

The Auditing Game:

The Dark Side of the Private Provision of a Public Good

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Abstract

The aim of auditing is to protect active and potential investors from accounting fraud. However, the large number of auditing scandals demonstrates that auditing has a dark side. This dark side of auditing is the topic of this paper. Correct auditing is a public good, provided by private auditing firms that are paid by the audited enterprise itself. Auditing firms, therefore, may be dubbed as agents of two principals, the audited firm and the public. Reputation theory conjectures that reputational concerns of auditors and the reputational costs of auditors' failure prevent shallow and fraudulent behavior of auditors. In contrast, empirical evidence does not support this claim. While it may be irrational for a large audit firm (such as Arthur Andersen LLP) to sacrifice its reputational capital for a single client by doing superficial audits (such as WorldCom), it may be quite rational for the engagement partners of the auditing firm to do so. The result might be a conspiracy against the public and investors. Because of inelastic supply of experienced auditors and a highly concentrated market of big auditing firms, reputational losses due to auditing scandals for the audit firms' local partners and staff seem to be rather small. In order to protect the public and investors from superficial auditing, neither higher legal transparency requirements nor higher fines for auditing failures are very helpful. Rather than further tightening laws, insider information by whistleblowers, short-sellers and investigative journalists can be more effective in detecting and deterring intentional and unintentional misinformation from auditors and firms.

Key words: auditing scandals, auditing game, cooperative behavior, fraud, reputation

JEL-classification: D82, G18, K13, M41, M42, M48

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1. Introduction and Literature Review

One of the great problems of the accounting industry is the scope of accounting scandals. On the one hand, accounting scandals are common with audit firms represented by their local auditors which either cannot prevent fraud or may even help with fraud executed by the management of the client firms of the auditors. On the other hand, reputation theory claims that it is irrational for a large audit firm (such as Arthur Andersen LLP) to sacrifice its reputational capital for a single client. The idea behind this claim is that there should be a reasonable chance that bad audit quality, e.g. by misreporting or help with fraud, will be uncovered in a way that damages the auditing firm's reputation, implying the loss of future business.

The importance of reputation in the audit industry is not fundamentally questioned even by recent regulatory attempts, like EU (Regulation No 537/2014) and German regulations (for instance, the “Public Accountant Act”, WPO, 2021). While these regulations make minor changes concerning oversight, rotation, liability, fines and sanctions of auditors, they do not significantly alter the rules of the audit game. One of the most recent German regulations which is a follow-up to the big Wirecard accounting scandal, is entitled “Financial Market Integrity Strengthening Act”, (Finanzmarktintegritätsstärkungsgesetz, FISG, 2021), and has e.g. increased the liability of the auditor for grossly negligent mandatory performance (limits of liability are discussed below). But the basic assumption that the industry will deliver good audit quality, if it is left to self-regulation, remains in the new law.

It will become clear that the empirical content of reputation theory depends empirically on several preconditions. We will check the applicability of reputation theory in the case of audit firms and auditors in his paper. We do so by analyzing the determinants of benefits and costs of reputation. This paper contributes to the theory by reconceptualizing the theory of reputation in an auditing context. It also reconciles the interaction between auditors and their customers in a game theoretical setting. Stylized facts of audit scandals can be better (re-)interpreted in this new setting than in the established model structures. We also analyze some of the initiatives and ideas for fraud prevention in our setting. The paper also contributes to the use of a cooperative solution in a noncooperative game in the context of auditing.

Usually, reputation theory is applied by modelling the interaction between an audit firm, which can build up, and also lose, reputation and a client firm. When a common diagnosis of audit scandals hints at misaligned incentives, it must be asked at which level the incentives do work most strongly: at the partner level or at the level of the firm? While in the usual reputation model-setting firms interact with firms, we draw attention to the interaction of managers and auditors. This is in line with the recommendation given by Ye (2021), in a review of analytical papers on the economics of auditing. In this review, a lack of the capture of the “actual practice” in auditing firm is diagnosed (Ye, 2021, p.72). Our setting with *local* auditors and managers answers the question of who does business with whom in the context of fraudulent behavior. Given that audit firms interact with firms in fraudulent activities, reputational penalties after detection are expected in reputational theory. But when *individual* auditors interact with *individual* managers in fraudulent activities, both can impose costs on investors (Doxey et al., 2021), that is, on parties other than those they do business with. While the auditor does harm the reputation of the audit firm, the manager decreases shareholder and stakeholder value. When the interaction of managers and (local, individual) auditors is the relevant interaction to be studied, as we will show, the outcome is different from an interaction between business

firms and audit firms. This has a tremendous effect on the applicability and appropriateness of the concept of reputation. Thus, for example, while it may be irrational for a large audit firm (such as Arthur Andersen LLP) to sacrifice its reputational capital for a single client (such as WorldCom), it may be quite rational for partners of the auditing firm to do so (Macey, 2004; Painter, 2004; Ribstein, 2004). It has been shown empirically that audit fraud is independent from the reputation of the audit firm (Gerretty and Lehn, 1997). Moreover, also the auditing performance of Arthur Anderson, measured by the frequency of financial restatements, did not differ significantly from the performance of other big auditing firms (Eisenberg and Macey, 2004).

Our setting of managers interacting with audit partners (in short: auditors) resembles business interactions and their effects on third parties. While the auditor acts as the agent of the manager of a client firm, she may do harm to the shareholders of this firm at the same time, which can be considered as a third party to the relationship. This setting has much in common with environmental externalities (Karpoff, Lott, and Wehrly, 2005) that differ from frauds and other types of wrongdoing in that they impose costs on parties other than those with whom the polluting firm does business. This means here that auditors do not do business with investors, but nevertheless misreporting does hurt them. Empirically, in the case of environmental externalities the reputational penalties are seemingly small compared to prospective legal penalties. Share value losses here usually only reflect legal penalties (see, for instance, the so-called Diesel scandal in the automobile industry).

A good case in point is the infamous German Wirecard scandal. The audit firm EY has claimed that the Wirecard management has been successful in deceiving the auditors, which had no chance to see through the fraud. The KPMG special auditor for Wirecard, Mr. Geschonneck, holds an entirely different view. The official parliamentary committee report, (Deutscher Bundestag, 2021p. 335) states:

"At the beginning, Mr. Geschonneck explained, the audit standards applied in the investigation: In determining and analyzing the facts, we used the audit standards of the Institute of German Auditors, IDW, as a benchmark. Our investigative and auditing activities essentially consisted of process recordings, document and data analyses, interviews with the persons involved, background research in public sources on natural and legal persons and individual investigations and individual audits. The auditors from KPMG had carried out standard auditing activities, which the company also carried out for other clients. Mr. Geschonneck listed IDW PS 302 as an example, according to which third-party confirmations were obtained. In this respect, no fundamental forensic activities were carried out."

We will show that the perspective of Mr. Geschonneck perfectly fits our model as presented below. Thereby we follow the recommendation of Minlei Ye to capture actual auditing practice in analytical auditing research (Ye, 2021, p. 72). If we assume a dyadic relationship between a local auditor and the (local) management of the client firm, we find an incentive for shallow auditing when the local auditor is afraid of detecting severe problems that could cost him his auditing assignment with his client firm, including the loss of all future fees. The local auditor therefore will be less interested in saving the reputation of the audit firm as a by-product of deep auditing because his client is his entire business case. On the other hand, a fraudulent firm is just another client for a large audit firm, adding only a small contribution to its total fees. Shallow auditing means to restrict auditing diligence to a level that renders it superficially sound. With deep auditing, however, further auditing effort is applied with the assumption that the firm's accounting might be fraudulent. Deep auditing could both reduce the profit of the local audit partner and increase the risk of bringing up unpleasant news about the eventually financially unhealthy state of the client firm. Interestingly, the above mentioned IDW Standard PS 302 requires *more or less mandatorily* to obtain reliable external

confirmations for funds, *even with normal year-end closing work*. This supports our argument that not fraud, but shallow auditing was at stake here.

In the relevant literature¹ (see, e.g., Karpoff and Lott, 1993; Alexander, 1999; Fich and Shivdasani, 2007), it is argued that a potential reputation loss may prevent auditing firms from superficial and too friendly auditing. The detection of accounting fraud, despite an auditing certificate, blames the auditing firm and may be punished by a reputation loss. According to Karpoff, Lee & Martin (2008), a reputational penalty can be defined as the expected loss in the present value of future cash flows due to lower sales and higher contracting costs. An implication of reputation theory is that reputation does not matter that much, when its benefits are small and there are no substantial costs by losing it. Applied to a detected audit scandal, where the legal-regulatory system imposed penalties, there is no substantial loss of reputation as long as the legal-regulatory costs are higher than the loss in future cash flows or stock market capitalization. Nonetheless, this is only one part on the cost side. Fraud has, e.g., given the Andersen partners economic advantages before bankruptcy, but have there been any personal reputation losses in the form of, for instance, unemployment thereafter? When the supply of experienced auditors for global firms is scarce, there will be excess demand for their services, however inaccurate they have been carrying out their audits. The scarcity of experienced auditors had a great impact on the market demand for Andersen auditors after the indictment and then conviction in 2002 of the firm Arthur Andersen. Interestingly, the conviction of Arthur Andersen was legally based on the obstruction of justice in its role as auditor of Enron. Afterwards, the industry underwent a fast consolidation. While Arthur Andersen lost clients (for a detailed account of their client losses, see Jensen, 2003, 2006) the move of Andersen partners and employees into the remaining industry occurred remarkably smoothly. Most of

¹ See Ye (2021) for a thorough review of theoretical papers in auditing research.

the partners and employees have been hired by three firms of the so-called Big Four, with PricewaterhouseCoopers holding back and taking on only a small number of Andersen's employees and partners. Grant Thornton, one of the largest second tier firms, took the chance of moving upwards in the ranking of auditor experience and hired a sizeable number of former Andersen partners and employees. In effect, Grant Thornton hired 60 partners and 500 staff members (Bugbee Brown, A. (2006), 47 f). All in all, although the firm Arthur Andersen was dissolved, a loss of *personal* reputation does not seem to have followed the Andersen crisis. In accordance with Rajan & Zingales (2001), it can be said that auditing firms are human capital-intense and that they have not much physical capital. Put differently, the employees are the firms' capital.

Another implication of reputation theory is that high quality auditing first translates into higher sales and profits and finally into reputational gains. But it can well be the case that the market, that is the managers of the client firm, demand acquiescence and empathy. Interestingly EY increased the number of important audit clients in 2021 despite the Wirecard scandal mentioned above (Fehr, 2021). To put it differently, it cannot be excluded that opportunistic auditors who shy away from a clean opinion on financial statements even when they suspect that the statements include omissions and misrepresentations, are demanded by clients. Depending on the market structure, it cannot be excluded that in some segments of the market there will be demand for auditors who develop reputation with managers (Ronen, 2006). This behavior may be enforced by the fact that a critical audit report increases the probability of a client to switch auditors. In other words, auditors usually may not be encouraged by this outcome to hand in such a report (Levinthal and Fichman, 1988; Seabright, Levinthal, and Fichman, 1992).

From the beneficial side of reputation, client firms will not necessarily demand high quality auditing in form of critical reports. But what about the costs of auditor misbehaving in

that respect? The potential costs of fraudulent behavior have diminished since the shift by the audit firms from partnerships to limited liability entities (Ribstein, 2004). Thereby incentives to improve reputation and quality have been reduced, relative to the prior regime in which partners were jointly liable for negligence.

