
Audit Market Regulation, Supplier Concentration, and the Quality of Audited Financial Statements

Dissertation

zur Erlangung des Grades
Doktor der Wirtschaftswissenschaften (Dr. rer. pol.)
am Fachbereich Wirtschaftswissenschaften
der Universität Konstanz

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Konstanz, 23.Juli 2012

Tag der mündlichen Prüfung: 25. September 2012

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Introduction and Summary

In its recently published Green Paper, the European Commission 2010 discusses various reform proposals to enhance the reliability of audits and to re-establish trust in the financial market. The Commission primarily focuses on two topics: increasing auditor independence and reducing the high level of audit market concentration. However, these two topics and the reforms suggested are discussed entirely separately.

This dissertation consists of three self-contained, but thematically and methodically related research papers that aim at disentangling the EU-Commission's separating approach. The papers have been written during my participation at the "*Doctoral Programme in Quantitative Economics and Finance*" at the University of Konstanz between October 2008 and July 2012.

Chapter 1, *Auditing, Consulting, and Audit Market Concentration*, is the result of joint work with Ulrike Stefani and will be published in one of the next issues of the *Zeitschrift für Betriebswirtschaft*. Based on a model in the tradition of the circular market matching models introduced by Salop 1979, the audit market structure is endogenous in this research paper, instead of exogenous as usually assumed in the related literature. We show that prohibiting statutory auditors the joint supply of non-audit services to audit clients as a measure intended to improve auditor independence can have counter-productive secondary effects on audit market concentration. In fact, our model demonstrates that auditors' incentives to remain independent from their clients and the structure of the audit market are simultaneously determined. Because market shares are endogenous in our model, it is not even clear that prohibiting the joint supply of non-audit services indeed increases the quality of audited financial statements.

Chapter 2, *The Interdependence between Audit Market Structure and the Quality of Financial Reporting: The Case of Non-Audit Services*, was also written together with Ulrike Stefani. Again, the research object is the prohibition of the joint supply of audit and non-audit services. However, the circular market matching model in this chapter is extended by a strategic auditor-manager game. This game takes into account the auditors' and clients' strategic decisions with respect to the audit effort exerted and the dis-

tortion of financial statements. We show that prohibiting general consulting services, which are generally contracted before the audit is conducted (and thus have no influence on auditor independence), can result in an increase in audit market concentration. This, in turn, has a negative effect on audit quality. Our model predicts the opposite effects to occur for a prohibition on audit-related non-audit services that are negotiated during the audit process. Clients purchase these services in order to tempt auditors to compromise their independence. The effects of a ban on “single-provider” auditing and consulting thus depend on the kind of services an auditor is allowed to offer, and, in particular, on the point in time at which consulting services are negotiated.

Chapter 3, *The Effects of Audit Firm Rotation on the Structure of the Audit Market*, investigates the effects of mandatory audit firm rotation, another important reform proposed by the European Commission. I show that this measure can have a positive effect on audit market concentration only if the maximum audit firm tenure does not exceed the cooling-off period required after an obligatory auditor change. Since short audit firm tenures are not regarded as cost-efficient, however, the EU-Commission proposes maximum audit firm tenures exceeding the cooling-off period; my model predicts that this cannot lead to an increase in the equilibrium number of audit firms. In addition, I show that mandatory audit firm rotation can lead to a persistent auditor-client mismatch, given existing learning costs for first-time audits. Additionally, I show that a mandatory rotation can lead to a crowding-out of mid-tier audit firms by Big X audit networks.

As reliable financial statements are essential for financial market stability, auditing plays a crucial role in preventing further financial crises. So this dissertation addresses a currently highly observed field of accounting research. By combining micro- and macroeconomic model approaches, this thesis expands the methodology used for investigations in this field of research. This leads to interesting results, which shed new light on the effects of different measures proposed to increase audit quality.

Einleitung und Zusammenfassung

In ihrem 2010 erschienenen Grünbuch erörtert die Europäische Kommission verschiedene Maßnahmen, um die Glaubwürdigkeit der Abschlussprüfung und damit letztlich das Vertrauen in die Finanzmärkte zu steigern. Die Kommission konzentriert sich hierbei im Wesentlichen auf zwei Ziele: Die Stärkung der Unabhängigkeit des Abschlussprüfers und die Verringerung der hohen Anbieterkonzentration auf dem Prüfungsmarkt. Allerdings werden diese beiden Ziele und die vorgeschlagenen Maßnahmen vollkommen getrennt voneinander betrachtet.

Diese Doktorarbeit besteht aus drei eigenständigen, thematisch und methodisch aber eng verwandten Forschungsarbeiten, die diese getrennte Betrachtungsweise aufheben. Die Arbeiten entstanden im Rahmen meiner Teilnahme am „*Doctoral Programme in Quantitative Economics and Finance*“ an der Universität Konstanz und wurden zwischen Oktober 2008 und Juli 2012 verfasst.

Kapitel 1, *Auditing, Consulting, and Audit Market Concentration*, entstand in Zusammenarbeit mit Ulrike Stefani und wird in einer der nächsten Ausgaben der *Zeitschrift für Betriebswirtschaft* erscheinen. Basierend auf einem Modell in der Tradition der von Salop 1979 eingeführten „Circular Market Matching Models“ wird hier die Prüfungsmarktstruktur endogenisiert und nicht, wie in der Literatur bisher üblich, als exogen angenommen. Es wird erörtert, dass ein Verbot von Nicht-Prüfungsleistungen von Abschlussprüfern als Maßnahme zur Erhöhung der Unabhängigkeit unerwünschte Nebeneffekte auf die Prüfungsmarktkonzentration haben kann. Darüber hinaus veranschaulicht das Modell, dass sich die Anreize zur Unabhängigkeit und die Struktur des Prüfungsmarktes gegenseitig beeinflussen. Im Ergebnis steht noch nicht einmal zweifelsfrei fest, dass ein Verbot von Nicht-Prüfungsleistungen tatsächlich die Anreize zur Unabhängigkeit erhöhen würde.

Auch Kapitel 2, *The Interdependence between Audit Market Structure and the Quality of Financial Reporting: The Case of Non-Audit Services*, wurde zusammen mit Ulrike Stefani verfasst. Hier wird erneut das Verbot von Nicht-Prüfungsleistungen von Wirtschaftsprüfern untersucht. Allerdings wird der Matching-Modell-Ansatz noch um ein

Prüfer-Manager-Spiel erweitert, welches das strategische Verhalten von Prüfern und Mandanten im Hinblick auf die Prüfungsanstrengung und die Verzerrung des Jahresabschlusses abbildet. Es wird dargestellt, dass ein Verbot von allgemeinen, vor der Durchführung der Prüfung akquirierten Beratungsleistungen (die keinen Einfluss auf die Unabhängigkeit des Prüfers haben) zu einer Erhöhung der Marktkonzentration führen kann, was die Prüfungsqualität negativ beeinflusst. Im Gegensatz dazu wird auch gezeigt, dass ein Verbot von prüfungsnahen, nach der Prüfung auszuhandelnden Beratungsleistungen nicht nur die Qualität der Prüfung erhöht, sondern auch die Marktkonzentration senkt. Der Zukauf dieser Leistungen kann zur Beeinflussung der Entscheidung der Abschlussprüfer eingesetzt werden. Die Wirkung eines Verbots von Nicht-Prüfungsleistungen für Abschlussprüfer hängt also maßgeblich von der Art der Beratungsleistungen und insbesondere vom Zeitpunkt des Vertragsabschlusses für die Beratung ab.

Kapitel 3, *The Effects of Audit Firm Rotation on the Structure of the Audit Market*, befasst sich mit einer weiteren zentralen Maßnahme aus dem Grünbuch der Europäischen Kommission, dem obligatorischen externen Prüferwechsel. Hier wird aufgezeigt, dass diese Maßnahme nur einen positiven Effekt auf die Prüfungsmarktkonzentration haben kann, wenn die maximale Mandatsdauer nicht länger als die Wartezeit bis zur Erlaubnis einer erneuten Prüfung nach einem Wechsel ist. Allerdings schlägt die EU-Kommission eine maximale Amtsdauer vor, welche die Cooling-off period übersteigt. Das Modell zeigt jedoch, dass diese Konstellation die Anzahl an im Markt aktiven Prüfungsfirmen nicht erhöhen kann. Weiter wird dargestellt, wie ein obligatorischer Prüferwechsel bei existenten Lernkosten für eine erstmalige Prüfung zu einem persistenten Mandanten-Prüfer-Mismatch führen kann. Darüber hinaus wird gezeigt, dass aufgrund von obligatorischen Prüferwechseln mittelgroße Prüfungsgesellschaften von großen Prüfungsgesellschaften vom Prüfungsmarkt verdrängt werden können (Crowding Out).

Da verlässliche Jahresabschlüsse entscheidend für die Stabilität der Finanzmärkte sind, spielt die Abschlussprüfung bei der Vermeidung weiterer zukünftiger Finanzkrisen eine entscheidende Rolle. Die vorliegende Doktorarbeit befasst sich somit mit einem aktuell stark beachteten Zweig der Accounting-Forschung. Durch die Verwendung von mikro- und makroökonomischen Modellansätzen erweitert diese Arbeit den methodischen Rahmen, der in diesem Forschungsbereich bisher Anwendung fand. Diese Erwei-

terung führt zu interessanten Ergebnissen, die neue Aufschlüsse über den Effekt unterschiedlicher Maßnahmen zur Erhöhung der Qualität der Abschlussprüfung geben.

References of the Introduction and Summary

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CHAPTER 1

Auditing, Consulting, and Audit Market Concentration

1.1 Motivation

Ever since the recent global financial crisis brought to light the urgent need to stabilize the financial system, legislators around the world have begun to implement far-reaching measures to tighten the regulation of the banking sector. In addition, there has been vigorous debate about the respective roles of central banks, supervisory bodies, and rating agencies. With regard to financial accounting, the discussion has mainly focused on the advantages and disadvantages of fair-value accounting in comparison to historical cost accounting. To date, the audit profession has not come under much fire, even though numerous financially distressed banks had received unqualified audit opinions.

In a recently published Green Paper, however, the European Commission 2010 has shifted its attention towards the role of auditing. In particular, the Commission calls into question the adequacy of the current legislative framework and puts several proposals for enhancing the efficacy of auditing up for discussion. The aim of the proposed measures is to enhance the contribution of auditing in the process of re-establishing trust and market confidence, which would in turn increase the stability of the financial markets.

The Commission primarily addresses two major issues: the independence of auditors and the structure of the audit market. To reinforce *auditor independence*, the Commission proposes several measures, including assigning the responsibility for appointing and remunerating an auditor to a third party rather than to the audited company itself, the mandatory rotation of audit firms, a limit on the proportion of fees an audit firm can earn from a single audit client in relation to its total audit revenues, and the reinforcement of rules that prevent auditors from offering non-audit services to their audit clients. With regard to the *structure of the audit market*, the Commission recognizes that there are now only a handful of global audit firms able to perform audits on large, complex companies and financial institutions. The Commission predicts that the collapse of one of these “systemic” audit firms could potentially impair the stability of the financial system. Thus, the Commission recommends the mandatory formation of audit firm consortia in which at least one non-systemic audit firm is involved in auditing large clients, the mandatory rotation of audit firms to introduce more dynamism and capacity into the audit market, the mandatory re-tendering of mandates after a fixed period, and the re-

duction of barriers to market entry for small audit firms. The measures the Commission discusses are neither new nor completely convincing, and there has been prolonged discussion about the arguments put forward. Until now, however, the topics of “auditor independence” and “market structure” have generally been discussed separately.

In the following paper, we show that prohibiting non-audit services as a measure intended to improve auditor independence can have counter-productive secondary effects on audit market concentration. Our arguments are based on an audit market model in the tradition of the circular market matching models introduced by Schmalensee 1978 and Salop 1979. We distinguish between generalist audit firms that can provide consulting and audit services to both large and small clients, and small audit firms specialized in auditing small corporations. We assume that, compared to small audit firms, large audit firms have higher fixed costs and higher costs for planning the audit process. Small audit firms, in turn, have higher costs per unit of auditing clients for which they are not perfectly specialized. We assume that knowledge spillovers flowing from non-audit to audit services reduce the costs incurred in planning the audit process.

Our results indicate that prohibiting the provision of non-audit services to audit clients has direct effects on the structure of the audit market. If there is no competition between large and small audit firms for small clients during the time before the prohibition becomes effective, a ban on providing consulting services to audit clients actually leads to a further *increase* in absolute market concentration (e.g., as measured by the concentration ratio). More precisely, we predict that the equilibrium number of large audit firms will decrease, because realizable total profits will decrease if the provision of non-audit services is prohibited. This effect on market structure is in direct contrast to the aims the Commission has outlined in its Green Paper. If, however, small and large audit firms effectively compete for small clients, our model predicts that a prohibition of consulting services would *increase* the number of small audit firms (because prohibiting large audit firms to offer non-audit services eliminates their cost advantages derived from knowledge spillovers and thus increases the small audit firms’ competitiveness), but would still *decrease* the number of “systemic” suppliers. Thus, the effect that a prohibition of the joint supply of audit and non-audit services has on the equilibrium market structure depends on the cost structures of the small and large suppliers of audit services, and on the degree of competition for small audit clients. Our results also show

that regulatory reforms that address auditor independence cannot be discussed without taking their effects on market structure into account.

The latter result is particularly important because the auditor's incentive to remain independent is determined by the economic importance of the respective client in comparison to the economic advantages the auditor derives from serving all other clients. Thus, independence is affected by the equilibrium number and size of audit firms, i.e., by the structure of the audit market. When we take the resulting equilibrium number of audit firms into account, we demonstrate that the effect of prohibiting non-audit services on the independence of large audit firms is not straightforward: If we take the relation between the profit contribution an audit firm can earn from one single large client and the sum of the profit contributions from all other clients as a surrogate for auditor independence, prohibition naturally leads to a loss of the profit contribution earned from providing consulting services (*negative* consulting effect), which should increase the auditor's incentives to remain independent. However, the consulting effect is partially offset by an increase in the profit contribution earned from auditing the large client (*positive* audit effect), which is caused by a decrease in the equilibrium number of large suppliers. Since the consulting effect exceeds the auditing effect, the net effect of the prohibition is negative, i.e., the large audit firm's incentive to remain independent increases. But a large audit firm's independence from a large client increases only if auditors that do not issue an unqualified opinion actually also lose the profit contribution derived from providing consulting services to that client; if we only look at the profit contribution from auditing, independence decreases as a result of the prohibition of non-audit services. Thus, our model shows that the assumption that prohibiting the joint supply of non-audit services improves auditor independence is at least questionable.

The paper is organized into three sections. In Section 1.2, we review the relevant literature. Section 1.3 presents our market matching model. In Section 1.4, we summarize our principal findings and derive conclusions regarding the Commission's proposal for audit market regulation.

1.2 Literature

To date, only a few analytical papers have directly addressed the effects of the joint supply of audit and non-audit services. Beck/Wu 2006, for example, focus on the trade-off between audit fees and audit quality. They present a nonstrategic, dynamic Bayesian model to analyze audit quality, which is measured as the precision of the auditor's posterior beliefs regarding client-specific characteristics. In their model, audit quality is affected by two components: Auditors learn from doing audits over time (learning effect), and auditors can perform non-audit services that influence their clients' managerial decisions (business advisory effect). Thus, providing non-audit services enables the auditor to anticipate changes in their clients' business models. The results of Beck/Wu 2006 indicate that large professional fees can lead auditors to provide non-audit services that increase engagement risk and reduce audit quality.

DeAngelo 1981 has put forward a different definition of audit quality, viewing it as the market-assessed joint probability that auditors will both discover and report material misstatements in their clients' accounting systems. Based on her model, DeAngelo 1981 argues that the ratio between the economic advantage auditors derive from one client ("quasi-rent") and the sum of the economic advantages they earn from providing services to all of their clients is crucial for auditor independence. The provision of non-audit services can increase the profit contribution derived from one specific client, and thus increase the economic advantage auditors put at risk if they deviate from an unqualified audit opinion.

In line with this argument, Beck et al. 1988 presented a model to analyze the relationship between non-audit services and auditor independence. They showed that the provision of recurring non-audit services that decrease the auditor's start-up costs for auditing a client can decrease the quasi-rent derived from that particular client, and thus reduce the threat to auditor independence. Non-recurring non-audit services, however, are predicted to increase the client-specific quasi-rent only if knowledge spillovers reduce the ongoing costs for auditing the client.¹ Although Beck et al. 1988 offer a detailed explanation of the conditions that must be fulfilled for non-audit services to increase a client-specific quasi-rent, the authors do not address the *ratio* of quasi-rents that

¹ See Ewert 1990, p. 197ff., Dopuch 1988, and Graham 1988 for a critique.

is crucial for the potential impairment of auditor independence, because neither the behavior of other clients nor the effect of allowing or prohibiting non-audit services on the auditors' market shares is explicitly modeled. In the present paper, we analyze market shares and the equilibrium number of audit firms. Although our focus is not on auditor independence, based on our model the quasi-rent ratio (seen as an indicator for auditor independence) can be derived for situations in which providing consulting services is allowed, and compared to the ratio from a situation in which auditors do not perform non-audit services. Thus, we are able to investigate whether a prohibition of the joint supply of audit and non-audit services indeed improves auditor independence.

The idea of applying a market matching model to the audit market has also been presented in papers by Chan 1999 and Simons/Zein 2011. To model the auditors' decisions regarding the level of audit quality they want to supply (i.e., quality-related audit market segmentation), Simons/Zein 2011 adopt a linear market matching model based on Hotelling 1929. An interesting result of this paper is that improving the market position of mid-tier audit firms can lead to a decrease in overall audit quality. Chan 1999 uses a three-stage variant of the Hotelling 1929 spatial-competition model, taking into account auditors' start-up costs and thus relationship-specific economic interests. He focuses on auditors' decisions regarding their specialization with respect to client characteristics and on the economic implications of low-balling. However, Chan 1999 and Simons/Zein 2011 do not address the effects of non-audit services.

1.3 A Model of the Audit Market

1.3.1 Assumptions

We use a circular market matching model inspired by Salop 1979 to analyze the interdependence between the joint supply of audit and consulting services and the structure of the audit market. We assume that the supply side of the audit market consists of two kinds of audit firms. In particular, we assume that there is a small number of large generalist audit firms, indexed by $i=1, \dots, n$, and a large number of small specialized

audit firms, indexed by $j = 1, \dots, m$. In line with empirical concentration studies,² we assume that there are more small audit firms than large ones.³ Generalist audit firms employ a large number of audit staff with a variety of individual abilities and thus have a wide spectrum of professional knowledge at hand. In this way, large audit firms are able to provide a variety of audit and consulting services worldwide to all kinds of clients with varying audit-relevant characteristics. Specialized audit firms, in contrast, have only a small number of audit staff, and consequently the range of their professional competencies is limited. Therefore, we assume that specialists can provide audit services but not consulting services to their clients. The results of our analysis would not change if we assumed that specialists could provide consulting services in addition to audit services (to small clients only).

The demand side of our model is also made up of two groups, here based on the size of companies to be audited: a large number of small clients and a small number of large clients. We assume that small clients only demand 1 unit of audit services each, whereas large clients buy $\alpha > 1$ units of audit services in addition to 1 unit of consulting services.⁴ Our results do not change qualitatively when all clients are assumed to demand consulting services. To simplify the analysis, we initially assume that large clients are restricted to buying audit and consulting services from the same supplier. Since we take into account knowledge spillovers from consulting to auditing and thus the cost savings arising from economies of scope, this demand behavior would also emerge endogenously. Particularly in the case of audit-related consulting services, the joint supply of the two services can also be observed in real-world business practice. Moreover, we assume that generalist audit firms do not compete with pure consulting firms to provide non-audit services.⁵

² See, for example, GAO 2008 for the US, Ewert/London Economics 2006 for Europe, Stefani 2006 for Switzerland, and Bigus/Zimmermann 2008, Petersen/Zwirner 2008, Köhler et al. 2010, and Quick/Sattler 2011b for Germany.

³ We derive the conditions that must be fulfilled for the assumption $m > n$ to emerge endogenously below.

⁴ Our results from analyzing fee data from Switzerland and the USA show that clients of the (three and four) respective market leaders indeed demanded considerably more non-audit services than clients of the small audit firms. For the years 2002 to 2009, we observed an average ratio between non-audit fees and audit fees in Switzerland and in the USA of 30.57% and 21.67% for clients of non-Big X audit firms, whereas this ratio was 67.84% and 35.55% for clients of Big X auditors.

⁵ The question of whether competition in the consulting market affects competition in the market for audit services is not the focus of this paper (for a formal analysis of this argument, see Wu 2006).

As in the model presented by Salop 1979, suppliers and consumers are uniformly distributed on a unit circle (see Figure 1.1). The position of a client on the circle describes the client's audit and consulting-specific characteristics, such as its complexity (e.g., number of reports to be made, industry diversification, number of business areas, geographic dispersion of operations, corporate structure, listing status, and accounting standard in use) and its risk (e.g., financial position, management incentives regarding earnings management, and quality of the internal control system). With regard to the distribution of clients on the unit circle, we consider a continuous case. The mass of small clients is normalized to 1, and large clients have a mass of $0 < \mu < 1$. The position of an audit firm on the unit circle determines the correspondence between the audit firm's specialization and the client's characteristics.

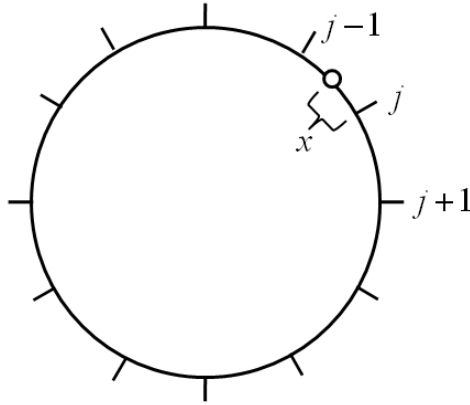


Figure 1.1: Audit firms and clients on the unit circle

The cost structure of the audit firms is as follows: Every audit firm incurs some *fixed costs* that arise even if the audit firm does not provide services to any client. We assume the fixed costs of specialized audit firms, c_F^s , to be lower than the fixed costs of generalist audit firms, c_F^l , i.e., $c_F^s < c_F^l$. This assumption reflects the higher overhead costs of generalist audit firms employing a large number of audit staff.⁶ These fixed costs can also be interpreted as a market entry barrier.

⁶ The large audit firms' higher number of partners and assistants also contributes to the increased costs associated with acquiring and retaining audit staff and the higher expenses incurred for professional training. Chen et al. 2008 found empirical evidence that the number of training hours of partners and assistants is higher in big firms compared to middle-sized and small audit firms.

In addition, audit firms incur some variable costs for auditing a certain client. We assume that an auditor's variable costs consist of a component dependent on the client's characteristics and of a component that is not affected by the client's characteristics.

Characteristic-independent audit costs reflect the costs associated with regulatory oversight of public company audits and the effort necessary to plan the audit process (e.g., expenses incurred to allocate audit staff to the audit firm's various clients, costs arising from the determination of the scope of system audits and from auditing particular cases, and costs arising from the effort of estimating the clients' inherent risk and control risk). In our model, characteristic-independent audit costs thus occur even in a situation in which auditor and client are at the same spot on the unit circle. An audit firm's cost for one unit of auditing a client with characteristics the auditor is perfectly specialized in is normalized to $c_0^l > 0$ for generalist audit firms and to $c_0^s = 0$ for specialized audit firms. The assumption $c_0^l > c_0^s$ reflects the fact that large audit firms simply have more staff that must be assigned to different tasks. In addition, we assume that large audit firms have higher reputational and litigation risks than small audit firms, and must therefore exert more effort in planning the audit than small audit firms do. Since we assume that only large audit firms can audit large (listed) clients, large audit firms face more restrictive requirements from regulatory oversight and must cope with more demanding accounting and auditing standards than small suppliers do.

Characteristic-dependent audit costs, in contrast, are affected by the distance x between the audit firm and the client's position on the unit circle.⁷ As mentioned above, this distance represents the difference between a client's characteristics and an auditor's main focus regarding these characteristics. Characteristic-dependent audit costs reflect the audit effort actually exerted in conducting the audit, given a certain predetermined level of assurance that clients' financial statements are free from material misstatement. We assume that the characteristic-dependent audit costs increase linearly with the dis-

⁷ Based on data for US audits performed by an international public accounting firm, O'Keefe et al. 1994 found that client characteristics explain more than 80% of the cross-sectional variation in the quantity of professional labor input. Measures for the client characteristics used in this study (client size, complexity, and risk) were similar to those used in prior audit pricing studies. Fee studies also indicate that the characteristics of the client and the auditor-client relationship account for a large degree of the variance in audit fees (for a meta-analysis of the audit fee studies, see Hay et al. 2006).

tance x .⁸ Thus, the variable costs for auditing a small client located x units away from the audit firm are $c_0^l + c_A^l \cdot x$ per unit of audit services for a generalist audit firm, and $c_A^s \cdot x$ for a specialized audit firm (see Figure 1.2).

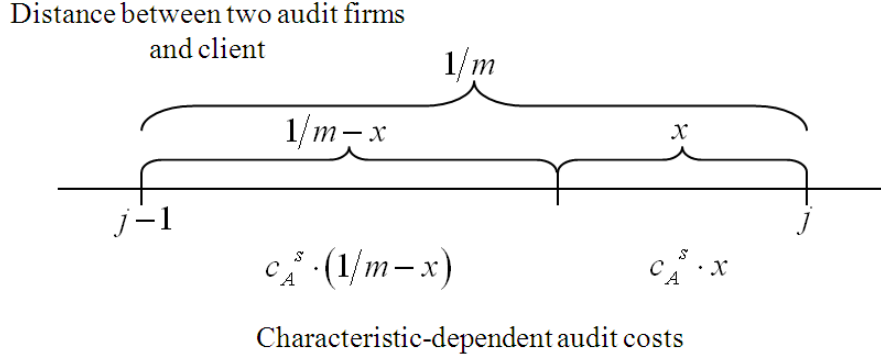


Figure 1.2: Characteristic-dependent costs for auditing a small client at location x

Because $c_0^l > c_0^s$, small audit firms have an advantage in auditing small clients matching or close to their own specialization (i.e., for which there is only a small distance between audit firm and client on the unit circle). Generalist audit firms, in contrast, have an advantage in auditing small clients with characteristics they are not explicitly specialized in, because we assume that $c_A^l < c_A^s$ holds (see Raghunandan et al. 2004). This cost relation accounts for the small audit firms' specialization on the one hand and the broader competencies of large audit firms on the other. In addition, this relation takes into account the large audit firms' capacity advantages, as their cost increase for auditing more clients is smaller than the cost increase for small audit firms. We do not, however, account for the possibility that providing services to clients with similar characteristics could lead to a reduction in fixed costs (e.g., as a result of the auditor's industry specialization; see Cairney/Young 2006 and Hogan/Jeter 1999).

We assume that only large audit firms have the capacities necessary to audit large clients.⁹ The variable costs for auditing a large client at distance x are thus given by $\alpha \cdot (c_0^l + c_A^l \cdot x)$, as these clients demand α units of audit services.

⁸ The results we obtain would be qualitatively similar if we assumed a concave or a convex cost function.

For providing audit services, an arbitrary large or small audit firm $a = i, j$ demands an audit fee denoted by $fee_A^a(x)$. Thus, we allow for price discrimination based on the distance between client and audit firm. We do not explicitly model the empirical result that large audit firms, because of higher audit quality in comparison to small suppliers, better reputation, or a “deep pockets mentality”, charge higher audit fees than small suppliers, *ceteris paribus* (see the meta-analysis conducted by Hay et al. 2006). However, inclusion of “Big X” price-premiums that are fixed across clients would not alter our results, since additional fixed-fee components could be regarded as a reduction in the characteristic-independent variable audit costs.

In addition to audit services, each large client is assumed to also demand 1 unit of consulting services. As with the audit costs, we assume that a large audit firm’s consulting costs depend on the locations of the audit firm and the client on the unit circle. An audit firm’s costs for providing consulting services to a client located at the same spot on the unit circle are normalized to 0. We denote the consulting costs for a client located x units away from the audit firm by $c_C \cdot x$. If audit and consulting services are provided by the same audit firm, we refer to the combined fee an arbitrary large audit firm i charges a large client as $fee_{A+C}^i(x)$.

Large audit firms naturally earn additional profits from providing consulting services, which are evidently more profitable than audit services. In line with the arguments against the prohibition of the joint supply of audit and consulting services put forward by the auditing profession, we assume that offering consulting services additionally reduces audit costs. More specifically, we assume that knowledge spillovers from consulting to auditing decrease the characteristic-independent audit costs. In particular, we assume that the audit firm receives information about its client’s business in the course of providing consulting services, and that this information eases the planning of the audit process (e.g., because the auditor learns about the actual inherent risk and the control risk of the client; see Beck/Wu 2006). If an audit firm provides consulting services for a large client located x units away from its own location, audit costs per unit of audit services are thus reduced to $\gamma \cdot c_0^l + c_A^l \cdot x$, with $0 < \gamma < 1$.

⁹ Not only do small accounting firms face severe challenges in obtaining audit contracts from large clients, but it also seems that they are not very interested in serving this market segment (see GAO 2008). In addition, there is empirical evidence that the choice of the auditor depends on client characteristics (see Knechel et al. 2008).

The question of whether knowledge spillovers actually exist has received a great deal of attention in the empirical accounting literature. Most of the studies using a single-equation model with audit fees as a dependent and non-audit fees as an independent variable have obtained a positive relationship between non-audit fees and audit fees,¹⁰ which could either be the result of knowledge spillovers or of systematic differences between clients purchasing non-audit services and clients receiving audit services only. Tests based on audit fees, however, rely on the assumption that services are billed consistently with the “physical flow of knowledge” (Simunic 1984, p. 685), so the results of these studies might be contaminated by pricing policies and cross-subsidization between services.¹¹ Since non-audit fees could be endogenous in the audit fee regression, an econometric test using single-equation models with audit fees (non-audit fees) as a dependent (independent) variable can result in biased coefficients. Thus, the significantly positive association between audit and non-audit fees documented in the literature could be the result of biased or inconsistent estimation of the non-audit fee coefficient induced by the use of endogenous variables in single-equation models. Whisenant et al. 2003 found that characteristics of clients, auditors, and the auditor-client relationship simultaneously determine audit and non-audit fees.¹² In particular, Whisenant et al. 2003 were unable to detect a significant association between audit and non-audit fees using a simultaneous specification of the audit and non-audit fee system.¹³ One major additional problem in obtaining empirical evidence for economies of scope seems to be the specification of the non-audit fee model, since we do not have a good theoretical understanding of the production of consulting services, nor do we have sufficiently powerful in-

¹⁰ See Simunic 1984, Simon 1985, DeBerg et al. 1991, and Bell et al. 2001 (US); Butterworth/Houghton 1995 and Craswell/Francis 1999 (Australia); and Ezzamel et al. 1996 (UK). Palmrose 1986, however, documented a positive relationship between audit fees charged by one supplier and non-audit fees paid to a different supplier that did not perform the audit, which contradicts the argument for knowledge spillovers.

