1 and 2 and given the auditor with a decreased reputation is not replaced for any t_0 and W_1^* there is a unique credibility $\mu_0^*(t_0, W_1^*)$, with

$$0.5 < \mu_0^*(0, W_1^*) < \mu_0^*(t_0, W_1^*) < \mu_0^*(1, W_1^*) = 1$$

and the function $V(\mu_0^*(t_0, W_1^*)|t_0, W_1^*)$ associated with $\mu_0^*(t_0, W_1^*)$ is continuous and non-decreasing in both arguments.

Proof: Appendix.

The idea of constructing the equilibrium value $\mu^*(t_0, W_1^*)$ can best be seen in a picture that summarizes the argument given in the appendix:

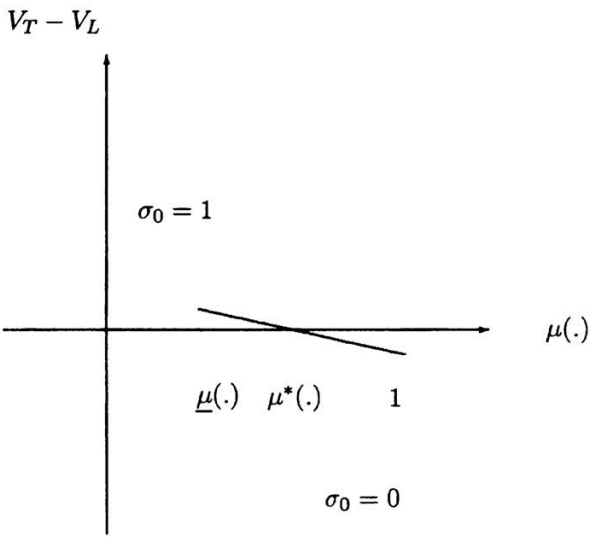

Figure: Propositions 3 and 4 – The Basic Argument

To ensure that the σ_0^* we constructed in this way is indeed an equilibrium we have to check that it would indeed be a best reply for the client not to replace the auditor with the declined reputation. If the behavior strategy constructed in this way is not part of a sequential equilibrium there is a second possibility.

To cover the other possible candidate for a sequential equilibrium of the two period game, assume that even an auditor with a reputation that has declined but was not completely damaged is replaced then the situation changes as follows.

Life time utility if reputation increases is still given by

$$V_T(t_0) = z_0 - c + \alpha(t_1^r)G + 0.5\Big[\gamma\big(R_1(\pi) - R_1(\mu_0(t_1^r))\big)(1-b)\Big] \tag{21}$$

On the other hand a decline in reputation would imply a life time utility of

$$V_L(t_0) = z_0 - c + \gamma\big(R_0(\pi) - R_0(\mu(t_0))\big)(1-b) \tag{22}$$

Now we can prove an analogous proposition to Proposition 3 for this case.

Proposition 4: Given Assumptions 1 and 2 and given the auditor with a decreased reputation is replaced for any t_0 and W_1^*, there is a unique credibility $\mu_0^*(t_0, W_1^*)$, with

$$0.5 < \mu_0^*(0, W_1^*) < \mu_0^*(t_0, W_1^*) < \mu_0^*(1, W_1^*) = 1$$

and the function $V(\mu_0^*(t_0, W_1^*)|t_0, W_1^*)$ associated with $\mu_0^*(t_0, W_1^*)$ is continuous and non-decreasing in both arguments.

Proof: Appendix.

Corollary 1: In any sequential equilibrium of the two period game an opportunistic auditor will tell the truth with a strictly positive probability but not with probability one.

This result basically shows how reputation effects enter an equilibrium of the two period game. There is a unique sequential equilibrium, in which the opportunistic auditor does not lie with probability one in the first period. He does, however, never tell the truth with probability one. Here is the reason why. Assume he would: then his reputation for honesty would not be affected. Having no incentive to be honest, he would lie systematically. So this can't be an equilibrium. The incentive for honesty comes from the fact that an auditor expects future rents from cost savings, which he can't realize if he lost his credibility in the first period.

5. The Impact of Rotation

The framework developed above allows us to easily assess the impact of a mandatory rotation policy. Assume a law comes into place that prescribes auditors to look for a new client in every period. As a consequence an auditor's profit declines because he can't earn a rent due to cost savings from client specific knowledge in the future.

What remains for them are only possible gains from collusion. How does rotation influence σ_0? It is clear that reputation effects are still at work. After the initial period auditors are separated into auditors with a high or a decreased reputation and the outside pool with the initial reputation t_0.