It may well be the case that both the beneficial effects of building up reputation and the costs of eventually losing it do only materialize if there is a reasonable risk that misreporting will be “publicly” uncovered. The chances of detection depend on several factors. Where auditors develop reputation with managers for acquiescence, the client firm will presumably not take strong efforts to uncover accounting problems. In addition, clients with greater risk of fraud are less likely to engage new auditors in competitive bidding, consistent with the theory that these companies seek to limit access to information that might reveal their high-risk status (Adams, Bedard and Johnstone, 2005). Among other factors, detection also hinges on the economic climate and profitability of the firm. In addition, the visibility of fraud plays a role and the visibility itself derives from the characteristics of the client firm’s business. To start with the latter, it has been found empirically (Gerrey and Lehn, 1997) that the costlier it is to value assets, the more likely accounting fraud becomes. One proxy for the ease of carrying out comprehensible audits could be the ratio of intangible to tangible assets in a client firm. It is to be assumed that the higher this ratio the higher is the potential for accounting fraud.

The importance of the business firm’s economic situation for fraud detection can be recognized by considering a profitable firm in a climate of economic prosperity. Auditors will stand then a great opportunity to not be detected while committing or ignoring fraud, because the profitability of the firm will hide fraud. But this is not the end of the story. The next question is who will pay the penalties? Usually, the clients will reimburse litigation costs. This may even increase auditor’s reputation with opportunistic clients as detected audit misdeeds show the auditor’s willingness to cooperate with the clients, to the detriment of investors (Ronen, 2006).

We saw that after the Andersen-Enron audit scandal most of the partners and employees were hired either by three of the Big Four or by aspiring second tier audit firms. In more general terms, the market structure among audit firms and market demand for, as well as the scarcity of experienced auditors, directly determine the benefits and costs of audit reputation. These factors can easily outweigh effects of audit quality. Starting with market structure of audit firms, mandatory audits of global firms create demand for a global network of experienced auditors. However, there exists only a small number of audit firms, i.e., the Big Four (or even less) first-tier firms and several second-tier firms.² Therefore, the expected losses of personal reputation of a fraudulent auditor seem to be rather small, even in the most extreme case of an audit firm going bankrupt. With such a bankruptcy not only the number of choices among audit firms is decreased, but also the remaining audit firms do not have much choice amongst the available auditors. Section 2 prepares the ground by presenting some facts on auditing scandals. Building upon that, a model for an extended auditing game is presented in section 3. The first part of the model (3.1.) implicitly takes the perspective of the entire auditing firm, where reputational capital may be very high compared to the potential profit by doing superficial audits for a single client. The second part of the model (3.2.) shows from a more “local” perspective that when individual auditors interact with individual managers in fraudulent activities, both can profit while imposing costs on investors, that is, on parties other than those they do business with. Section 4 presents some policy implications while section 5 concludes.

² See Cox, 2006, for an analysis of the oligopolistic structure of the US accounting profession. – Moreover, Jones, Temouri and Cobham (2018) found empirical evidence for a positive correlation between the use of the Big Four and multinational enterprises’ tax haven network.

2. Auditing Scandals

In the Appendix you find an impressive list of the biggest accounting scandals over the last decades. For reasons we have explained above it is difficult to come up with direct empirical tests for our analysis. The argument that straightforward explains this difficulty follows from our perspective of analysis: it is the dyadic relationship between a local auditor and the local management of the client firm. This relationship is, by definition, not covered by written contracts, especially when it includes fraud or at least poor oversight. But this does not preclude other propositions that can be made using the facts known about the scandals. We will stress propositions concerning three aspects of auditing scandals:

- (1) the importance of intangibles,
- (2) the identity of the detectors of fraud and
- (3) the scandal involvement of Big Four firms or their predecessors.

These determinants taken alone or viewed in their interplay call into question the empirical range of reputation theory. As will be explained below, even the most obvious stylized facts of these auditing scandals do not lend support to the most relevant claims made by reputation theory in accounting.

In the old industrial economy with long-term assets, e.g., plants and equipment, the auditor had to validate data, through extensive counting of inventory etc. The economywide movement from tangible to intangible assets with very long lives and from liabilities whose principal and terms are known to other factors such as found in derivatives, has substantially reduced the ability of all external observers, be they auditors or investors, to validate the values presented in the financial statements. The consequences of this development are severe: the more intangibles are relevant in the business model of a firm, the more difficult the valuation of assets becomes. Gerrey and Lehn (1997) found out empirically that the costlier it is to value

assets the more likely accounting fraud becomes. A good breeding ground for carrying out poor quality audits could be intangible assets in a client firm. Our assumption that the higher this ratio the higher is the potential for accounting fraud, does show up in the data in the appendix. We use a crude proxy for intangibles according to the firm's industry and/or the business model it has. As demonstrated, the overwhelming majority of firms involved in the biggest accounting scandals are highly intangible firms. These data hint at a possible connection between opportunities for and results of (at least) poor quality audits.

The finding explained above has a direct impact on the identity of the detectors of fraud. Looking at the detectors it stands out that about 50 % of the 84 scandals mentioned have been communicated by regulating institutions while investors, whistleblowers and the media in sum have found out about 25% of them. Assuming that the regulating institutions in the US are experienced and are well equipped technically and legally to handle these problems, it comes to mind that the above-mentioned intangibles problem makes it hard for every actor outside the firm to detect these scandals. When the auditors involved communicate only in about 11% of the cases these to legal institutions, this begs the question how well-informed they were about the scandal? This finding fits nicely with our perspective of individual auditors interacting with individual managers. These fraudulent activities do at least impose costs on investors. In the case the actors mentioned above have detected the scandal, the passive auditor, how ignorant he might have been, has done severe harm to the reputation of the audit firm. This finding again calls into question the high average service quality in the audit sector assumed by most accounting academics.

Turning to the involvement of Big Four firms or their predecessors, it is noteworthy that the biggest claim made by audit reputation theory says the more successful - using size and sales as a proxy for success - the audit firm, the less likely it will sacrifice its reputational capital for a single client. However, the data in the appendix speak a different language. In

many of the big scandals one of the Big Four firms or of their predecessors has been involved. We have to note that the scope of the auditing scandals reflects the size of the involved client firm which is an indicator of the size of the audit firm having carried out the audit. But the theorized losses of reputational capital of audit firms that should follow detected scandals do not seem to exist at all. Neither do they show up in large business losses or insolvencies of audit firms nor in published unemployment of auditors involved in the scandals. The involvement of Big Four firms over and over again questions the empirical content of reputation theory.

We cannot empirically distinguish the reasons for the lack of loss of reputation capital. One reason may be that in some segments of the market auditors will have gained who have developed a profitable reputation with managers (Ronen, 2006). An only partly conflicting reason may be the inelastic supply of experienced auditors and a highly concentrated market of big auditing firms. Whatever the reasons for the absence of empirical losses of reputation after misbehavior of auditors are, the empirical facts do not lend support for this part of the theory of reputation.

3. The Extended Auditing Game

3.1 Structure of the game

In this section, the structure of the auditing game will be shown. To start with, it is assumed that both the auditing company and the firm have two objectives, namely profit and reputation. Profit is the objective of both firms which depends to a certain extent from their reputation for firm-outsiders' viewpoint as investors, the general public and other firms. For the auditing firm, reputation may be more important than for the economic company. The reason is that an auditing firm that is suspected to be unreliable might lose auditing contracts with other

economic firms because these firms fear to lose their investors' confidence. This may imply that there is a minimum reputation requirement for the auditing company. In contrast, it might be more relevant for the economic firm to reach a minimum profit goal. However, it holds true for both companies that higher reputation must be „bought“ with lower profits et vice versa. For instance, managers of the economic firm could increase profits by using fraudulent accounting methods. Partners of the audit firm could increase profits by hiding fraudulent accounting, at the price of putting thereby their own reputation and the firm's reputation at risk.

These partners are relevant for the on-site audit quality. This aspect is captured in the following by the notion “shallowing auditing” (low quality audit), in contrast to “deep auditing” (high quality audit). As demonstrated experimentally by Balafoutas et al. (2020), remuneration based on incentives for the performance of professional internal auditors, led to under-reporting or over-reporting of the performances of other persons, depending on whether the compensation scheme was competitive or collective. In addition, internal profit sharing and fixed compensation of partners in auditing firms was correlated with auditing quality in a German empirical investigation. Audit quality suffered the most when partners were remunerated mostly with a variable compensation in cases of small profit pools (Ernstberger et al., 2020). In a Belgian investigation of Big Four audit firms, Dekeyser et al. (2021) found also connections between audit quality and the compensation of the partners. While there was a negative correlation between compensation by fees and audit quality, the correlation between partners' “observable net wealth” and audit quality was positive (Dekeyser et al., 2021).

The above reasoning may have some implications for the level of accuracy of accounting and auditing. Maximum reputation can be defined *ex negativo* as the absence of accounting fraud on the economic firm's side and on the auditing firm's side as the absence of any hiding or concealing of accounting fraud. Reputation of both firms depends on accuracy in such a way that a higher degree of accuracy is positively correlated with a higher level of

reputation. As a consequence of these relationships, profit maximization and reputation maximization seem not possible at the same time as there is a trade-off between profits and reputation. Put differently, reputation is unattainable without incurring some cost. A further consequence is that also maximal accuracy in accounting and auditing will presumably not be attainable. To paraphrase this with Darby and Karni (1973), there exists an optimum amount of fraud in a society with free competition, but not freely available financial information. Hidden information inside the economic firm and the possibility of hidden actions of both firms are serious economic obstacles to diminish fraudulent behavior.

In the following, the behavior of the economic and the auditing firm will be studied in game-form (see Figure 2 below). There are three players, the first player, the “Manager”, is the management of the economic firm, player two is the auditing firm, the “Auditor” and player three represents the external authority, the public prosecutors and the courts, briefly “Courts”. The auditing game is a game with imperfect information. The management of the firm may be honest or fraudulent; this assumption is in accordance with the model of Corona and Randhawa (2010). Auditors of the firm cannot *a priori* know whether the management conducts honest or fraudulent accounting.

In the second stage of the game, auditors decide on the level of auditing. It is assumed here that auditors are of equally high ability, in contrast to Corona and Randhawa (2010). In their model, the type of auditor is defined *ex ante* and cannot change in the game. “Nature” decides there whether an auditor is of low or high ability. In the game of this paper, auditors choose instead the level of auditing, i.e., whether the auditing will be deep or shallow, assuming that „deep auditing“ is legally possible. Deep auditing means that auditors are completely independent and accurate up to the point of the minimum-profit constraint for the auditing firm.

Such auditors might be called Kantian³ auditors. In contrast, shallow auditing implies that auditors either do not look actively to detect fraud or that they even collude tacitly with a fraudulent management.

With honest accounting, it does not matter whether auditors choose deep or shallow auditing. The game ends at this point and the payoff for the management and the auditing firm are paid. With fraudulent accounting, auditors may or may not detect fraud, depending on the chosen level of auditing. Deep auditing is assumed to detect fraud always, whereas shallow auditing will never. In the last step, courts decide on the level of fines (big or small) and payoffs are paid. It has to be noted that the “external” losses of the audit firm from shallow accounting always encompass both reputation loss and a fine imposed by courts. In this paper, we refer to reputation losses as the present value of market-imposed losses of sales on audit firms, due to their shallow auditing. Since the probability of detection of accounting fraud is exogenously determined by criminal courts, a multiperiod model seems not to be required.

The latter point is important. Structurally, in this three-player game only two are active players in the sense that they make strategic choices. The Manager can choose to be honest or fraudulent and the Auditor can decide to audit deeply or shallowly. The Courts, however, do not actively choose their fraud detection probability. This is rather given by an *ex ante* determined rate of control, as in other areas of state control, for instance, tax audits. In addition, it is worth mentioning that auditors are sworn in as “organs of the administration of justice”. This gives their statements greater credibility and it can be interpreted as a partial delegation of financial law enforcement to the auditors’ profession.