¹¹ Using data on audit staff hours, O’Keefe et al. 1994 did not find evidence of knowledge spillovers from management consulting and/or tax consulting to audit services. Davis et al. 1993 found a weakly significant *positive* relationship between tax services and different audit effort measures and between accounting-related consulting services and audit hours weighted by billing-rate ratios. If additional effort is required for audits of clients who also purchase non-audit services and the demand for auditing is inelastic (see Beck et al. 1988, p. 52-54), these results do not support the existence of audit production efficiencies arising from knowledge spillovers.

¹² Antle et al. 2006 also have used a simultaneous-equations specification to estimate audit and non-audit fee models, finding evidence consistent with the existence of knowledge spillovers. Their result thus stands in opposition to the findings of Whisenant et al. 2003. Their fee models, however, might be mis-specified, since important variables measuring audit effort are not included.

¹³ Moreover, they showed that the significant coefficient of audit fees in a single-equation model with non-audit fees as a dependent variable (as documented in DeBerg et al. 1991, Barkess/Simnett 1994, and Craswell 1999) is also sensitive to simultaneous-equations bias.

struments to estimate audit and non-audit fees. However, an adequate definition of the non-audit fee equation is particularly crucial if a simultaneous-equations specification is applied.

1.3.2 Reference Situation I: A Market Consisting of Specialized Audit Firms Only

As a starting point, we consider a market that consists solely of a constant number m of small audit firms. By assumption, potential clients of the specialized audit firms must stem from the group of small clients that demand 1 unit of audit services each.

To derive the audit fees and an arbitrary audit firm's number of clients, we consider a random pair of similar audit firms. The similarity of these two suppliers is given by their smallest possible distance $1/m$ on the unit circle. Assume that x is some point on the unit circle located between audit firms j and $j-1$ (i.e., we define x to lie between 0 and $1/m$ units away from audit firm j). As audit firms are assumed to be homogeneous with respect to the efficiency of the audit process, a client is willing to buy audit services from a supplier j located x units away on the unit circle instead of from the second-nearest supplier $j-1$ located $1/m-x$ units away only if the requested fee of audit firm j , $fee_A^j(x)$, is smaller than the fee of audit firm $j-1$, $fee_A^{j-1}(1/m-x)$. Thus, audit firm j wins the audit contract only if $fee_A^j(x) \leq fee_A^{j-1}(1/m-x)$. However, it would only be profitable for audit firm j to accept a client at location x if the fee charged was higher than or equal to the corresponding audit costs, i.e., if $fee_A^j(x) \geq c_A^s \cdot x$, or, equivalently, if $x \leq fee_A^j(x)/c_A^s$. Analogously, it is profitable for audit firm $j-1$ to audit the client at location x only if $fee_A^{j-1}(1/m-x) \geq c_A^s \cdot (1/m-x)$, or if $(1/m-x) \leq fee_A^{j-1}(1/m-x)/c_A^s$. Figure 1.3 graphs the costs for auditing an arbitrary small client in between two small audit firms.

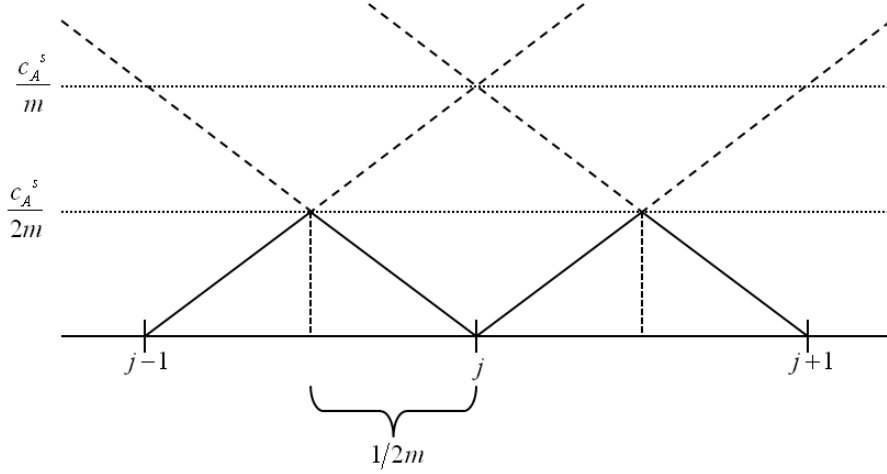


Figure 1.3: Costs for auditing an arbitrary small client in between two small audit firms

In our model, the two audit firms compete for a client in a Bertrand competition by undercutting each other's audit fees. Thus, a client at position x' will accept an audit contract with audit firm j instead of a contract with audit firm $j-1$ only if $fee_A^j(x') \leq fee_A^{j-1}(1/m - x')$ or if $c_A^s \cdot x' \leq c_A^s \cdot (1/m - x')$ (i.e., if $x' \leq 1/m - x'$, so the client is closer to audit firm j than to audit firm $j-1$). Thus, audit firm j can set its audit fee to $fee_A^j(x') = c_A^s \cdot (1/m - x')$, which is the last competitive fee offer of audit firm $j-1$. Similarly, for a client located closer to audit firm $j-1$ than to audit firm j at x'' , so that $c_A^s \cdot x'' \geq c_A^s \cdot (1/m - x'')$ holds (i.e., $x'' \geq 1/m - x''$), audit firm $j-1$ wins the contract and charges a fee of $fee_A^{j-1}(1/m - x'') = c_A^s \cdot x''$.

The threshold for the apportionment of clients located in between two audit firms on the unit circle is found at location $\bar{x} = 1/2m$, as the two audit firms' costs for auditing a small client are identical at this spot, i.e., $c_A^s \cdot \bar{x} = c_A^s \cdot (1/m - \bar{x})$. At this point exactly between the two audit firms, the audit fee is $fee_A^j(\bar{x}) = c_A^s / 2m = fee_A^{j-1}(1/m - \bar{x})$. Since we assume a continuous number of clients, we do not have to determine which of the two audit firms wins the audit contract with the client located exactly at point $\bar{x}$.

The maximum audit fee an audit firm j can charge is the fee that the client located at the same spot on the unit circle as audit firm j is willing to accept. The audit fee for

this client is determined by the costs of the second-nearest audit firm $j-1$ (at a distance of $1/m$ units) and is given by $fee_A^j(0) = c_A^s / m$. As this reasoning holds for both directions on the unit circle, audit firm j 's revenues from providing audit services to small clients, given a certain number m of small audit firms, can be calculated as

$$\Pi_A^j = 2 \cdot \frac{1}{2m} \cdot \left[\frac{c_A^s}{2m} + \frac{1}{2} \left(\frac{c_A^s}{m} - \frac{c_A^s}{2m} \right) \right] = \frac{3 \cdot c_A^s}{(2m)^2} \quad (1.1)$$

Figure 1.4 depicts these revenues graphically.

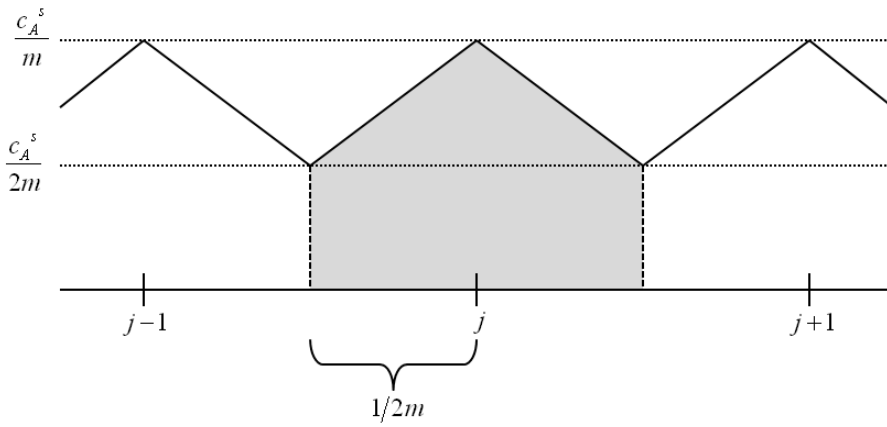


Figure 1.4: Small audit firms' revenues from providing audit services

In our model, every small client gets an audit contract. The restriction $x \leq fee_A^j(x) / c_A^s$ for an audit contract to be profitable is always fulfilled, since the threshold company located $1/2m$ units away from the two nearest audit firms on the unit circle is charged an audit fee of $fee_A^j(1/2m) = c_A^s / 2m$. Thus, the profitability restriction $1/2m \leq (c_A^s / 2m) / c_A^s = 1/2m$ is always fulfilled. In addition, none of the audit firms has monopoly power at their spot on the unit circle, because the nearest other audit firm, $j-1$, has an incentive to audit this client for a fee of $fee_A^{j-1}(1/m) = c_A^s / m$. Thus, the audit firm located at the same spot as a client cannot charge a monopoly fee exceeding the costs of audit firm $j-1$.

To calculate the profit contribution resulting from the provision of audit services, we must subtract the variable costs (i.e., the characteristic-independent costs, which are

normalized to $c_0^s = 0$ for small audit firms, and the characteristic-dependent costs $c_A^s \cdot x$) from the revenues. The characteristic-dependent costs for a client located at the same spot on the unit circle as the audit firm are 0. The costs for auditing the client at the greatest possible distance $(1/2m)$ would be $c_A^s/2m$. The calculation of the characteristic-dependent audit costs C_A^j of a small audit firm j is analogous to the calculation of the revenues:

$$C_A^j = 2 \cdot \frac{1}{2m} \cdot \frac{1}{2} \cdot \frac{c_A^s}{2m} = \frac{c_A^s}{(2m)^2} \quad (1.2)$$

The profit contribution audit firm j earns can thus be calculated as

$$\pi_A^j = \Pi_A^j - C_A^j = \frac{c_A^s}{2m^2} \quad (1.3)$$

An illustration of this profit contribution can be found in Figure 1.5.

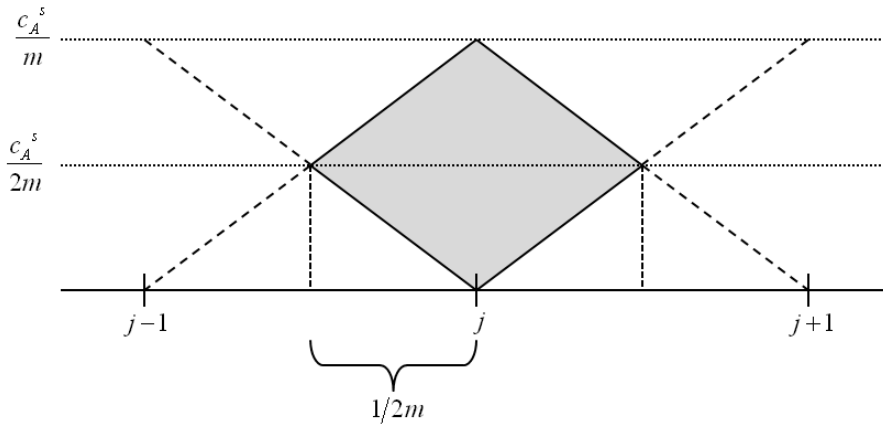


Figure 1.5: Small audit firms' profit contribution earned from providing audit services

To derive the equilibrium number of small audit firms in a market without large suppliers, we must take the fixed costs c_F^s into account. If we abstract from additional market entry barriers, audit firms will enter the market if they can earn positive profits, i.e., if $\pi_A^j - c_F^s > 0$. If profits are negative, small audit firms will drop out. Thus, in

market equilibrium, the condition $\pi_A^j - c_F^s = 0$ or $c_A^s / 2m^2 = c_F^s$ must be fulfilled. The equilibrium number m^* of small suppliers is therefore

$$m^* = \sqrt{\frac{c_A^s}{2 \cdot c_F^s}}.^{14} \quad (1.4)$$

Obviously, the equilibrium number of small audit firms decreases with the fixed costs c_F^s , and increases with the characteristic-dependent audit costs per unit of “distance” x , c_A^s .

1.3.3 Reference Situation II: A Market Consisting of Generalist Audit Firms Only

Large Audit Firms Provide Only Audit Services

In the following section, we consider a situation in which the audit market consists only of n large audit firms. Large audit firms differ from small suppliers in two audit-related aspects: First, only large audit firms are capable of auditing large clients. Second, compared to specialized audit firms, large audit firms have an advantage regarding characteristic-dependent audit costs per unit of “distance” x (because $c_A^l < c_A^s$), but operate at a disadvantage in terms of characteristic-independent audit costs ($c_0^l > c_0^s = 0$). In the first step, we assume that large audit firms provide audit services but not consulting services.

Analogous to the analysis of an audit market consisting purely of small audit firms, we consider two similar large audit firms, i and $i-1$. We assume that x is some point on the unit circle that lies between audit firms i and $i-1$. Taking the positive characteristic-independent audit costs c_0^l of a large audit firm into account, it is profitable for audit firm i to audit a (small or large) client located x units away only if $fee_A^i(x) \geq c_0^l + c_A^l \cdot x$. For the second-nearest audit firm $i-1$, providing audit services to a client at distance $1/n - x$ is advantageous only if $fee_A^{i-1}(1/n - x) \geq c_0^l + c_A^l \cdot (1/n - x)$.

¹⁴ In fact, numbers of audit firms between $m^*/2$ and m^* would also be possible equilibria if we considered a sequential market entry decision. Since we do not focus on the auditors’ specialization decision, in the following sections we only consider the number of audit firms for which the zero-profit condition is fulfilled.

Thus, audit firm i rather than audit firm $i-1$ will audit a client at position x' if $c_0^i + c_A^i \cdot x' \leq c_0^i + c_A^i \cdot (1/n - x')$, i.e., if audit firm i is closer to that client than audit firm $i-1$ is ($x' \leq 1/n - x'$). For this client, audit firm i can charge an audit fee of $fee_A^i(x') = c_0^i + c_A^i \cdot (1/n - x')$. If, in contrast, a client is located x'' units away from audit firm i , and $x'' \geq 1/n - x''$, then audit firm $i-1$ can realize a fee of $fee_A^{i-1}(1/n - x'') = c_0^i + c_A^i \cdot x''$, because $c_0^i + c_A^i \cdot x'' \geq c_0^i + c_A^i \cdot (1/n - x'')$.

As in the case of a market consisting solely of small audit firms, the threshold for the division of clients between two large audit firms is given by $\bar{x} = 1/2n$. The audit fee for small clients located at this point is given by $fee_A^i(\bar{x}) = c_0^i + c_A^i/2n$, and again the fee charged for a client situated at exactly the same spot as the audit firm is $fee_A^i(0) = c_0^i + c_A^i/n$. These arguments lead to the revenues a large audit firm i can realize from auditing small clients:

$$\Pi_{As}^i = 2 \cdot \frac{1}{2n} \cdot \left[c_0^i + \frac{c_A^i}{2n} + \frac{1}{2} \left(\left(c_0^i + \frac{c_A^i}{n} \right) - \left(c_0^i + \frac{c_A^i}{2n} \right) \right) \right] = \frac{c_0^i}{n} + \frac{3 \cdot c_A^i}{(2n)^2} \quad (1.5)$$

Considering the large clients' demand for auditing α as well as their mass μ results in the revenue an arbitrary large audit firm i can earn from auditing large clients:

$$\Pi_{Al}^i = (\mu \cdot \alpha) \cdot \left(\frac{c_0^i}{n} + \frac{3 \cdot c_A^i}{(2n)^2} \right) \quad (1.6)$$

Again, every client gets an audit contract, and no audit firm can exercise monopoly power. Summing up both partial revenues yields the large audit firm i 's revenues from providing audit services:

$$\Pi_A^i = \Pi_{As}^i + \Pi_{Al}^i = (1 + \mu \cdot \alpha) \cdot \left(\frac{c_0^i}{n} + \frac{3 \cdot c_A^i}{(2n)^2} \right) \quad (1.7)$$

To calculate the profit contribution of auditing, variable costs (i.e., $c_0^i > 0$ and $c_A^i \cdot x$) must be subtracted from the revenues. The costs for auditing the clients at the smallest

and the largest distance on the unit circle are c_0^l and $c_0^l + c_A^l/2n$, respectively. Thus, the variable costs of a large audit firm i for auditing small and large clients are given by

$$\begin{aligned} C_{As}^i &= 2 \cdot \frac{1}{2n} \cdot \left[c_0^l + \frac{1}{2} \left(\left(c_0^l + \frac{c_A^l}{2n} \right) - c_0^l \right) \right] = \frac{c_0^l}{n} + \frac{c_A^l}{(2n)^2} \text{ and} \\ C_{Al}^i &= (\mu \cdot \alpha) \left(\frac{c_0^l}{n} + \frac{c_A^l}{(2n)^2} \right). \end{aligned} \quad (1.8)$$

In sum, the variable costs of audit firm i are

$$C_A^i = C_{As}^i + C_{Al}^i = (1 + \mu \cdot \alpha) \left(\frac{c_0^l}{n} + \frac{c_A^l}{(2n)^2} \right) \quad (1.9)$$

Subtracting the variable audit costs from the revenues results in the profit contribution of a large audit firm i :

$$\pi_A^i = \Pi_A^i - C_A^i = (1 + \mu \cdot \alpha) \cdot \frac{c_A^l}{2n^2} \quad (1.10)$$

The equilibrium number of suppliers in a market consisting only of large audit firms that do not provide consulting services is given by

$$n_A^* = \sqrt{(1 + \mu \cdot \alpha) \cdot \frac{c_A^l}{2 \cdot c_F^l}} \quad (1.11)$$

Similar to the situation of a market of small audit firms, the equilibrium number of large audit firms increases with the characteristic-dependent costs c_A^l , and decreases with the fixed costs c_F^l . In addition, the equilibrium number of large audit firms increases with the mass of large clients, μ , and their demand for auditing, α . The characteristic-independent costs c_0^l have no effect on the equilibrium number of audit firms, since they are identical across audit firms and fully shifted to the clients.

In the beginning, we assumed that there were more specialized audit firms than generalists. Comparison of our results for the separate markets (equations (1.4) and (1.11)) indicates that this assumption can also evolve endogenously. The condition $m^* > n^*$ is fulfilled if the ratio between characteristic-dependent audit costs and fixed audit costs

for specialized audit firms is larger than the respective weighted cost ratio for generalists:

$$\frac{c_A^s}{c_F^s} > \frac{(1 + \mu \cdot \alpha) \cdot c_A^l}{c_F^l} \quad (1.12)$$

The above inequality holds if the small audit firms' characteristic-dependent costs c_A^s (fixed audit costs c_F^s) are relatively high (low), and if the large audit firms' characteristic-dependent costs c_A^l (fixed audit costs c_F^l) are relatively low (high). These conditions are in line with our initial assumptions $c_F^s < c_F^l$ and $c_A^s > c_A^l$. In addition, inequality (1.12) – necessary for $m^* > n^*$ to hold – requires that this cost effect not be offset by a comparatively large number of large clients, μ , or by an excessive demand for audit services, α .

Large Audit Firms Provide Consulting Services To Their Audit Clients

In contrast to the preceding section, we now consider a situation in which generalist audit firms can also provide consulting services to their large audit clients. We assume that consulting services create spillover effects on the costs incurred for audits of large clients, i.e., the characteristic-independent audit costs for large clients who buy consulting services are reduced to $\alpha \cdot (\gamma \cdot c_0^l + c_A^l \cdot x)$. The costs for auditing small clients, however, are assumed to be unaffected, since small clients do not demand consulting services in our model.

As before, the consulting costs for a client located x units away from the audit firm are $c_C \cdot x$. Given these assumptions, the respective fees a client at the threshold $\bar{x} = 1/2n$ and a client located at the same spot as the audit firm must pay to receive audit and consulting services from audit firm i are given by

$$\begin{aligned} fee_{Al+C}^i(1/2n) &= \alpha \cdot (\gamma \cdot c_0^l + c_A^l/2n) + c_C/2n \text{ and} \\ fee_{Al+C}^i(0) &= \alpha \cdot (\gamma \cdot c_0^l + c_A^l/n) + c_C/n. \end{aligned} \quad (1.13)$$

From providing auditing and consulting services to large clients, audit firm i earns revenues of

$$\Pi_{Al+C}^i = (\mu \cdot \alpha) \cdot \left(\frac{\gamma \cdot c_0^l}{n} + \frac{3 \cdot c_A^l}{(2n)^2} \right) + \mu \cdot \frac{3 \cdot c_C}{(2n)^2}. \quad (1.14)$$

The costs for providing auditing and consulting services for large clients are

$$C_{Al+C}^i = (\mu \cdot \alpha) \cdot \left(\frac{\gamma \cdot c_0^l}{n} + \frac{c_A^l}{(2n)^2} \right) + \mu \cdot \frac{c_C}{(2n)^2}, \quad (1.15)$$

and the profit contribution from providing auditing and consulting services to large clients is

$$\pi_{Al+C}^i = \Pi_{Al+C}^i - C_{Al+C}^i = (\mu \cdot \alpha) \cdot \frac{c_A^l}{2n^2} + \mu \cdot \frac{c_C}{2n^2}. \quad (1.16)$$

The profit contribution from auditing small clients is similar to the expression stated above in equation (1.10):

$$\pi_{As}^i = \Pi_{As}^i - C_{As}^i = \frac{c_A^l}{2n^2}. \quad (1.17)$$

The total profit contribution of a large audit firm thus is given by

$$\pi_{A+C}^i = \pi_{Al+C}^i + \pi_{As}^i = (1 + \mu \cdot \alpha) \cdot \frac{c_A^l}{2n^2} + \mu \cdot \frac{c_C}{2n^2}. \quad (1.18)$$

The equilibrium number of large audit firms follows from the zero-profit condition ($\pi_{A+C}^i = c_F^l$):

$$n_{A+C}^* = \sqrt{(1 + \mu \cdot \alpha) \cdot \frac{c_A^l}{2 \cdot c_F^l} + \mu \cdot \frac{c_C}{2 \cdot c_F^l}}. \quad (1.19)$$

Thus, in comparison to a situation in which the joint supply of audit and consulting services is prohibited, the equilibrium number of large audit firms is strictly *larger* if generalists can also provide consulting services to large clients, i.e., $n_{A+C}^* > n_A^*$ (see equation (1.11)). The reasoning behind this result is that consulting services are quite profit-

able for audit firms.¹⁵ The additional direct profit contribution $\pi_C^i = \mu \cdot (c_C / 2n^2)$ earned from consulting services attracts more suppliers to enter the market, i.e., the number of audit firms increases. Interestingly, the fact that knowledge spillovers reduce the characteristic-independent costs c_0^i for auditing large clients has no effect on the equilibrium number of audit firms, since these costs are fully shifted to the clients.

We can derive qualitatively similar results if we assume that providing consulting services for a large client also reduces the costs for auditing a small client located at the same spot as the large client. However, we must consider the fact that the profit contribution realizable for small clients affects the last fee offer an audit firm is willing to accept in order to secure an audit and consulting contract with a large client. Specifically, it might be profitable to make a fee offer below actual costs for providing services to large clients. Because of spillover effects, this pricing strategy can yield a profitable contract with a small client at the same spot. Not surprisingly, we find that the profit contribution derived in this scenario is even larger than in the case in which only the audit costs of the large client actually buying consulting services are reduced. The optimal number of audit firms increases with the profit contribution, because fixed costs are assumed to be constant across the scenarios we consider. Thus, the equilibrium number of generalist audit firms is larger in the case of knowledge spillovers also to small clients, as compared to a situation in which consulting services reduce only the costs for auditing the client actually buying the consulting services.

To sum up, large audit firms can increase their profit contribution from auditing by providing consulting services, which increases the equilibrium number of audit firms. Therefore, prohibiting the joint supply of audit and non-audit services reduces audit firms' profit contributions, and thus reduces the optimal number of suppliers. Our result thus has important policy implications for a market in which only generalist audit firms are present.

¹⁵ Anecdotal evidence suggests that the profession is seriously affected by decreasing hourly rates for auditing, which is seen as a springboard for attracting clients to buy higher-margin non-audit services (see, for example, Göggelmann 2010). The reasoning for “dumping pricing” is related to the overcapacities of audit firms (see o.V. 2009). There is, however, also evidence indicating that the decrease in revenues from non-audit services caused by the implementation of regulatory restrictions is being offset by a substantial *increase* in audit fees and in higher profit margins for audit services (see Weil 2004, Weil 2005, and Gullapalli 2005).

Concentration studies show that the market segment of listed companies of some national audit markets are indeed characterized by a situation in which (almost) exclusively large audit firms are present. The European Commission considers auditors of internationally listed firms, and notably of financial institutions, as “systemic”; maintaining the number of “systemic” audit firms, in turn, is one of the major objectives the Commission seeks to achieve through the implementation of the measures outlined in its Green Paper. If, however, the joint provision of audit and consulting services is abolished in the market setting we have just analyzed, our model predicts a *decrease* in the number of large audit firms. Thus, the Commission’s goals of decreasing audit market concentration and of improving auditor independence interact.¹⁶ The prohibition of the joint supply of audit and consulting services therefore might be counter-productive if a high level of market concentration (defined as a low number of suppliers active in a market segment, or a high value of the concentration ratio) is viewed as undesirable.

In addition, it is not clear whether a prohibition of the joint supply of auditing and consulting indeed strengthens an auditor’s incentives to remain independent. The ratio between the profit contribution a generalist audit firm earns from auditing (and consulting) one specific client, $pc^i(x)$, to the total profit contribution $\pi^i(n^*)$ a generalist can realize can be considered an indicator for auditor independence. Since this ratio’s maximum value is obtained for a client located at exactly the same spot as the audit firm, we focus on $r(0) = pc^i(0)/\pi^i(n^*)$. Since the zero-profit condition $\pi^i(n^*) = c_F^l$ must be fulfilled, $\pi^i(n^*)$ remains constant across our scenarios if we take into account the optimal number of audit firms. Thus, only the client-specific profit contribution $pc^i(0)$ is relevant. Assuming that knowledge spillovers only affect the large client actually buying consulting services, the profit contribution derived from auditing the most profitable *small client*, $pc^i(0)$, is given by

$$pc_{As}^i(0) = c_0^l + c_A^l/n^* - c_0^l = c_A^l/n^*. \quad (1.20)$$

¹⁶ Based on an empirical study, Quick/Sattler 2011b make a similar argument regarding the interrelation between restricting the fee an audit firm is allowed to earn from a single audit client to a certain percentage (also viewed as a possible means to increase auditor independence) and the level of audit market concentration.

Prohibiting non-audit services would lead to a *decrease* in the optimal number of large suppliers, which would *increase* the individual profit contribution $pc_{As}^i(0)$, i.e., *weaken* the auditor's incentive to remain independent.

For the most profitable *large client*, however, the profit contributions from auditing (and consulting services) are given by

$$pc_{Al+C}^i(0) = \frac{\alpha \cdot c_A^l}{n_{A+C}^*} + \frac{c_c}{n_{A+C}^*} \text{ in the case of auditing and consulting, and} \quad (1.21)$$

$$pc_{Al}^i(0) = \frac{\alpha \cdot c_A^l}{n_A^*} \text{ if only auditing is allowed.} \quad (1.22)$$

Here, prohibition of non-audit services would eliminate the second term in equation (1.21) (*negative* consulting effect), which would, of course, strengthen auditor independence; nevertheless, the first term in (1.22) is larger than in (1.21), since $n_A^* < n_{A+C}^*$, i.e., the profit contribution derived from auditing the most profitable large client is higher if only auditing services are provided, as compared to a situation in which the joint supply of the two services is allowed (*positive* audit effect). Thus, the effect of a prohibition of non-audit services on auditor independence depends on whether auditors who do not issue an unqualified audit opinion on a client's financial statements also lose the associated consulting contract. If this is the case, a prohibition increases independence from large clients, since $pc_{Al+C}^i(0) > pc_{Al}^i(0)$ holds. If, in contrast, only the audit contract is lost, a prohibition decreases auditor independence.¹⁷ Thus, there might be counter-productive secondary effects on auditor independence from small (and possibly also large) clients if we take the effects on the market structure into account.

¹⁷ Khurana/Raman 2006 and Quick/Warming-Rasmussen 2009, for example, document the fact that addressees of financial reports perceive auditor independence to be impaired if auditing and consulting services are acquired from the same supplier, and Frankel et al. 2002 report a positive relationship between non-audit fees and the magnitude of discretionary accruals. Larcker/Richardson 2004 and Lim/Tan 2008, in contrast, observe that audit quality increases with the level of non-audit services, and Jenkins/Krawczyk 2001 find a favorable effect on perceived auditor independence in appearance (or no effect). Quick/Sattler 2011a demonstrate that attestation services and tax consulting services do not significantly affect earnings management, whereas consulting services from the category "miscellaneous" impair the quality of financial statements.

Large Audit Firms Provide Consulting Services, But Not To Their Audit Clients

In the preceding section, we have shown that a prohibition of the joint supply of audit and consulting services is predicted to decrease the equilibrium number of large audit firms. One argument against a decrease in the number of suppliers is that audit firms might circumvent the loss of profitable consulting contracts by providing non-audit services to companies other than their audit clients. Figure 1.6 illustrates the reasoning we apply to derive a large audit firm's resulting profit contribution.