Clients know that an auditor costs c and we assume that competition in the auditor market allows them to squeeze the fees to marginal costs. As before it is not too difficult to include an endogenous process of the fee determination at the expense of lengthy additional arguments.

Now a client with a safe project would always prefer to hire an auditor with an increased reputation and this would also be the preference of a client with a risky project for the very same reasons we already gave when we discussed the client's replacement decision. Auditors with a decreased reputation are out of business since for the same price a client could get an auditor with a higher reputation. Since there are always more clients than auditors it is not clear that an auditor will get a job again after he has been rotated. Denote the probability of being rematched with a client after period 0 by λ

Now we can determine the equilibrium value of σ_0 by the same construction as above. If we compare life time utilities of the opportunistic auditor:

$$V_T(t_0) = (z_0 - c) + \lambda\Big[(z_1 - c) + 0.5\big[\gamma\big(R_1(\pi_1) - R_1(\mu_0(t_1^r))\big)(1-b)\Big] \tag{23}$$

$$V_L(t_0) = (z_0 - c) + \gamma\big(R_0(\pi_0) - R_0(\mu_0(t_0))\big)(1-b) \tag{24}$$

Since $z_0 = z_1 = c$, it is clear that for all $\mu_0(t_0) \in [\underline{\mu}, 1]$, $V_T(t_0) - V_L(t_0) < 0$ which means that under rotation it will always be an equilibrium that an opportunist lies. So we have shown:

Proposition 5: Under mandatory rotation an opportunistic auditor will always lie with probability 1 in any sequential equilibrium.

Proof: Follows immediately from (23) and (24). □

One moment of reflection shows that this result makes intuitive sense. What is going on here is that with no rents to gain from an ongoing relation the only thing that can be gained from honesty is to have expected collusion

gains in the future. If an auditor lies now he has the same gains for sure today already. *By destroying rents from an ongoing relation, the rotation rule undermines the incentives for building up a reputation for honesty.* The rents an auditor can gain from incumbency make reputation a valuable asset. Investing today by forgoing a short run collusive gain can pay off by a higher expected payoff from a continued relation tomorrow. Since rotation destroys future rents it devalues reputation as an asset.

6. Conclusions

The analysis of mandatory rotation rules shows that it is not at all obvious that this measure will enhance the independence of auditors and improve the protection of investors from manipulated financial statements. It shows also that the existence of gains from incumbency can not in general be seen as a threat to independence as it is often argued in the regulatory debate as well as in the auditing literature. Propositions (3) and (4) tell us that opportunistic auditors have a strong incentive for honesty ("σ_0 is large") if their benefits from incumbency are high enough. We have seen that rotation undermines this incentive.

This argument shows that a simple intuition about reputation building in the special relation of auditors, clients, and an outside capital market can be reproduced by a model incorporating some real world features in a fairly abstract manner. Being a highly stylized picture of the real world we have to ask ourselves what lesson can we learn from such an analysis.

An important aspect of the model is that it can give us some orientation about the forces that are instrumental for the main argument of the paper. We want to emphasize two aspects. First of all there have to be possibilities that the capital market can learn about the auditor's credibility. Second – and of equal importance – the market for initial audits has to be competitive, so that the gains from incumbency become really important for an auditor.

As for the first aspect it is clear that the learning possibilities in the real world are far less clear-cut than in the model here. However, the analysis shows that with fuzzier learning possibilities the basic reputation mechanism would clearly be at work as well but it would be weaker. The more transparent the process of financial reporting and auditing standards is the better are the learning possibilities of the capital market. This increases the markets effectiveness as a disciplinary device against manipulation of financial statements.

Deciding whether the market for initial audits is indeed competitive is an empirical issue. The empirical evidence seems to support this assumption

for the U.S, where the market for initial audits has been characterized by strong price competition despite clear evidence of concentration. Much less is known about Europe where there are considerable differences in the national rules and markets. It is clear that in a world where auditors can also earn substantial rents in initial audits the reputation effect described here is weakened and can be of smaller importance than this model suggests.

The analysis builds on costs and benefits of contracts between clients and the auditing firm: gains from reputation and the magnitude of quasi-rents. A rough estimate of these numbers, though perhaps difficult to obtain would however be needed to finally assess the importance of the argument emphasized in this paper in the context of other arguments discussed in the rotation debate as summarized in Arruñada and Paz-Arres.