³ Kantian ethics are applied in several economic environments as, for instance, tax avoidance (Lenz, 2018), shareholder theory (Mansell, 2013) and accounting (Vladu et al., 2017).

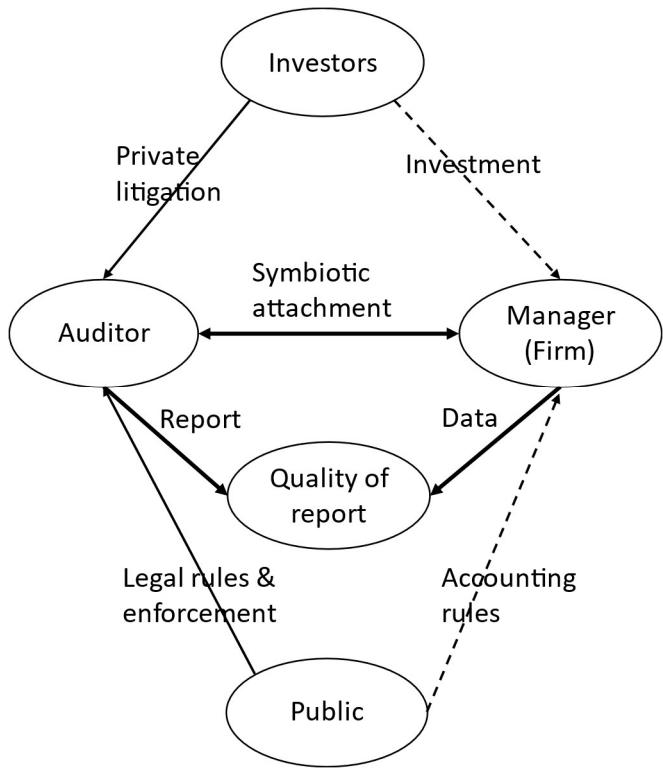


Figure 1: The Auditor as a “servant of two masters”

Source: Own depiction.

The Auditor and the Manager are embedded in relationships with investors and the general public that also encompasses former and potential investors, as well as organizations that observe the firm and the outcome of the audit. A second principal-agent relationship results from the interest of the investors and the public in the certification of fraud-free accounting by the Manager. Lawmakers belong to the general public, but they also provide the accounting rules for the Manager and the legal auditing rules for the Auditor. On behalf of the legal authorities as principal, the Auditor as agent must verify the correct application of the accounting rules by the Manager. To incentivize the Auditor, the law provides fines for sanctioning the violation of auditing rules, as well as public prosecutors and courts for law enforcement. In addition, investors might threaten to litigate against the Auditor if they recognize rule violations. The Auditor is dependent on the firm insofar as the latter must provide the data for the audit. The quality of the audit report is among others determined by data quality. Moreover, the Auditor finds out a lot about the firm that can be useful for business

consulting. In this way, the Auditor and the Manger can enter into a symbiotic attachment (Schanze, 1993).⁴

In effect, auditors are “double agents” or “servants of two masters”, as it were. The state, representing investors interests by enacting accounting laws, is the first master and the audited company is the second master, as it selects and pays its auditor.⁵ Nevertheless, only auditors and managers are strategically active or rational players. This corresponds with the practical experience of Richard Kaplan that it is the “corporate leadership” who is the addressee of the audit report, and neither investors nor the public (Kaplan, 2014, p. 366). In Kaplan’s plain words: “After all, the audit personnel who were the subjects of praise and admiration were the ones who earned the highest epithet: “He [still always “he”] knows how to keep clients happy.”” (Kaplan, 2014, p. 365). In other words, there are strong incentives not to deliver negative audit results to the management that employs and remunerates auditors (Moore et al., 2006).

The state, represented by public prosecutors and courts, acts as “nature” in this game since it does not strategically adjust the detection probabilities of law enforcement (see Tsebelis, 1990, for this differentiation).

3.2 The bright side of the game

In Figure 2, the audit game of Figure 1 is specified with additional assumptions. From the auditor’s viewpoint, “Nature” selects the type of the firm management’s accounting method as

⁴ Dabrowka Grodz (2016) proposed a policy to change the appointment and payment of external auditors. She suggested a Public Auditing Board whose obligation is to appoint and pay auditors. In this way, the “second master” would take over the role of the principal in the auditing game.

⁵ In a variant of the audit game in Appendix 2 of this paper, a strategically active (large) investor is included who decides whether to trust the auditor’s certificate and hold the investment or to distrust it and sell the investment.

either honest with probability h or fraudulent with probability $1-h$. Nevertheless, it is the management that decides on honest or fraudulent accounting. Therefore, the Manager is an active player in the auditing game. The Auditor chooses deep or shallow auditing with probability d and $1-d$, respectively. With deep auditing, accounting fraud is always detected with probability of 1. Applying shallow auditing, fraud is detected with probability p .⁶ Detected accounting fraud is punished with a big fine, b , with probability f and with a small one, s , otherwise.

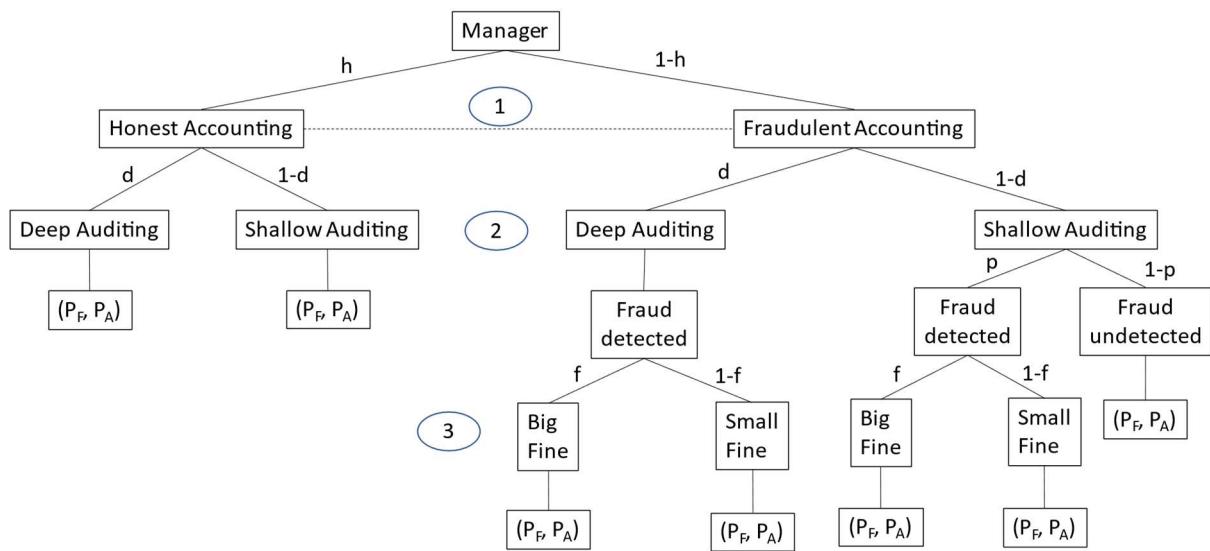


Figure 2: A specification of the auditing game

Source: Own depiction.

The payoffs are assumed as follows. Firstly, the case of honest accounting is described. The firm's true profit is Y , net of accounting fees. In the case of shallow auditing, there is no additional cost (for instance, provide additional accounting evidence) due to the audit. With deep accounting, however, further accounting effort is necessary that reduces the firm's profit

⁶ Gimbar and Mercer (2021) report that auditors overestimate the probability of a jury verdict because of negligence, and therefore, they also anticipate too negative consequences for reputation and litigation. However, since these results are found in a rather artificial environment (auditors had to decide on the risk that a jury will return a verdict in real negligence lawsuits), it seems not applicable to behavior in the practice of auditing (see, for instance, Kaplan, 2014).

by a . The accounting fee, F , contains two elements: a fixed fee of K and a variable component, $c \cdot Y$, that is dependent on the true profit of the firm:

$$F = K + c \cdot Y, 0 \leq c < 1. \quad (1)$$

In contrast to shallow accounting, deep accounting requires additional effort of the Auditor and imposes additional auditing cost of e . This reduces the remuneration of the Auditor to $F-e$.

Secondly, fraudulent accounting under deep auditing and fraud detection reduces the firm's true profit to $Y-a-b$ with a big fine and to $Y-a-s$ with a small fine. With shallow auditing and undetected fraud, the firm's profit is $Y+g$, with $g > 0$ as fraudulent profit. However, if the fraud is externally detected, the firm's profit is $Y-b$ with a big fine and $Y-s$ with a small fine. The Auditor's payoff with fraudulent accounting and deep auditing is $F-e$. With shallow accounting and undetected fraud, the Auditor payoff is F . However, with externally detected fraud the Auditor's remuneration is assumed as $K-r$ with $K-r \leq 0$. This means that the Auditor loses its profit share, $c \cdot Y$, and receives only the fixed fee K which is not large enough to compensate for the losses that consist of a reputation loss, ρ , and a fine, D :

$$r = \rho + D \quad (2)$$

Furthermore, it is assumed that $F - e > (1 - p)F + p(K - r)$, i.e., that deep auditing provides a higher auditing remuneration than shallow auditing with external fraud detection. In addition, for the firm is supposed that fraudulent accounting brings about a higher payoff with shallow auditing, i.e., $Y + (1 - p)g - p[s + f(b - s)] > Y$.

To sum up, the payoffs read as follows (P_F : payoff of the firm; P_A : payoff of the Auditor):

- Honest accounting
 - Deep auditing: $P_F = Y-a$, $P_A = F-e$, $Y-a, F-e > 0$,

- Shallow auditing: $P_F = Y, P_A = F$
- Fraudulent accounting
 - Deep auditing:
 - Big fine: $P_F = Y-a-b, P_A = F-e$
 - Small fine: $P_F = Y-a-s, s < b, P_A = F-e$
 - Shallow auditing:
 - Fraud detected:
 - Big fine: $P_F = Y-b, P_A = K-r$,
 - Small fine: $P_F = Y-s, P_A = K-r$
 - Fraud undetected: $P_F = Y+g, P_A = F$

First of all, it is checked whether there are pure strategy Nash equilibria for the auditing game.

To check it, the payoffs are shown in the payoff matrix in Table 1.

		Manager	
		Honest accounting	Fraudulent accounting
Auditor	Deep auditing	$F-e; Y-a$	$F-e ; Y-a-s-f(b-s)$
	Shallow auditing	$F; Y$	$(1-p)F+p(K-r); Y+(1-p)g - p[s+f(b-s)]$

Table 1: Payoff matrix of the auditing game

Source: Own calculations.

As is easy to verify, there is no Nash equilibrium in pure strategies. With honest accounting on the side of the Manager, shallow auditing would be the best response of the Auditor, whereas with fraudulent accounting, deep auditing would be the Auditor's best response. However, with deep auditing, honest accounting is the best response of the Manager, whereas with shallow auditing, fraudulent accounting would be the best response of the

Manager. It follows that no “tacit collaboration” between Auditor and Manager, which will be discussed in 3.3., can become a possible equilibrium in the setting discussed here.