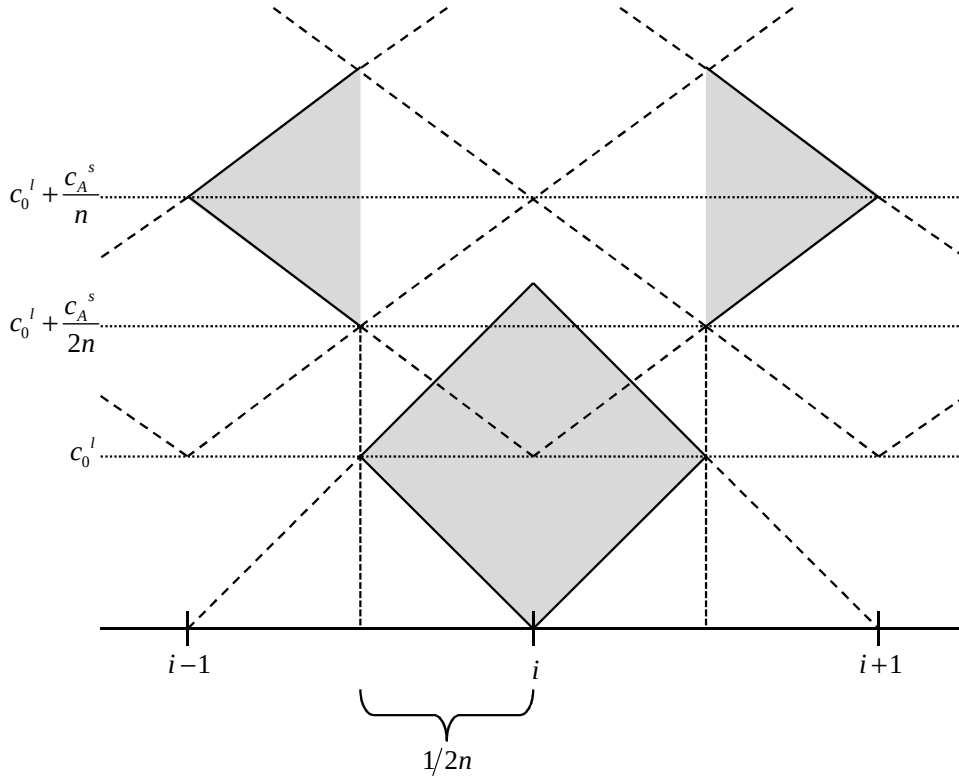


Figure 1.6: Large audit firms' profit contribution earned from providing audit and consulting services to various clients

Assume that audit firm i provides consulting services to the clients the audit firm is specialized in, i.e., to clients within a distance of $x \leq 1/2n$ on both sides of the unit circle. As a result of the prohibition, audit firm i does not audit clients in this region, but only clients at distance $x > 1/2n$. Audit firm i therefore competes with audit firm $i-2$ ($i+2$) for audit contracts with clients at distance $x > 1/2n$ to the “left” (“right”) of audit firm i ; because audit firm $i-1$ ($i+1$) provides consulting services to these clients, $i-1$ ($i+1$) is not allowed to compete for audit contracts in this region.

The costs audit firm i incurs by auditing clients at distance $1/2n$ ($1/n$) are given by $\alpha \cdot (c_0^l + c_A^l/2n)$ ($\alpha \cdot (c_0^l + c_A^l/n)$), since there are no knowledge spillovers from consulting for one client to auditing a different client. The audit costs of competitor $i-2$ ($i+2$) determine the fee audit firm i can charge:

$$\begin{aligned} fee_A^i(1/2n) &= \alpha \cdot (c_0^l + c_A^l \cdot (3/2n)) \text{ and} \\ fee_A^i(1/n) &= \alpha \cdot (c_0^l + c_A^l/n). \end{aligned} \quad (1.23)$$

Thus, the profit contribution for auditing clients at distances of $1/2n < x \leq 1/n$ is the same as in the case without consulting, i.e.,

$$\pi_A^j = \mu \cdot \alpha \cdot \frac{c_A^l}{2n^2}. \quad (1.24)$$

Since the total profit contribution from auditing and consulting is unaffected by the prohibition against the joint supply of the two services if audit firms re-arrange their audit and consulting contracts, the equilibrium number of audit firms is the same as in the case in which audit firms are allowed to provide both services to their clients. Audit fees, however, increase due to the prohibition by $\alpha \cdot (c_A^l/2n)$, on average.¹⁸

1.3.4 A Combined Market Consisting of Specialized and Generalist Audit Firms

Motivation

Up to this point, we have investigated two different partial markets consisting of either only small or only large audit firms. The assumption of segmented audit markets has practical relevance for national audit markets that are characterized by high values of the concentration ratio. Simplistically, these markets can be divided into a group of large audit firms providing audit (and non-audit) services primarily to large corporations

¹⁸ The qualitative results of our analysis do not change if audit firm i audits clients it is specialized in and provides consulting services to clients outside this region: The profit contribution from consulting would not change, but the average consulting fees would increase by $c_C/2n$. Which of these cases is more costly for the clients depends on the relation between $\alpha \cdot c_A^l$ and c_C .

and a group of small suppliers providing audit services predominantly to small clients.¹⁹ For other audit markets, however, the allocation of clients among audit firm types is less clear-cut. In less concentrated markets, there might be competition between large and small audit firms, at least for smaller listed corporations or for larger unlisted firms.²⁰ In the next step of our analysis, we thus investigate a combined audit market consisting of both large and small audit firms. As above, small audit firms are assumed to audit small clients only. Thus, in our model there is competition for small clients between the two types of audit firms; for auditing and consulting services for large clients, however, there is competition only within the group of large suppliers.

Large audit firms do not compete against small audit firms for providing audit services to small clients

In the first step, we assume that – prior to the prohibition against providing both kinds of services to audit clients – large audit firms cannot effectively compete against small audit firms, because their characteristic-independent audit costs are large compared to those of their smaller competitors. Moreover, we assume that providing consulting services only affects the costs for auditing the client actually buying consulting services. Thus, we assume that the market is effectively separated into large and small suppliers.

In the reference situation with only small audit firms, the highest fee a specialized audit firm could charge was the fee for auditing a small client located at exactly the same spot on the unit circle, i.e., $fee_A^j(0) = c_A^s / m^*$. Inserting the equilibrium number of firms m^* (see equation (1.4)) leads to $fee_A^j(0) = \sqrt{2 \cdot c_A^s \cdot c_F^s}$. If the small audit firm's maximum fee is lower than an arbitrary large audit firm i 's minimum costs in-

¹⁹ From fiscal years 2002 to 2009, the three largest audit firms (KPMG, PricewaterhouseCoopers, and Ernst & Young) audited on average 86% of listed corporations headquartered in Switzerland (not including financial institutions and real estate or insurance companies; data from *Thomson One, Audit Analytics*, and from annual reports). Thus, the Swiss audit market can serve as an example of a separated audit market.

²⁰ Between 2002 and 2009, the largest four audit firms in the USA (KPMG, PricewaterhouseCoopers, Ernst & Young, and Deloitte) provided audit services to only 56% of the listed companies headquartered in the USA, on average (data from *Thomson One, Audit Analytics*, and from annual reports). Thus, small audit firms had a non-negligible market share even in the market for listed companies, at least if the number of clients is used as a measure of calculating the concentration ratio.

curred for auditing a small client (i.e., $c_{As}^i(0) = c_0^l$), no large audit firm would win an audit contract with a small client. If condition $c_0^l > \sqrt{2 \cdot c_A^s \cdot c_F^s}$ is fulfilled, the m^* specialized audit firms would provide audit services to all of the small clients, charging an average audit fee of $\overline{fee}_{As} = (3/4) \cdot (c_A^s / m^*) = 3/4 \cdot \sqrt{2 \cdot c_F^s} \cdot \sqrt{c_A^s}$. This average audit fee equals the total audit fees small clients pay, since the mass of small clients is normalized to 1.

Prohibiting the joint supply of audit and consulting services in this scenario can only affect the market segment of large firms. The equilibrium number of large audit firms would decrease from $n_{Al+C}^* = \sqrt{(\mu \cdot \alpha) \cdot \frac{c_A^l}{2 \cdot c_F^l} + \mu \cdot \frac{c_C}{2 \cdot c_F^l}}$ to $n_A^* = \sqrt{(\mu \cdot \alpha) \cdot \frac{c_A^l}{2 \cdot c_F^l}}$. The derivation of the equilibrium number of large audit firms is analogous to that for equations (1.11) and (1.19), taking into account that the large audit firms do not audit small clients (the index Al indicates that solely large clients are audited). In our model, a decrease in the number of large audit firms is equivalent to an *increase* in absolute market concentration, since the number of small audit firms remains constant. This effect is exactly the opposite of what the European Commission had envisioned for the strategy of prohibiting consulting services.

The average fee large clients have to pay for the combined services of auditing and consulting is

$$\overline{fee}_{Al+C} = \alpha \cdot \left(\gamma \cdot c_0^l + \frac{3 \cdot c_A^l}{4n_{Al+C}^*} \right) + \frac{3 \cdot c_C}{4n_{Al+C}^*} = \gamma \cdot \alpha \cdot c_0^l + 3/4 \cdot \sqrt{2 \cdot c_F^l} \cdot \sqrt{\alpha / \mu \cdot c_A^l + 1 / \mu \cdot c_C},$$

whereas the average audit fee when only auditing is allowed is $\overline{fee}_{Al} = \alpha \cdot \left(c_0^l + \frac{3 \cdot c_A^l}{4n_A^*} \right) = \alpha \cdot c_0^l + 3/4 \cdot \sqrt{2 \cdot c_F^l} \cdot \sqrt{\alpha / \mu \cdot c_A^l}$. In line with the arguments put forward by the auditing profession (and their clients), average audit fees would thus increase, at least for large clients (we compare the fee component related to audit services, i.e., the first term in the average combined fee, $\overline{fee}_{Al+C}$, in the case in which consulting is allowed, with the average audit fee after the prohibition of consulting services is enacted, $\overline{fee}_{Al}$). The total fees paid in the two cases are $\mu \cdot \overline{fee}_{Al+C}$ and $\mu \cdot \overline{fee}_{Al}$. To compare the total fee paid in

the two scenarios, one could assume a separate market for consulting services for the case in which audit firms are not allowed to provide consulting services to their audit clients. If we stick to the same linear consulting cost pattern as in the preceding analysis, there would be an equilibrium number of consulting firms of $o^* = \sqrt{\mu \cdot \frac{c_C^C}{2 \cdot c_F^C}}$, where c_F^C are the fixed costs and c_C^C the characteristic-dependent costs of firms offering consulting services only. Average consulting fees would be $\overline{fee_C} = \frac{3 \cdot c_C^C}{4o^*} = 3/4 \cdot \sqrt{2 \cdot c_F^C} \cdot \sqrt{1/\mu \cdot c_C^C}$. It becomes clear that whether the overall fee paid increases or decreases is dependent on the cost structure of firms offering only consulting services. If we assume that consulting firms' fixed costs and characteristic-dependent costs are comparable to those of audit firms, i.e., $c_F^C \approx c_F^I$ and $c_C^C \approx c_C$, consulting fees would also increase as a result of the prohibition on providing combined services.²¹ Remember that we have assumed that non-audit services are supplied by large audit firms only, i.e., there are no consulting firms. Thus, we can assume that firms offering only consulting services would have higher costs than audit firms, and thus there would be a cost increase for auditing as a result of the prohibition against the joint supply of audit and non-audit services.

To sum up, the prohibition against consulting services reduces the number of large audit firms and increases the audit fees large clients have to pay, but does not affect competition among small audit firms. This result for the combined market is analogous to the comparison based on separate markets,²² and is not surprising, since the markets are effectively separated due to the higher costs large audit firms incur. Separation would, however, also evolve endogenously and not simply by assumption. We investigate the more interesting case of a combined audit market in the next section.

²¹ This result, however, is straightforward, since we did not assume that audit firms incur additional fixed costs for providing consulting services to their clients.

²² For the case in which consulting also affects the costs for auditing small clients that are similar to the large clients consuming consulting services, our results are unaffected if the more restrictive restriction $\gamma \cdot c_0^I > \sqrt{2 \cdot c_A^S \cdot c_F^S}$ is fulfilled.

There is competition between large and small audit firms for providing audit services to small clients

In this section, we assume parameter constellations that ensure competition between large and small audit firms for small clients during the time period before the prohibition on supplying both services goes into effect. First, for a given number of audit firms, we derive the number of clients that audit firms can contract with and the audit fees paid in the cases with and without consulting (short-term effect). As there is no direct short-term effect of prohibiting consulting services on the market for auditing small clients (if consulting only affects the costs for auditing clients actually receiving consulting services), we assume in the following analysis that there are knowledge spillovers also to similar small clients. Second, we investigate how the equilibrium number of audit firms changes, i.e., how a prohibition on consulting services affects market structure in the long run.

We assume an initial market with a number of large audit firms n and small audit firms m . In addition, we presume that both large and small audit firms are uniformly distributed on the unit circle. Thus, the distance between an arbitrary large audit firm i and the nearest large audit firm $i-1$ is again $1/n$, and the distance between two small audit firms is $1/m$. The small audit firm with the shortest distance to the large audit firm i in one direction of the unit circle is located somewhere between the two extreme distances 0 and $1/m$. A distance of 0 means that the nearest small audit firm is located at exactly the same spot on the unit circle as audit firm i , and thus the second-nearest small audit firm's position on the unit circle is at a distance of $1/m$. A distance of $1/2m$ means that the large audit firm i is located exactly in between two small audit firms. A distance of slightly less than $1/m$ means that on one side of the unit circle, the next small audit firm's position is only very slightly shifted from the large audit firm's location, so that the distance to the next firm on the other side of the circle is nearly $1/m$. We label the distance between the large audit firm i and the nearest small audit firm j as d ($0 \leq d < 1/m$).

Due to reasons of symmetry, large audit firms get audit and consulting contracts with large clients within a distance of $1/2n$ in each direction of the unit circle. Within this

distance, characteristic-independent costs for both large and small clients are given by $\gamma \cdot c_0^l$ per unit of audit service.

The lowest audit fee a specialized audit firm can charge if it effectively competes with the nearest small audit firm applies to a small client located at a distance of $1/2m$, i.e., $fee_A^j(1/2m) = c_A^s/2m$. If $c_0^l < c_A^s/2m$ holds (e.g., if the costs a large audit firm incurs for auditing a client located at exactly the same spot are lower than the audit fee the small audit firm at the largest possible distance $1/2m$ charges), large audit firms can win audit contracts with small clients, even if consulting services are prohibited. If we make the more restrictive assumption $c_0^l + c_A^l/2n < c_A^s/2m$, we can ensure that small audit firms always compete with their nearest large audit firm. Thus, in the following analysis we consider a situation in which the prohibition of consulting services does not lead to separation of the combined market of small and large audit firms. If, however, knowledge spillovers from consulting are very high, i.e., γ is very low, a prohibition on consulting could lead to separate audit markets for large and small clients (see Figure 1.7). For this effect to occur, the conditions $\gamma \cdot c_0^l + c_A^l/2n < c_A^s/2m$ and $c_0^l > c_A^s/2m$ must be fulfilled.

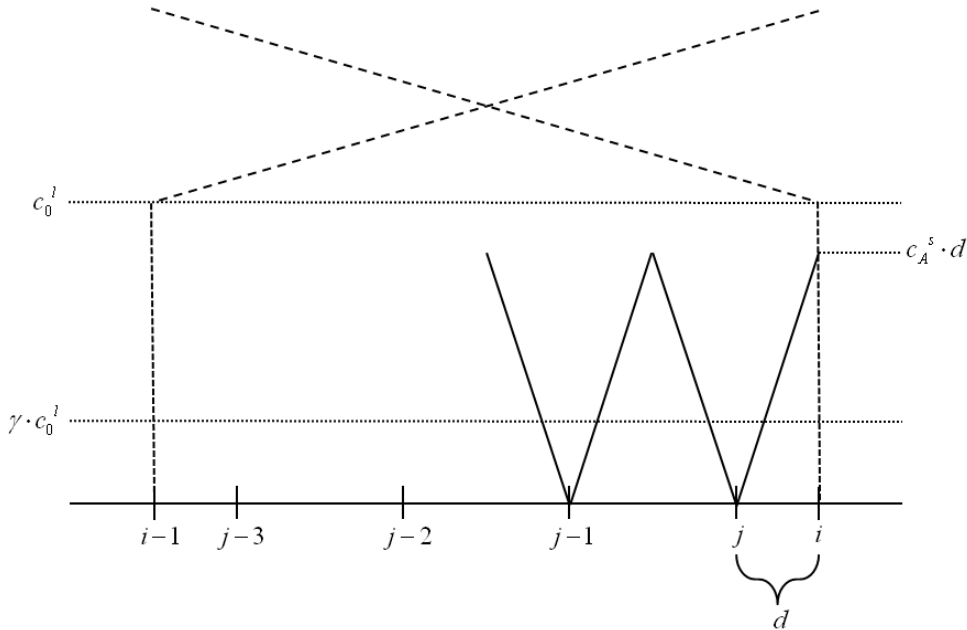


Figure 1.7: Cost structures of small and large audit firms if a prohibition on providing consulting services leads to separation of the audit markets

With consulting, the costs of the large audit firm i to audit a small client at exactly the same spot on the unit circle are given by $c_{As}^i(0) = \gamma \cdot c_0^l$, whereas the nearest large competitor's costs would be $c_{As}^{i-1}(1/n) = c_0^l + c_A^l/n$. These costs are always larger than i 's costs. The costs of the nearest small audit firm j are $c_{As}^j(d) = c_A^s \cdot d$. Audit firm i effectively competes with audit firm j for the audit contract with the small client located at exactly the same spot as audit firm i if $c_A^s \cdot d < c_0^l + c_A^l/n$. Otherwise, i competes with the nearest other large audit firm $j+1$ (see Figure 1.8).

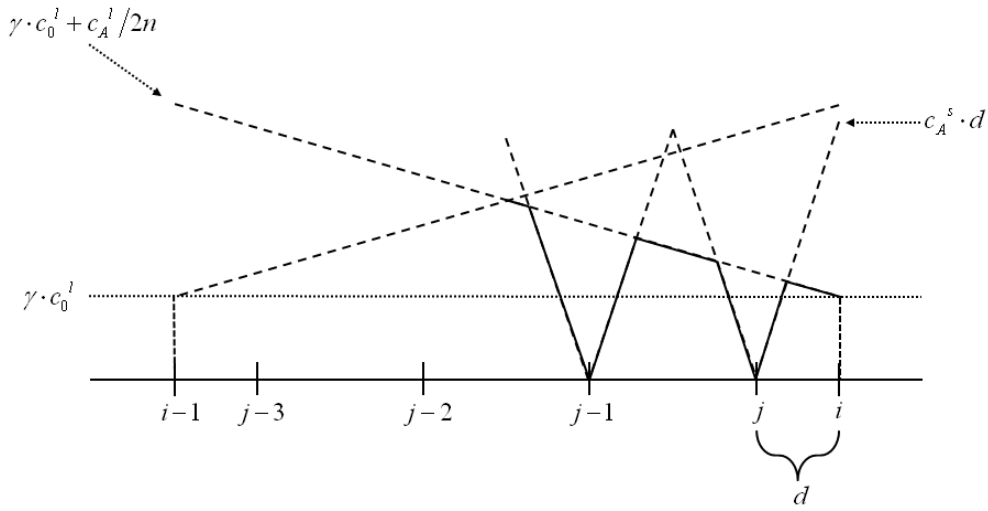


Figure 1.8: Cost structures of small and large audit firms

If $c_{As}^i(0) = \gamma \cdot c_0^l < c_A^s \cdot d = c_{As}^j(d)$, the large audit firm i wins the contract with the small client at exactly the same spot as audit firm i and can charge a fee of $\min\{c_A^s \cdot d; c_0^l + c_A^l/n\}$. Given the assumption $c_A^s \cdot d < c_0^l + c_A^l/2n$, the large audit firm i can charge an audit fee of $fee^i(0) = c_A^s \cdot d$ to the client at the same spot on the unit circle.²³

The threshold at which the large audit firm i 's costs are higher than the costs of the small audit firm j can be derived from $c_{As}^i(\bar{x}^0) = \gamma \cdot c_0^l + c_A^l \cdot \bar{x}^0$

²³ If the assumption does not hold because the number of large audit firms n is sufficiently high and c_0^l is sufficiently low, the large audit firm i effectively competes with the nearest other large audit firm $i-1$ and could charge a fee of $fee^i(0) = c_0^l + c_A^l/n$.

$\geq c_A^s \cdot (d - \bar{x}^0) = c_{As}^j \cdot (d - \bar{x}^0)$ i.e., $\bar{x}^0 \geq (c_A^s \cdot d - \gamma \cdot c_0^l) / (c_A^s + c_A^l)$. If the distance between the large audit firm i and a potential client exceeds this threshold, the nearest small audit firm j wins the contract with the small client and can charge the large audit firm i 's costs as an audit fee. The threshold at which the large audit firm i 's costs are lower than the small audit firm j 's costs can similarly be derived from $c_{As}^i(\underline{x}^0) = \gamma \cdot c_0^l + c_A^l \cdot \underline{x}^0 \leq c_A^s \cdot (\underline{x}^0 - d) = c_{As}^j(\underline{x}^0 - d)$ and is given by $\underline{x}^0 \geq (c_A^s \cdot d + \gamma \cdot c_0^l) / (c_A^s - c_A^l)$. If the large audit firm i effectively competes with the small audit firm j , audit firm i wins the contracts with small clients if the distance exceeds this threshold. Due to the small clients' mass of 1, the number of clients of the small audit firm j can be calculated by subtracting these two thresholds:

$$\underline{x}^0 - \bar{x}^0 = 2 \cdot c_A^s \cdot \frac{d \cdot c_A^l + \gamma \cdot c_0^l}{(c_A^s)^2 - (c_A^l)^2}. \quad (1.25)$$

If the joint supply of audit and non-audit services is prohibited, in the short run the number of clients of the small audit firm j would *increase* to

$$2 \cdot c_A^s \cdot \frac{d \cdot c_A^l + c_0^l}{(c_A^s)^2 - (c_A^l)^2}, \quad (1.26)$$

i.e., $\Delta^j = 2 \cdot c_A^s \cdot (1 - \gamma) \cdot c_0^l / ((c_A^s)^2 - (c_A^l)^2)$ small clients shift from the large audit firm i to the small rival j .

For some arbitrary small audit firm $j-t$ at a distance larger than that of the small audit firm j (see Figure 1.9), which effectively competes with the large audit firm i , one can generalize the threshold at which audit firm i 's costs exceed audit firm $j-t$'s costs by solving $c_{As}^i(\bar{x}^t) = \gamma \cdot c_0^l + c_A^l \cdot \bar{x}^t \geq c_A^s \cdot (t/m + d - \bar{x}^t) = c_{As}^j(t/m + d - \bar{x}^t)$:

$$\bar{x}^t > \frac{(t/m + d) \cdot c_A^s - \gamma \cdot c_0^l}{c_A^s + c_A^l}. \quad (1.27)$$

If i and $j-t$ effectively compete, $j-t$ wins the consulting contracts with small clients and can charge a fee equal to audit firm i 's costs. Similarly, one can compute the gen-

eral threshold at which audit firm i 's costs for auditing small clients are smaller than the costs of some arbitrary small audit firm $j-t$ by solving $c_{As}^i(\underline{x}^t) = \gamma \cdot c_0^l + c_A^l \cdot \underline{x}^t \leq c_A^s \cdot (\underline{x}^t - t/m - d) = c_{As}^j(\underline{x}^0 - t/m - d)$:

$$\underline{x}^t > \frac{(t/m + d) \cdot c_A^s + \gamma \cdot c_0^l}{c_A^s - c_A^l}. \quad (1.28)$$

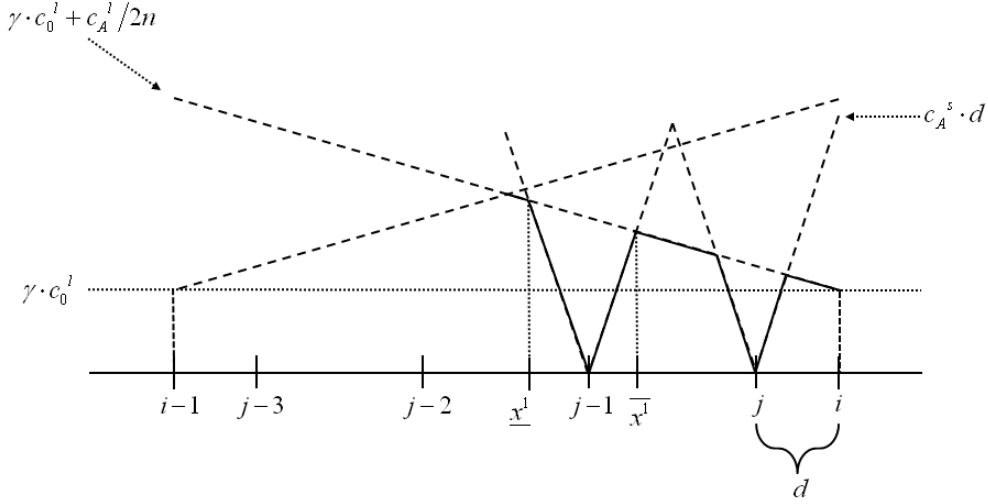


Figure 1.9: Contracting region of audit firm $j-t$ with $t=1$

The difference between these thresholds gives the number of small clients for an arbitrary small audit firm $j-t$ that effectively competes with the nearest large audit firm i :

$$\underline{x}^t - \overline{x}^t = 2 \cdot c_A^s \cdot \frac{(t/m + d) \cdot c_A^l + \gamma \cdot c_0^l}{(c_A^s)^2 - (c_A^l)^2}. \quad (1.29)$$

A prohibition on consulting would, in the short run, result in a number of clients given by

$$2 \cdot c_A^s \cdot \frac{(t/m + d) \cdot c_A^l + c_0^l}{(c_A^s)^2 - (c_A^l)^2}, \quad (1.30)$$

and thus to $\Delta^{j-t} = 2 \cdot c_A^s \cdot (1-\gamma) \cdot c_0^l / \left((c_A^s)^2 - (c_A^l)^2 \right)$ more clients for any arbitrary small audit firm $j-t$ that effectively competes with the large audit firm i . Thus, the increase in the number of clients due to a prohibition on consulting services is identical for each small audit firm.

An arbitrary small audit firm $j-t$'s costs when consulting is not prohibited are given by

$$\begin{aligned} C_{As+Cs}^{j-t} &= \frac{1}{2} (\underline{x}^t - t/m - d) \cdot c_A^s \cdot (\underline{x}^t - t/m - d) \\ &\quad + \frac{1}{2} (t/m + d - \bar{x}^t) \cdot c_A^s \cdot (t/m + d - \bar{x}^t) \\ &= \left[(c_A^s)^3 + (c_A^l)^2 \cdot c_A^s \right] \cdot \frac{\left((t/m + d) \cdot c_A^l + \gamma \cdot c_0^l \right)^2}{\left((c_A^s)^2 - (c_A^l)^2 \right)^2}. \end{aligned} \quad (1.31)$$

The large audit firm i 's costs, and thus the revenues of audit firm $j-t$ within this region, are given by

$$\begin{aligned} \Pi_{As+Cs}^{j-t} &= (\underline{x}^t - \bar{x}^t) \cdot \left[\gamma \cdot c_0^l + c_A^l \cdot \bar{x}^t \right. \\ &\quad \left. + \frac{1}{2} \left[\gamma \cdot c_0^l + c_A^l \cdot \underline{x}^t - \left(\gamma \cdot c_0^l + c_A^l \cdot \bar{x}^t \right) \right] \right] \\ &= 2 (c_A^s)^3 \cdot \frac{\left((t/m + d) \cdot c_A^l + \gamma \cdot c_0^l \right)^2}{\left((c_A^s)^2 - (c_A^l)^2 \right)^2}. \end{aligned} \quad (1.32)$$

Subtracting the costs from the revenues leads to a profit contribution of

$$\pi_{As+Cs}^{j-t} = \Pi_{As+Cs}^{j-t} - C_{As+Cs}^{j-t} = c_A^s \cdot \frac{\left((t/m + d) \cdot c_A^l + \gamma \cdot c_0^l \right)^2}{\left((c_A^s)^2 - (c_A^l)^2 \right)^2} > 0. \quad (1.33)$$

A prohibition on consulting would lead to a similar result with c_0^l instead of $\gamma \cdot c_0^l$, i.e.,

$$\pi_{As}^{j-t} = \Pi_{As}^{j-t} - C_{As}^{j-t} = c_A^s \cdot \frac{\left((t/m + d) \cdot c_A^l + c_0^l \right)^2}{\left((c_A^s)^2 - (c_A^l)^2 \right)^2} > \pi_{As+Cs}^{j-t}. \quad (1.34)$$

This result holds for small audit firms $j-t$ that effectively only compete with the large audit firm i . Dependent on the shifted positions of large and small audit firms as well as on the relative number of small and large firms, a similar result holds for the small client located at the margin between the two large audit firms i and $i-1$.

Thus, it is clear that prohibiting consulting services in the short run leads to an increased number of clients for small audit firms and also to increased revenues. The large audit firms, in contrast, lose clients to their small competitors, and they additionally lose the revenues from consulting for large clients.²⁴ Because the small audit firms' profit contributions depend on their position relative to their nearest largest competitor (i.e., $\partial \pi_{As}^{j-t} / \partial t > 0$), we cannot use the zero-profit constraint to calculate a new specific market equilibrium. However, taking into account the increased profit contributions of the small audit firms and the decline in large audit firms' profit contributions (which are also dependent on the ratio between the profit contribution from consulting and the profit contribution from auditing), we predict that in the long run, more small and fewer large audit firms will be active in the market for auditing small clients. This development leads to higher average audit fees for large clients. Even though there are more small audit firms, the audit fees of small clients will also increase, because the large audit firms' costs increase and thus small suppliers can charge higher fees.