The central conclusion which we could draw from the preceding analysis is the following. Given informational asymmetries and provided that there are always some auditors in the market that have an opportunistic attitude towards independence a perfect world is not attainable. The intention of making auditors more independent from the pressure of their clients by compulsory rotation will have the adverse effect of strengthening collusive incentives. So if there is concern about collusive tendencies due to long term auditor-client relations alternative measures than a rotation rule should be considered. Competition in the auditor market and a capital market that is able to learn about the trustworthiness of auditors will be a better safeguard for the protection of auditor independence than the regulatory intervention of mandatory rotation.

Proofs

Proof of Lemma 1

- By assumption the total amount of inputs used in each period is less than the aggregate endowment of the capital good. This implies that the storage technology is in use in each period. Competition among lenders will drive interest rates then to the levels described by (3) and (4). Lenders are satisfied with such a payoff by risk-neutrality.
- Remember that $\mu_0(.)$ is given by $\mu(\sigma_0|t_0,p) = \frac{1}{1+(1-\sigma_0)(1-t_0)}$. It is clear that at $\sigma_0 = 1$,credibility is maximal and hence $\mu_0(.) = 1 > 1/2$. Assume the auditor always lies so $\sigma_0 = 0$. Then $\mu(\sigma_0|t_0) = \frac{1}{(2-t_0)} > 1/2\ \forall t_0 > 0$.
- Assume not then $\pi + \mu > 1$ and $\frac{1}{1-b(1-\mu_0(\sigma_0|t_0))} < \frac{1}{1-b\pi_0(\sigma_0|t_0)} \cdot \frac{1}{1-b(1-\mu_0(\sigma_0|t_0))} < \frac{1}{1-b\pi_0(\sigma_0|t_0)}$ implies that $1 - b\pi_0(\sigma_0|t_0) > 1 - b(1 - \mu_0(\sigma_0|t_0))$ since both denominators are strictly positive. $1 - b\pi_0(\sigma_0|t_0) > 1 - b(1 - \mu_0(\sigma_0|t_0)) \Longleftrightarrow 1 - b(\pi_0(\sigma_0|t_0) + \mu_0(\sigma_0|t_0)) > 1 - b \Longleftrightarrow (\pi_0(\sigma_0|t_0) + \mu_0(\sigma_0|t_0)) < 1$ contradiction. □

Proof of Proposition 1

By Lemma 1, $\mu_0(.)$ is always larger than 1/2 and $\pi_0 = 1$, so $\pi_0 + \mu_0 > 1$. Again by Lemma 1 it follows that $R(\mu_0(.)) < R(\pi_0(.))$ for all σ_0. Since $\gamma[R_0(\pi_0) - R(\mu_0)](1-b) > 0$ by the fact that b is strictly smaller than 1, the opportunistic auditor's best reply is then to choose $\sigma_0 = 0$, i.e., the opportunist will always lie. Given this strategy, beliefs are determined and the market chooses interest factors according to (4) and (5). These beliefs are obviously consistent. □

Proof of Proposition 3

For $\mu_0 \in [0,1]$ and W_1^* we define the function $D(\mu_0|t_0, W_1^*) \equiv V_T(t_0) - V_L(t_0)$.

For any t_0 and W_1^*, $D(\mu_0|t_0, W_1^*)$ is strictly decreasing on $[0,1]$, because $U_T(t_0) - U_L(t_0) = -\gamma(R(\pi) - R(\mu(t_0))$ is strictly decreasing and $W_{1T}^* - W_{1L}^*$ is non-increasing in $\mu(.)$.

Now for any t_0 and W_1^*, $D(\mu_0|t_0, W_1^*) = 0$ must have a unique solution $\mu^*(t_0, W_1^*)$ with $\mu^*(t_0, W_1^*)$ continuous because by the fact that $D(\mu_0|t_0, W_1^*)$ is strictly decreasing, Assumption 3 and the fact that $D(\mu_0 = 1|t_0, W_1^*) < 0$ the equation must have a unique root. Given the uniqueness of the solution, continuity of $\mu^*(t_0, W_1^*)$, follows directly from the continuity of $D(.)$.

The function $V^*(\mu^*(t_0, W_1^*)|t_0, W_1^*)$ is non-decreasing in both arguments because $V^*(\mu^*(t_0, W_1^*)|t_0, W_1^*) = V_T(\mu^*(t_0, W_1^*)|t_0, W_1^*) = V_L(\mu^*(t_0, W_1^*)|t_0, W_1^*)$ and V_T and V_L are increasing in μ and W.