Therefore, the mixed-strategy equilibrium is determined. The firm’s expected payoff in the auditing is given by:

$$EU_F = h \cdot EU_F^H + (1 - h) \cdot EU_F^F, \quad (3)$$

$$EU_F = h(Y - d \cdot a) + (1 - h)\{d[Y - a - s - f(b - s)] + (1 - d)\{p[Y - s - f(b - s)] + (1 - p)(Y + g)\}\},$$

$$EU_F = Y - a \cdot d + (1 - h)\{g - [d(1 - p) + p][g + s + f(b - s)]\}. \quad (4)$$

The auditor’s expected payoff yields:

$$EU_A = h \cdot EU_A^H + (1 - h) \cdot EU_A^F, \quad (5)$$

$$EU_A = h(F - d \cdot e) + (1 - h)\{d(F - e) + (1 - d)[(1 - p)F + p(K - r)]\},$$

$$EU_A = F - d \cdot e - (1 - h)p[F - (K - r)(1 - d)]. \quad (6)$$

The mixed-strategy Nash equilibrium of the non-cooperative auditing game results from the maximization of the respective expected payoffs, whereby the firm maximizes its payoff by choosing the probability for honest accounting, h , and the auditor the probability for deep auditing, d .

The firm’s maximization problem reads:

$$\max_h EU_F = Y - a \cdot d + (1 - h)\{g - [d(1 - p) + p][g + s + f(b - s)]\}, \quad (7)$$

which gives the first-order condition:

$$\frac{\partial EU_F}{\partial h} = [d(1 - p) + p][g + s + f(b - s)] - g = 0 \quad (8)$$

and hence:

$$d^* = \frac{g-p[g+s+f(b-s)]}{(1-p)[g+s+f(b-s)]} = \frac{g(1-p)-p[s+f(b-s)]}{g(1-p)+(1-p)[s+f(b-s)]}, \quad (9)$$

with:

$$\frac{\partial d^*}{\partial p} = \frac{-[s+f(b-s)]}{(1-p)^2[g+s+f(b-s)]} < 0, \frac{\partial d^*}{\partial f} = \frac{g(b-s)}{-(1-p)[g+s+f(b-s)]^2} < 0, \frac{\partial d^*}{\partial g} = \frac{f(b-s)+s}{(1-p)[f(b-s)+s+g]^2} > 0.$$

(10)

The optimal probability for deep auditing is larger than zero if the potential gain by fraudulent accounting is higher than the expected punishment:

$$d^* > 0 \text{ if } g > \frac{p[s+f(b-s)]}{1-p}; \text{ otherwise: } d^* = 0. \quad (11)$$

The auditor's maximization problem reads:

$$\max_d EU_A = h(F - d \cdot e) + (1-h)\{d(F - e) + (1-d)[(1-p)F + p(K - r)]\}, \quad (12)$$

which gives the first-order condition:

$$\frac{\partial EU_A}{\partial d} = -(1-h)p(K - r) - e = 0 \quad (13)$$

and therefore:

$$h^* = \frac{e+p(K-r)}{p(K-r)}, \quad (14)$$

with

$$\frac{\partial h^*}{\partial p} = \frac{-e}{p^2(K-r)} > 0 \text{ for } K - r < 0, \frac{\partial h^*}{\partial r} = \frac{e}{p(K-r)^2} > 0. \quad (15)$$

The probability for honest accounting is larger than zero if the reputation loss plus the fine is higher than the expected cost for deep auditing:

$$h^* > 0 \Leftrightarrow r > \frac{e+pK}{p} \text{ for } (K - r) < 0; h^* = 0 \text{ otherwise.} \quad (16)$$

Moreover, the probability for honest accounting increases in both the fraud detection probability by shallow auditing, p , and the size of the reputation loss, r .

The mixed-strategy Nash equilibrium is, therefore, for $g > \frac{p[s+f(b-s)]}{1-p}$ and $r > \frac{e+pK}{p}$ for $r > K$ given by:

$$(d^* = \frac{g-p[g+s+f(b-s)]}{(1-p)[g+s+f(b-s)]}, h^* = \frac{e+p(K-r)}{p(K-r)}). \quad (17)$$

Note that the probability for deep auditing in the non-cooperative Nash equilibrium is increasing in the potential gain by fraudulent accounting, g , and decreasing in the exogenous probability of fraud detection, p , and the exogenous probability for a high fine, f . By contrast, the probability for honest accounting in the non-cooperative Nash equilibrium, h , depends on the effort cost of the auditor, e , the size of the loss r and $(K-r)$, as well as the exogenous probability of fraud detection, p . The probability for honest accounting increases in r and in p for $r > K$.

It is to be noted that K from a single client is very small for a large audit firm, while its reputational capital at stake may be relatively high. But as is argued in the introduction above, the reputation loss after audit scandals was rather small. Therefore, the detection of accounting fraud depends predominantly on the exogenous detection probability, p .

3.3 The dark side of the game

The bright side of the auditing game is based on the implicit assumption that the Manager of the firm and the Auditor are actors in a non-cooperative game. This implicit assumption may be justified if there was only one principal-agent situation in the game Manager and Auditor are supposed to play. The Manager is the principal and the Auditor the agent who perform the

audit to provide the Manager with a certification of honest accounting. As shown in Figure 1, the assumption of a single principal-agent constellation is too simple.

The dark side of the double agency of the Auditor is that the quality of the audit depends on data reported by the Manager. As argued above, the close relationship between Manager and Auditor can bring about a symbiotic arrangement (Schanze, 1993) between them, although they are in a principal-agent relationship. The reason is that both the Auditor and the Manager have common interests. Both prefer less effort and cost, as well as higher incomes and profits (Hohenfels and Quick, 2018). In addition, the Auditor is paid by the first principal, the Manager, but not by the second principals, investors and the public. Concerning the second principals, the Auditor has a decisive interest not to be negatively sanctioned. Taking all aspects together, the Auditor and the Manager may consider playing according to their own rules, i.e., to cooperate. This cooperation may not be open, but rather tacit (Quick and Henrizi, 2018). Furthermore, shallow auditing in the past might slowly drive auditors to cooperate with managers now and in the future in order to cover-up auditing misbehavior in the past (Corona and Randhawa, 2010).

Another good point in case on how shallow auditing in tacit collusion does materialize are the activities of the auditing firm EY in the Wirecard case. As the official Wambach Report clearly states several times, the problem was not fraudulent behavior by the Wirecard management deceiving the auditors, but shallow auditing:

“On March 29, 2017, the board of directors and the supervisory board were informed verbally and in writing about potential obstacles to the examination. The auditor announces a limited confirmation note of the Auditor for the consolidated and annual financial statements of Wirecard AG for the 2016 financial year, if not in the short term sufficient and adequate audit evidence on more than 20 open-ended questions relevant to the completion of central

relevance and above all the fraud allegations of a whistleblower concern, will be submitted. The audit evidence received essentially consists of oral and written statements by the board of directors. A further clarification of the content of the open Points is not apparent from the working papers. The consolidated financial statements were published on April 5th, 2017, and the annual financial statements were published on April 25th, 2017, each issued an unqualified audit confirmation note” (Wambach, 2021, p. 36, own translation).

Since the seminal game theoretic papers of Bernheim, Peleg and Whinston (1987) and Bernheim and Whinston (1987), it is well-known that a non-cooperative game might have a superior cooperative solution. Moreover, although binding cooperative commitments in the context of auditing are neither enforceable nor expedient, tacit cooperative commitments between Auditor and Manager may nevertheless be possible because of mutual interests in such a commitment.

If in the following the Auditor chooses shallow auditing – i.e., $d = 0$ – with unity probability, the Auditor is called “tacitly cooperating” with the. This assumption is in line with the earlier on mentioned statement by Mr. Geschonneck, the KPMG special auditor for Wirecard. Of course, it must pay for the Auditor to cooperate with the Manager in this way. Using (6) and inserting the results of (17) into $EU_A(d^*, h^*)$, this will happen if the following condition is met:

$$EU_A(d = 0, h = 0) = F - p [F - (K - r)] > F + e \left(\frac{F}{K-r} - 1 \right) = EU_A(d^*, h^*), \quad (18)$$

$$EU_A(d = 0, h = 0) > EU_A(d^*, h^*) \Leftrightarrow p_A^c < \frac{e}{r-K} \quad (19)$$

with p_A^c as the Auditor’s critical external detection probability.

Hence, for a critical external detection probability smaller than p_A^c , tacit collusion from the Auditor’s viewpoint is feasible because it provides a higher expected payoff. To put it

differently: p_A^c is the upper bound of the range within tacit collusion is feasible. The determinants of this bound are the effort level of deep auditing, e , the monetary and reputation losses by detection of shallow auditing, r , and the fixed fee for auditing, K , provided that $r > K$. Let K^* be the upper limit that guarantees $r > K$ for the individual audit firm. The critical detection probability p_A^c for shallow auditing increases in K until $K \leq K^*$ and decreases in r :

$$\frac{\partial p_A^c}{\partial K} = \frac{e}{(r-K)^2} > 0, \frac{\partial p_A^c}{\partial r} = \frac{-e}{(r-K)^2} < 0.$$
Furthermore, the probability increases in e , the additional auditor effort for a deep audit, if $r > K$. These results are in line with economic intuition as the higher K does not incentivize deep accounting since it is a fixed sum that is independent of auditing quality. But this also means that a higher K up to $K \leq K^*$ implies a higher p_A^c . Hence, the more expensive the mere threat of losing K becomes when doing deep auditing, the larger gets the critical detection probability.

These results can easily be reconciled with the results of the empirical papers cited above. A higher K up to K^* implies a higher p_A^c . Hence, the more expensive the mere threat of losing K becomes when doing deep auditing, the larger gets the critical detection probability. K can be viewed as “variable compensation” for local partners; Gosh and Siriviriyakul (2018) show for “K” that a 100% increase in tenure increases audit fees by 7% for the Big 4 audit firms.

The smaller K , e.g. because of a large profit pool of the audit firm, the less the incentive for shallow auditing, because the eventual loss of K and of one client will be compensated by the national or worldwide firm. We can interpret the size of the profit pool as a proxy for the size and the relevance of reputation for the national or worldwide firm. Therefore, the reputational concerns of the firm would lead to a quality enhancing income insurance of the client auditors on the local level. In this respect, firms with high reputation provide a

comparable high difference between r and K . Thereby they decrease, c.p., the incentive for shallow auditing.

The dependency of local partners on high values of K – because of small firmwide profit pools – can be increased when partners carry extensive debt which leads to low audit quality (Dekeyser et al., 2021). By contrast, net wealth of the auditor, serving as an insurance coverage against fluctuating K up to $K \leq K^*$, positively affects audit quality (Dekeyser et al., 2021).

Furthermore, the Auditor's critical external detection probability increases in e , the additional auditor effort for a deep audit. How can this be reconciled with empirical results? Gosh and Siriviriyakul (2018) show in their paper on quasi rents of tenure and effort that: „Audit effort decreases with audit firm tenure across all groups of filers“, that goes hand in hand with economic bonding between auditor and client. To illustrate the argument on effort elaborated in our model, we assume that e_{2d} (e_{1d}, e_{1s}) stands for shallow, s, and deep, d, auditing with quasi rents in t_2 and in t_1 , respectively, with $e_{2s} < e_{1s} < e_{1d} < e_{2d}$ (according to Gosh and Siriviriyakul, 2018). Therefore, it holds that $(e_{2d} - e_{2s}) > (e_{1d} - e_{1s})$, i.e., because of the decrease of effort with audit tenure over time a larger amount of effort would be required to exercise deep auditing in t_2 after shallow auditing in t_1 than to apply already deep instead of shallow auditing in t_1 .

The higher the total loss of the Auditor (measured as $r = \rho + D$) is when shallow auditing is detected, the smaller the range of the external detection probability that makes collusion attractive. Collusion is also attractive for the Auditor if the additional effort of deep auditing is high and the net loss of an externally detected fraud, $r-K$, is small.