1.4 Conclusion

In the aftermath of the recent financial crisis, the European Commission is seeking to improve the independence and reliability of audit firms in order to contribute to the stabilization of the financial system. In its recently published Green Paper, the European Commission suggests a two-pillar policy: First, the Commission points to the need to further increase auditor independence, and proposes a prohibition on the provision of non-audit services to audit clients as one possible way of achieving this goal. Simultaneously, the Commission is concerned about the high level of supplier concentration in

²⁴ A similar result holds for the case in which not all small audit firms in between two large audit firms effectively compete with the large audit firms. If small audit firms in a relatively large distance to the nearest large audit firm compete with each other, these small audit firms can be investigated as in reference situation I. The analysis of the audit firms relatively near to the large audit firms' positions is the same as described in this section.

most of the national audit markets within the European Union, and thus suggests methods of increasing the market position of second-tier audit firms. In the present paper, we show that the prohibition of the joint supply of audit and non-audit services might have adverse effects on audit market concentration. This interrelation between these two focal issues on the Commission's agenda was not addressed in the Green Paper.

Our findings are based on a circular market matching model in the tradition of Salop 1979. We first investigated separate markets in which only large generalist audit firms or small specialized audit firms were active. In this scenario, our model predicts that the prohibition on supplying audit clients with non-audit services would decrease the number of large audit firms active in the market. The reasoning behind our findings is that a prohibition of the joint supply of audit and non-audit services increases audit costs. Given a certain amount of fixed costs, the reduced profit contribution large audit firms can earn in a pure audit market decreases the optimal number of suppliers. Since the number of corporations to be audited is constant, and we preclude competition between large and small audit firms, a decrease in the number of generalists is in line with an *increase* in audit market concentration.

Second, we investigated a market setting in which small and large audit firms competed to audit small clients. Given certain cost parameters, a prohibition of non-audit services could lead to a segmentation of the audit market, i.e., to the elimination of competition between large and small audit firms for small clients. This effect occurs if the knowledge spillovers from consulting are very high. If competition between large and small suppliers for small clients is still existent even after the prohibition, our model predicts that a prohibition of non-audit services would create a relatively disadvantageous situation for large audit firms. Thus, the small audit firms' number of audit clients would increase, whereas the large audit firms would lose audit clients as well as profitable consulting contracts. Consequently, the number of large audit firms would decrease, while the number of small audit firms as well as their revenues would increase.

Our results indicate that the prohibition on supplying non-audit services to audit clients has secondary effects on the structure of the audit market. Thus, auditor independence and market concentration cannot be treated separately. However, whether the prohibition of non-audit services increases or decreases market concentration depends on the cost structures of small and large audit firms as well as on the degree of competition

for small audit clients. Further detailed empirical studies of the national audit markets are necessary in order to provide support for arguments for or against the joint provision of audit and non-audit services.

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CHAPTER 2

The Interdependence between Audit Market Structure and
the Quality of Financial Reporting:
The Case of Non-Audit Services

2.1 Motivation

Immediately following the recent financial crisis, there was an outpouring of public criticism aimed at banks, central banks, bank regulators, standard-setters, rating agencies, and hedge funds. As many of the financially distressed institutions had only just received unqualified opinions from their auditors, the Commission of the European Communities began to direct its focus toward the auditing process. With the publication of the Green Paper “Audit Policy: Lessons from the Crisis” in October 2010,²⁵ the EU Commission puts up for discussion a variety of measures intended to strengthen the function of auditing, so that in the future the auditing process could make a greater contribution to the stabilization of the financial system.²⁶ In November 2011, the EU Commission issued a proposal regarding regulatory reforms intended to improve the quality of audits of public-interest entities,²⁷ as well as a proposal for a directive that will attempt to expand the internal market for statutory audits by improving the conditions for small and medium-sized firms.²⁸

In the current debate, the EU Commission places high priority on the strengthening of *auditor independence*, i.e., the willingness of statutory auditors to communicate any errors they uncover in financial statements to the public. The EU Commission therefore proposes the implementation of a limitation on the fees an audit firm can earn from the provision of related financial audit services to an audited entity of at most 10% of the fees paid by that entity for the statutory audit. In addition, the Commission suggests implementing a cap on the total fees from audit and related financial audit services that may be received from a specific public-interest entity of 15% (as a proportion of an audit firm’s total revenue) over two consecutive years. Moreover, the more frequent use of joint audits, the adoption of mandatory audit firm rotation for public-interest entities after a maximum period of six years (exceptionally eight years) in addition to rotation of the key audit partner(s) after seven years are discussed, among other measures. The EU Commission also suggests a restriction on the joint provision of non-audit ser-

²⁵ See Commission of the European Communities 2010.

²⁶ However, thus far there has been no concrete evidence to suggest that failures in the audit process were actually responsible for the financial crisis. There has been critical discussion on this issue concerning the complaint of the Attorney General of New York against Ernst & Young in the case of Lehman Brothers and the actions of the Public Prosecutor’s Office in Berlin against PricewaterhouseCoopers with regard to SachsenLB.

²⁷ See Commission of the European Communities 2011b.

²⁸ See Commission of the European Communities 2011a.

vices.²⁹ More precisely, the Commission proposes that in all cases statutory auditors should be prevented from providing their audit clients with non-audit services that are assessed as incompatible with the independent public-interest function of auditing.³⁰ In contrast, for non-audit services that are not fundamentally incompatible with the audit function, the EU Commission suggests that the audit committee be empowered to assess whether or not the auditor should provide these services to the audited entity;³¹ however, audit-related financial services could still be provided.³² In general, the idea behind the abolition of “single-provider” auditing and consulting is to reduce the business interests of the auditor in the audited company. In theory, auditor independence is endangered when consulting profits contingent on decisions regarding the audit certification are at stake (“threat of self-interest”), or when auditors must assess the results of their own services (“threat of self-review”). Consequently, the EU Commission argues that large audit firms should not be allowed to supply any non-audit services to public-interest entities and ought not to belong to a network that provides non-audit services within the European Union.³³

²⁹ Article 22 Par. 2 of the Statutory Audit Directive 2006/43/EU prescribes that in cases in which an objective, reasonable, and informed third party would draw the conclusion that their independence was at risk, auditors should not provide audit services. However, Article 22, which also addresses the provision of non-audit services, has been differently implemented in the various Member States. In France, for example, there is a ban on the provision of non-audit services by auditors; other Member States are far less restrictive.

³⁰ See Commission of the European Communities 2011b, Article 10.3.a. These services include expert services unrelated to the audit; tax consultancy; general management and other advisory services; bookkeeping and preparation of accounting records and financial statements; designing and implementing internal control or risk management; procedures related to the preparation and/or control of financial information included in financial statements and advice on risk; valuation services; providing fairness opinions or contribution-in-kind reports; actuarial and legal services; designing and implementing financial information technology systems for public-interest entities; participating in the client’s internal audit and the provision of services related to the internal audit function; and broker or dealer, investment adviser, or investment banking services.

³¹ See Commission of the European Communities 2011b, Article 10.3.b., which addresses the provision of human resources services (including recruiting senior management) and providing comfort letters for investors in the context of the issuance of an undertaking’s securities.

³² These services include auditing or reviewing of interim financial statements, providing assurance on corporate governance statements or on corporate social responsibility matters, providing assurance on or attestation of regulatory reporting to regulators of financial institutions beyond the scope of the statutory audit, providing certification of compliance with tax requirements where such attestation is required by national law, and any other statutory duty related to audit work imposed by European Union legislation on the statutory auditor or audit firm (see Commission of the European Communities 2011b, Article 10.2).

³³ See Commission of the European Communities 2011b, Article 10.5. A large audit firm is one that generates more than one-third of its annual audit revenues from large public-interest entities or belongs to a network with combined annual audit revenues within the European Union of more than € 1,500,000,000.

The second major criticism raised by the EU Commission is related to the *high concentration of the audit market*. Numerous empirical studies have indeed confirmed that the level of supplier concentration in the audit market is quite high, most notably in the segment of listed companies.³⁴ In most of the internal audit markets of EU Member States, the so-called “Big 4”³⁵ provide audit services to more than 90% of listed companies.³⁶ Taking into consideration the industry specialization of audit companies, in reality only very few suppliers are capable of auditing complex financial institutions. For example, in Germany, auditing and consulting services for banks and insurance companies are dominated by only two of the Big 4 firms.³⁷ In addition, there is evidence that market concentration is increasing over time.³⁸ Most critically, the EU Commission has expressed its fear that the existing supply structure contradicts the principles of a free common market and could represent a risk for the functioning of market mechanisms. There is also the concern that the collapse of one of the “systemic” suppliers could lead to an interruption in the capital market’s supply of audited financial information, which, in turn, could have negative effects on the stability of the financial system. Other stakeholders have also recently expressed their concerns about the high level of audit market concentration.³⁹

In its current reform proposals, the EU Commission follows a two-pronged policy in which “auditor independence” and “market concentration” are generally regarded as two separate areas of action. The arguments laid out in the Green Paper and in the recently published proposals implicitly assume that these two problem areas can be considered separately; that is, measures strengthening auditor independence will have, at

³⁴ Quick/Wolz 2003 and Bigus/Zimmermann 2008 provide concentration studies of the German audit market, and Stefani 2006 investigates the Swiss market for audit services. The General Accounting Office 2008 analyzes the situation in the US, and Ewert/London Economics 2006 and Le Vourc’h/Morand 2011 present evidence regarding audit market concentration within the EU.

³⁵ The following audit companies are considered the “Big 4”: PwC, KPMG, Deloitte, and Ernst & Young.

³⁶ See Ewert/London Economics 2006, p. 22f., and Le Vourc’h/Morand 2011, p. 89ff.

³⁷ Le Vourc’h/Morand 2011 document similar findings in their analysis of market concentration by category of industry in EU Member States.

³⁸ Studies spanning several years are presented by Köhler et al. 2010 and by Quick/Sattler 2011.

³⁹ The House of Lords (see House of Lords 2011a, House of Lords 2011b) and the British Office of Fair Trading (OFT) (see Office of Fair Trading 2011b) have articulated concerns about audit quality and the high concentration of suppliers in the UK’s national audit market. The OFT notes that in 2010 the Big 4 firms in aggregate accounted for 99% (98.5%) of the audit fees paid by FTSE-100 (FTSE-250) companies. As a result, the OFT has referred the market for the supply of statutory audit services to large companies in the UK to the Competition Commission for further investigation (see Office of Fair Trading 2011a). In addition, the OFT has proposed measures intended to counteract the fact that market shares are unequally distributed between large and small audit firms.

the most, negligible effects on market structure and *vice versa*, a change in the level of market concentration will not affect the quality of audited financial statements.

In the present paper, we focus on the potential effects of the proposed prohibition of the joint supply of audit and non-audit services by audit firms. Using a formal model, we show that the abolition of “single-provider” auditing and consulting, a measure intended to strengthen auditor independence, can also have adverse effects on market structure. Thus, strengthening auditor independence and reducing market concentration may represent competing goals. This conflict, however, has not yet been sufficiently addressed either by the EU Commission or in the academic literature.⁴⁰ The failure to anticipate mutual interference of the proposed measures could lead to counterproductive regulatory decisions.

Our arguments are based on a model that integrates a strategic game between a manager and an auditor into a market model in the tradition of the circular market matching models introduced by Schmalensee 1978 and Salop 1979. Using a strategic auditor-manager game, we investigate the managers’ incentives to misreport their firms’ bad economic conditions, as well as the auditors’ incentives to exert high audit effort (in order to detect misreporting) and to correctly report their findings to the public. We assume that auditors’ effort costs depend on their specialization with regard to clients’ audit-relevant characteristics. We calculate an auditor’s *ex ante* expected costs for auditing a specific client, and then determine cost-covering audit fees by assuming *Bertrand* competition between audit firms. The zero-profit constraint then leads to the equilibrium number of audit firms active in the market for audit services.

Regulations regarding the scope of services auditors are allowed to provide differ significantly across EU Member States, and in some countries the provision of consulting services is not significantly restricted. In its proposals, the EU Commission differentiates between non-audit services (services that are incompatible with the audit function) and related financial audit services. Thus, we analyze three different scenarios:

First, we consider the case in which audit firms are not allowed to provide non-audit services to their audit clients. To demonstrate the effects of the proposed ban on “single-

⁴⁰ Comunale/Sexton 2005 investigate the effects of mandatory auditor rotation and multi-year appointment of auditors on the resulting market share distribution by means of a *Markov* model; Bleibtreu/Stefani 2011 present a formal analysis of the effects of a ban on “single-provider” auditing and consulting on market structure.

provider” auditing and consulting, we use the results of *Case I* as a reference point, i.e., we compare *Case I* to two additional scenarios in which audit firms are permitted to offer different kinds of non-audit services.

Second, we investigate a scenario in which audit firms are allowed to supply general non-audit-related consulting services in addition to the audit. Since audit and consulting services are negotiated simultaneously and fees are sunk at the point in time at which decisions during the audit process are made, non-audit fees do not affect auditor independence in our single-period setting. However, the option to provide general, non-audit-related consulting services increases audit firms’ profit contributions and thus the equilibrium number of audit firms. The resulting increase in the degree of auditor industry specialization tends to reduce the additional cost of exerting high audit effort; this, in turn, decreases the *average* probability that managers will misrepresent negative economic circumstances. Since the possibility to buy consulting services *ex ante* does not alter the managers’ decision-relevant payoffs, the auditors’ strategies are unaffected. Thus, the average quality of audited financial statements is actually higher in a situation in which “single-provider” auditing and consulting is permitted (i.e., our model predicts a negative relationship between the level of market concentration and the quality of audited financial statements). An additional effect of the joint provision of audit and non-audit services is that average audit fees are lower than when audit firms provide audit services only. Overall, the prohibition of audit firms providing consulting services would actually *increase* concentration (i.e., reduce the number of audit firms) and simultaneously *decrease* the quality of financial reporting (i.e., increase the percentage of deceptive financial reports). This result is the exact opposite of the aims the Commission has outlined in its recent reform proposals.

Third, we analyze a scenario in which managers request audit-related non-audit services in order to tempt auditors to compromise their independence. More precisely, audit-related consulting services are purchased in return for a clean audit opinion after the auditor has detected a false report. We assume that auditors have superior bargaining power in setting non-audit fees. Our results indicate that since auditors benefit from the additional supply of non-audit services, the *individual* probability that managers will misreport decreases; as was the case with the provision of general consulting services, the managers’ payoffs and thus the auditors’ strategy remain unchanged. Thus, auditors’ expected costs (but also their audit fees and their profit contribution) decrease as a result

of the additional supply of non-audit services. This, in turn, leads to a decrease in the number of audit firms. An effective ban on the provision of audit-related consulting services would thus indeed increase the number of audit firms, i.e., would *decrease* the level of market concentration.

We can summarize our findings as follows: First, measures intended to strengthen auditor independence might have unintended secondary effects on the already high level of supplier concentration. Second, if the effects on the equilibrium number of audit firms resulting from the prohibition of non-audit services are taken into account, a ban on “single-provider” auditing and consulting might actually have adverse effects on the quality of audited financial statements. Third, the effects outlined above depend on the kind of non-audit services the auditor is allowed to offer and, crucially, on the point in time at which these services are negotiated.

The paper is organized into five sections. In Section 2.2, we briefly review the relevant literature. Section 2.3 presents our model and an analysis of a situation in which audit firms are not allowed to provide consulting services. In Section 2.4, we investigate the effects of the supply of general, non-audit-related consulting services in addition to the audit, as well as the effects of the joint provision of audit-related consulting services. Section 2.5 summarizes our principal findings and derives conclusions regarding the EU Commission’s proposal for audit market regulation.

2.2 Literature

To date, only a few analytical papers have directly addressed the effects of the joint supply of audit and non-audit services. Wu 2006, for example, presents a model in which accounting firms provide both audit and non-audit services, examining how competitive behavior in the markets for audit services and for non-audit services, respectively, affects oligopolistic competition in the other market. Although knowledge spillovers from auditing to consulting or *vice versa* (e.g., in the form of cost savings) are always beneficial to auditors, knowledge spillovers also provide an economic link between the two markets. Since oligopolistic competition in one of the markets will affect audit firms’ strategies in the other market (“competition crossovers”), knowledge spill-

overs can thus result in aggressive competition (e.g., price reductions). Based on a *Cournot* duopoly game in quantities, Wu 2006 analyzes the trade-off between these two economic forces in oligopolistic markets and audit fee price-setting. In contrast to our paper, Wu 2006 emphasizes the resulting market equilibrium rather than the strategic interaction between auditors and clients.

Beck/Wu 2006 focus on the trade-off between audit fees and audit quality. They present a non-strategic, dynamic *Bayesian* model to analyze audit quality, which is measured as the precision of the auditor's posterior beliefs regarding client-specific characteristics. In their model, audit quality is affected by two components: Auditors learn from doing audits over time ("learning effect"), and auditors can perform non-audit services that influence their clients' managerial decisions ("business advisory effect"). Consequently, providing non-audit services enables auditors to anticipate changes in their clients' business models. The results of Beck/Wu 2006 indicate that large professional fees can lead auditors to provide non-audit services that increase engagement risk and reduce audit quality. Since empirical evidence regarding the existence of knowledge spillovers is mixed,⁴¹ our model neglects both information effects and direct cost reductions resulting from the joint supply of the two services, focusing instead on the effects on market structure.

DeAngelo 1981 defines audit quality as the market-assessed joint probability that auditors will both discover and report material misstatements in their clients' accounting systems. Based on her model, DeAngelo 1981 argues that the ratio between the economic advantage an auditor derives from one client (the "quasi-rent") and the sum of the economic advantages earned from providing services to all clients is crucial for auditor independence. The provision of non-audit services can increase the profit contribution derived from one specific client, thus raising the economic advantage auditors would put at risk should they deviate from an unqualified audit opinion.

⁴¹ Most of the studies using a single-equation model with audit fees (non-audit fees) as a dependent (independent) variable have found a positive relationship between non-audit fees and audit fees (see Simunic 1984, Simon 1985, DeBerg et al. 1991, Butterworth/Houghton 1995, Ezzamel et al. 1996, Craswell/Francis 1999, Bell et al. 2001), which could be the result of knowledge spillovers. However, models taking into account the endogeneity between non-audit fees and audit fees have shown that these findings might be the result of a biased estimation of the non-audit fee coefficient (see Whisenant et al. 2003; Antle et al. 2006 provide contradictory results). In addition, studies based on audit staff hours did not find evidence consistent with the existence of audit production efficiencies arising from knowledge spillovers (see Davis et al. 1993, O'Keefe et al. 1994).

In line with this argument, Beck et al. 1988 analyzes the relationship between non-audit services and auditor independence, demonstrating that the provision of recurring non-audit services that decrease an auditor's start-up costs for auditing a client can decrease the quasi-rent derived from that particular client, and thus reduce the threat to auditor independence. Non-recurring non-audit services, however, are predicted to increase the client-specific quasi-rent only if knowledge spillovers reduce the ongoing costs for auditing the client.⁴² Although Beck et al. 1988 offer a detailed explanation of the conditions that must be fulfilled in order for non-audit services to increase the client-specific quasi-rent, the authors do not specifically determine the ratio of quasi-rents that indicates a threat to auditor independence, as neither the behavior of other clients nor the effect of allowing or prohibiting non-audit services on an auditor's market share is explicitly modeled. In the present paper, in contrast, market shares and the equilibrium number of audit firms are endogenously determined within a market matching model. Our model thus allows investigation of the relationship between the scope of services auditors are permitted to provide and market share, as well as the effect of auditors' market shares on the quality of audited financial statements.

The idea of applying a market matching model to the audit market has also been proposed by Chan 1999 and by Simons/Zein 2011. To model auditors' decisions regarding the level of audit quality they will supply (i.e., quality-related audit market segmentation), Simons/Zein 2011 adopt a linear market matching model based on Hotelling 1929. One interesting finding is that improving the market position of mid-tier audit firms can lead to a decrease in overall audit quality. Chan 1999 uses a three-stage variant of the Hotelling 1929 spatial-competition model, taking into account auditors' start-up costs and thus relationship-specific economic interests. He focuses on auditors' decisions regarding their specialization with respect to client characteristics and on the economic implications of low-balling. However, neither Chan 1999 nor Simons/Zein 2011 address the effects of the provision of non-audit services.

This paper is closely related to the model presented by Bleibtreu/Stefani 2011, who also use a circular market matching model. However, the focus of Bleibtreu/Stefani 2011 is on the effects of a prohibition of non-audit services on the equilibrium number of different types of audit firms. In particular, they differentiate between generalist audit

⁴² See Ewert 1990, p. 197ff., Dopuch 1988, and Graham 1988 for a critique.

firms that can provide consulting and audit services and small audit firms specialized in auditing small corporations. Large audit firms are assumed to have higher fixed costs and higher costs for planning the audit process, whereas small audit firms have higher costs per unit of auditing clients for which they are not perfectly specialized. In addition, knowledge spillovers flowing from non-audit to audit services reduce the costs incurred in planning the audit process. The results indicate that prohibiting the provision of non-audit services to audit clients has direct effects on the structure of the audit market. In particular, Bleibtreu/Stefani 2011 show that the effect that a prohibition of the joint supply of audit and non-audit services has on the equilibrium market structure depends on the cost structures of small and large suppliers of audit services, and on the degree of competition for small audit clients. One drawback of their study is that the strategic interaction between managers and auditors is not explicitly modeled; in the present paper, we address managers' reporting decisions and auditors' effort choices, and thus directly investigate the effect the scope of services has on the quality of audited financial statements.

2.3 The Model

2.3.1 General Structure of the Model

In the present paper, we jointly investigate (1) the matching between audit firms and clients, audit fee price-setting, and audit firms' equilibrium market shares, and (2) the strategic interaction between auditors and clients during the auditor-client contractual relationship. Consequently, we integrate two separate games into our model:

We use a *sequential game* to model the decision-making of the auditor and the company to be audited in the phase of preparing and auditing financial statements, i.e., after the two parties have entered into an audit contract. In this game, managers make decisions about the quality of their company's financial statements, and auditors determine audit quality, i.e., the audit effort exerted for a specific client and the corresponding reporting strategy (which is contingent on the findings uncovered during the audit). We apply backwards induction to derive the managers' and auditors' optimal strategies regarding financial reporting and audit quality, respectively.

In addition, we apply the *circular location model* proposed by Salop 1979 to analyze audit fee price-setting during the negotiating process. More precisely, we embed the optimal decisions from the strategic game between auditors and clients, which determine expected audit costs and reputational effects, into a market matching model. This allows us to derive the actual level of audit fees, the equilibrium matching between clients and audit firms, and the resulting market share distribution.

The joint analysis of the matching between clients and audit firms and thus of equilibrium market shares (*ex ante*) on the one hand and auditors' and clients' decision-making during the process of preparing and auditing financial statements (*ex post*) on the other enables us to address the effect of the number of audit firms on audit quality and, conversely, how the incentive-influenced strategic interaction of players affects the market shares of audit firms. Our model allows simultaneous consideration of both audit market concentration and the quality of audited financial statements. In particular, we investigate the effects resulting from a prohibition of the supply of non-audit services to audit clients.

To analyze the effect of the joint provision of auditing and consulting services, we consider three scenarios with different approaches to the additional supply of non-audit services to audit clients. *Case I*, in which audit firms do not provide consulting services at all, serves as the benchmark case. In *Case II*, audit firms offer general, non-audit-related consulting services. Consulting services and audit services are simultaneously negotiated. In *Case III*, audit firms can extend the audit by providing audit-related non-audit services; in contrast to *Case II*, non-audit services are negotiated only after auditors have detected manager misrepresentations of actual economic conditions. We assume that clients are legally obligated to demand audits, but that purchase of non-audit services in *Case III* is optional. For simplicity, we assume in *Case II* that general consulting services are valuable for all clients, and thus all clients actually demand non-audit services.⁴³

⁴³ However, our results would remain unchanged if only some clients bought non-audit services, provided that each audit firm has an identical share in the market for consulting services.

2.3.2 Strategic Auditor-Manager Interaction (Case I)

To analyze the strategic auditor-manager interaction during the process of preparing and verifying a company's financial statements, we start from the assumption that a manager and an auditor have already entered into an audit contract that determines the audit fee, fee_A . Thus, the audit fee is fixed for the following game. In the next step, we use the market matching model described in the subsequent section to determine the cost-covering audit fees that emerge as the equilibrium of a game between n competing audit firms.

As a reference point, we first describe *Case I*, in which audit firms are not allowed to supply non-audit services to audit clients. For *Case I*, Figure 2.1 illustrates the timeline of the players' decisions, their respective information sets, and the payoffs resulting from the players' choices.

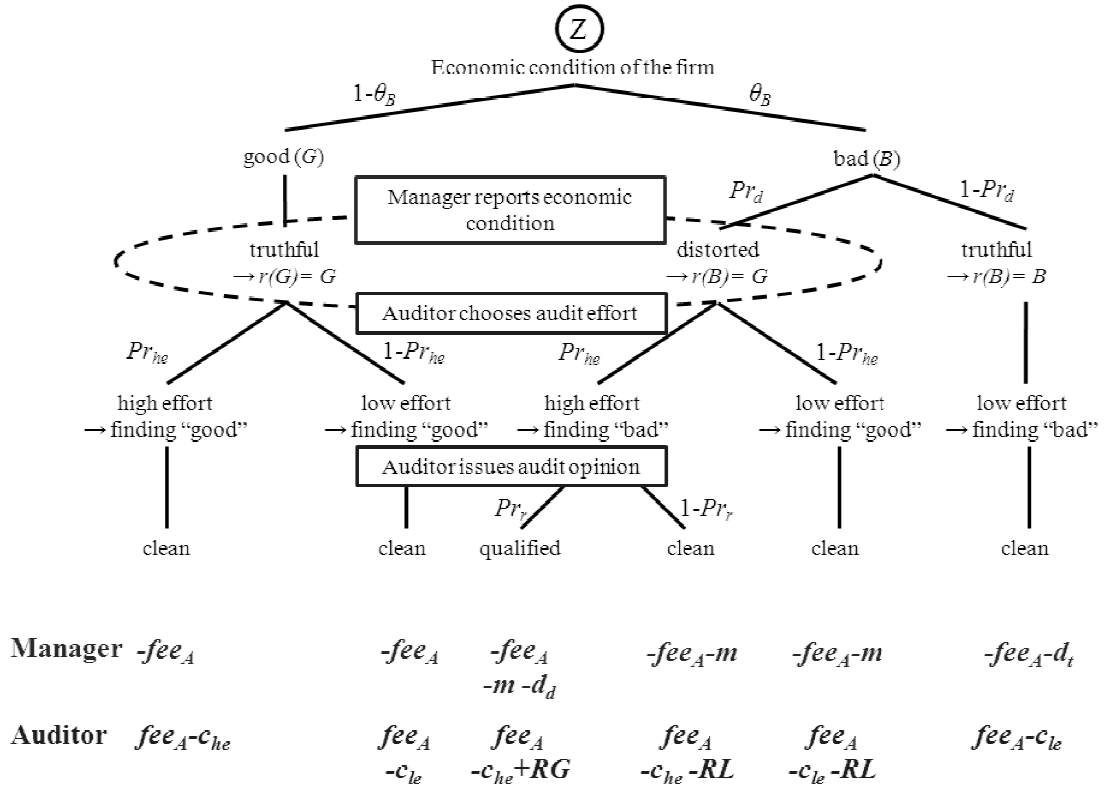


Figure 2.1: Decisions and payoffs for the game analyzing the strategic auditor-client interaction

We assume that after both parties have agreed upon the audit contract, one of two different economic states of the company, good (G) or bad (B), can emerge. With the exogenous probability $0 < \theta_B < 1$, the economic condition of the client will be bad; the economic condition will be good with the probability of the complementary event ($\theta_G = 1 - \theta_B$).

For simplicity, we presume that managers do not have an incentive to under-report the economic condition of their firm – for example, in order to meet analysts’ forecasts, to signal the poor performance of their predecessors in the case of a change in the board of executive directors,⁴⁴ or to set aside earnings for future fiscal years if managers’ bonuses are already maxed out.⁴⁵ In our model, managers thus always report G truthfully, i.e., $r(G) = G$. However, if the economic condition of the company is bad, managers must decide whether they will report truthfully ($r(B) = B$) or falsely report that the firm is in good shape ($r(B) = G$): (1) If managers truthfully report $r(B) = B$, their utility decreases by d_t . This decrease in utility d_t can be interpreted as a consequence of capital markets reacting negatively to bad news or as a reduction in managers’ performance-contingent compensation. (2) Managers can exert some manipulation effort m ($m < d_t$) to overstate the economic condition of their firm (i.e., $r(B) = G$).⁴⁶ In doing so, however, managers must accept the risk that auditors will detect their misreporting and refuse to issue a clean audit opinion for their financial statements. A qualified or adverse audit report would result in a decrease of d_a in the managers’ utility, signifying a loss of reputation, a decrease in performance-based compensation, or adverse reactions from in-

⁴⁴ There is empirical evidence that supports this scenario: Cotter et al. 1998 found that senior management changes are associated with greater write-downs taken to the income statement. Pourciau 1993 provides evidence that incoming executives manage accruals to decrease earnings in the year of an executive change and increase earnings the following year. Wilson/Wang 2010 found significant income-decreasing earnings management in years in which both a change of CEO and a change of board chairperson took place. However, Murphy/Zimmerman 1993 found discretionary influence on turnover-related changes in R&D, advertising, capital expenditures, and accounting accruals only in poorly performing firms experiencing a non-routine change in CEO.

⁴⁵ Healy 1985 and Holthausen et al. 1995 present empirical evidence in line with the “big bath” hypothesis.

⁴⁶ There is empirical evidence indicating that managers engage in earnings management to maximize their performance-contingent payments (see, for example, Healy 1985, Balsam 1998, Guidry et al. 1999, and Holthausen et al. 1995). In addition, there is evidence that managers avoid reporting earnings that fall short of analyst forecasts (see, for example, Burgstahler/Eames 2006).

vestors or creditors.⁴⁷ We assume $d_d > d_t$, i.e., that the consequences for a manager who is caught misreporting are more severe than those for a manager who honestly and voluntarily admits the bad economic condition of the corporation. We denote the probability that managers will distort financial statements (i.e., $r(B)=G$) as Pr_d .

With regard to audit effort, we consider two alternatives: (1) Auditors can exert high effort (he), which enables them to perfectly observe their client's actual economic condition, or (2) choose low effort (le), which allows misstatements in the client's financial reports to remain undetected. Exerting high audit effort induces higher audit costs than low audit effort, i.e., $c_{he} > c_{le}$. We describe these costs in more detail in the next section.