The unique solution to the auditors problem is $\max[\underline{\mu}, \mu^*(t_0, W_1^*)]$. If $\mu^*(t_0, W_1^*) \in [\underline{\mu}, \mu^*(t_0, W_1^*)]$ we know already that $D(.)$ is decreasing on this interval. Furthermore by Assumption 3, we have $D(\underline{\mu}) \geq 0$. At the maximal credibility -i.e. at $\mu = 1$, (1) toghether with (18) and (19) imply that $D(1) < 0$. Now, if $\mu^*(t_0, W_1^*) \leq \underline{\mu}$ then by the properties of $D(.)$ the only solution can occur at $\mu^*(t_0, W_1^*) = \underline{\mu}$. In the other case the solution must occur at $\mu^*(t_0, W_1^*)$, which is continous by the arguments given above. □

Proof of Proposition 4

Since Assumption 3 holds in the case where the auditor is not replaced, it must hold as well in the case where he is replaced, since in this case we can delete one negative term from the difference $D(\underline{\mu})$. Again (1) together with (18) and (19) imply that D(1)<0. Therefore the prove of proposition 4 follows from the proof of proposition 3. □

References

Antle, R. (1982), "The Auditor as an Economic Agent", Journal of Accounting Research, 503-527.

– (1984), "Auditor Independence", Journal of Accounting Research, 1-20.

Arens, A. A. / Loebbecke, J. K (1991), "Auditing, An integrated Approach", Prentice-Hall.

Arruñada, B. / *Paz-Ares,* C. (1997), "Mandatory Rotation of Company Auditors: A Critical Examination", International Review of Law and Economics 17, 31-61.

Baiman, S. / *Evans,* J. H. / *Noel,* J. (1987), "Optimal Contracts with a Utility-Maximizing Auditor", Journal of Accounting Research, Autumn , 217-244.

Baron, D. P. / *Besanko,* D. (1991), "Regulation, Asymmetric Information, and Auditing", Rand Journal of Economics, Vol. 14, Nr. 4, 447-470.

Benabou, R. / *Laroque,* G. (1992), "Using Priviledged Information to Manipulate Markets: Insiders, Gurus and Credibility", Quarterly Journal of Economics, 921-957.

Border, K. / *Sobel,* J. (1987), "Samurai Accounting: A Theory of Auditing and Plunder", Review of Economic Sudies, LIV, 525-540.

Chemmanur, Th. / *Fulghieri,* P. (1994), "Investment Bank Reputation, Information Production and Financial Intermediation", Journal of Finance, 46,1, 57-79.

DeAngelo, L. E. (1981a), "Auditor Independence, "Low Balling" and Disclosure Regulation", Journal of Accounting and Economics, 113-127.

– (1981b), "Auditor Size and Audit Quality", Journal of Accounting and Economics, 3, 183-199.

Deneckere, R. (1996), "Mandatory Rotation and the Market for Audit Services", National Science Foundation Research Proposal.

DePalma, A. / *Deneckere,* R. (1995), "The Market for Audit Services and Mandatory Rotation", Working Paper, HEC, Université de Genève.

Diamond, D. (1989), "Reputation Aquisition in Debt Markets", Journal of Political Economy, 97, 828-862.

Dye, R. A. (1991), "Informationally Motivated Auditor Replacement", Journal of Accounting and Economics, 347-374.

European Commission (1996), "The Role, the Position and the Liability of the Statutory Auditor Within the European Union", Green Paper, http://europa.eu.int/en/record/green/gp9607/ind\"ud.htm.

Fudenberg, D. / *Tirole,* J. (1991), "Game Theory", MIT-Press.

Hayek, F. (1949), "Individualism and Economic Order", London, Routledge & Kegan Paul LTD., 92-107.

Herzig, N. / *Watrin,* Ch. (1995) "Obligatorische Rotation des Wirtschaftsprüfers-ein Weg zur Verbesserung der externen Unternehmenskontrolle?", Zeitschrift für Betriebswirtschaftliche Forschung, 47, 775-803.

Kanodia, Ch. / *Mukherji,* A. (1994) "Audit Pricing, Lowballing and Auditor Turnover: A Dynamic Analysis", The Accounting Review, (69),4,593-615.

Klein, B. (1980), "Borderlines of Law and Economic Theory: Transaction Cost Determinants of Unfair Contractual Performance", A.E.R. Papers and Proceedings 70, 356-362.