The Manager will also tacitly collude with the Auditor if the expected payoff is larger with collusion, i.e., if $EU_F(h = 0, d = 0) > EU_F(h^*, d^*)$. The latter requires:

$$EU_F(h = 0, d = 0) = Y + g(1 - p) - p[s + f(b - s)] > Y + \frac{a\{g - p[g + s + f(b - s)]\}}{(1-p)[g + s + f(b - s)]} = \\ EU_F(h^*, d^*), \quad (20)$$

$$EU_F(h = 0, d = 0) > EU_F(h^*, d^*) \text{ if } p_F^c < \max \left\{ 1 - \frac{a}{g + s + f(b - s)}, \frac{g}{g + s + f(b - s)} \right\}, \quad (21)$$

with p_F^c as the Manager's (and, hence, the firm's) critical external detection probability. Note that there are two such values as the determining inequality is quadratic in p and has therefore two solutions for p_F^c .

This detection probability increases in the size of the fraudulent gain, g (as well as in the size of the fines, s and $f(b-s)$):

$$\frac{\partial p_F^c}{\partial g} = \frac{a}{[g + s + f(b - s)]^2} > 0, \quad \frac{\partial p_F^c}{\partial g} = \frac{s + f(b - s)}{[g + s + f(b - s)]^2} > 0, \text{ respectively.} \quad (22)$$

The Auditor and the Manager may collude rather than play non-cooperatively Nash, i.e., $(h = 0, d = 0)$, if both critical external detection probability values are low:

$$p_A^c < \frac{e}{r - K} \text{ and } p_F^c < \max \left\{ 1 - \frac{a}{g + s + f(b - s)}, \frac{g}{g + s + f(b - s)} \right\}. \quad (23)$$

Given that the external detection probability of accounting fraud is rather small, the Manager has an incentive for fraudulent accounting and at the same time the Auditor has an incentive to audit shallowly. Although the brand of the auditing firm may be destroyed (as, for instance, in the case of Arthur Andersen), the individual auditors are much less endangered by reputation loss. It is noteworthy that while a fraudulent firm is just another client for a large audit firm, adding only a small contribution to its total fees, this client is at the same time the entire business case of the local audit partner. If we assume a dyadic relationship between a local auditor and the (local) management of the client firm, we find an incentive for shallow auditing when the local auditor is afraid of detecting severe problems. That could cost her the auditing assignment with her client firm, including the loss of all future fees, and thereby

putting her partnership at the audit firm at risk. Put differently, tacit collusion may be a cooperative solution for the audit game. The “local” perspective taken here is also applied by the Financial Reporting Council, FCR, in the UK, the audit and accounting regulator’s disciplinary tribunal, which in a recent case centers on the claim that the audit firm KPMG forged documents and provided misleading information during audit inspections. This inspection could result in fines, individuals being barred from the profession and other sanctions directed at individuals (WSJ, 2022).

3.4 Sed quis custodiet ipsos custodes (But who will guard the guardians)?

In his Nobel Prize lecture 2007, Hurwicz asked the old question of the Roman author Juvenal, “But who will guard the guardians?”. The relevance of this question reveals itself if an insight of Hurwicz is accounted for, namely: “Truth is not a Nash equilibrium” (Hurwicz, 2007, p. 283), although in a different context. On the bright side of the auditing game, both the Auditor and the Manager play mixed strategies in the auditing game. As a consequence, “truth” is not fully guaranteed. On its dark side, the game demonstrates that there are substantial opportunities to cheat to the detriment of investors and the public. However, as briefly said above, the key problem is that auditors are the agents of two principals. Almost ironically, the principal who is the target of the auditing is obliged to choose and to pay the agent. This then leads to the question “But who will guard the auditors from misbehaving?” or as Myerson (2009, p. 69) put it “who enforces the enforcers (i.e., auditors) to enforce our (accounting) laws”.

It might be argued that more rigorous reading of the mixed Nash equilibrium of the non-cooperative auditing game gives several hints for a solution of the double agent problem. That is, the parameters of the model – the external detection probability of fraud, p , the probability for small and big punishments, s and b , the liability and reputation, r , of the audit

firms – should be set to make deep auditing of auditors and honest accounting of managers – a dominant strategy. The simplest way to do that would be to set the external detection probability equal to unity, $p = 1$. However, if it were possible to set this probability equal to unity, why should there be auditors? Moreover, the sizes of punishments cannot be increased so much, that deep auditing and honest accounting will become a dominant strategy. The same holds true for the liability of audit firms. Finally, there are three additional variables that cannot be easily set externally: the fix payment for audits, K , the effort cost of auditing, e , and the size of the fraudulent profit, g . In this respect, the effort cost, e , is particularly relevant. The deeper the auditing is, the higher will be the effort cost – and the less likely becomes honest accounting according to the mixed strategy Nash equilibrium value, h^* .

Another solution to the Guardian issue might be internal guardians (Hurwicz, 2007; see Ronen, 2010, for an overview of several attempts to reform corporate auditing). Audit firms are business organizations with principals and agents within it. Even if the firm faces reputational constraints that may prevent the firm as a whole from (open or tacit) cooperation with the audited firm, this does not hold necessarily for the auditors as agents of the audit firm as a principal. The reason is that there may be strategic incentives for the individual auditor to ignore the reputational concern of the audit firm. In this respect, it is not the audit firm that may have a strategic incentive to cooperate with the managers of the audited firm, but the individual auditors. Therefore, internal guardians could probably solve the Guardian issue. As pointed out by Myerson (2009), such a solution would be based on (team) leaders within the audit firm organizations who monitor team members and prevent them from *moral shirking*, that is, from cooperating (openly or tacitly) with managers of the firm they audit. In this respect, *team spirit* (Alchian and Demsetz, 1972, p. 790) or a sense of *group identity* (Myerson, 2009, p. 74), supported and enforced by a team leader, might be at least a partial solution. However, even here the Guardian issue arises anew as the question remains who will guard team leaders

themselves from misbehaving, except that team leaders are motivated by Kantian duty of beneficence (Mansell, 2013).

By theory, in (big) audit firms, the incentive for high-quality, deep auditing within an audit firm should come from career opportunities, in particular, from being promoted to a partner status. However, as it seems, to become a partner in an audit firm, auditors are motivated to attract new, wealthy client firms. This incentive deviates starkly from a high-quality incentive if new client firms value the cooperation between auditor and firm managers higher than deep, high-quality audits. Since the firms themselves choose and pay the audit firm, it seems not very likely that audit quality is decisive for the choice of the audit firm. Gosh and Siriviriyakul (2018) find that in Big Four audit firms, audit fees increase with tenure length whereas auditing costs decline. In contrast to smaller, non-Big Four firms, Big Four firms realize quasi rents from their lengthy tenure (Gosh and Siriviriyakul, 2018). The realization of quasi rents seems not to be related with audit quality, but rather with firm-auditor bonding. However, as long as the public perception of the reputation of the audit firm is not seriously damaged, complaisant auditors may have a competitive advantage over high-quality auditors. To put it briefly, internal guardians provided by the audit firm's organization may not solve the Guardian issue.

In recent times, a new form of internal guardian originated, namely whistleblowers. As insiders they have information advantages in comparison to persons outside firms. Moreover, whistleblowers can come from the audited firm, as well as from the audit firm. In the model presented above, whistleblower activities would increase the probability p for a detection of accounting fraud by a non-auditor. In several countries (e.g., U.S. and U.K.), whistleblowers are legally protected against retaliation and they may also receive rewards for whistleblowing. Although whistleblowing is an effective instrument to detect corporate financial fraud (Wilde, 2017; Call et al., 2018), it is also a double-edged sword against fraud. The first reason is that

the rewards must be substantially large to compensate for the individual whistleblower's risk and costs, but high rewards provide incentives for false reports (Givati, 2016; Buccirossi, Immordino and Spagnolo, 2017). The second reason is psychological. Whistleblowing, considered as a kind of denunciation violates social norms of otherwise cooperating individuals. Its consequence might be a reduction of cooperation in the respective firms, as was demonstrated experimentally by Wallmeier (2019). After all, Jenk (2016) argues that whistleblowing may be good for society, but does not pay for the whistleblower. Hence, although whistleblower can add power to the enforcement of legal rules by detecting accounting fraud, the personal consequences are seemingly too serious so that whistleblowing will rather be an exception. Therefore, it may not increase the detection probability, p , to a decisive extent.

Another solution of the Guardian issue is external guardians (Hurwicz, 2007). As indicated by equation (23), cooperation between Auditor and Manager depends on the critical size of the external detection probability. This is empirically evident from the accounting scandals reported in Section 2 and in the Appendix, but also from Dyck, Morse and Zingales (2010).

The most promising external guardians are:

- regulators and other authorities,
- investors (short sellers) and
- the media.

Regulators and authorities determine the legal standards of accounting, but they must also enforce the respective rules. In effect, they define the "rules of the game" and are responsible for rule enforcement, i.e., they are the referees. In this respect, auditors are agents of the rule enforcers. In contrast to auditors, regulators and authorities do not have a strategic incentive

problem, but an information incentive problem. The strategic incentive issue of auditors is the result of the principal-agent relationship between auditors and managers, where the firm of the manager pays the agent-auditors. The information incentive issue between the regulators and authorities on one side and auditors on the other side results also from a principal-agent relationship where the agent is not paid by the principal. However, the agent-auditors have an informational advantage in this relationship that they may use in their own economic interest. Put differently, the auditors may earn an information rent due to their knowledge of the internal financial accounting of the firm they audit. This information will not necessarily be shared with the principal-authority. Therefore, the authorities may not be able to react timely to prevent scandals. Although the respective authorities are institutionally indispensable, they are not equally well suitable external guardians. Finally, as argued and theoretically demonstrated by Ewert and Wagenhofer (2019), there might be too much enforcement that decreases the quality of firms' financial reporting as enforcement and auditing can be either complements or substitutes for each other.

This is different for investors and in particular for short-sellers. Although they do not have a direct relationship with auditors, they have financial stakes in the respective firms. Investors and short-sellers have, therefore, strong monetary incentives for monitoring firms from outside. The latter is not possible without information that exceeds what is publicly known about firms. Even gossip might be relevant for them. The possibility for short-selling stock is a strong instrument to transform new information into actions and money. The downside of short-selling is, of course, that it can put falsely enormous pressure on firms or even ruin them. This downside is mitigated by respective short-selling risks for short-sellers themselves, for instance, when stocks become more expensive than expected (Engelberg, Reed and Ringgenberg, 2018). Nevertheless, short-sellers have more information than other traders (Reed, 2013), and this informational advantage is crucial for their role in fraud detection.

In the external detection of corporate fraud, the media may participate. Recently, this became visible to the general public by investigations in tax evasion, as e.g. the so-called Panama papers. However, according to Rosoff (2007), mass media in particular may be a cure, but also a cause of corporate crime. The reason is that mass media may enhance the hype of new firms over and above of realistic expectations. In addition, mass media may increase the public's expectation gap with respect to the function and objective of audits, particularly after the detection of corporation fraud (Cohen et al., 2017). Media can also be a cure for corporate fraud as investigative journalism supports the detection of such crimes.

In the aftermath of the Wirecard scandal in Germany, Ewert and Wagenhofer (2020) ask for more transparency of audits and their results. According to recommendations of Ewert and Wagenhofer, besides the publication of problems with internal control systems of big enterprises and a better coordination of the regulatory authorities, the quality of audits should be published to force reputation losses on audit firms with shallow audits. As said in the first section of this paper, the main issue is that even scandalous firm events seem not to reduce reputation of auditors (partially in contrast to audit firms) to a significant extent. The complexity of auditing, as well as the scarcity of experienced auditors, may prevent auditors from the consequences of detected financial fraud scandals. Therefore, it seems rather unlikely that transparency of audit quality is the key in the fight of corporate fraud. In effect, transparency may not be a reliable external guardian in the Guardian issue.