We assume that auditors cannot observe their client's economic condition prior to conducting the audit. If, however, managers have truthfully reported negative economic conditions, auditors do not need to exert high audit effort, since $r(B)=B$ is always credible. Thus, auditors issue a clean opinion on the report $r(B)=B$ and earn the profit contribution $fee_A - c_{le}$ for the audit. If, on the other hand, managers have reported $r(B)=G$ or $r(G)=G$, auditors are only imperfectly informed about their clients' actual economic condition when choosing their audit effort: (1) If auditors exert low effort, they cannot determine whether the actual situation is G or B , i.e., they cannot prove that $r(B)=G$ is misleading. Thus, auditors will have to issue a clean audit report on both $r(B)=G$ and $r(G)=G$. If it later turns out that the economic condition was actually B and that $r(B)=G$ was therefore deceptive, auditors will face a loss of RL (e.g., reputational damages or legal action initiated by third parties), which must be subtracted from the profit contribution, $fee_A - c_{le}$.⁴⁸ (2) If auditors exert high audit effort, they can perfectly reveal the actual economic situation of the firm. Thus, they will know that $r(G)=G$ is true and will issue a clean audit opinion, but will only earn the lower

⁴⁷ For empirical evidence, see, for example, Menon/Williams 2010.

⁴⁸ The most prominent example is perhaps the financial scandal involving Enron, which resulted in heavy damage to the reputation of Arthur Andersen, a wave of clients changing their statutory auditor following Arthur Andersen's indictment, and finally the audit firm's demise soon after convictions were obtained. Chaney/Philipich 2002, Krishnamurthy et al. 2006, and Asthana et al. 2010, among others, found that the market reacted negatively to Andersen clients after news of the indictment was released.

profit contribution, $fee_A - c_{he}$. Auditors exerting high effort can also prove that the report $r(B) = G$ is misleading and can then decide whether they will report their findings truthfully (qualified or adverse audit opinion) or whether they prefer to conceal their findings (clean audit opinion). If they decide not to issue a clean opinion, they can realize a reputational gain (RG) in addition to the profit contribution, $fee_A - c_{he}$; after knowingly issuing an unearned clean audit opinion for $r(B) = G$, they risk reputational losses of RL , which must be subtracted from the profit contribution. We define $RG + RL \equiv R$, Pr_{he} as the probability that auditors will choose a high effort level after having observed $r(B) = G$ or $r(G) = G$, and Pr_r as the probability that the auditor will not issue a clean audit opinion after uncovering a misstated report of $r(B) = G$ (i.e., the probability that the auditor will remain independent).

We make the standard assumptions of risk neutrality, perfect rationality, and common knowledge of these attributes and of all payoffs and probabilities. We apply backwards induction to determine the players' optimal strategies.

Given the payoffs described above, auditors who have exerted high audit effort will truthfully announce their eventual findings that a manager's report of $r(B) = G$ misstates the economic condition of the firm, i.e., $Pr_r = 1$.⁴⁹ In the next step, we determine auditors' effort choices and managers' reporting strategies:

(1) If managers truthfully report $r(B) = B$, auditors always choose low audit effort in order to save the difference in costs $c_{he} - c_{le} \equiv \Delta c$ for auditing the client. (2) If managers report $r(G) = G$ or $r(B) = G$, in contrast, the auditor does not know the actual economic condition of the firm prior to conducting the audit. Although auditors make their audit effort choices chronologically after managers have decided how to report, the players' strategies can be analyzed as simultaneous decisions. If managers do not distort financial reports with certainty, there is obviously no Nash equilibrium in pure strategies. Auditors exert high audit effort if the probability of distorted financial statements,

⁴⁹ Thus, in *Case I* of our model, the problem of auditor independence (see DeAngelo 1981, Antle 1984, Magee/Tseng 1990, Dye 1991, and Lee/Gu 1998) is not at issue.

Pr_d , is relatively high, i.e., if $Pr_d \geq \frac{(1-\theta_B)}{\theta_B} \cdot \frac{\Delta c}{R-\Delta c}$. Thus, managers will report

$r(B)=G$ with probability

$$Pr_d^* = \frac{(1-\theta_B)}{\theta_B} \cdot \frac{\Delta c}{R-\Delta c}, \quad (2.1)$$

because at this level, auditors are indifferent about whether to exert high or low effort after observing reports of good economic conditions. We assume that reputational effects are relatively large in comparison to the difference in audit costs, i.e., $\theta_B \cdot R > \Delta c$.

Consequently, managers randomize between their pure strategies ($Pr_d^* < 1$).

Managers prefer $r(B)=G$ over $r(B)=B$ if the probability of high audit effort, Pr_{he} , is relatively low, i.e., if $Pr_{he} \leq \frac{d_t - m}{d_d}$. Managers are therefore indifferent with respect

to misreporting or truthfully reporting a bad economic condition if auditors exert high audit effort after having observed a report of a good economic condition with probability

$$Pr_{he}^* = \frac{d_t - m}{d_d} < 1. \quad (2.2)$$

These probabilities specify the Nash equilibrium in mixed strategies. Our model resembles the Matching Pennies games that have frequently been applied to study problems inherent to accounting and auditing.⁵⁰ As in these Matching Pennies games, the probability that the auditor will exert high audit effort depends only on the manager's payoffs, whereas the manager's probability of misreporting depends only on the auditor's payoffs.⁵¹

⁵⁰ See Magee 1980 and Fellingham/Newman 1985. Smith et al. 2000 have extended the model sequentially by offering the auditor the choice of auditing the internal control system before a Matching Pennies game is played. Anderson/Young 1988 use a similar game for planning internal audits, as have Matsumura/Tucker 1995 and Tucker/Matsumura 1997 for second-partner reviews. For extensions of the basic model, see Fellingham et al. 1989, Newman/Noel 1989, Patterson 1993, Bloomfield 1995, and Newman et al. 2001.

⁵¹ Goeree/Holt 2001, Goeree et al. 2003, Bloomfield 1997, and Fischbacher/Stefani 2007 have investigated the (often counter-intuitive) behavioral predictions of Matching Pennies games and document experimental results regarding their predictive power.

2.3.3 Market Matching Model (Case I)

To derive audit fees and the equilibrium number of audit firms, we apply the circular market matching model presented by Salop 1979 to our audit market. Again, we first consider *Case I*, in which auditors do not provide non-audit services. We assume that all of the auditors' potential clients are uniformly distributed on a unit circle. The position of a client on the unit circle describes its audit-relevant characteristics, such as its complexity, industry diversification, number of business areas, geographic dispersion of operations, corporate structure, listing status, or accounting standard in use. We assume that clients are distributed continuously on the unit circle and normalize the mass of clients to 1. In addition, we assume that a certain discrete number n ($i = 1, 2, \dots, n$) of audit firms is also uniformly distributed on the unit circle.⁵² The position of an audit firm on the unit circle determines the correspondence between the audit firm's specialization and a client's characteristics, i.e., the auditor's industry specialization. The structure of this model is visualized in Figure 2.2.

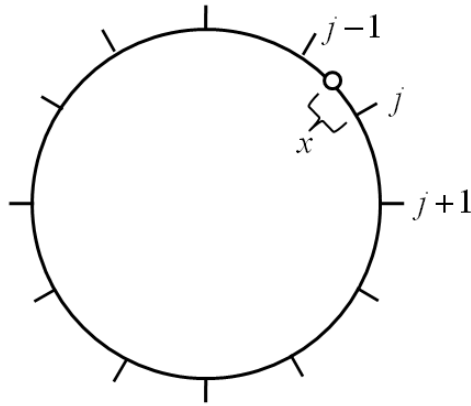


Figure 2.2: Audit firms and clients on the unit circle

The larger the difference between a client's characteristics and an audit firm's specialization (i.e., the larger the distance x between client and auditor on the unit circle),

⁵² The uniform distribution of audit firms also emerges in equilibrium (see Salop 1979).

the higher the costs for auditing this specific client.⁵³ Thus, we assume that the audit costs c_{he} and c_{le} described above increase linearly with the distance x ,⁵⁴ and that the costs $c_{he}(x)$ for exerting high audit effort increase at a faster rate than the costs $c_{le}(x)$ for low audit effort. More precisely, we presume that the respective costs for exerting high and low effort in auditing a specific client located x units away from the audit firm are

$$\begin{aligned} c_{he}(x) &= a_{he} \cdot x \text{ and } c_{le}(x) = a_{le} \cdot x, \\ \text{with } a_{he} &> a_{le} \text{ and } a_{he} - a_{le} \equiv \Delta a. \end{aligned} \quad (2.3)$$

To derive equilibrium audit fees, we provisionally use a fixed number n of audit firms active in the market. We consider two arbitrary audit firms, i and $i-1$, located next to each other on the unit circle, and an arbitrary client located in between the two audit firms, at a distance of $x' < 1/2n$ to audit firm i . Thus, audit firm i is more specialized in the potential client's characteristics than audit firm $i-1$ is, and therefore has a cost advantage over audit firm $i-1$. The costs incurred by audit firm i for auditing the client at distance x' are $a_{he} \cdot x'$ when high audit effort is exerted and $a_{le} \cdot x'$ for low audit effort.

Given the cost structure outlined above, a manager's individual equilibrium probability to misreport is not identical across clients, since $Pr_d^*(x)$ depends on the distance x to the audit firm:

$$Pr_d^*(x) = \frac{(1-\theta_B)}{\theta_B} \cdot \frac{\Delta a \cdot x}{R - \Delta a \cdot x} \quad (2.1a)$$

$Pr_d^*(x)$ is a convex function of x , since $\partial Pr_d^*(x)/\partial x = \frac{(1-\theta_B)}{\theta_B} \cdot \frac{\Delta a \cdot R}{(R - \Delta a \cdot x)^2} > 0$ and

$$\partial^2 Pr_d^*(x)/\partial x^2 = \frac{(1-\theta_B)}{\theta_B} \cdot \frac{2 \cdot (\Delta a)^2 \cdot R}{(R - \Delta a \cdot x)^3} > 0. \text{ Because additionally exerting high audit}$$

effort becomes comparatively more expensive the less specialized the audit firm is in its

⁵³ O'Keefe et al. 1994 found that client characteristics explain more than 80% of the cross-sectional variation in the quantity of professional labor input. Audit fee pricing studies also confirm that the characteristics of the client and the auditor-client relationship explain the variance in audit fees to a large extent (for a meta-analysis of the audit fee studies, see Hay et al. 2006b).

⁵⁴ Our results would be qualitatively similar if we assumed a concave or a convex cost function.

client's business, the client's option of misreporting becomes more attractive with larger values of x . The probability of a deceptive report, $Pr_d^*(x)$, increases as a_{he} increases and decreases with increasing a_{le} . To ensure $Pr_d^*(x) < 1$ for every possible distance x , we adjust our previous assumption $\theta_B \cdot R > \Delta c$ to $\theta_B \cdot R > \Delta a/2$, because in our model $x = 1/2$ is the largest possible distance between an audit firm and its client ($n=1$).

As derived in the preceding section, audit firms randomize between exerting high and low audit effort (i.e., they exert high audit effort with probability Pr_{he}^*), and clients randomize between their pure reporting strategies (i.e., they misreport a bad economic condition with probability $Pr_d^*(x)$).⁵⁵ The respective costs audit firms i and $i-1$ can *ex ante* expect to incur from performing an audit for a client at a distance $x' < 1/2n$ away from audit firm i are thus given by

$$\begin{aligned} E[c^i(x')] &= [a_{le} + (1 - \theta_B) Pr_{he}^* \cdot \Delta a + \theta_B Pr_{he}^* \cdot \Delta a \cdot Pr_d^*(x')] \cdot x' \text{ and} \\ E[c^{i-1}(1/n - x')] &= [a_{le} + (1 - \theta_B) Pr_{he}^* \cdot \Delta a + \theta_B Pr_{he}^* \cdot \Delta a \cdot Pr_d^*(1/n - x')] \cdot (1/n - x'). \end{aligned} \quad (2.4)$$

The probability of misreporting, $Pr_d^*(x)$, has an aggravating influence on the expected audit effort costs. Since $\partial Pr_d^*(x)/\partial x > 0$, the probability that managers will misreport bad economic conditions is higher for clients at a great distance than for clients located near the audit firm. In addition, audit effort costs $c_{he}(x) = a_{he} \cdot x$ and $c_{le}(x) = a_{le} \cdot x$ (and thus also $\Delta c = \Delta a \cdot x$) directly increase with an increasing distance between the audit firm and its client. Overall, for clients at a distance $x' < 1/2n$, the expected audit costs of audit firm i are always lower than the expected audit costs of its competitor $i-1$ ($E[c^i(x')] < E[c^{i-1}(1/n - x')]$).

In addition to the direct audit effort costs, the respective reputational effects audit firms i and $i-1$ expect *ex ante* must also be taken into account:

$$\begin{aligned} E[Re^i(x')] &= \theta_B \cdot (Pr_{he}^* \cdot R - RL) \cdot Pr_d^*(x') \text{ and} \\ E[Re^{i-1}(1/n - x')] &= \theta_B \cdot (Pr_{he}^* \cdot R - RL) \cdot Pr_d^*(1/n - x'). \end{aligned} \quad (2.5)$$

⁵⁵ If $x = 0$, managers apply a pure strategy (i.e., $Pr_d^*(0) = 0$). However, this does not affect our results, since we assume a continuous distribution of clients on the unit circle.

Again, the expected reputational effects become more severe as the distance between audit firm and client increases ($\partial Pr_d^*(x)/\partial x > 0$). Whether the expected reputational effect is positive or negative depends on the sign of the term $Pr_{he}^* \cdot R - RL = \frac{d_t - m}{d_d} \cdot (RG + RL) - RL$. Intuitively, the expected reputational effect will be negative (positive) for relatively high (low) values of RL and low (high) values of RG . Moreover, an auditor's expected reputational effect will be negative (positive) for relatively high (low) values of a manager's decrease in utility resulting from an adverse audit opinion, d_d , and for high (low) values of a manager's effort costs for misrepresentation of a bad economic situation m (because the probability that auditors will exert high effort decreases as d_d and m increase). The expected reputational effect is also negative (positive) when d_t , the decrease in utility affecting managers who truthfully report a bad economic condition, is relatively low (high) (because the probability that auditors will exert high effort decreases as d_t increases). In the following analysis, we assume $Pr_{he}^* \cdot R - RL < 0$, i.e., the reputational effect acts as a disincentive to auditors who might fail to exert high effort (or fail to report their findings correctly). Given this assumption, the expected reputational effect for audit firm i from auditing the client at distance $x' < 1/2n$ is less severe than that for audit firm $i-1$, i.e., $E[Re^i(x')] > E[Re^{i-1}(1/n - x')]$. The (negative) reputational effect must be subtracted from the expected audit costs in order to calculate *expected reputation-adjusted audit costs*.

In equilibrium, auditors select a probability of exerting high effort that renders clients indifferent with respect to misreporting or truthfully reporting the bad economic condition of their company. The utility that a client can expect after having engaged an audit firm can thus be calculated as

$$E[U^M] = -\theta_B \cdot d_t, \quad (2.6)$$

since the audit fee, $fee^i(x)$, can be regarded as sunk after the contract has been signed. Because $E[U^M]$ does not depend on the distance between the client and its audit firm, managers simply choose the audit firm offering the lowest fee. To determine audit fees, we assume *Bertrand* price competition, i.e., audit firms i and $i-1$ undercut each other.

er's fee offers up to the point at which one audit firm reaches its own expected reputation-adjusted audit costs. As audit effort costs are lower and expected reputational effects are less severe for audit firm i than for audit firm $i-1$, audit firm i gets the contracts with clients at distance $x' < 1/2n$, i.e., a company always selects the audit firm located nearest to the client.

These results for a client at a specific distance x' can be generalized to all clients located in the region $x \leq 1/2n$ in between two arbitrary audit firms i and $i-1$. The highest fee audit firm i can demand is equal to the expected reputation-adjusted audit costs of the competitor $i-1$ located nearest to audit firm i , since this competitor's expected costs are the last fee offer of that audit firm. The expected reputation-adjusted audit costs for audit firm i for auditing a client at distance $x \leq 1/2n$ are given by

$$\begin{aligned} E[C^i(x)] &= E[c^i(x)] - E[Re^i(x)] \\ &= [a_{le} + (1 - \theta_B) \cdot Pr_{he}^* \cdot \Delta a + \theta_B \cdot Pr_{he}^* \cdot \Delta a \cdot Pr_d^*(x)] \cdot x \\ &\quad - \theta_B \cdot (Pr_{he}^* \cdot R - RL) \cdot Pr_d^*(x), \end{aligned} \quad (2.7)$$

whereas the expected reputation-adjusted audit costs for audit firm $i-1$ (and thus the fee audit firm i can demand) are

$$\begin{aligned} fee^i(x) &= E[C^{i-1}(1/n - x)] \\ &= [a_{le} + (1 - \theta_B) \cdot Pr_{he}^* \cdot \Delta a + \theta_B \cdot Pr_{he}^* \cdot \Delta a \cdot Pr_d^*(1/n - x')] \cdot (1/n - x') \\ &\quad - \theta_B \cdot (Pr_{he}^* \cdot R - RL) \cdot Pr_d^*(1/n - x). \end{aligned} \quad (2.8)$$

The reputation-adjusted audit costs of audit firm i increase as the distance x between audit firm i and the client increases, while audit fees decrease with an increasing distance x .

The expected profit contribution of audit firm i from auditing some client at distance $x \leq 1/2n$ can be calculated by subtracting the expected reputation-adjusted audit costs of audit firm i from the audit fees demanded:

$$\begin{aligned}
E[pc^i(x)] &= fee^i(x) - E[C^i(x)] \\
&= a_{le} \cdot (1/n - 2x) + (1 - \theta_B) \cdot Pr_{he}^* \cdot \Delta a \cdot (1/n - 2x) \\
&\quad + \theta_B \cdot Pr_{he}^* \cdot \Delta a \cdot [Pr_d^*(1/n - x) \cdot (1/n - x) - Pr_d^*(x) \cdot x] \\
&\quad - \theta_B \cdot (Pr_{he}^* \cdot R - RL) \cdot [Pr_d^*(1/n - x) - Pr_d^*(x)].
\end{aligned} \tag{2.9}$$

Given a certain number n of audit firms on the market, the expected overall profit contribution of audit firm i can be computed by integration and multiplication by 2 (in order to take both sides of the unit circle into account):

$$\begin{aligned}
E[PC^i(n)] &= 2 \cdot \int_0^{1/2n} E[pc^i(x)] dx \\
&= a_{le}/2n^2 + (1 - \theta_B) \cdot Pr_{he}^* \cdot \Delta a / 2n^2 \\
&\quad + 2 \cdot \theta_B \cdot Pr_{he}^* \cdot \Delta a \cdot \int_0^{1/2n} [Pr_d^*(1/n - x) \cdot (1/n - x) - Pr_d^*(x) \cdot x] dx \\
&\quad - 2 \cdot \theta_B \cdot (Pr_{he}^* \cdot R - RL) \cdot \int_0^{1/2n} [Pr_d^*(1/n - x) - Pr_d^*(x)] dx,
\end{aligned} \tag{2.10}$$

which can be simplified to

$$\begin{aligned}
E[PC^i(n)] &= 2 \cdot \int_0^{1/2n} E[pc^i(x)] dx \\
&= \frac{a_{le}}{2n^2} + 2 \cdot (1 - \theta_B) \cdot \left(\frac{R}{\Delta a} \cdot RL \right) \cdot \ln \left[1 + \frac{(\Delta a / 2n)^2}{R^2 - R \cdot \Delta a / n} \right].
\end{aligned} \tag{2.10a}$$

Since $\partial E[PC^i(n)] / \partial n < 0$, the expected overall profit contribution of an arbitrary audit firm decreases with an increasing number of audit firms n .

We assume that every audit firm incurs some fixed costs c_{FA} in addition to the expected direct audit effort costs and reputational effects. These fixed costs can also be interpreted as a market entry barrier. Subtracting the fixed costs c_{FA} from the expected overall profit contribution, $E[PC^i(n)]$, allows calculation of an audit firm's expected profits. If audit firms can earn positive profits, new suppliers will enter the market.⁵⁶ If

⁵⁶ The current estimation is that the sector for audits of large companies is not attractive enough to encourage additional providers to enter the market, i.e., the potential risks and returns do not justify the necessary investment (see PricewaterhouseCoopers 2010, par. 17).

profits are negative, audit firms will leave the market.⁵⁷ Thus, the equilibrium number of audit firms, n^* , can be calculated by solving

$$E[PC^i(n^*)] = c_{FA} \quad (2.11)$$

for n^* . We consider the probability that the manager's published financial statements will accurately reflect the economic condition of the audited company, i.e.,

$$\Phi = 1 - \theta_B \cdot Pr_d^*(x) \cdot \left[(1 - Pr_{he}^*) + Pr_{he}^* (1 - Pr_r^*) \right], \quad (2.12)$$

as a measure of the quality of a specific client's audited financial statements. Given the payoffs for *Case I*, auditors are always independent ($Pr_r^* = 1$), i.e., Φ reduces to $1 - \theta_B \cdot Pr_d^*(x) \cdot (1 - Pr_{he}^*)$. This formulation has two interpretations. First, the quality of audited financial statements is not identical across an audit firm's clients: The greater the distance x , the larger the individual probability $Pr_d^*(x)$ that the manager will misreport ($\partial Pr_d^*(x)/\partial x > 0$), and the lower the quality Φ of disclosed information ($\partial \Phi/\partial x < 0$).⁵⁸ Second, the quality of audited financial statements also depends on the equilibrium number n of audit firms active in the market. Since the maximum possible distance between audit firm and auditee ($x^{max} = 1/2n$) decreases with increasing n , the upper value for the probability that managers will misreport bad economic conditions at their firms also decreases as n increases:

$$\begin{aligned} Pr_d^*(x^{max}, n) &= \frac{(1 - \theta_B)}{\theta_B} \cdot \frac{\Delta a/2n}{R - \Delta a/2n} \text{ with} \\ \partial Pr_d^*(x^{max}, n)/\partial n &= -\frac{(1 - \theta_B)}{\theta_B} \cdot \frac{\Delta a/2n^2 \cdot R}{(R - \Delta a/2n)^2} < 0. \end{aligned} \quad (2.1b)$$

Intuitively, a low number of audit firms active in the market (i.e., a high level of audit market concentration) means that there is a comparatively large number of clients una-

⁵⁷ For example, General Accounting Office 2003 discusses the fact that a number of small audit firms exited the market after the introduction of the Sarbanes-Oxley Act, because of the associated increase in the costs of auditing public corporations. Thus, one of the consequences of the act was a decrease in the competition for small mandates.

⁵⁸ For clients that perfectly fit the auditor's industry specialization ($x = 0$), the quality of audited financial statements is at its maximum, since $\Phi = 1 - \theta_B \cdot Pr_d^*(0) \cdot (1 - Pr_{he}^*) = 1$ (i.e., the manager's report always is accurate).

ble to find an audit firm located nearby (i.e., there is a lack of specialist audit firms). Since the probability $Pr_d^*(x)$ of misreporting increases as the distance x increases, and the maximum possible distance is larger when there are only few audit firms, the average quality of audited financial statements increases as the number n of audit firms increases. Figure 2.3 illustrates this effect (for simplicity, $Pr_d^*(x)$ in Figure 2.3 is assumed to be linear, which is a reasonable approximation given relatively high values of R).

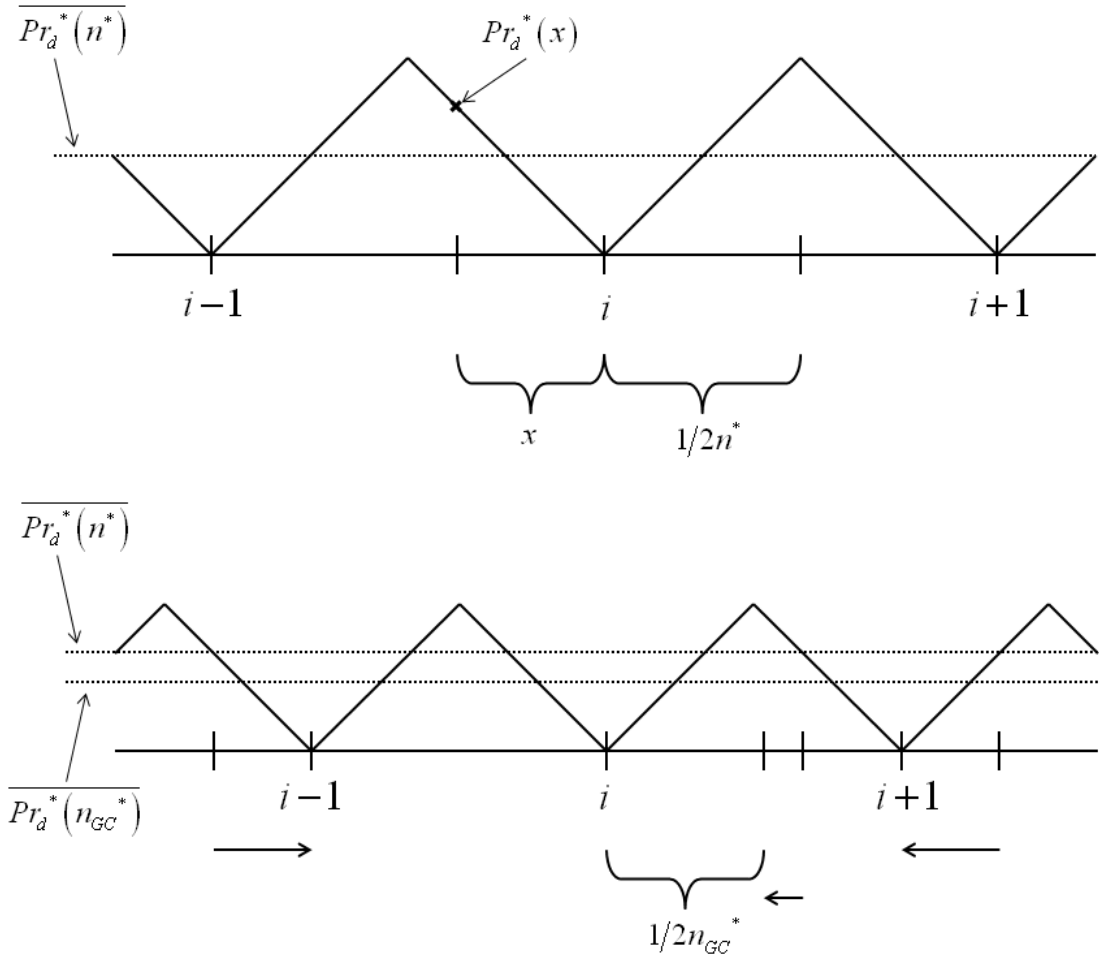


Figure 2.3: The probability that managers will misreport a bad economic condition, given a low number n^* (above) or a high number n_{GC}^* (below) of audit firms

Thus, a high level of audit market concentration can indeed have *negative* consequences for the quality of financial information disclosed. In our model, however, the underlying reason is not that audit firms skimp on audit effort because they believe that

their dominant market position protects them from punishment (as they are “too big to fail”), but rather that managers exploit the fact that exerting high audit effort becomes more costly as the distance between auditor and client increases. The average probability of misrepresenting bad economic conditions and thus the expected percentage of distorted financial reports can be calculated as

$$\overline{Pr_d^*(n^*)} = 2n^* \cdot \int_0^{1/2n^*} Pr_d^*(x) dx = \frac{(1-\theta_B)}{\theta_B} \cdot \left[2 \cdot n^* \cdot \frac{R}{\Delta a} \cdot \ln\left(\frac{R}{R-\Delta a/2n^*}\right) - 1 \right], \quad (2.13)$$

with $\partial \overline{Pr_d^*(n^*)} / \partial n^* < 0$. The corresponding measure for the average quality of audited financial statements is

$$\begin{aligned} \Phi &= 1 - \theta_B \cdot \overline{Pr_d^*(n^*)} \cdot (1 - Pr_{he}^*) \\ &= 1 - (1 - \theta_B) \cdot \left[2 \cdot n^* \cdot \frac{R}{\Delta a} \cdot \ln\left(\frac{R}{R-\Delta a/2n^*}\right) - 1 \right] \cdot \left(1 - \frac{d_t - m}{d_d} \right), \end{aligned} \quad (2.12a)$$

which decreases as $\overline{Pr_d^*(n^*)}$ increases and – because $\partial \overline{Pr_d^*(n^*)} / \partial n^* < 0$ – increases with increasing n^* . That is, the greater the number of active audit firms in the market, the higher the average quality of audited financial statements.

2.4 The Effect of Non-Audit Services

2.4.1 Case II: General Consulting Services

In this section, we investigate the effects of the joint provision of consulting services on audit fees, on the equilibrium number of audit firms, and on the quality of audited financial statements. As mentioned above, we differentiate between two scenarios regarding the scope of non-audit services audit firms are permitted to supply to their audit clients. We begin with *Case II*, in which audit firms are only allowed to offer general, non-audit-related consulting services that are clearly distinct from the audit service. Because in *Case II* both audit and non-audit fees are negotiated at the beginning of the period, they can be regarded as sunk in the game between auditors and clients. Therefore, non-audit fees do not have any immediate influence on the players’ decisions; in

particular, non-audit fees do not affect auditor independence.⁵⁹ Moreover, we assume that the provision of consulting services does not directly affect audit costs, e.g., through knowledge spillovers. As audit firms in our model are homogeneous except for their location on the unit circle, we assume that each audit firm has the same share of $1/n$ of the market for consulting services.⁶⁰ In addition, we assume that auditors earn some fixed profit contribution π_{GC} per client from the provision of consulting services.⁶¹

Taking into account this positive profit contribution from the provision of consulting services, the total profit contribution of an arbitrary audit firm i can be represented as

$$\begin{aligned} E[PC_{GC}^i(n)] &= 2 \cdot \int_0^{1/2n} [E[pc^i(x)] + \pi_{GC}] dx \\ &= E[PC^i(n)] + \pi_{GC}/n. \end{aligned} \quad (2.14)$$

For a given number of audit firms n , $E[PC_{GC}^i(n)]$ for *Case II* is clearly larger than $E[PC^i(n)]$ for *Case I* (in which the provision of non-audit services was not allowed).