Klein, B. / *Leffler,* K. (1981) "The Role of Market Forces in Assuring Contractual Performance", Journal of Political Economy, 89, 615-641.

Kreps, D. / *Wilson,* R. (1982), "Reputation and Imperfect Information", Journal of Economic Theory, 27, 253-279.

Kofman, F. / *Lawarree,* J. (1993), "Collusion in Hierarchical Agencies", Econometrica, 629-656.

Laffont, J. J. / *Martimort,* D. (1997), "Collusion under Asymmetric Information", Econometrica 65,4, 873-911.

Leffson, U., (1988), "Wirtschaftsprüfung", Wiesbaden, Gabler Verlag.

Magee, R. P. / *Tseng,* M. Ch. (1990), "Audit pricing and Independence", Accounting Review, 65, 315-336.

Marshall, A., (1949), "Principles of Economics". An Introductory Volume, 8th Edition, New York, Macmillan.

Melumad, N. / *Thoman,* L. (1990), "On Auditors and the Courts in an Adverse Selection Setting", Journal of Accounting Research, (28), 1, 77-120.

Milgrom, P. / *Roberts,* J. (1992), "Economics, Organization and Management", Prentice Hall International.

Mookherjee, D. / *Png,* I. (1989), "Optimal Auditing, Insurance and Redistribution", Quarterly Journal of Economics, 339-415.

Richter, M. (1975), "Die Sicherung der Aktienrechtlichen Publizität durch ein Aktienamt", Köln.

Sen, P. K. / *Geitzman,* M. B. (1997) " Auditor Rotation: An Economic Analysis of the European Unions Fifth Directive", Presentation at the Conference of the European Economic Association in Toulouse.

Sobel, J. (1985), "A Theory of Credibility", Review of Economic Studies, 52, 557-573.

Stevens, M. (1991) "The Big Six", Simon & Schuster, New York.

Teoh, S. W. (1992) "Auditor Independence, Dismissal Threats, and the Market Reaction to Auditor Switches", Journal of Accounting Research, 1-23.

Tirole, J. (1986), " Hierarchies and Bureaucracies: On the Role of Collusion in Organizations", Journal of Law, Economics and Organizations, 2, 181-214.

– (1992), "Collusion and the Theory of Organizations" in: Advances in Economic Theory, Vol 2, ed. J.J. Laffont, 151-206, Cambridge University Press.

Williamson, O. (1979), "Transaction Cost Economics: The Governance of Contractual Relations", Journal of Law and Economics 22, 233-61.

Wilson, R. (1983), "Auditing: Perspectives from Multiperson Decision Theory", The Accounting Review, Vol 58, 2, 305-318.

Zusammenfassung

Im Zuge der Debatte um die Verbesserung der Unternehmenskontrolle sind regulierungspolitische Maßnahmen für den Markt für Wirtschaftsprüfer ein oft diskutiertes Thema, insbesondere die obligatorische zeitliche Begrenzung des Prüfmandats (Rotation). Die Überlegung, die hinter diesem Vorschlag steht, ist die Vermutung, daß die Vorteile, die ein Prüfer aus einem fortgesetzten Prüfungsmandat hat, seine Unab-

hängigkeit – und damit die Qualität der externen Unternehmenskontrolle – gefährden, da der Klient mit dem Abbruch des Mandats drohen kann. Die vorliegende Arbeit untersucht dieses Argument im Rahmen eines spieltheoretischen Modells. Das zentrale Ergebnis der Analyse zeigt, daß in einer Welt, in der der Kapitalmarkt in der Lage ist zu lernen, ob ein Prüfer glaubwürdig ist oder nicht, Rotationsregeln die Unabhängigkeit des Prüfers nicht verbessern sondern untergraben.

Abstract

Mandatory Rotation is a recurring topic in discussions about regulating the auditing industry. In particular during the last few years some spectacular financial scandals have stimulated this debate worldwide. The benefits of an auditor from long term relations with the client have been frequently seen as a threat to auditor independence. It has therefore been suggested to restrict an auditor's tenure by introducing mandatory rotation. A rotation rule has been hoped to enhance auditor independence because a client can then not influence the auditor by threatening him with a termination of the auditing mandate. This paper investigates this argument in a game-theoretic framework. The main result of the analysis is that in a world where auditors can acquire a reputation for independence because the public can learn whether an auditor is trustworthy or not, regulation by rotation rules is impairing independence rather than enhancing it.

JEL-Klassifikation: G38, M49

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