4. Policy Implications

To incentivize auditors to certify only deeply researched financial statements of their client firms is a very difficult task. In our paper, the double-agent nature of the auditor-firm relationship is the key to the understanding of the issue. Despite legal regulations and

professional standards, auditors are selected by firms and also paid by them. In this way, the relationship between auditors and their client firms resembles a symbiotic attachment. Put differently, there is an asymmetry for the auditor double-agent that tilts the game to the favor of the firm.

As argued in the relevant literature, the auditing firm has “skin in the game” (Taleb, 2018) as it risks its reputation by shallow auditing or even collaboration with a fraudulent firm. However, as the accounting scandals demonstrate, this “skin” is not really big. The reason is that only a few big auditing firms are able and capable to audit large corporations. Even if an auditing firm is destroyed in an accounting scandal, the firms’ partners and employees do not lose much in such an event because they are needed furthermore in the business. Since also whistleblowing is of mixed blessing, the question is how the incentives for deep auditing can be intensified.

Increasing the liability of the auditing firms might be such an instrument. As pointed out by Ronen, the success of this policy hinges on the expected liability costs that are determined by the probability of fraud detection by the regulator and the respective civil litigation (Ronen, 2010, p. 203). According to Ronen, the detection probability is low and the chances for civil litigation are lower or even non-existent (Ronen, 2010, p. 204). Finally, the liability costs can be transferred to the clients (Ronen, 2010, p. 204). In this way, the intended incentives deflagrate.

Ronen (2002, 2006, 2010) himself proposed another solution to the auditor incentive issue, a so-called “Financial Statement Insurance”, FSI for short. Firms are free to buy such an insurance or not. If they buy it, the insurer investigates “the risk of omissions and misrepresentations by examining a company’s internal controls and management incentive structures, its history and competitive environment, and other relevant factors” (Ronen, 2010,

p. 205). In addition, the insurer determines the coverage and the premium that a company must pay. An insured firm can select an auditor from a list that is provided by the insurer that also pays the auditing fees. The latter are afterwards recovered from the insured. Most importantly, the *investors* are insured in this way and not the managers or the company. That is, if investors suffer losses due to omissions or misrepresentations in the financial statement, they are compensated by the insurer (see Ronen 2002, 2006, as well as Ronen and Yaari, 2002; Ronen and Sagat, 2007, for more details).

Ronen's idea is in line with the model provided here. The main idea is to insure investors against the risk of fraudulent accounting by letting the respective firms pay for it. However, firms that chose a financial statement insurance have an incentive to avoid fraudulent accounting since they may not get such an insurance anymore if they were detected to be fraudulent. Moreover, the insurer takes over the responsibility to select trustworthy auditors for its list. Since the auditors are now paid by the insurer, the relationship between auditor and its client firm will change as there will be no incentive for a symbiotic relationship. The double-agent nature of auditors is dissolved as the principal of the auditor is now the insurer.

However, the insurance solution of Ronen did not find much support. The main reason might be that it is too complicated and that it requires a completely new insurance scheme. According to the 'dark side' of our above model, it might even be possible that the insurance and the auditors cooperate with each other to the disadvantage of investors.

A final attempt to tilt the auditing game to investors could be that investors as a group decide which auditing company is selected and investors pay the auditing directly. In this concept, investors are clearly the sole principal of auditors. The crucial issue of the concept is the heterogeneity and the number of investors. One could argue that the board of supervisors is the adequate representation of investors' interests. If this is accepted, this board may select

the auditors and pay them by reimbursing the payment directly from investors by, e.g., reducing their dividend payments accordingly. Nevertheless, also this approach is not completely immune to dark-side cooperation between auditors and managers. The information rent of auditors can be big enough to collaborate with a fraudulent management.

As it seems, the policy implications of the analysis in this paper is as follows:

1. It will not possible to create incentives such that the first-best solution of a fraud-free corporate world is realized. The reason is the information asymmetry between the firm and auditors on one side and the investors on the other side.
2. The remaining approaches to tilt the auditing game to investors are:
 - a. whistleblowers,
 - b. short sellers among the investors and
 - c. journalists and the media.
3. Although the mentioned persons may take part in improving the quality of accounting and auditing, these approaches have their own downside. Whistleblowers, short-sellers and journalists can falsely claim fraud and harm businesses and likely investors. Therefore, careful handling of such claims is recommended.

5. Conclusion

In this paper, auditing is investigated as a privately provided public good. The main aim of auditing is to protect the public and actual, as well as potential, investors from accounting fraud. However, auditors are paid by the firm for auditing. According to agency theory, auditors are agents of two principals whose objectives are not identical. In particular, managers of firms have their own aims that may deviate from their firm's aims. In a game between two principals and one agent, the possibility for complicity occurs. This gives rise to two games with different

outcomes, a bright-side game where auditing as a public good is provided with high quality. However, there may also exist a dark-side game where the auditors conspire with the management of the audited firm. Unfortunately, this conspiracy may not be a criminal association, but rather a tacit symbiotic arrangement. The existence of a criminal association can be detected with respective investigations. Tacit symbiotic arrangements are difficult to detect and even more difficult to prove.

In this paper, both the bright-side game and the dark side game are solved. It is demonstrated that shallow auditing is a method for tacit symbiotic arrangements that is not only difficult to detect, but also even more difficult to prevent. In particular on the cost side, the loss of reputation of the auditing firm may not be very noticeable for the auditors themselves. Although the brand of the auditing firm may be destroyed (as, for instance, in the case of Arthur Andersen), the individual auditors are much less endangered by reputation loss. On the revenue side, the client firm is the entire business case of the local audit partner. If we assume a dyadic relationship between a local auditor and the (local) management of the client firm, we find an incentive for shallow auditing if the local auditor is afraid of detecting severe problems that could cost her the auditing assignment with her client firm, including the loss of all future fees. Given that an auditing firm's capital consists to a very large extent of the auditors' human capital (Rajan & Zingales, 2001) and that the availability of auditors who are able to audit large companies is restricted, the auditing firm's reputation loss does not extend to auditors. As a consequence, reputation loss is only a weak threat to shallow auditing, i.e., to collaborate tacitly with the audited firm.

Since the dark-side collaborative game, in particular between local auditors and managers, is hardly to deter by usual policy methods, unusual internal and external controls by persons with "skin in the game" (Taleb, 2018) seem to be required. Whistleblowers from inside the firm, short-sellers, as well as journalists and the media are the relevant persons here.

Nevertheless, it is to emphasize that it will not be possible to reach the first-best state of fraud-free firm finances.

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Appendix 1

A1: The biggest accounting scandals and their revelation (since 1986)

Year	Company	Sector	Sector/exact activities	Audit Firm	Uncovered from (1)	Notes	Sources
1986	ESM Government Securities	Tertiated	Government securities dealer, specializing in repurchase agreements and reverse repurchase agreements.	Alexander Grant & Company	Regulator	SEC	https://www.washingtonpost.com/archive/business/1986/10/23/an-accounting-lesson/16aead22-cd5b-4012-af2b-491786526466/
1986	ZZZZ Best	Secondary	Carpet-cleaning company	x	Media	Los Angeles Times	http://www.globalfinancialdata.com/zzzz-worst-and-the-frankenstein-of-fraudsters/
1988	Bankers Trust	Tertiated	Asset Management company	Arthur Young & Co	Company itself	Bankers Trust told the Fed (Federal Reserve Board) the truth about its foreign exchange problem	https://money.cnn.com/magazines/fortune/fortune_archive/1992/09/07/76829/index.htm
1988	Barlow Clowes	Tertiated	Bond-washing' operation (gilt-edged Government bonds were purchased and sold in order to create tax advantages)	x	Regulator	Department of Trade and Industry	https://en.wikipedia.org/wiki/Barlow_Clowes
1989	Crazy Eddie	Secondary	Consumer electronics chain	x	Regulator	SEC und financial analysts	https://de.finance.yahoo.com/nachrichten/die-groesten-finanzbetrug-aller-zeiten-eddie-antar-alias-crazy-eddie-131851947.html
1989	MiniScribe	secondary	Manufacturer of disk storage products	x	Regulator	Investigative committee of outside directors	https://www.cbronline.com/news/massive_fraud_over_four_years_uncovered_at_miniscribe/
1990	Polly Peck	primary	Textile company	x	Regulator	Serious Fraud Office	https://www.bbc.com/news/uk-19161940
1991	Bank of Credit and Commerce International	tertiary	International bank	x	Audit	PWC	https://en.wikipedia.org/wiki/Bank_of_Credit_and_Commerce_International
1980 to 1992	Northguard Acceptance Ltd.	tertiary	Commercial and real estate lending	EY	Others	Investors	https://www.coursehero.com/file/p32hk5j/Facts-Northguard-Acceptance-Ltd-NGA-and-Northguard-Holdings-Ltd-NGH-lent-and/
1992	Phar-Mor	secondary	Chain of discount drug stores	Coopers & Lybrand	Regulator	Federal Bureau of Investigation	https://www.chicagotribune.com/news/ct-xpm-1992-08-04-9203100239-story.html
1996	Informix Corporation	tertiary	Software company	EY	Audit	EY	https://www.sfgate.com/bayarea/article/Hollow-Words-Federal-prosecutors-say-2896423.php
1997	Sybase	tertiary	Enterprise software and services company	EY	Company itself	Sybase announced that it had found inconsistencies in profits reporting	https://en.wikipedia.org/wiki/Sybase
1998	Cendant	tertiary	American provider of business and consumer services	EY	Audit	Audit committee set up by Cendant's Board of Directors	https://en.wikipedia.org/wiki/Cendant
1989 to 1998	Livent	tertiary	Theatre production company	Deloitte	Company itself	Livent announced they had discovered serious 'accounting irregularities	https://en.wikipedia.org/wiki/Livent

1998	Cinar	Tertiated	Children's television production companies	EY	Audit	Internal audit	https://en.wikipedia.org/wiki/Cinar_scandal
1999	Waste Management, Inc.	Primary	Waste company	Arthur Andersen	Audit	After the accounts were rechecked and recalculated in 1997, auditors discovered a misstatement of profits	https://www.value-research.net/2018/10/01/waste-management-inc/
2000	MicroStrategy	Tertiated	Software company	PWC	Regulator	SEC	https://www.washingtonpost.com/archive/politics/2000/03/21/microstrategy-stock-plunges-62/d8bcebbd-c605-429d-8e05-7990e65d9f3b/
2000	Unify Corporation	Tertiated	Developers of database management systems and tools for database development	Deloitte	Company itself	The company reported accounting irregularities	https://en.wikipedia.org/wiki/Daegis_Inc.
2000	Computer Associates	Tertiated	Software company	KPMG	Others	Shareholder-based class-action lawsuit accused CA	https://en.wikipedia.org/wiki/CA_Technologies
2000	Lernout & Hauspie	Tertiated	Development of computational speech recognition	KPMG	Media	Wall Street Journal	https://en.wikipedia.org/wiki/Lernout_%26_Hauspie
2000	Xerox	Tertiated	Technology and service company in the document management sector	KPMG	Regulator	SEC	https://en.wikipedia.org/wiki/Xerox
2001	One.Tel	Tertiated	Telecommunications company	EY	Others	Merchant bank Merrill Lynch warned that One-Tel was in danger of running out of cash	https://research-repository.griffith.edu.au/bitstream/handle/10072/42673/74746_1.pdf
2001	Enron	secondary	Energy, commodities, and services company	Arthur Andersen	Regulator	SEC	https://edition.cnn.com/2013/07/02/us/enron-fast-facts/index.html
2001	Swissair	secondary	Airline	PWC	Media	The press published the financial situation of the group	https://en.wikipedia.org/wiki/Swissair
2002	Bristol-Myers Squibb	tertiary	Pharmaceutical company	PWC	Company itself	The company came clean and issued a press release stating that it had made some errors in past financial reports and that it was correcting those numbers	https://de.slideshare.net/shivi010/memo-on-ethical-issue-of-deceiving-accounting-practices-faced-by-bristol-myers-squibb
2002	Global Crossing	tertiary	Telecommunications company	Arthur Andersen	Media	Roy Olofson, former vice president in a pres	https://edition.cnn.com/2002/TECH/internet/02/12/global.crossing.probe.idg/index.html
2002	Homestore.com	tertiary	Real estate websites	PWC	Regulator	SEC	https://www.alta.org/news/news.cfm?20050429-The-Homestore-white-collar-scandal
2002	ImClone Systems	tertiary	Biopharmaceutical company	KPMG	Regulator	SEC	https://www.sec.gov/news/press/2003-69.htm
2002	Merck & Co.	tertiary	Pharmaceutical drugs, vaccines and animal-health products	PWC	Regulator	SEC	https://money.cnn.com/2002/07/08/news/companies/merck/index.htm
2002	Merrill Lynch	tertiary	American investing and wealth management division of Bank of America	Deloitte	Regulator	FBI's Criminal Investigative Division	https://archives.fbi.gov/archives/news/pressrel/press-releases/three-top-former-merrill-lynch-executives-charged-with-conspiracy-obstruction-of-justice-perjury-in-enron-investigation