The equilibrium number of audit firms n_{GC}^* can again be found by solving

$$E[PC_{GC}^i(n_{GC}^*)] = c_{FA} + c_{FGC} \quad (2.15)$$

for n_{GC}^* , where c_{FGC} denotes the fixed costs additionally incurred by audit firms that also offer general consulting services. In line with anecdotal evidence from business practice, we assume that the provision of consulting services is quite profitable for audit

⁵⁹ In our model, an increase in auditor-client “economic bonding” due to non-audit fees would impair auditor independence only in a multi-period setting, provided that the client has an incentive to replace an auditor who has refused to issue a clean opinion. For this incentive to evolve endogenously, additional assumptions would be necessary, since the incumbent auditor is always cost-efficient. However, there is also empirical evidence showing that independence is not necessarily impaired: Raghunandan et al. 2003 did not find significant differences in unexpected non-audit fees, fee ratios, or total fees between firms issuing restatements and a control group; that is, the idea that non-audit services affect audit quality (leading to the need for restatements) is not supported. Hay et al. 2006a did not find evidence that the provision of non-audit services impairs auditor independence, and DeFond et al. 2002 did not find a significant association between non-audit fees and impaired auditor independence (measured by auditors’ propensity to issue going-concern audit opinions).

⁶⁰ Provided that audit firms have identical market shares from providing consulting services, we obtain qualitatively similar results even if not all clients demand consulting services. Furthermore, our results do not depend on whether an audit firm offers consulting services to its own audit clients or to competitors’ clients.

⁶¹ We would obtain similar results if we assumed the profit contribution to be dependent on the distance between audit firm and client.

firms, i.e., $\pi_{GC}/n^* > c_{FGC}$.⁶² Consequently, the equilibrium number of audit firms is greater than that found in *Case I*, i.e., $n_{GC}^* > n^*$. Thus, the number of audit firms is larger when there is an opportunity to win profitable consulting contracts. In other words, the prohibition of the joint supply of audit and general consulting services would *decrease* the number of suppliers, i.e., further *increase* the already high level of audit market concentration.⁶³ The EU Commission, however, has not taken the possibility of an intermediate-term reduction in the number of suppliers into account. On the contrary, it argues that concerns of independence require that the provision of non-audit services to a certain company should preclude an audit firm from carrying out the statutory audit of that company. The consequence would be a reduction in the number of audit firms available to provide statutory audits (for large public-interest entities in particular). To secure a minimum number of audit firms available to large public-interest entities, the EU Commission requests “that audit firms of significant dimension focus their professional activity on the carrying out of statutory audit and are not allowed to undertake other services unconnected to their statutory audit function such as consultancy or advisory services.”⁶⁴ However, our model predicts that this reform would lead to a further increase in the level of audit market concentration.

Our results also contradict the EU Commission’s expectation that the prohibition of non-audit services will increase the quality of audited financial statements: Since $\overline{\partial Pr_d^*(n^*)}/\partial n^* < 0$, it is clear that the percentage of distorted financial reports in *Case II* is *lower* than that found in *Case I* (in which consulting services were prohibited), i.e.,

$$\overline{Pr_d^*(n_{GC}^*)} < \overline{Pr_d^*(n^*)} \quad (2.16)$$

(see also Figure 2.3). In *Case II*, the average quality of audited financial statements is therefore higher than in *Case I*, i.e.,

$$\Phi_{GC} = 1 - \theta_B \cdot \overline{Pr_d^*(n_{GC}^*)} \cdot (1 - Pr_{he}^*) > \Phi = 1 - \theta_B \cdot \overline{Pr_d^*(n^*)} \cdot (1 - Pr_{he}^*). \quad (2.17)$$

⁶² It has often been argued that audit firms lower audit fees to get a foot in the door in order to sell the more profitable non-audit services, i.e., auditing serves as a “loss leader” (see Antle et al. 2006; Knechel 2007).

⁶³ This effect would be intensified if some audit firms decided to leave the audit market to focus on non-audit services (see Le Vourc’h/Morand 2011, p. 200).

⁶⁴ Commission of the European Communities 2011b, p. 15.

The reasoning behind this result is that the additional profit contribution earned from providing non-audit services increases the number of audit firms (i.e., decreases the level of audit market concentration). Thus, comparatively more clients can be matched with a specialist audit firm, which decreases the additional costs of exerting high audit effort; this, in turn, decreases the managers' average probability of misreporting.⁶⁵

An additional effect of the joint provision of audit and non-audit services is that average audit fees are lower: Every auditor's nearest competitor has lower fee-determining costs than in *Case I*, since the presence of additional suppliers leads to a decrease in the distance between competitors. A prohibition of the joint supply of audit and general consulting services would thus increase audit fees. In sum, the implementation of a ban on "single-provider" auditing and consulting would have undesirable effects on the level of supplier concentration and also on the average quality of audited financial statements. These effects would be even more pronounced if we explicitly assumed that the additional costs for exerting high audit effort would decrease due to beneficial knowledge spillovers from non-audit to audit services.

2.4.3 *Case III: Audit-Related Consulting Services*

In this section, we address the concern that non-audit services would impair auditor independence.⁶⁶ In general, there are two lines of reasoning: First, non-audit services could negatively affect auditor independence because auditors would risk losing a possibly substantial amount of non-audit fees in addition to the audit fee if they truthfully report errors and misstatements in their client's financial reporting to the public ("economic bonding"). Second, clients might directly use non-audit fees to "bribe" their auditor to not report unfavorable findings. In this section, we focus on the second argument, assuming that a manager can buy additional non-audit services *after* an auditor has detected the misrepresentation of a company's bad economic position.⁶⁷ If, however, the

⁶⁵ Lim/Tan 2008 found that audit quality (i.e., the propensity to issue going-concern opinions, the propensity to miss analyst forecasts, and the earnings-response coefficient) increases with the level of non-audit services acquired from industry specialist auditors rather than non-specialist auditors.

⁶⁶ Sharma/Sidhu 2001 and Frankel et al. 2002 provide evidence that auditor independence might be compromised when clients pay relatively high non-audit fees. Firth 2002 finds that companies paying relatively high consultancy fees are more likely to receive a clean audit opinion.

⁶⁷ We implicitly assume that if a contract for non-audit services is signed, auditors would rather issue a clean opinion against their better knowledge than push the manager to correct a misleading report. In our model, a correction of a report of $r(B) = G$ to $r(B) = B$ could be precluded if the manager's disutil-

demand for non-audit services results primarily from managers' attempts to influence auditors to issue clean audit opinions, managers will presumably buy audit-related non-audit services rather than general consulting services, either because the audit committee would not have to approve this decision, or because the committee would be less skeptical of such a move than of a sudden additional demand for general consulting services.

We regard the costs audit firms must incur for supplying audit-related consulting services as independent from the distance x between audit firm and client. This assumption is motivated by the fact that an auditor who has conducted an audit has already invested some distance-dependent costs in order to become familiar with the client's business operations. We assume that the auditor demands a fixed mark-up in order to issue a clean audit opinion against his or her better knowledge, i.e., we consider the profit contribution from non-audit services to be distance-independent. In our model, the client's motive for buying non-audit services is to influence the auditor's reporting strategy rather than to derive some additional utility from the consumption of non-audit services.⁶⁸ Thus, clients will not choose a supplier other than their auditor for non-audit services. Particularly in the case of audit-related consulting services, the demand of the two services from the same supplier can be frequently observed in business practice.

Consider the situation in which the auditor has exerted high audit effort and thus was able to detect that the client had misreported. In contrast to *Case I*, in which an auditor would refuse to issue a clean opinion when aware of a client's false report, the auditor and the client now have the option to use a consulting contract as a valuable consideration in determining the auditor's decision. Such a contract is acceptable for the client if the additional non-audit fee, fee_{ARC} , does not exceed the decrease in utility resulting from a qualified opinion, i.e., if $fee_{ARC} \leq d_d$. The auditor would agree on such a contract if the profit contribution from offering non-audit services, π_{ARC} , is at least as high as possible reputational effects, i.e., if $\pi_{ARC} \geq R$. Obviously, the profit contribution

ity after truthfully reporting a bad economic condition were taken into account in setting non-audit fees. Doing so, however, would not yield additional insight.

⁶⁸ However, Lau/Mensah 2009 found that payments to auditors for non-audit services are positively related to the client's one-period-ahead sales growth, i.e., the provision of non-audit services by the statutory auditor indeed seems to provide value to the firm. Even if the purchase of non-audit services is primarily intended to compromise auditor independence, the value obtained by the client may justify their availability.

from non-audit services cannot exceed non-audit fees. Thus, we summarize our conditions as $R \leq \pi_{ARC} \leq fee_{ARC} \leq d_d$. The respective decisions of the players are as follows:

When managers truthfully report $r(B) = B$, auditors still always choose low audit effort. Provided that the auditor and the client agree upon a non-audit services contract after the auditor detects fraudulence in the manager's report of $r(B) = G$, the auditor will not report this finding to the public, i.e., $Pr_r = 0$. When managers report $r(G) = G$ or $r(B) = G$, auditors will exert high audit effort if the probability of a distortion in the financial statements, Pr_{dARC} , is relatively high. Auditors are indifferent with respect to conducting high or low effort if managers report $r(B) = G$ with probability

$$Pr_{dARC}^*(x) = \frac{(1-\theta_B)}{\theta_B} \cdot \frac{\Delta a \cdot x}{\pi_{ARC} - \Delta a \cdot x} \leq Pr_d^* = \frac{(1-\theta_B)}{\theta_B} \cdot \frac{\Delta a \cdot x}{R - \Delta a \cdot x}, \text{ since } \pi_{ARC} \geq R. \quad (2.18)$$

The option to buy audit-related consulting services during the audit process thus tends to decrease the *individual* probability that a specific client will misreport, since the auditor's payoff after observing that financial statements are misleading increases by the additional profit contribution from non-audit services. $Pr_{dARC}^* < 1$ is always fulfilled, as $Pr_d^* < 1$ is assumed to hold.

Managers, however, also consider the (attractive) possibility of obtaining a clean audit opinion even after having misreported. They are indifferent with respect to misreporting or truthfully reporting a bad economic condition if the probability of auditors exerting high effort after observing a report of a good economic condition is

$$Pr_{heARC}^* = \frac{d_t - m}{fee_{ARC}} \geq Pr_{he}^* = \frac{d_t - m}{d_d}, \text{ since } fee_{ARC} \leq d_d. \quad (2.19)$$

After having misreported, managers must pay additional non-audit fees in order to receive a clean audit opinion, but at the same time they avoid the decrease in utility d_d resulting from receiving a qualified audit opinion. Since $fee_{ARC} \leq d_d$, the managers' net payoff after misreporting does not decrease, which, in turn, tends to increase the probability that the auditors will exert high effort. To ensure that $Pr_{heARC}^* < 1$ holds, we assume $fee_{ARC} > d_t - m$.

These probabilities specify the Nash equilibrium in mixed strategies for *Case III*. *Ceteris paribus*, the individual probabilities of false reports of $r(B) = G$ tend to decrease, whereas the probabilities for high audit effort tend to increase in comparison to *Case I*, given an arbitrary pair of audit firm and client.

In order to compare *Case III* to *Case I*, we assume that audit firms have superior bargaining power and thus obtain the benefits resulting from the joint supply of audit-related consulting services, i.e., $fee_{ARC} = d_d$ and $\pi_{ARC} > R$. The optimal strategies are therefore

$$Pr_{dARC}^*(x) = \frac{(1-\theta_B)}{\theta_B} \cdot \frac{\Delta a \cdot x}{\pi_{ARC} - \Delta a \cdot x} < Pr_d^*(x) \text{ and} \quad (2.18a)$$

$$Pr_{heARC}^* = \frac{d_t - m}{d_d} = Pr_{he}^*. \quad (2.19a)$$

Due to their superior bargaining power, exclusively auditors benefit from the additional supply of non-audit services; managers – in order to render auditors indifferent regarding their pure audit effort strategies – react with a decrease in their probability to misreport; managers' payoffs and thus auditors' strategies remain unchanged.

The expected direct audit costs of audit firm i can be calculated as

$$E[c_{ARC}^i(x)] = [a_{le} + (1-\theta_B) \cdot Pr_{heARC}^* \cdot \Delta a + \theta_B \cdot Pr_{heARC}^* \cdot \Delta a \cdot Pr_{dARC}^*(x)] \cdot x. \quad (2.20)$$

Since $Pr_{dARC}^*(x) < Pr_d^*(x)$, the expected direct costs of conducting the audit in *Case III* are lower than in *Case I*, i.e., $E[c_{ARC}^i(x)] < E[c^i(x)]$.

In calculating the expected reputational effects, we must take into account the fact that if the economic condition of the firm is bad and managers misreport, audit firms in any case suffer the loss RL (either because they do not detect the false report due to their low audit effort, or because they accept the loss in order to gain a consulting contract). For simplicity, we assume that the loss RL for the two scenarios is identical; that is, for reputational damages and legal liability, it does not matter whether the incorrect audit opinion results from low effort or from impaired independence. The expected reputational effect is thus given by

$$E[Re_{ARC}^i(x)] = \theta_B \cdot (-RL) \cdot Pr_{dARC}^*(x). \quad (2.21)$$

The opportunity to additionally earn the (positive) profit contribution from non-audit services, π_{ARC} , can be denoted by

$$E[Opp_{ARC}^i(x)] = \theta_B \cdot Pr_{heARC}^* \cdot \pi_{ARC} \cdot Pr_{dARC}^*(x). \quad (2.22)$$

Combining (2.21) and (2.22) leads to the expected consulting-adjusted reputational effect:

$$\begin{aligned} E[Re_{ARC}^{adj\ i}(x)] &= E[Re_{ARC}^i(x)] + E[Opp_{ARC}^i(x)] \\ &= \theta_B \cdot (Pr_{heARC}^* \cdot \pi_{ARC} - RL) \cdot Pr_{dARC}^*(x). \end{aligned} \quad (2.23)$$

Since $\pi_{ARC} > R$, the consulting-adjusted reputational effect for one specific client in *Case III* is less severe than its equivalent in *Case I*, i.e., $E[Re^i(x)] < E[Re_{ARC}^{adj\ i}(x)]$. Moreover, $E[Re_{ARC}^{adj\ i}(x)]$ is no longer necessarily negative; the term is positive for $\frac{d_t - m}{d_d} \cdot \pi_{ARC} > RL$, which would indicate that expected reputational losses are more than offset by the profit contribution earned from non-audit services.

The expected reputation-adjusted audit costs are thus

$$\begin{aligned} E[C_{ARC}^i(x)] &= E[c_{ARC}^i(x)] - E[Re_{ARC}^{adj\ i}(x)] \\ &= [a_{le} + (1 - \theta_B) \cdot Pr_{heARC}^* \cdot \Delta a + \theta_B \cdot Pr_{heARC}^* \cdot \Delta a \cdot Pr_{dARC}^*(x)] \cdot x \\ &\quad - \theta_B \cdot (Pr_{heARC}^* \cdot \pi_{ARC} - RL) \cdot Pr_{dARC}^*(x). \end{aligned} \quad (2.24)$$

If the auditor can sell additional non-audit services, both the decrease in expected direct audit effort costs ($E[c_{ARC}^i(x)] < E[c^i(x)]$) and the attenuation of the consulting-adjusted reputational effect ($E[Re^i(x)] < E[Re_{ARC}^{adj\ i}(x)]$) result in a decrease in the expected overall audit costs ($E[C_{ARC}^i(x)] < E[C^i(x)]$).

The audit fees of audit firm i are again determined by the expected reputation-adjusted audit costs of its nearest competitor, $i-1$:

$$fee_{ARC}^i(x) = E[C_{ARC}^{i-1}(1/n - x)]. \quad (2.25)$$

Given a certain number n of audit firms, we can conclude that the average demanded audit fees in *Case III* are lower than in *Case I*, as the competitors' expected overall costs also decrease, i.e., $fee_{ARC}^i(x) < fee^i(x)$.

The profit contribution of audit firm i can be represented by

$$E[pc_{ARC}^i(x)] = fee_{ARC}^i(x) - E[C_{ARC}^i(x)]. \quad (2.26)$$

Integration and consideration of both sides of the unit circle leads to the overall profit contribution:

$$\begin{aligned} E[PC_{ARC}^i(n)] &= 2 \cdot \int_0^{1/2n} E[pc_{ARC}^i(x)] dx \\ &= a_{le}/2n^2 + (1 - \theta_B) \cdot Pr_{he}^* \cdot \Delta a / 2n^2 \\ &\quad + 2 \cdot \theta_B \cdot Pr_{he}^* \cdot \Delta a \cdot \int_0^{1/2n} [Pr_{dARC}^*(1/n - x) \cdot (1/n - x) - Pr_{dARC}^*(x) \cdot x] dx \\ &\quad - 2 \cdot \theta_B \cdot (Pr_{he}^* \cdot \pi_{ARC} - RL) \cdot \int_0^{1/2n} [Pr_{dARC}^*(1/n - x) - Pr_{dARC}^*(x)] dx, \end{aligned} \quad (2.27)$$

which can be simplified to

$$\begin{aligned} E[PC_{ARC}^i(n)] &= 2 \cdot \int_0^{1/2n} E[pc_{ARC}^i(x)] dx \\ &= \frac{a_{le}}{2n^2} + 2 \cdot (1 - \theta_B) \cdot \left(\frac{\pi_{ARC}}{\Delta a} \cdot RL \right) \cdot \ln \left[1 + \frac{(\Delta a / 2n)^2}{\pi_{ARC}^2 - \pi_{ARC} \cdot \Delta a / n} \right]. \end{aligned} \quad (2.27a)$$

Compared to *Case I*, the overall audit costs and thus also the audit fees demanded are smaller when the auditor can supply additional audit-related consulting services. However, given a certain number n of audit firms, the overall profit contribution of an arbitrary audit firm is smaller for the case with audit-related consulting services than for the initial case without consulting, i.e., $E[PC_{ARC}^i(n)] < E[PC^i(n)]$, as

$\partial E[PC_{ARC}^i(n)]/\partial \pi_{ARC} < 0$. This result is illustrated in Figure 2.4 (again, for simplicity we assume linear costs).

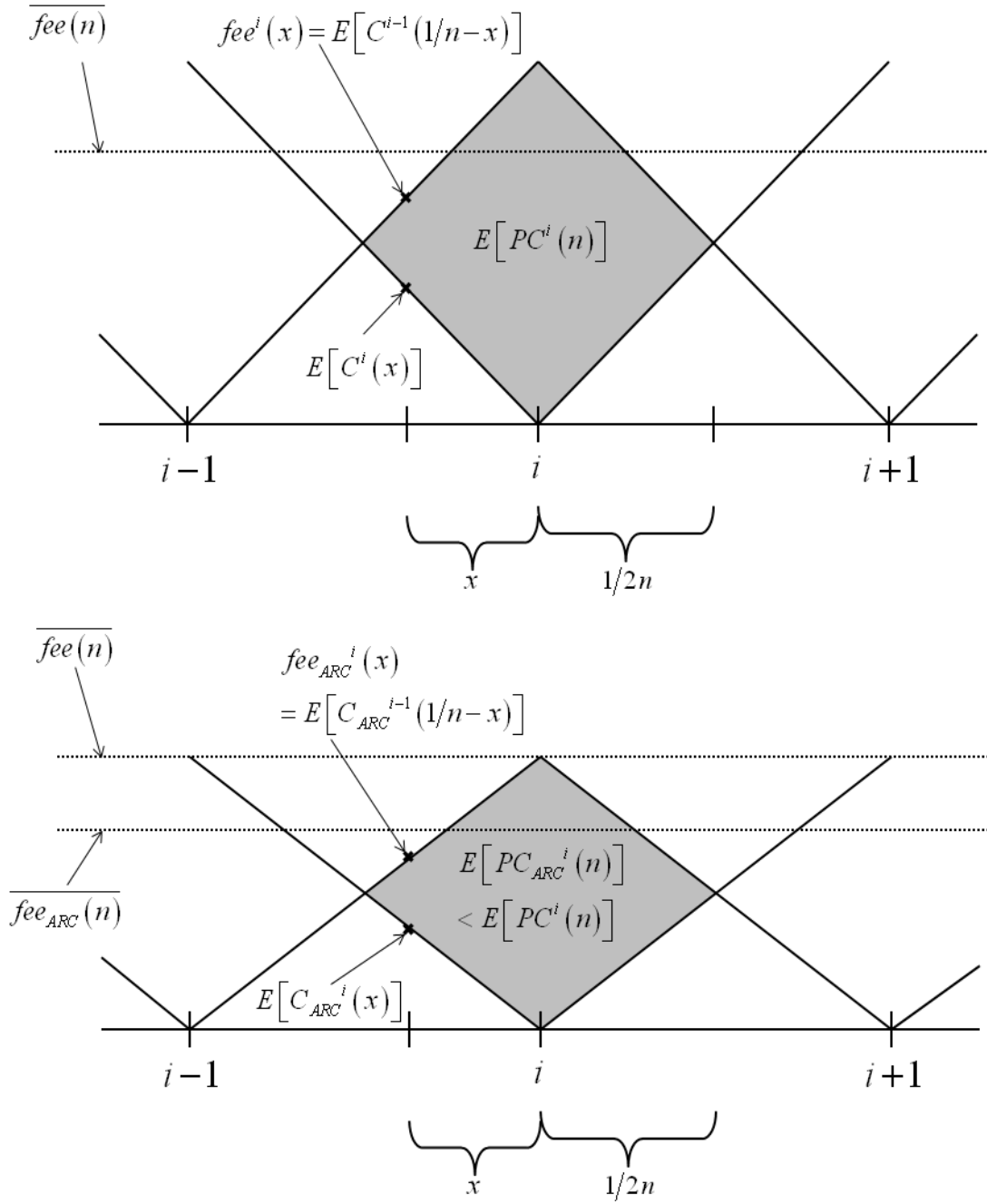


Figure 2.4: An audit firm's overall profit contributions in *Case I* (above) and *Case III* (below), given a certain number of audit firms n

Taking the fixed costs into account and solving for n leads to the equilibrium number of audit firms on the market, n_{ARC}^* :

$$E\left[PC_{ARC}^i(n_{ARC}^*)\right] = c_{FA}.^{69} \quad (2.28)$$

Because $\partial PC_{ARC}^i(n)/\partial n < 0$, the equilibrium number of audit firms in the three cases can be ordered as follows: $n_{ARC}^* < n^* < n_{GC}^*$. Thus, the equilibrium number of audit firms is *smaller* when audit firms are allowed to offer audit-related non-audit services to their audit clients in comparison to a situation in which consulting is prohibited. A ban on this kind of consulting services would thus indeed *increase* the number of audit firms active in the market, i.e., *reduce* the level of supplier concentration. This raises the question of whether a ban on “single-provider” auditing and consulting would also improve the quality of audited financial statements and should therefore be implemented.⁷⁰

The average probability that a manager will misrepresent a bad economic condition in his or her firm and thus the expected percentage of distorted financial reports can be calculated by

$$\begin{aligned} \overline{Pr_{dARC}^*(n_{ARC}^*)} &= 2 \cdot n_{ARC}^* \cdot \int_0^{1/2n_{ARC}^*} Pr_{dARC}^*(x) dx \\ &= \frac{(1-\theta_B)}{\theta_B} \cdot \left[2 \cdot n_{ARC}^* \cdot \frac{\pi_{ARC}}{\Delta a} \cdot \ln\left(\frac{\pi_{ARC}}{\pi_{ARC} - \Delta a/2n_{ARC}^*}\right) - 1 \right]. \end{aligned} \quad (2.29)$$

However, as $\partial \overline{Pr_{dARC}^*(n_{ARC}^*)}/\partial n_{ARC}^* < 0$ and $\partial \overline{Pr_{dARC}^*(n_{ARC}^*)}/\partial \pi_{ARC} < 0$, we cannot make a clear comparison between *Case III* and *Case I* regarding the average distortion probability. On the one hand, the number of audit firms is lower in *Case III*, which leads to a larger number of distorted financial reports, *ceteris paribus*. On the other hand, the lower profit contribution in *Case III* leads to a decrease in the average probability of deception.

⁶⁹ In order to avoid additional complexity, we refrain from introducing additional fixed costs for offering audit-related consulting services.

⁷⁰ The empirical evidence on the question of whether non-audit services impair auditor independence and audit quality is mixed. Ruddock et al. 2006 found that higher than expected levels of non-audit services are not associated with reduced news-based conservatism. Ashbaugh et al. 2003 present evidence that non-audit fees do not affect performance-adjusted discretionary current accruals and that there is no statistically significant association between firms meeting analyst forecasts and auditor fees.

In determining the quality of audited financial statements in *Case III*, we must take into account the fact that a distorted financial statement never becomes publicly observable, either because auditors do not detect false reports due to their low audit effort or because auditors compromise their independence. The corresponding measure for the quality of audited financial statements can be adjusted to

$$\begin{aligned}\Phi_{ARC} &= 1 - \theta_B \cdot \overline{Pr_{dARC}^*(n_{ARC}^*)} \\ &= 1 - (1 - \theta_B) \cdot \left[2 \cdot n_{ARC}^* \cdot \frac{\pi_{ARC}}{\Delta a} \cdot \ln \left(\frac{\pi_{ARC}}{\pi_{ARC} - \Delta a / 2n_{ARC}^*} \right) - 1 \right].\end{aligned}\quad (2.30)$$

Again, we cannot predict a clear effect, but the quality of audited financial statements in *Case III* decreases in most of the parameter constellations.

We can make the following qualitative comparison of *Cases II* and *III*: In *Case II*, the provision of profitable consulting services increases the audit firms' profit contributions, given a certain number n of audit firms. The managers' individual probability of misreporting remains constant for a given distance x and a given number n of audit firms. The higher profit contribution, however, increases the equilibrium number of audit firms. Thus, the average distance between audit firms and clients, and thus the *average* probability to misreport, decreases. In *Case III*, in contrast, the managers' *individual* probability of misreporting decreases in order to render the auditor indifferent with respect to exerting high or low audit effort. This decreases audit costs, audit fees, and the profit contribution derived from auditing. Thus, the equilibrium number of audit firms decreases.

2.5 Conclusion

In the present paper, we use a formal model to analyze the effects that a ban on the joint provision of audit and non-audit services could have on the level of audit market supplier concentration and on the quality of audited financial statements. Specifically, we embed the optimal decisions from a strategic auditor-manager game (in which expected audit costs and reputational effects are determined) into a market matching model. Our two-stage set-up allows us to simultaneously analyze the various effects of a joint provision of audit and non-audit services. First, we are able to investigate the di-

rect effect of a joint supply of the two services on the quality of audited financial statements (i.e., the managers' optimal reporting decisions and the auditors' optimal decisions regarding audit effort and independence). Second, we can predict the qualitative effects on the equilibrium structure of the audit market, effects that depend on audit firms' profits and thus on the scope of services audit firms are permitted to provide. Third, our model allows investigation of the interdependencies between audit firms' market shares and the quality of audited financial statements. As a result, our work contributes to the recent discussion on regulatory reforms intended to simultaneously address both the structure of the audit market and concerns regarding auditor independence.⁷¹

Our results indicate that a ban on general consulting services reduces audit firms' profits and thus decreases the equilibrium number of audit firms (i.e., increases market concentration). Moreover, a prohibition of the joint provision of the two services can have negative effects on the quality of audited financial statements, since the managers' average probability of misreporting increases. These effects are diametrically opposed to the aims the Commission has outlined in its Green Paper. With regard to the prohibition of audit-related consulting services demanded in order to "bribe" auditors, we predict a resulting increase in the equilibrium number of audit firms. However, the effect on the quality of audited financial statements cannot be exactly determined, and thus we cannot confirm the Commission's expectation of a clear positive effect. Moreover, our results are in line with the argument that a high level of audit market concentration does not necessarily mean that audit quality is low.⁷² The effects of a ban on "single-provider" auditing and consulting crucially depend on the point in time at which consulting services are negotiated.

Our analysis has several limitations. First, depending on the parameter constellations chosen, a wide variety of outcomes are possible; however, we demonstrate that not all of these outcomes are desirable from the regulator's perspective. Second, the determination of the specific outcome that will occur depends largely on the players' payoffs, the

⁷¹ See Commission of the European Communities 2010.

⁷² For example, the Swiss Federal Audit Oversight Authority argues that it "identified a larger average number of deficiencies per firm review at the small to medium-sized state-regulated audit firms than at the annually-inspected Big 3" (Federal Audit Oversight Authority FAOA 2010, p. 20), indicating that a high level of supplier concentration does not necessarily imply a low level of audit quality. The chairman of the PCAOB, James Doty, also speculated that measures intended to promote competition might have a negative effect on audit quality (see Doty 2011).

allocation of bargaining power, the level of competition, the suppliers' cost structures, and audit firms' adaptive reactions to regulatory changes. With regard to some of these aspects, there is to date only limited empirical evidence. Third, the situations in Member States can vary widely, such that one may question whether, from an economic perspective, a meaningful EU-wide solution can be found. It is likely that if implemented as proposed, these new regulations will result in the need for additional corrective legislation in the future.

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CHAPTER 3

The Effects of Audit Firm Rotation on the
Structure of the Audit Market

3.1 Motivation

In the aftermath of the financial crisis, there was an intense public debate about the means to improve the components of the financial system, to stabilize financial markets, and to rebuild trust and confidence of the market participants. With regard to the audit profession as a key contributor to market stability, incomprehension prevailed about the fact that during the financial crisis, financial institutions had received clean audit opinions although they had revealed enormous losses on positions they held both on and off balance, leaving the consequences of their collapse soon after to investors and taxpayers (Sikka 2009). As a reaction to the financial crisis, in 2010 the Commission of the European Communities published its Green Paper “Audit Policy: Lessons from the Crisis” (Commission of the European Communities 2010), which directed the focus on the role of the audit profession. Moreover, the EU-Commission claimed global leadership in the field of regulating the role and governance of auditors (for an analysis of the Green Paper, see Humphrey et al. 2011). The Green Paper was designed to stimulate the discussion in professional, academic, and regulatory circles. After the consultation process and a heated debate on the basis of the proposals, the EU-Commission issued a new proposal for a Directive (Commission of the European Communities 2011a), and explicitly addressed statutory audits of public-interest entities (Commission of the European Communities 2011b). Although some of the regulatory reforms suggested in the Green Paper have been abandoned in the meantime, some far-reaching measures are still prevailing. Amongst others, the EU-Commission adheres to the prohibition of the joint supply of audit and non-audit services, and to the implementation of the external audit firm rotation.

For statutory audits carried out within the European Union, Art. 42 (2) of the 8th EU Directive on statutory audits (see European Parliament and European Council 2006) currently only prescribes the *internal auditor rotation*, i.e., the replacement of the key audit partners after seven years. *Audit firm rotation*, in contrast, is not mandatory within the European Union. Today, Italy is the only EU Member State that prescribes the external rotation for listed companies.⁷³ Some countries outside the European Union, however, already have implemented a mandatory audit firm rotation rule.⁷⁴

⁷³ In Poland, audit firm rotation is mandatory only for insurance companies. Turkey, as a candidate for full EU membership, introduced a mandatory audit firm rotation for all companies in 2003. Spain had

Because audit firm tenure is not restricted within the EU, the Commission of the European Communities 2011b has recently expressed its concerns that – because auditors become too familiar with their clients – auditor independence might be threatened, even though key audit partners have to be replaced after seven years.⁷⁵ In addition, potentially unrestricted tenures create a strong economic incentive for auditors to issue a clean audit opinion, since otherwise they would risk losing their clients (and the corresponding economic benefits). Accordingly, the Commission of the European Communities 2011b has proposed the introduction of audit firm rotation as a measure to address the threat of familiarity and to improve audit quality. In its recently published proposal, the EU-Commission suggests a mandatory audit firm rotation for statutory auditors of public-interest entities after a maximum period of 6 years that may be – under certain exceptional circumstances – extended to 8 years (Art. 33, par. 1). If two statutory auditors or audit firms have been appointed throughout a continuous engagement of 6 years, the maximum duration of the engagements can be 9 years, and on an exceptional basis, an extension to 12 years should be possible. In addition, the EU-Commission requires a cooling-off period of four years (Art. 33, par. 2) before the audit firm is allowed to carry out the statutory audit of the same entity again.

In addition to auditor independence, the EU-Commission is concerned about the high level of audit market concentration. Most of the national audit markets within the European Union are characterized by a situation in which Big X audit firms dominate the market for statutory audits of public-interest entities (although the position of the market leader varies across countries, the 4 biggest audit firm networks are Deloitte & Touche, Ernst & Young, PricewaterhouseCoopers, and KPMG).⁷⁶ Mid-tier international audit firms or networks have a substantially smaller market share in this segment than the Big X, and nationally or locally active small audit firms generally only have a negligible number of listed clients. Since these audit firms face severe barriers to market entry, it is difficult for them to acquire new clients in the oligopolistic market segment of

a mandatory audit firm rotation until 1995, and Austria introduced a six year rotation before 2004, but repealed this rule even before it became effective.

⁷⁴ E.g., Brazil for banks and listed companies, Korea for companies listed on the Korean Stock Exchange or registered with the Korean Securities Dealers Automated Quotations, Singapore for banks, and India for banks, private insurance companies, and governmental companies.

⁷⁵ Empirical evidence generally does not support the concern that audit quality decreases with auditor tenure (see, for example, Johnson et al. 2002, Myers et al. 2003, Carcello/Nagy 2004, Knechel/Vanstraelen 2007; an exception is Davis et al. 2009).

⁷⁶ For empirical studies on audit market concentration, see, for example, Frankel et al. 2002, Ewert/London Economics 2006, United States General Accounting Office (GAO) 2008, Abidin et al. 2010, Dunn et al. 2011, and Le Vourc'h/Morand 2011.

statutory audits of listed companies. The EU-Commission argues that the collapse of one of the Big 4 audit networks would have severe consequences regarding the availability of audits, and in the end would negatively impact the stability of the financial system. Moreover, the EU-Commission points to the problems of the clients' lack of choice when appointing an audit firm, low degrees of dynamism and competition in the audit market, and a possibly low audit quality arising from the oligopolistic market structure.⁷⁷

The Commission of the European Communities 2011b expects that an external auditor rotation would not only improve auditor independence, but also increase the dynamism of the audit market, intensify competition for audit mandates, and mitigate the problems arising from a high level of supplier concentration. In particular, mandatory audit firm rotation is seen as a means to increase the chance that mid-tier audit firms gain mandates in the segment of statutory audits of listed companies. Thus, the question arises whether audit firm rotation increases competition between Big X and mid-tier audit firms, and whether mid-tier auditors can increase their market share due to this new rule.⁷⁸

In the US, there has also been a discussion about the implementation of the mandatory audit firm rotation. Already in 1977, the Metcalf Report suggested limiting the auditor's tenure, and in 1978, the Cohen Commission of the AICPA considered auditor rotation as a means to improve auditor independence. With the explanatory statement that audit firm rotation is not cost beneficial, the Cohen Commission in its final report finally rejected mandatory audit firm rotation. In 2002, however, the discussion of mandatory audit firm rotation was resumed within the framework of the passage of the Sarbanes-Oxley Act. Since respondents of the survey conducted by the U.S. Government Accountability Office (GAO) overwhelmingly opposed mandatory audit firm rotation (United States General Accounting Office (GAO) 2003b), auditor rotation was again rejected. Recently, the Public Company Accounting Oversight Board issued PCAOB

⁷⁷ Kallapur et al. 2010, in contrast, do not find empirical evidence for the assertion that *absolute* audit market concentration has a negative effect on audit quality; nevertheless, the authors document a negative impact of *relative* audit market concentration on audit quality.

⁷⁸ Quick/Sattler 2011, for example, document for a German sample that the percentage of clients changing their audit firms voluntarily is only 6,79% per year (data from 2005-2007). However, most of these voluntary changes occurred between Big 4 audit firms or from a mid-tier to a Big 4 audit firm, whereas changes from a Big 4 to a mid-tier audit firm are quite infrequent. Thus, the argument that the external rotation increases the mid-tier audit firms' market shares seems questionable.

Release No. 2011-006, which again suggested the implementation of auditor rotation.⁷⁹ The United States Congress also expressed specific concern about audit market concentration and directed the United States General Accounting Office (GAO) 2003a; United States General Accounting Office (GAO) 2008 to study supplier concentration and competition in the audit market.

Since regulators aim at solving two interconnected problems with the implementation of the external rotation (the improvement of auditor independence and the decrease in the actually high level of audit market concentration), the idea of this paper is to provide a formal analysis of the effects of the implementation of the external rotation on the level of audit market concentration. Thus, this paper might help in appreciating the regulatory imperatives that drive action at the EU-Commission, and in preventing unintended and potentially harmful consequences of the proposed reforms. Since the issue of the quality of audited financial statements has been addressed in Bleibtreu/Stefani 2012, the focus of the present paper is on the development of the market shares of mid-tier audit firms and the equilibrium number of smaller suppliers.

3.2 Literature

Empirical evidence regarding the effects of voluntary auditor changes on audit quality is mixed, i.e., there is no clear consensus that audit quality (measured by the frequency of qualified audit opinions or going concern opinions, litigation and results of SEC surveillance, results of external quality controls, or earnings management) is indeed higher in shorter auditor-client relationships.⁸⁰ The literature on voluntary auditor changes, however, shows that there are many possible explanations (e.g., mergers, a change in management, an increase in the client's complexity or internationalization, an IPO, etc.) in addition to the reasons that cause audit quality to decrease after an auditor change (e.g., opinion shopping, earnings management, and anticipating that first time audits might be less efficient).

⁷⁹ See Public Company Accounting Oversight Board (PCAOB) 2011. For a discussion, see Roush et al. 2011.

⁸⁰ For an overview of the literature on the clients' motives to change the audit firm and the auditor's incentives to resign from an audit engagement, see Stefani 2002, Cameran et al. 2005, Stefaniak et al. 2009, Fischkin/Gassen 2011, and Quick 2012.

A caveat of the studies cited above thus is that conclusions drawn from studies conducted in a regulatory environment without mandatory rotation cannot be transferred to evaluate the efficiency of audit firm rotation. Since there are not many national audit markets in which the external rotation is mandatory, there are only few studies on the effects of mandatory auditor changes. For the period between 1988 and 1995 in which audit firm rotation was mandatory in Spain, Gómez-Aguilar/Ruiz-Barbadillo 2003, for example, did not find a significant difference in the auditor's propensity to issue a going-concern opinion between periods with and without audit firm rotation. For Italy, where audit firm rotation is mandatory after nine years, Cameran 2008 documents that earnings management is highest in the periods after the auditor change, which would be an argument against the implementation of audit firm rotation.

In addition, evidence regarding the effect of audit firm rotation on supplier concentration is scarce.

In the analytic audit market literature, there are only few papers investigating the effects of the external rotation. Arruñada/Paz-Ares 1997, for example, argue that the effects of the external rotation are an increase in audit costs and audit fees, the destruction of specific assets, the distortion of competition, and a negative impact on audit quality. Their formal analysis, however, does not aim at directly calculating the resulting market shares.

Sen/Gietzmann 2002 model the decisions of three risk-neutral players: an owner with an investment project that he wants to be continued only if its profitable, an empire-building manager who oversees the project and wants the project always to continue, and an auditor. Sen/Gietzmann 2002 then analyze the incentives for a new auditor to provide sufficient effort to correctly evaluate the project and the incentives for an incumbent to be influenced by reappointment concerns. Based on these considerations, Sen/Gietzmann 2002 define a set of conditions for which mandatory rotation is advantageous. The structure of the audit market, however, is not in the focus of this paper.

Comunale/Sexton 2005 investigate the effects of mandatory audit firm rotation and multi-year appointment of auditors on the resulting market share distribution of the Big 5 audit firms by means of a Markov model. They find that audit firm rotation would have tangible effects on the market shares of the Big 5 audit firms active in the S&P 500 market, but that their shares would not depend significantly on the rotation period.

Comunale/Sexton 2005 conclude that mandatory rotation would not create excessive market power in any of the Big 5 audit firms. Since Comunale/Sexton 2005 consider a market segment where virtually only the Big 5 audit firms are present, they do not analyze the effects of the implementation of audit firm rotation on the market shares of mid-tier audit firms.

3.3 A Formal Analysis of the Effects Resulting from Audit Firm Rotation

3.3.1 *Reference Case: Mid-Tier Audit Firms Only, No Audit Firm Rotation*

This section describes the structure of the basic model. To investigate the effects of the implementation of mandatory audit firm rotation, I first consider a reference situation without audit firm rotation.

I assume that there are clients (e.g., large or complex public-interest entities) that will always hire a Big X audit firm (“Big X-only clients”). In addition to the internationalization of the clients’ business, reasons for the choice of a Big X audit firm might be that mid-tier audit firms would not have the capacities to provide large clients with the necessary audit services, mid-tier audit firms would violate the fee cap (i.e., the predetermined critical proportion of audit fees an audit firm can receive from a single client, compared to the total audit revenues of the firm),⁸¹ independence concerns would arise since a smaller audit firm would have a strong economic interest not to lose an important client,⁸² or that the client’s credit contract contains a “Big X only-clause”. However, there are also clients (e.g., smaller or less complex public-interest entities) that will always choose a mid-tier audit firm as an auditor, since the additional costs for hiring a Big X would exceed the corresponding economic benefits (“mid-tier-only clients”).⁸³ In addition, there are mid-sized clients that effectively can choose from a large

⁸¹ Fee caps are already statutory in various EU Member States (among them Austria, Belgium, Denmark, Germany, Ireland, and the United Kingdom), and their implementation has recently been suggested by the Commission of the European Communities 2010. For an empirical analysis in the German context, see Quick/Sattler 2011.

⁸² Previous findings regarding the relationship between audit fees and independence in mind are mixed, but there is evidence of a negative association between client importance and independence in appearance. For an overview, see Quick 2012.

⁸³ For empirical evidence on the connection between client characteristics and auditor choice, see Francis et al. 2009.

set of Big X and mid-tier audit firms. Since empirical evidence suggests that national audit firms do not provide audit services to public-interest entities, and the EU-Commission's proposal regarding audit firm rotation addresses statutory auditors of public-interest entities only, small audit firms are not taken into account here. As a starting point, only mid-tier audit firms and their potential "mid-tier-only clients" are considered. Thus, possible auditor changes from mid-tier to Big X audit firms and *vice versa* are also neglected.

In the following model, the demand-side of the market consists of public-interest entities which can choose their statutory auditor among several mid-tier audit firms. These potential audit clients differ in some audit-specific characteristics (e.g., industry diversification, number of business areas, geographic dispersion of operations, corporate structure or accounting standard in use). In the following, a market matching model in the tradition of Salop 1979 is applied to the audit market. Thus, a continuous mass of potential audit clients which are uniformly distributed on the unit circle is assumed. A client's location on this unit circle then corresponds to a combination of audit-related characteristics. The mass of clients that choose a mid-tier audit firm is normalized to 1.

I further assume an initial discrete number, n , of mid-tier audit firms (indexed by $i = 1, 2, \dots, n$), which are also uniformly distributed on the unit circle. An audit firm's location on the unit circle corresponds to its specialization with regard to the client's audit-specific characteristics. The larger the distance between an audit firm and its client, x , on the unit circle, the less specialized is the audit firm in the client's characteristics. The difference x determines the auditors' costs for conducting the audit. To be more precise, I assume two cost components: In addition to the fixed costs, c_F , an audit firm also incurs characteristic-dependent costs $c_A \cdot x$ for conducting the audit, which increase linearly in the distance between audit firm and client. The costs for an arbitrary audit firm i for auditing a client in distance x are given by

$$c^i(x) = c_A \cdot x \quad (3.1)$$

To derive the fees demanded as well as the profit contribution earned from auditing, I assume *Bertrand* competition between the mid-tier audit firms. Thus, audit firms undercut each other's audit fee offers up to the point where one of the competitors reaches its

own costs. I assume that every client chooses the audit firm offering the lowest fee.⁸⁴ In equilibrium, each audit firm demands an audit fee that equals the costs of the competitor located most closely on the unit circle, because the nearest competitor has the lowest audit costs, compared to all other competitors active on the market. The fee audit firm i can demand from the client in distance x is

$$fee^i(x) = c^{i-1} \left(\frac{1}{n} - x \right) = c_A \cdot \left(\frac{1}{n} - x \right). \quad (3.2)$$

The profit contribution of an arbitrary audit firm i from auditing a client in distance x is the difference between the fee earned and the costs induced by auditing this client, i.e.,

$$pc^i(x) = fee^i(x) - c^i(x) = c_A \cdot \left(\frac{1}{n} - 2x \right). \quad (3.3)$$

Audit firms get audit contracts only with clients in a distance $0 \leq x \leq 1/2n$, because clients exceeding this distance could be audited by the competitor at a lower cost. The overall profit contribution can be computed by integrating (in order to take the total clientele of the audit firm into one direction of the unit circle into account) and multiplying by 2 (in order to account for both sides of the unit circle):

$$PC^i = 2 \cdot \int_0^{1/2n} pc^i(x) dx = \frac{c_A}{2 \cdot n^2} \quad (3.4)$$

⁸⁴ If audit firms are homogeneous with respect to their audit cost structure, this result emerges even if the possibility of managers distorting the financial reports of their firms and auditors randomizing between exerting high or low audit effort are taken into account (see Bleibtreu/Stefani 2012).

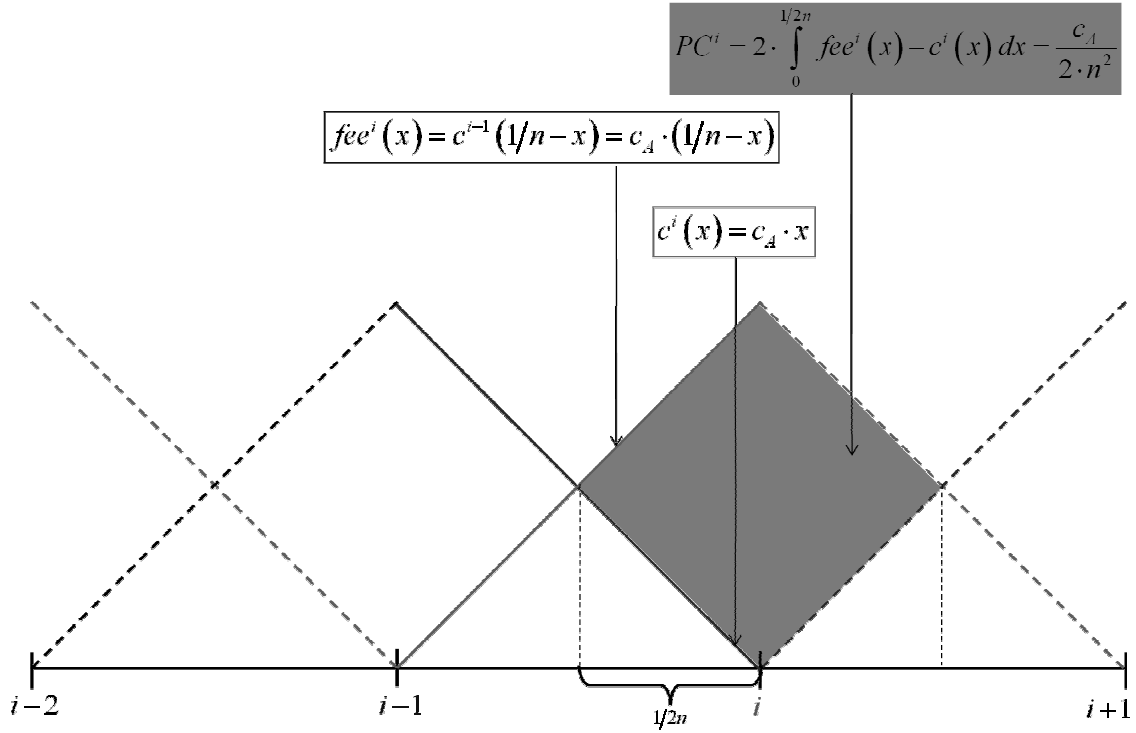


Figure 3.1: Auditor-client matching for the reference case (mid-tier audit firms only, no audit firm rotation)

Subtracting fixed costs from the overall profit contribution yields the audit firms' total profits. If audit firms can make positive profits, additional audit firms will enter the market. In case of negative profits, in contrast, audit firms will leave the market. Thus, the equilibrium number of audit firms is reached if audit firms' total profits are 0. The equilibrium number of mid-tier audit firms can be computed by setting the overall profit contribution equal to the fixed costs $\left(\frac{c_A}{2 \cdot n^2} = c_F\right)$:

$$n^* = \sqrt{\frac{c_A}{2 \cdot c_F}}. \quad (3.5)$$

The number of audit firms can be interpreted as a reverse measure of the absolute audit market concentration: The higher the number of audit firms (with equal market shares), the smaller is the level of audit market concentration.

Using the results of Bleibtreu/Stefani 2012, the following conclusions regarding the relationship between the equilibrium number of audit firms and the quality of financial statements can be made: The higher the number of audit firms active on the market, the

higher is the average quality of financial reports, because clients that have hired a comparatively specialized auditor (i.e., clients with a smaller distance on the unit circle to their audit firm) distort their financial statements with a lower probability than clients with an audit firm that is not familiar with the client's business. As the average distance between auditors and their clients decreases in the number of audit firms, a higher number of audit firms leads to a smaller percentage of distorted financial reports.

3.3.2 Audit Firm Rotation: The Effects of the Maximum Audit Firm Tenure

In the following, I investigate the effects of the external rotation for a simple scenario in which only mid-tier audit firms and only "mid-tier-only clients" are present. In the following, I make the simplifying assumption that audit firms have to change all of their clients at the same point in time.⁸⁵ In addition, I abstract from possible cost reductions arising from learning curve effects. In this setup, the relative effects of the maximum audit firm tenure in relation to the cooling-off period can be analyzed.

For simplicity, I assume that clients mandatorily have to change their audit firms if a pre-determined time span of $T \geq 1$ years has expired. The cooling-off period T^{CO} , i.e., the number of periods an audit firm is forbidden to audit a former client again, is normalized to 1 period. I first consider the artificial case in which the maximum audit firm tenure is identical to the cooling-off period, i.e., $T = T^{CO} = 1$:

Starting with the cost-efficient auditor-client matching derived for the reference case, audit firm i audits all clients in a distance $0 \leq x \leq 1/2n$ in between the locations of audit firms i and $i-1$, and audit firm $i-1$ serves all clients in distance $1/2n \leq x \leq 1/n$ (measured from audit firm i). If clients were not allowed to keep the most cost-efficient audit firm also for the following period ($t=1$) because mandatory audit firm rotation becomes effective, there would be an enforced auditor change to the second-cheapest audit firm. Thus, a client in distance $1/2n \leq x \leq 1/n$ to audit firm i would choose audit firm i in the period of a mandatory audit firm rotation, since audit firm $i-1$ would not be al-

⁸⁵ In the present model with a continuous distribution of audit clients, a loss of single clients would not have an effect on the overall profit contribution determining market concentration. In a discrete setup with a finite number of audit clients, however, an auditor change of one single client would have an impact on an audit firm's profit contribution. Even in a discrete setting, the simultaneous rotation of all clients would lead (in the long run), on average, to the same overall profit contribution as a sequential rotation.

lowed to offer audit services to this client anymore. Audit firm i then competes with the third-nearest audit firm $i - 2$ for this client. The costs of audit firm i , the fee it can demand, and the profit contribution from auditing the clients in distance $1/2n \leq x \leq 1/n$ are given by

$$c^i \left(x \middle| \frac{1}{2n} \leq x \leq \frac{1}{n} \right)_{T=1, t=1} = c_A \cdot x, \quad (3.6)$$

$$fee^i \left(x \middle| \frac{1}{2n} \leq x \leq \frac{1}{n} \right)_{T=1, t=1} = c^{i-2} \left(\frac{2}{n} - x \middle| \dots \right) = c_A \cdot \left(\frac{2}{n} - x \right) \text{ and} \quad (3.7)$$

$$pc^i \left(x \middle| \frac{1}{2n} \leq x \leq \frac{1}{n} \right)_{T=1, t=1} = 2 \cdot c_A \cdot \left(\frac{1}{n} - x \right); \quad (3.8)$$

the index $t = 1$ denotes the period of the mandatory auditor change. As the same holds for the other side on the unit circle, the profit contribution audit firm i earns from auditing all clients in distance $1/2n \leq x \leq 1/n$ in this period is given by

$$PC_{T=1, t=1}^i = 2 \cdot \int_{1/2n}^{1/n} pc^i(x | \dots)_{T=1, t=1} dx = \frac{c_A}{2 \cdot n^2} \quad (3.9)$$

(see Figure 3.2). Analogously, audit firm $i - 1$ gets contracts with all clients in distance $0 \leq x \leq 1/2n$ from i , and audit firm i cannot earn profits from these clients anymore.

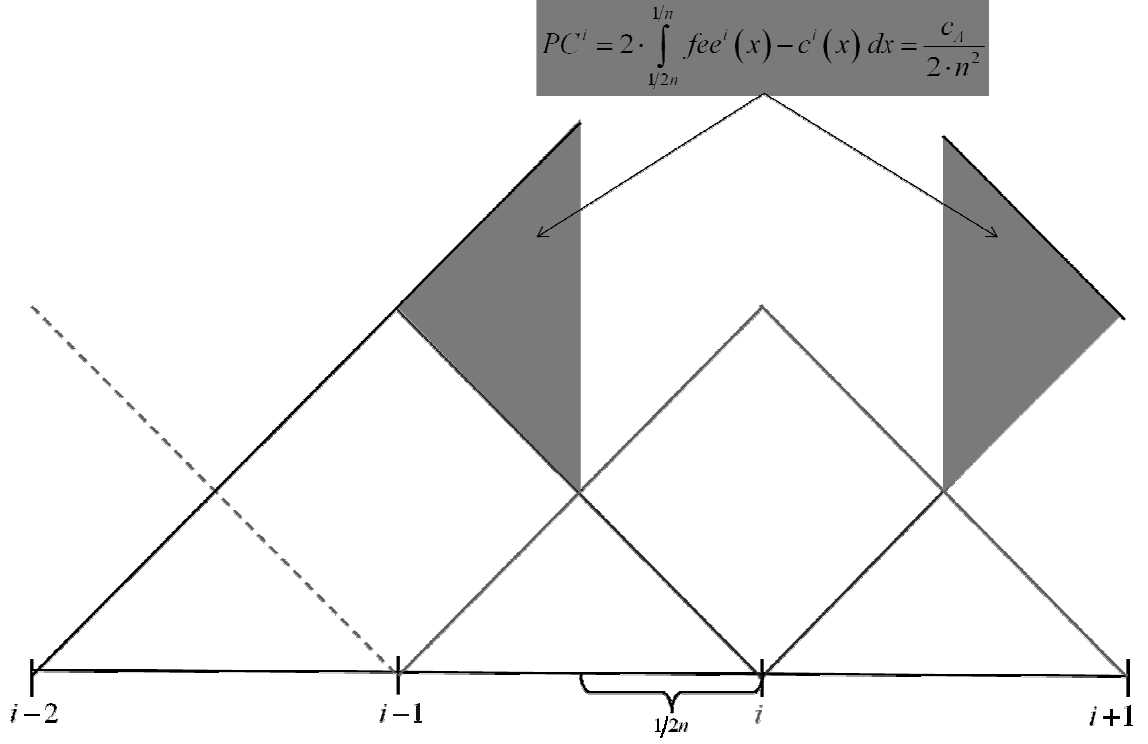


Figure 3.2: Auditor-client matching for the case $T = T^{CO} = 1$ in period $t = 1$ (only mid-tier audit firms are present, no learning costs)

After the cooling-off period has expired in $t = 2$, audit firm i is allowed to audit clients in distance $0 \leq x \leq 1/2n$ again, and thus clients switch back to the audit firm that is most specialized in their business. But since the cooling-off period and the maximum audit firm tenure are identical (i.e., $T = T^{CO} = 1$), audit firm $i - 1$ is not allowed to compete for audit contracts with these clients. Thus, audit firm i can demand a fee that is equal to the costs of the second-nearest competitor, $i + 1$. The respective costs, fees, and profit contributions in $t = 2$ (see Figure 3.3) are given by

$$c^i \left(x \mid 0 \leq x \leq \frac{1}{2n} \right)_{T=1, t=2} = c_A \cdot x \quad (3.10)$$

$$fee^i \left(x \mid 0 \leq x \leq \frac{1}{2n} \right)_{T=1, t=2} = c^{i+1} \left(\frac{1}{n} + x \mid \dots \right) = c_A \cdot \left(\frac{1}{n} + x \right), \text{ and} \quad (3.11)$$

$$pc^i \left(x \mid 0 \leq x \leq \frac{1}{2n} \right)_{T=1, t=2} = \frac{c_A}{n}. \quad (3.12)$$

At the same time, audit firm i loses the clients in distance $1/2n \leq x \leq 1/n$ to audit firm $i-1$.

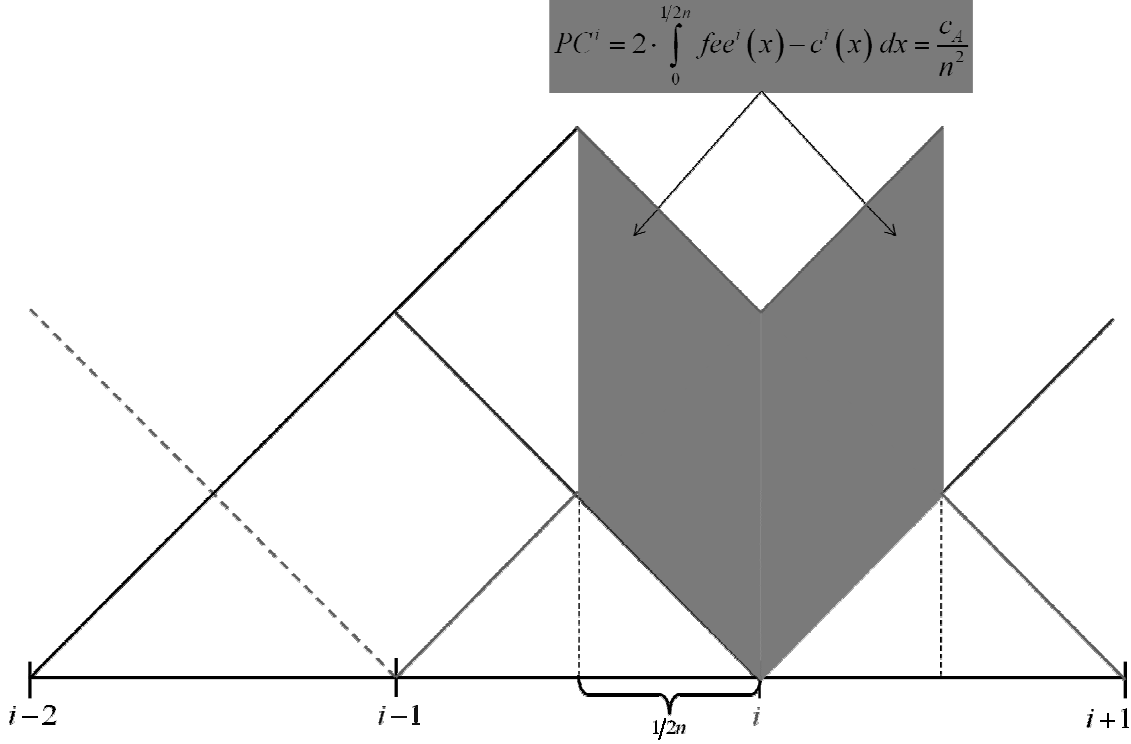


Figure 3.3: Auditor-client matching for the case $T=T^{CO}=1$ in period $t=2$ (only mid-tier audit firms are present, no learning costs)

Thus, the profit contribution for this period is given by

$$PC_{T=1, t=2}^i = 2 \cdot \int_0^{1/2n} pc^i(x|\dots)_{T=1, t=2} dx = \frac{c_A}{n^2}. \quad (3.13)$$

In fact, audit firm i can increase its total profit contribution in the period in which its nearest competitor $i-1$ is not allowed to compete for a certain segment of clients and clients therefore have to pay a comparatively high audit fee that is derived from the last fee offer of audit firm $i+1$ that is not specialized in their business.