2002	Peregrine Systems	tertiary	Enterprise software company	Arthur Andersen	Regulator	FBI, SEC	https://www.wsj.com/articles/SB105702139224606700
2002	Qwest Communications	tertiary	Telecommunications carrier	Arthur Andersen; KPMG	Regulator	SEC	https://www.justice.gov/opa/pr/justice-department-returns-44-million-victims-qwest-communications-fraud; https://en.wikipedia.org/wiki/Joseph_Nacchio
2002	Tyco International	tertiary	Security systems company	PWC	Regulator	SEC	http://www.math.chalmers.se/Stat/Grundutb/CTH/mve220/1718/Hashem-Rami-Tyco%20International.pdf
2002	WorldCom	tertiary	Long-distance telephone company	Arthur Andersen	Company itself	Internal audit, Cynthia Cooper	https://www.theguardian.com/business/2002/jun/28/corporatefraud.worldcom
2002	Kmart	secondary	Box department store	PWC	Regulator	The stewardship review was conducted by Kmart's bankruptcy counsel, the Chicago law firm Skadden, Arps, Slate, Meagher & Flom and two forensic accounting firms; also SEC and FBI	https://core.ac.uk/download/pdf/5009888.pdf
2002	Sunbeam	secondary	Electric home appliances	Arthur Andersen	Regulator	SEC	https://www.researchgate.net/publication/256034894_Accounting_Fraud_Business_Failure_and_Creative_Auditing_A_Micro-Analysis_of_the_Strange_Case_of_Sunbeam_Corp/link/54975830cf28d6deca48e93/download
2002	Adelphia	tertiary	Cable television company	Deloitte	Others	Suspicion of Oren Cohen, analyst	https://www.cnet.com/news/the-end-of-the-adelphia-saga/
2002	AOL	tertiary	American web portal and online service provider	EY	Regulator	SEC	https://www.faz.net/aktuell/wirtschaft/bilanzskandale-aol-time-warner-gibt-fehlbuchungen-zu-171797.html
2002	CMS Energy	primary	Energy company	Arthur Andersen	Regulator	SEC	https://www.essays24.com/essay/Cms-Energy-Scandal-And-Rebound/23402.html
2002	Duke Energy	primary	Energy company	Deloitte	Regulator	SEC	https://money.cnn.com/magazines/fortune/fortune_archive/2004/09/06/380319/index.htm
2002	Vivendi Universal	tertiary	French media group	Arthur Andersen	Media	Financial Times	https://www.manager-magazin.de/digitales/it-a-203671.html
2002	Dynegy	primary	Energy company	Arthur Andersen	Media	Wall Street Journal; afterwards investigations from SEC	http://www.na-businesspress.com/JAF/SellersF_Web14_2_.pdf
2002	El Paso Corporation	primary	Provider of natural gas and related energy products	Deloitte	Regulator	Federal Energy Regulatory Commission	https://en.wikipedia.org/wiki/El_Paso_Corp.
2002	Freddie Mac	tertiary	Home mortgage financing	PWC	Regulator	Office of Federal Housing Enterprise Oversight	https://www.forbes.com/2003/12/11/cx_aw_1211freddie.html?sh=262b3c533835
2002	Halliburton	primary	Oil field service companies	Arthur Andersen	Audit		https://corpwatches.org/article/halliburton-bribery-scandal-deepens
2002	Mirant	secondary	Production and marketing of electric power	KPMG	Company itself	Issues were uncovered during consolidation; internal review	https://www.bizjournals.com/atlanta/stories/2002/07/29/daily22.html
2002	Nicor	secondary	Natural gas distributor	Arthur Andersen	Regulator	Inquiries by Illinois State Police, the Illinois Commerce Commission	https://www.chicagotribune.com/news/ct-xpm-2002-07-20-0207200467-story.html
2002	Reliant Energy	Primary	Energy company	Deloitte	Regulator	U.S. Attorney's Office, with the assistance of Trial	https://archives.fbi.gov/archives/news/pressrel/press-releases/reliant-energy-services-

						Attorneys from the Antitrust Division of the Department of Justice and Commodity Futures Trading Commission (CTFC), as well as special agents of the FBI	inc.-and-four-of-its-officers-charged-with-criminal-manipulation-of-california-electricity-market
2002	Symbol Technologies	Tertiated	Manufacturer and worldwide supplier of mobile data capture and delivery equipment	x	Regulator	SEC	https://www.crn.com/news/channel-programs/21401451/symbol-technologies-settles-with-sec.htm
2003	Nortel	Tertiated	Telecommunications company	Deloitte	Regulator	SEC	https://www.reuters.com/article/us-nortel-charges-chro-idUSN1936265020080619
2003	Royal Ahold	Secondary	International retail grocery and food service company	Deloitte	Regulator	SEC and the US attorney-general's office; Ducht and U.S. law enforcement authorities	https://www.theguardian.com/business/2003/feb/27/5
2003	Parmalat	Primary	Food company	Grant Thornton SpA	Others	Class action lawsuit filed by the U.S. pension fund	https://www.manager-magazin.de/finanzen/artikel/a-280802.html
2003	HealthSouth Corporation	Tertiated	Post-acute healthcare services	EY	Regulator	SEC, FBI	https://www.nzz.ch/articleCHX C6-1.88671
2004	AIG	Tertiated	Insurance Group	PWC	Company itself	On April 24, 2003, a senior Chiquita officer and a Chiquita Board member, along with outside counsel, disclosed to officials of the U.S. Department of Justice that Chiquita had been making payments to the AUC for years	https://www.justice.gov/archive/opa/pr/2007/March/07_nsd_161.html
2004	Chiquita Brands International	primary	Producer and distributor of bananas and other products	EY	Regulator	SEC	https://www.sec.gov/litigation/leases/lr17169.htm
2008	Bernard L. Madoff Investment Securities LLC	tertiary	Security trader	Friehling & Horowitz	Others	Harry Markopolos, portfolio manager for an equity derivatives asset management firm; tried to convince SEC for further investigations	https://www.fraud-magazine.com/article.aspx?id=313
2008	Anglo Irish Bank	tertiary	Bank	EY	Others	The Central Bank of Ireland revealed that they became aware of problems surrounding loans from Anglo Irish Bank to FitzPatrick; later Financial Regulator	https://archive.is/20120722081656/http://www.belfasttelegraph.co.uk/business/business-news/anglo-irish-bank-chief-quits-after-hiding-pound87m-loans-14114216.html#selection-1907.21-1907.41
2009	Satyam Computer Services	Tertiated	Information technology services company	PWC	Company itself	Raju (former chairman) wrote a letter to the Securities and Exchange Board of India (SEBI) and his company's shareholders	https://qz.com/india/379877/the-satyam-scandal-how-indias-biggest-corporate-fraud-unfolded/
2009	Biovail	Tertiated	Pharmaceutical company	x	Regulator	SEC	https://www.theglobeandmail.com/report-on-business/biovail-settles-fraud-allegations-with-sec/article17982630/
2009	Taylor, Bean & Whitaker	Tertiated	Mortage lending company	PWC	Regulator	Special Inspector General of the	https://www.wikiwand.com/en/Taylor,_Bean_%26_Whitaker

						Troubled Asset Relief Program (SIGTARP) and suspension by the Federal Housing Administration from issuing FHA mortgage loans and Ginnie Mae mortgage-backed securities	
2010	Lehman Brothers	Tertiated	Investment bank	EY	Company itself	Lehman Brothers Holdings initiating the largest bankruptcy proceeding	https://www.zeit.de/wirtschaft/2018-09/lehman-finanzkrise-henry-paulson-usa/seite-3; http://som.yale.edu/sites/default/files/files/001-2014-3A-V1-LehmanBrothers-A-REVA.pdf
2010	Kinross Gold	Primary	Gold and silver mining company	KPMG	Regulator	SEC	https://www.sec.gov/litigation/admin/2018/34-82946.pdf
2009 to 2011	Monsanto	Tertiated	Seeds and biotechnologies	Deloitte	Regulator	SEC	https://www.sec.gov/news/press-release/2016-25.html
2011	Amir-Mansour Aria	tertiary	Investment company	IAO (Audit organization) and other Audit firms	Others	The fraud reportedly was first identified at Bank Melli	https://en.wikipedia.org/wiki/2011_Iranian_embezzlement_scandal
2011	Bank Saderat Iran	tertiary	Banking and financial services company	IAO (Audit organization) and other Audit firms	Others	The fraud reportedly was first identified at Bank Melli	https://en.wikipedia.org/wiki/2011_Iranian_embezzlement_scandal
2011	Sino-Forest Corporation	primary	Forest plantation operators	EY	Regulator	OSC (Ontario Securities Commission)	https://medcraveonline.com/SIJ/SIJ-03-00145.pdf
2011	Olympus Corporation	secondary	Medical equipment firm	EY	Audit	Years later, Olympus' external auditor, KPMG, did not agree with the vastly overvalued goodwill ascribed to the purchases	https://files.eric.ed.gov/fulltext/EJ1053608.pdf
2012	Autonomy Corporation	tertiary	Enterprise software company	Deloitte	Regulator	Serious Fraud Office (United Kingdom), SEC and FBI	https://en.wikipedia.org/wiki/HP_Autonomy
2013	Pescanova	primary	Fishing company	BDO Spain	Regulator	Spain's stock market regulator	https://www.reuters.com/article/uk-pescanova-idUKBRE93F15N20130416
2014	Petrobras	secondary	Petroleum company	PWC	Regulator	Federal investigation	https://www.britannica.com/event/Petrobras-scandal
2014	Tesco	primary	Supermarket	PWC	Company itself	Tesco discovered overstatements of its figures; They asked Deloitte to undertake a review	https://www.accaglobal.com/gb/en/student/sa/features/tesco-scandal.html
2012 to 2014	Penn West Exploration	primary	Oil and natural gas production company	KPMG	Regulator	SEC	https://www.sec.gov/litigation/leases/2020/lr24809.htm
2015	Toshiba	tertiary	Technology company	EY	Regulator	Independent investigative panel	https://www.investopedia.com/articles/investing/081315/toshiba-s-accounting-scandal-how-it-happened.asp
2015	Valeant Pharmaceuticals	tertiary	Pharmaceutical company	PWC	Others	Andrew Left (citron Research founder) a short seller of Valeant shares	https://citronresearch.com/wp-content/uploads/2015/10/Valeant-Philador-and-RandO-final-a.pdf; https://www.newyorker.com/magazine/2016/04/04/inside-the-valeant-scandal

2016	Alberta Motor Association	tertiary	Representatives for traffic safety, travel and consumer protection, and crime prevention, AMA represents its members' interests to the industry and all levels of government	x	Others	AMA, a non-profit organization that partners with the Canadian Automobile Association	https://www.cbc.ca/news/canada/edmonton/alleged-8-2-million-alberta-motor-association-fraud-is-among-top-five-most-costly-says-expert-1.3712594
2016	Odebrecht	tertiary	Diversified businesses in the fields of engineering, construction, chemicals and petrochemicals.	x	Regulator	Brazilian investigators	https://www.bbc.com/news/business-39194395
2017	Wells Fargo	tertiary	Bank	KPMG	Others	Three whistle-blowers (Prudential employees)	https://www.bloomberg.com/news/articles/2017-01-26/prudential-says-trio-in-whistle-blower-case-fired-for-misconduct
2018	1Malaysia Development Berhad	tertiary	Strategic development company	EY, Deloitte, KPMG	Others	Anwar Ibrahim, a political leader in opposition to Najib	https://en.wikipedia.org/wiki/1_Malaysia_Development_Berhad_scandal#cite_note-2
2020	Wirecard AG	tertiary	Payment processor and financial services provider	EY	Media	Dan McCrum, Financial Times	https://www.ndr.de/fernsehen/sendungen/zapp/So-hat-Dan-McCrum-Wirecard-Skandal-aufgedeckt,wirecard110.html
2020	Luckin Coffee	secondary	Coffee chain	EY	Others	Muddy Waters, Investor	https://www.nzz.ch/nzz-asien/bilanzskandal-bei-chinas-kaffeehausbetreiber-luckin-nzz-asien-ld.1553957

*If no clear statements available.

Appendix 2: The audit game with an active investor

The bright side of the game

In Figure A2, instead of strategically passive public prosecutors and courts a strategically active Investor is introduced who may or may not trust the Auditor's certificate. If the certificate is not trusted, the Investor sells her company shares, otherwise she holds the shares. The selling probability, decided by the Investor, is s , the holding probability is accordingly $(1-s)$. As in the previous game, the Manager (representing the firm) decides on the honesty of accounting with probability h and the Auditor chooses deep (d) or shallow auditing ($1-d$).

The payoffs are as follows. (1) As in the game of the main text, the Manager gets Y with honest accounting, if the Investor trusts the auditing. If the Investor does not trust the certificate with honest accounting, the firm loses some earnings and gets $Y-C > 0$. The justification of this assumption is that other investors might follow the example of the Investor and sell part or all their shares. With fraudulent accounting, but certified by the Auditor, the firm earns $Y+G$ if Investor trusts the certificate and holds her shares, and $Y+G-C$ if the Investor does not trust the certificate and sells her shares. As above, fraudulent accounting must provide a certain additional profit, G , just when the profit would otherwise be zero. If fraudulent accounting is found by deep auditing and the certificate is denied, the firm's payoff is $Y-B-C$. It can be zero or negative.

(2) As before, the Auditor earns a fee, F , for auditing whether deep or shallow, but expends effort, e , in deep auditing. If fraudulent accounting is detected afterwards although Auditor did not deny the certificate, the fee is reduced by pR , as before.

(3) The Investor's payoff is for simplicity always normalized to zero if she sells her shares, for whatever reason. By contrast, she earns E if she holds her shares by trusting the Auditor's certificate when the Manager is honest. In case of a fraudulent Manager and shallow

auditing, holding the shares amount to a loss of $-E$. If fraudulent accounting is detected by Auditor's deep auditing, the Investor can sell (give back) the shares on time with zero profit.

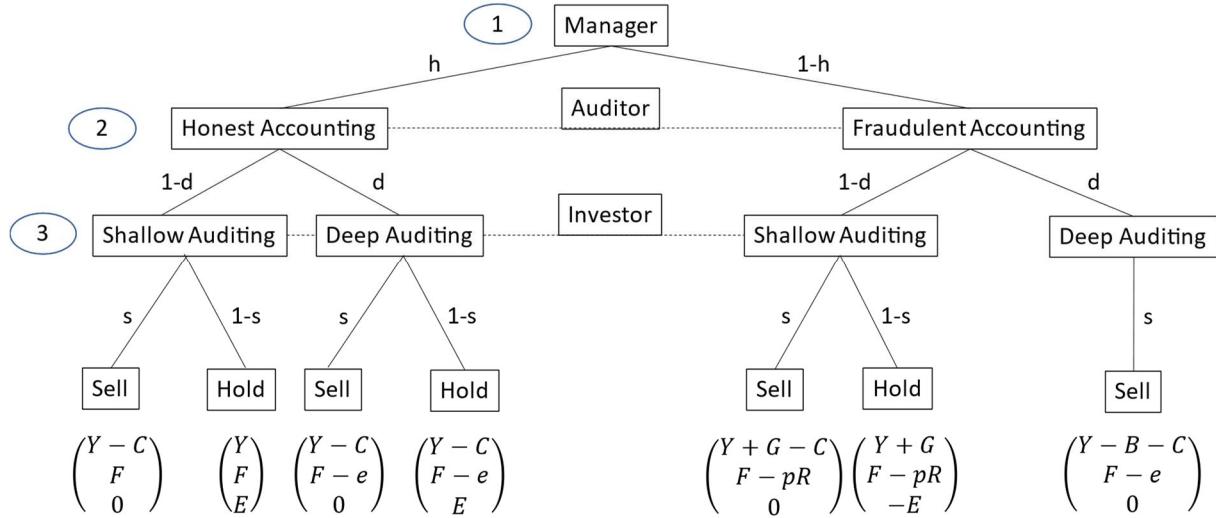


Figure A2: The audit game with an active Investor
Source: Own depiction.

This game structure gives the following expected payoffs for the respective player:

the Manager's expected payoff reads:

$$EU_F = Y - sC - (1 - h)\{d[B + C(1 - s)] - (1 - d)G\}, \quad (\text{A2.1})$$

the Auditor's expected payoff is given by:

$$EU_A = F - de - (1 - d)(1 - h)pR, \quad (\text{A2.2})$$

the Investor's payoff is determined as:

$$EU_I = E[h(2 - d) + d - 1](1 - s). \quad (\text{A2.3})$$

Maximizing the Manager's expected payoff with respect to her choice variable h gives:

$$\max_h EU_F \rightarrow FOC: \quad d = \frac{G}{B+G+C(1-s)}. \quad (\text{A2.4})$$

Hence, the probability for deep auditing, which results depend on the Investor's probability for holding shares, $(1-s)$.

Maximization of the Auditor's expected payoff with respect to d yields:

$$\max_d EU_A \rightarrow FOC: \quad h = \frac{pR-e}{pR}. \quad (\text{A2.5})$$

The Auditor determines the optimal probability for honesty that depends on the game's parameters only.

The Investor maximizes her expected payoff by choosing s :

$$\max_s EU_I \rightarrow FOC: \quad d = \frac{2h-1}{h-1} \quad (\text{A2.6})$$

that gives the probability for deep auditing for the Auditor, only depending on management's probability for honesty.

Inserting equation (A2.5) into equation (A2.6) and using the resulting d in equation (A2.4) yields the following Nash equilibrium in mixed strategies:

$$(h^*, d^*, s^*) = \left(\frac{pR-e}{pR}, \frac{2e-pR}{e}, \frac{(2e-pR)(C+B+G)-eG}{C(2e-pR)} \right). \quad (\text{A2.7})$$

There are three different Nash equilibria possible, depending on the constellation of parameter values in equation (A2.7).

(1) For $e < pR < 2e$, there exists a mixed strategies Nash equilibrium (h^*, d^*, s^*) with $h^*, d^*, s^* \in (0,1)$, with the values given by equation (A2.7). This means that managers are sometimes fraudulent, but auditors and investors control the firm by stochastic deep audits and share selling.

(2) For $pR - e \leq 0$, the result of the game is a pure-strategy Nash equilibrium. From $h^* = \frac{pR-e}{pR}$ in equation (A2.7) it follows that the Manager is never honest, $h^* = 0$. However, as can be seen by equation (A2.6), for $h = 0$ it results that $d = 1$. If the Manager is dishonest with probability 1, the Auditor chooses always deep auditing. Moreover, inserting $d = 1$ into equation (A2.4) yields: $s = 1 - \frac{B}{C}$. Since B is the firm's cost of being found fraudulent with deep auditing, it is to be expected that $B \geq C$. Hence, in this case $s = 0$, and the Investor never sells her shares. The reason is quite simple: the Auditor takes over the responsibility of surveilling the Manager.

(3) There is a further Nash equilibrium for $pR > 2e$. As can be recognized directly by

equation (A2.7), $\frac{e}{pR} < h^* \leq 1$. Moreover, $d^* = 0$. This seems to be counterintuitive

because the Manager is not always honest with certainty. However, in this case $s^* = 1$,

i.e., the shareholder sells her shares with unity probability. Since by equation (A2.7)

$$s^* = \frac{(2e-pR)(C+B+G)-eG}{C(2e-pR)}, s^* < 1 \text{ requires: } \frac{(2e-pR)(C+B+G)-eG}{C(2e-pR)} < 1. \text{ Because of } pR > 2e,$$

$(2e - pR)(C + B + G) - eG > C(2e - pR)$. Collecting and rearranging terms yields:

$$\frac{2e-pR}{eG} > 1 \text{ which is impossible because of } 2e - pR < 0 \text{ and } eG > 0. \text{ Hence,}$$

shareholders do no longer trust auditors (as well as managers) with this constellation of

parameters, and they act accordingly.

The dark side of the game

For this alternative game, too, it is to be checked whether the Manager and the Auditor can successively collude. Collusion means as before: $h = 0, d = 0$. Collusion is generally possible if:

$$EU_F(h = 0, d = 0, s^*) > EU_F(h^*, d^*, s^*) \text{ and} \quad (\text{A2.8})$$

$$EU_A(h = 0, d = 0, s^*) > EU_A(h^*, d^*, s^*). \quad (\text{A2.9})$$

The respective expected payoffs for the Manager, the Auditor and the Investor read:

$$EU_F(h = 0, d = 0) = Y + G - sC, \quad (\text{A2.10})$$

$$EU_A(h = 0, d = 0) = F - pR \text{ and} \quad (\text{A2.11})$$

$$EU_I(h = 0, d = 0) = -E(1 - s). \quad (\text{A2.12})$$

For the Manager, the comparison of the collusive and the non-cooperative solution yields:

$$EU_F(h = 0, d = 0, s^*) - EU_F(h^*, d^*, s^*) = G > 0. \quad (\text{A2.13})$$

Hence, for the Manager collusion pays if the surplus income, G , is larger than zero.

For the Auditor, the comparison of the collusive and the non-cooperative solution yields:

$$EU_A(h = 0, d = 0, s^*) - EU_A(h^*, d^*, s^*) = e - pR. \quad (\text{A2.14})$$

Collusion of the Auditor does only payoff if $e - pR > 0$, i.e., if the expected reputation damage is smaller than the additional effort for deep auditing.

This gives the following result for the dark (collusive) game: It pays always for the Manager to collude if an extra income of $G > 0$ is at stake. However, it is the Auditor who decides whether or not collusion occurs. Only if the additional effort cost of deep auditing is larger than the expected value of the reputation damage, the Auditor may agree to collude.