In the following odd periods ($t=3, 5, \dots$), mandatory audit firm rotation leads to the same results as in $t=1$, and the outcomes in the even periods ($t=4, 6, \dots$) are identical to those in $t=2$. Thus, audit firm i earns an average overall profit contribution of

$$\overline{PC_{T=1}^i} = \frac{1}{2} \cdot [PC_{T=1, t=1}^i + PC_{T=1, t=2}^i] = \frac{3}{4} \cdot \frac{c_A}{n^2} > PC^i, \quad (3.14)$$

which is higher than in the reference situation without mandatory auditor rotation. The respective equilibrium number of audit firms thus is also higher than in the reference situation:

$$n_{T=1}^* = \sqrt{\frac{3}{4} \cdot \frac{c_A}{c_F}} > n^*. \quad (3.15)$$

This result changes if the more realistic case in which the maximum audit firm tenure is larger than the cooling-off period is considered (i.e., $T > T^{CO} = 1$). For audit firm i , the audit costs, the audit fee, and the profit contribution earned from auditing clients in distance $1/2n \leq x \leq 1/n$ for period $t = 1$ (i.e., the period of the first mandatory auditor change), are again given by equations (3.6), (3.7), and (3.8), and the overall profit contribution for period $t = 1$ is the same as in equation (3.9):

$$PC_{T>1, t=1}^i = \frac{c_A}{2 \cdot n^2}. \quad (3.16)$$

The audit firm's overall profit contribution in period $t = 2$ (and the following $T - 1$ periods up to the next mandatory auditor change in $t = T + 2$), however, changes: In contrast to the previous case $T = T^{CO}$, audit firm $i - 1$ now is allowed to compete for clients in distance $0 \leq x \leq 1/2n$ from audit firm i , because the maximum audit firm tenure has not yet expired for audit firm $i - 1$. Thus, the resulting costs, fees, and profit contributions for $t = 2, \dots, T + 1$ are identical to the situation without mandatory audit firm rotation, and the overall profit contribution of an arbitrary audit firm i for these periods is analogous to (3.4):

$$PC_{T>1, t=2, \dots, T+1}^i = \frac{c_A}{2 \cdot n^2}. \quad (3.17)$$

The profit contribution after the mandatory auditor change in $t = T + 2$ is the same as given in (3.16), and so on. The audit firm i 's average profit contribution thus stays constant over time and is given by

$$\overline{PC_{T>1}^i} = \frac{c_A}{2 \cdot n^2} = PC^i, \quad (3.18)$$

which is identical to the reference situation without mandatory audit firm rotation. The equilibrium number of audit firms thus also remains unchanged, e.g., the introduction of the external rotation rule is predicted not to increase the number of mid-tier audit firms, because the inefficiencies arising from a forced mismatch of audit firms and their clients does *not* increase audit firms' total profit contributions. In the absence of learning curve effects and potential Big X competitors, the introduction of the external rotation with $T > T^{CO}$ *per se* thus does not affect the structure of the audit market. Only a mandatory audit firm rotation with a very short maximum audit firm tenure that is identical to the cooling-off period (i.e., $T = T^{CO} = 1$) leads to an increase in the equilibrium number of audit firms and thus to a decrease in the level of absolute audit market concentration. Thus, in the absence on auditor change costs for clients and learning curve effects for auditors, a *short tenure* is preferable if the only goal is to reduce audit market concentration.

Moreover, the effect of the introduction of an external rotation rule with $T > 1$ on audit quality is non-ambiguous, since the inefficient auditor-client matching deteriorates audit quality (whereas the equilibrium number of audit firms remains constant). For the case $T = T^{CO} = 1$, the prediction is less clear, since two opposing effects become effective: On the one hand, the resulting decrease in audit market concentration increases audit quality, since audit firms are more specialized (the maximum distance x between audit firms and their clients decreases in the number of audit firms). On the other hand, the inefficient auditor-client matching in the periods of the forced auditor change reduces audit quality. With respect to audit quality, a *short tenure* thus at least weakly dominates the case $T > 1$.

3.3.3 Audit Firm Rotation: The Effect of Learning Costs

In the preceding section, the focus was on investigating the effects of the implementation of the external rotation on distorting the efficient auditor-client matching, on the corresponding increase in audit costs and audit fees, and on the resulting number of mid-tier audit firms. Audit costs were assumed to be constant over time and to depend

on the distance between client and audit firm only. One argument frequently raised against the introduction of the external rotation, however, is that auditors incur considerable start-up costs in order to become familiar with the client's business. Thus, there is the concern that first-time audits may be less effective than audits performed by an incumbent that has already gained some years of experience with the client.⁸⁶ But in addition to audit quality, start-up costs can also influence the effects resulting from the introduction of the external rotation on the market structure. In particular, both an incumbent audit firm that is most specialized in a client's business and an incumbent that has been hired just because of the external rotation rule have a cost advantage over possible competitors. Thus, some actually cost-inefficient auditor-client matchings enforced through the audit firm rotation might be stable over a certain time span. This issue is investigated in the following section:

I assume that an audit firm has to incur additional characteristic-dependent start-up costs $c_L \cdot x$ to audit a client in distance x for the first time. These costs are also assumed to occur when a client re-hires the audit firm after the cooling-off period has expired. The start-up costs are relevant only for the first period of an audit engagement, i.e., they are assumed to completely disappear if an audit firm has become acquainted with the client's business.⁸⁷ Thus, the incumbent audit firm always has some cost advantage over its competitors. Given a certain distance x , however, audit quality is assumed to be constant over time, i.e., I do not assume that first-time audits are of a lower quality, *ceteris paribus*.

To derive the effects of the introduction of the external rotation, the reference situation without mandatory audit firm rotation has to be adjusted for these learning costs. If audit firms i is the incumbent of clients in distance $0 \leq x \leq 1/2n$, the respective audit costs, audit fees, and profit contributions of audit firm i are:

⁸⁶ There is empirical evidence supporting the concern that audit quality is lower in the initial years of an auditor-client relationship. Geiger/Raghunandan 2002 show that short tenure is positively associated with audit reporting failures; Carcello/Nagy 2004 find that fraudulent financial reporting is more frequent in the initial years of the engagement, and Johnson et al. 2002 find evidence for reduced earnings quality in the first years.

⁸⁷ The more realistic assumption that learning costs depend on the time span an audit firm has not audited a certain client does not change the results qualitatively, i.e., there would still be an inefficient auditor-client matching, but the profit contribution would be rather comparable to the case described above. If start-up costs decrease during the audit engagement and increase during the cooling-off period, the respective following results are mitigated.

$$c^i(x)_L = c_A \cdot x, \quad (3.19)$$

$$fee^i(x)_L = c^{i-1} \left(\frac{1}{n} - x \right) = (c_A + c_L) \cdot \left(\frac{1}{n} - x \right), \quad (3.20)$$

$$pc^i(x)_L = c_A \cdot \left(\frac{1}{n} - 2x \right) + c_L \cdot \left(\frac{1}{n} - x \right), \text{ and} \quad (3.21)$$

$$PC_L^i = 2 \cdot \int_0^{1/2n} pc^i(x) dx = \frac{c_A}{2 \cdot n^2} + \frac{3 \cdot c_L}{4 \cdot n^2} \quad (3.22)$$

(the index L denotes that learning costs are taken into account). The respective equilibrium number of audit firms follows from the zero-profit condition and is given by

$$n_L^* = \sqrt{\frac{2 \cdot c_A + 3 \cdot c_L}{4 \cdot c_F}}. \quad (3.23)$$

For the case with a maximum audit firm tenure identical to the cooling-off period ($T = T^{CO} = 1$), the situation with start-up costs is comparable to the respective situation without learning costs. The auditor-client matching follows the same pattern; only the profit contributions change, because in $t=1,3,5,\dots$ ($t=2,4,6,\dots$) both audit firms i and $i-2$ ($i+1$) have to incur start-up costs. The overall profit contributions of audit firm i are given by

$$PC_{L, T>1, t=1,3,5,\dots}^i = \frac{c_A + c_L}{2 \cdot n^2} \text{ and} \quad (3.24)$$

$$PC_{L, T>1, t=2,4,6,\dots}^i = \frac{c_A + c_L}{n^2}. \quad (3.25)$$

The average overall profit contribution and the number of audit firms can be calculated to

$$\overline{PC}_{L, T=1}^i = \frac{3}{4} \cdot \frac{c_A + c_L}{n^2} \text{ and} \quad (3.26)$$

$$n_{L, T=1}^* = \sqrt{\frac{3}{4} \cdot \frac{c_A + c_L}{c_F}} > n_L^*. \quad (3.27)$$

Again, the equilibrium number of audit firms is larger in a situation with mandatory audit firm rotation ($n_{L,T=1}^*$) than in a situation in which audit tenure is not restricted (n_L^*). This result, however, only emerges in a situation in which the maximum audit firm tenure is equal to the cooling-off period.

As outlined above, the EU-Commission has proposed a maximum audit firm tenure of 6 years and a cooling off period of 4 years. Cases with a maximum audit firm tenure exceeding the cooling-off period ($T > T^{CO} = 1$), however, differ not only quantitatively from the respective results without learning costs. The main difference is the fact that audit firms can keep clients they are not well specialized for more than only the cooling-off period, because as a result of the enforced auditor change, they gain a cost advantage from becoming the incumbent auditor.

To analyze the effects of learning costs for the situation $T > T^{CO} = 1$, consider the exemplary case of $T = 2$ where the maximum audit firm tenure is twice the cooling-off period.⁸⁸ I start again from period $t = 1$ when the clients in between the audit firms i and $i - 1$ in distance $1/2n \leq x \leq 1/n$ from i are not allowed to re-hire audit firm $i - 1$ again. In the period of the mandatory auditor change, audit firm i gains audit contracts with all clients in distance $1/2n \leq x \leq 1/n$. But contrary to the previous cases, audit firm i will not be re-hired by all clients in distance $0 \leq x \leq 1/2n$ after the cooling-off period has expired, and does not lose all clients in distance $1/2n \leq x \leq 1/n$ to audit firm $i - 1$. In $t = 2$, audit firms i and $i - 1$ have the following costs for auditing the clients in distance $0 \leq x \leq 1/2n$ and $1/2n \leq x \leq 1/n$, respectively:

$$c^i \left(x \middle| 0 \leq x \leq \frac{1}{2n} \right)_{L, T=2, t=2} = (c_A + c_L) \cdot x, \quad (3.28)$$

$$c^{i-1} \left(\frac{1}{n} - x \middle| 0 \leq x \leq \frac{1}{2n} \right)_{L, T=2, t=2} = c_A \cdot \left(\frac{1}{n} - x \right), \quad (3.29)$$

$$c^i \left(x \middle| \frac{1}{2n} \leq x \leq \frac{1}{n} \right)_{L, T=2, t=2} = c_A \cdot x, \text{ and} \quad (3.30)$$

⁸⁸ Larger maximum audit firm tenures follow comparable patterns.

$$c^{i-1} \left(\frac{1}{n} - x \middle| \frac{1}{2n} \leq x \leq \frac{1}{n} \right)_{L, T=2, t=2} = (c_A + c_L) \cdot \left(\frac{1}{n} - x \right). \quad (3.31)$$

Whether audit firm i can keep clients in a distance $1/2n \leq x \leq 1/n$ after the cooling-off period has expired depends on the distance x and the magnitude of the learning costs c_L . Similarly, some of the clients audit firm i is most specialized in, i.e., clients in a distance $0 \leq x \leq 1/2n$, will contract with i , while others will not. The threshold up to that audit firm i can re-acquire the clients it is most specialized in is given by

$$\underline{x} \leq \frac{c_A}{(2c_A + c_L) \cdot n} \text{ with } 0 \leq \underline{x} \leq \frac{1}{2n}, \quad (3.32)$$

whereas the distance up to that i keeps the clients it is not well specialized in is given by

$$\bar{x} \leq \frac{c_A + c_L}{(2c_A + c_L) \cdot n} \text{ with } \frac{1}{2n} \leq \bar{x} \leq \frac{1}{n}. \quad (3.33)$$

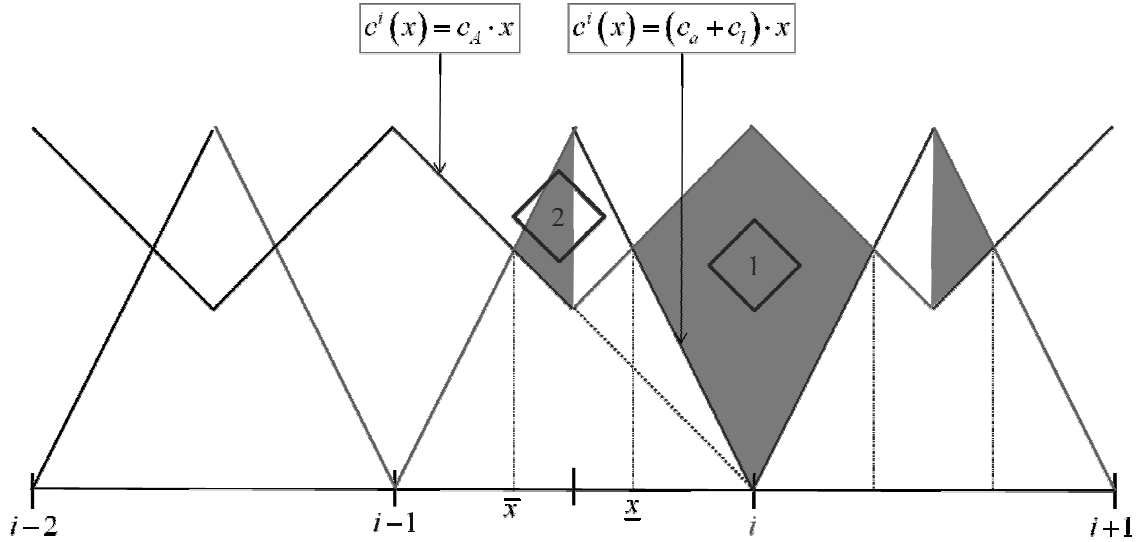


Figure 3.4: Auditor-client matching for the case $T=2 > T^{CO}=1$ in period $t=2$ (only mid-tier audit firms are present; audit firms incur learning costs)

This allocation of clients to audit firms (see Figure 3.4) leads to a sequential auditor change of clients of a certain characteristics combination (i.e., located in a certain area of the unit circle), since clients in distance $1/2n \leq x \leq \bar{x}$ have to change their auditor

mandatorily one period before clients in distance $0 \leq x \leq \underline{x}$. The costs and fees from auditing clients in these different regions over the different periods are given in Table 3.1 in the appendix. Table 3.2 in the appendix summarizes the profit contributions of the different regions in the different periods, and Table 3.3 states the overall profit contributions earned in the periods. The average overall profit contribution sums up to

$$\overline{PC}_{L,T=2}^i = \frac{1}{24} \cdot \frac{48 \cdot c_A^3 + 88 \cdot c_A^2 \cdot c_L + 61 \cdot c_A \cdot c_L^2 + 15 \cdot c_L^3}{(2c_A + c_L)^2 \cdot n^2} < PC_L^i, \quad (3.34)$$

and the equilibrium number of audit firms can be computed to

$$n_{L,T=2}^* = \sqrt{\frac{1}{24} \cdot \frac{48 \cdot c_A^3 + 88 \cdot c_A^2 \cdot c_L + 61 \cdot c_A \cdot c_L^2 + 15 \cdot c_L^3}{(2c_A + c_L)^2 \cdot c_F}} < n_L^*. \quad (3.35)$$

In the practically relevant case in which the maximum audit firm tenure exceeds the cooling-off period, the introduction of mandatory auditor rotation even *decreases* the number of suppliers if audit firms have to incur start-up costs for first-time audits. The reasoning is that an (actually cost-inefficient) audit firm that has become the incumbent due to the forced auditor change has a cost advantage over the audit firm that is more specialized in auditing a certain set of clients, but would have to incur start-up costs to perform the audit after the cooling-off period is over.

The problem of an inefficient auditor-client matching gets even more severe than in the previous case without learning costs. Thus, the implementation of the audit firm rotation in fact has two effects that both *decrease* audit quality: An inefficient auditor-client matching *and* a higher level of audit market concentration. To sum up, the EU-Commission will not reach its goals of an improvement of audit quality and a decrease in audit market concentration if the audit firm rotation is implemented and audit firms have start-up costs.

3.3.4 Audit Firm Rotation: The Effect of Competition between Mid-Tier and Big X Audit Firms

In the preceding sections, I have assumed that there is no competition between mid-tier and Big X audit firms. One argument of the EU-Commission in favor of the introduction of mandatory audit firm rotation, however, is that this rule would increase the

probability that mid-tier audit firms will gain new clients in the segment of statutory audits of listed companies. In this section, I thus analyze the effects of mandatory audit firm rotation if mid-tier audit firms compete against Big X audit firms for audit contracts with mid-sized public-interest entities.

Like mid-tier audit firms, Big X audit firms will not provide audit services to a client if the audit costs exceed the corresponding audit fee. I assume that the audit costs c_A^{Big} a Big X audit firm has to incur do not depend on the client's characteristics, i.e., audit costs are fix.⁸⁹ To isolate the effects of competition between mid-tier audit firms and Big X audit firms, I neglect learning curve effects for the following part of the analysis.

If the Big X audit firms' costs are comparatively high ($c_A^{Big} \geq 3c_A/2n^*$ with n^* as defined as in equation (3.5)), the results regarding the effects of a mandatory audit firm rotation derived in section 3.3.2 would not change: If the Big X audit firms' costs are always higher than the mid-tier audit firms' largest possible fee offer (see equation (3.7)), a Big X audit firm would not get an audit contract with any client even in $t=1$ when an auditor change would be inevitable.

To allow for competition between Big X and mid-tier audit firms, I thus consider the more interesting case of $c_A/n \leq c_A^{Big} < 3c_A/2n$. In the absence of mandatory audit firm rotation, Big X audit firms would not be able to acquire clients that can also choose a mid-tier audit firm. In the period of a forced auditor change, however, the mid-tier audit firms cannot demand the same fees as in section 3.3.2, since a Big X audit firm can become more cost-efficient than a competing mid-tier audit firm that is not specialized in the client's business. Thus, the overall profit contribution of mid-tier audit firms decreases. This, in turn, leads to a decrease in the number of mid-tier audit firms. If the decrease in the number of mid-tier audit firms is severe enough to ensure $c_A^{Big} < c_A/n$, mid-tier audit firms will finally lose market shares in case $T > 1$.⁹⁰

As an example, I consider a case without start-up costs, an audit cost relation of $c_A/n \leq c_A^{Big} < 3c_A/2n$, and an audit firm rotation rule with $T > 1$. The largest possible fee demanded by some arbitrary mid-tier audit firm i in a situation where no Big X

⁸⁹ Introducing characteristic-dependent costs that are smaller than those of the mid-tier audit firm (like in Bleibtreu/Stefani 2011) would not change the results qualitatively.

⁹⁰ For $T = 1$, the positive effect of an increase in the number of mid-tier audit firms resulting from the introduction of a mandatory audit firm rotation is mitigated, since the increase in the number of audit firms is lower than shown in section 3.2.

audit firms are present is given by $fee^i(0) = c_A/n$ (see equation (3.2)). Without mandatory audit firm rotation, the equilibrium number of mid-tier audit firms is thus identical to n^* from equation (3.5), since the Big X audit firms' last fee offers are always higher than the costs of the nearest mid-tier competitor $i-1$ of audit firm i . Nevertheless, the presence of Big X audit firms affects the results derived in section 3.3.2 for a situation in which the external audit firm rotation is effective:

In the period of the first mandatory auditor change ($t=1$), mid-tier audit firm i does not only compete with the mid-tier audit firm $i-2$ (into one direction of the unit circle) for clients in distance $1/2n \leq x \leq 1/n$, but also with the Big X audit firms. Consequently, mid-tier audit firm i can at most demand a fee that is equal to the costs of its more cost-efficient competitor, i.e., $fee^i(x|1/2n \leq x \leq 1/n)_{B,T>1, t=1} = \min\{c_A \cdot (2/n - x); c_A^{Big}\}$. Thus, from clients in distance $1/2n \leq x \leq 2/n - c_A^{Big}/c_A$, audit firm i can demand a fee equal to the Big X audit firms' costs c_A^{Big} , whereas from clients in distance $2/n - c_A^{Big}/c_A \leq x \leq 1/n$, it can demand a fee equal to the costs $c_A \cdot (2/n - x)$ of the nearest mid-tier competitor $i-2$. The costs, fees, and resulting profit contributions of mid-tier audit firm i are summarized in the following equations:

$$c^i\left(x\left|\frac{1}{2n} \leq x \leq \frac{1}{n}\right.\right)_{B,T>1, t=1} = c_A \cdot x, \quad (3.36)$$

$$fee^i\left(x\left|\frac{1}{2n} \leq x \leq \frac{2}{n} - \frac{c_A^{Big}}{c_A}\right.\right)_{B,T>1, t=1} = c_A^{Big}, \quad (3.37)$$

$$fee^i\left(x\left|\frac{2}{n} - \frac{c_A^{Big}}{c_A} \leq x \leq \frac{1}{n}\right.\right)_{B,T>1, t=1} = c^{i-2}\left(\frac{2}{n} - x\right) = c_A \cdot \left(\frac{2}{n} - x\right), \quad (3.38)$$

$$pc^i\left(x\left|\frac{1}{2n} \leq x \leq \frac{2}{n} - \frac{c_A^{Big}}{c_A}\right.\right)_{B,T>1, t=1} = c_A^{Big} - c_A \cdot x, \text{ and} \quad (3.39)$$

$$pc^i\left(x\left|\frac{2}{n} - \frac{c_A^{Big}}{c_A} \leq x \leq \frac{1}{n}\right.\right)_{B,T>1, t=1} = 2 \cdot c_A \cdot \left(\frac{1}{n} - x\right) \quad (3.40)$$

(the index B denotes that competitive Big X audit firms are taken into account).

Compared to the results of section 3.2, the overall profit contribution of mid-tier audit firm i is lower by the amount of

$$\Delta^i = \left(\frac{3}{2n} - \frac{c_A^{Big}}{c_A} \right) \cdot \left(\frac{3}{2n} \cdot c_A - c_A^{Big} \right) = \frac{(3 \cdot c_A - 2 \cdot n \cdot c_A^{Big})^2}{4 \cdot c_A \cdot n^2} > 0 \quad (3.41)$$

in every period of a mandatory auditor change (see Figure 3.5).

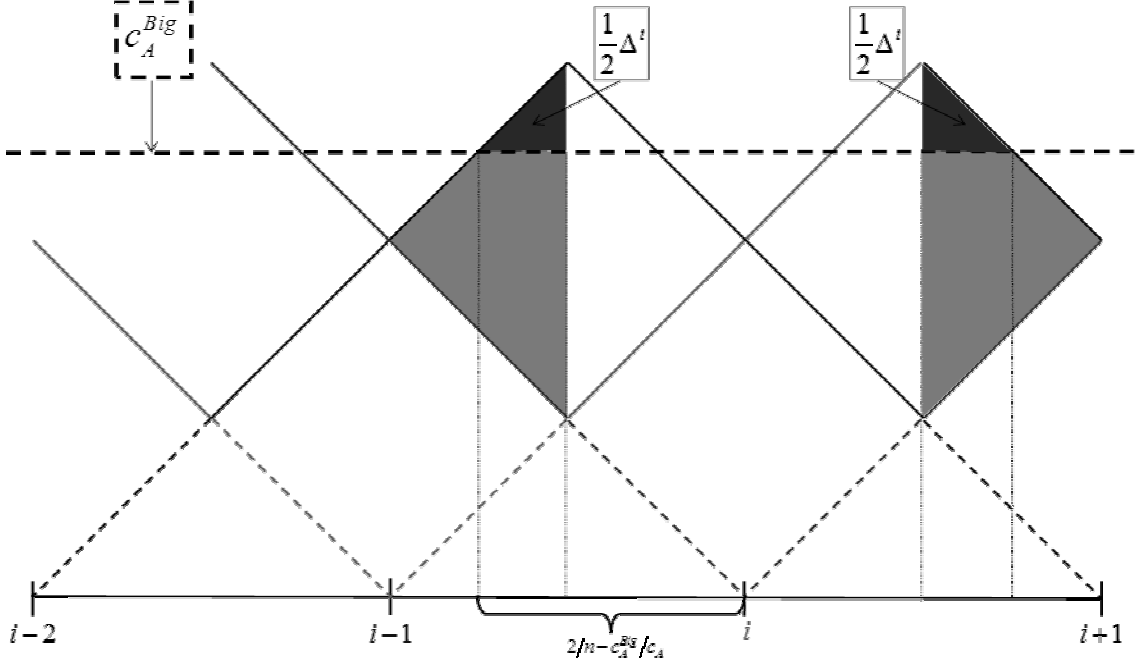


Figure 3.5: Profit contribution of mid-tier audit firm i for the case $T > T^{CO} = 1$ in period $t = 1$ (mid-tier and Big X audit firms are present; no learning costs)

In the long run, this reduction decreases the equilibrium number of mid-tier audit firms. As the average overall profit contribution for some maximum audit firm tenure of $T > 1$ is given by

$$\begin{aligned} \overline{PC}_{B,T>1}^i &= \frac{1}{T+1} \left[(T+1) \cdot PC^i - \Delta^i \right] \\ &= \frac{1}{24} \cdot \frac{2 \cdot c_A^2 \cdot T - 7 \cdot c_A^2 + 12 \cdot c_A \cdot c_A^{Big} \cdot n - 4 \cdot (c_A^{Big})^2 \cdot n^2}{c_A \cdot (T+1) \cdot n^2} < PC^i, \end{aligned} \quad (3.42)$$

the equilibrium number of mid-tier audit firms in this scenario is given by $n_{B,T>2}^* < n^*$.

The reduction in the number of audit firms, in turn, further increases the reduction Δ^i in the profit contribution of the mid-tier audit firms in a period after a mandatory auditor change ($\partial \Delta^i / \partial n < 0$). Thus, the equilibrium number of audit firms decreases even more.

If the equilibrium number of mid-tier audit firms, $n_{B,T>2}^*$, fulfills $c_A^{Big} < c_A / n_{B,T>2}^*$, mid-tier audit firms will also lose some clients to the Big X audit firms even if there is no institutional need to change the auditor. To sum up, the introduction of a mandatory audit firm rotation rule would lead to a reduction of mid-tier audit firms. If this reduction is sufficiently high, actually a complete crowding-out of mid-tier audit firms by Big X audit firms is possible, even though in the absence of such a rule, the Big X would not be cost-efficient in auditing clients that can also choose a mid-tier audit firm. This is shown in the following.

To further analyze the crowding-out scenario, I consider a case without mandatory audit firm rotation, but with competing Big X audit firms that have audit costs of $c_A^{Big} < c_A / n$. An arbitrary mid-tier audit firm i can demand fees that are equal to the minimum of the costs of the nearest mid-tier competitor $i-1$ and the costs of the Big X audit firms ($fee^i(x) | 0 \leq x \leq 1/2n = \min\{c_A \cdot (1/n - x); c_A^{Big}\}$). Thus, for clients in a distance $0 \leq x \leq 1/n - c_A^{Big} / c_A$, audit firm i can demand fees equal to the Big X audit firm's costs, whereas clients in distance $1/n - c_A^{Big} / c_A \leq x \leq 1/2n$ have to pay fees equal to the costs of the mid-tier audit firm $i-1$. This leads to the following overall profit contribution of mid-tier audit firm i (see Figure 3.6):

$$PC_{B,T>1,t=0}^i = \frac{c_A}{2n^2} - \frac{(c_A - n \cdot c_A^{Big})^2}{c_A \cdot n^2}. \quad (3.43)$$

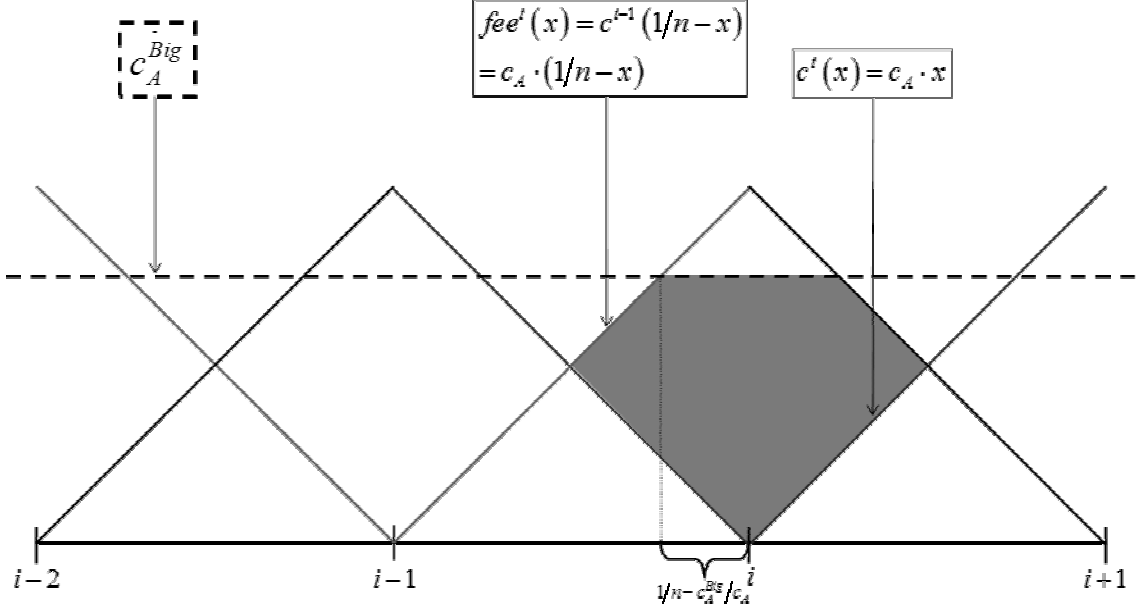


Figure 3.6: Profit contribution of mid-tier audit firm i for the case without mandatory audit firm rotation in period $t = 0$ (mid-tier and Big X audit firms are present; no learning costs)

If an audit firm rotation is required, the presence of Big X audit firms does not only affect the fees the mid-tier audit firm can demand; in addition, mid-tier audit firm lose considerable market shares to the Big X. In contrast to the previous case ($c_A/n \leq c_A^{Big} < 3c_A/2n$) where audit firm i got audit contracts with all clients in distance $1/2n \leq x \leq 1/n$ in the period of the mandatory auditor change, it now can only contract with clients in distance $1/2n \leq x \leq c_A^{Big}/c_A$. Only for these clients, the costs of the mid-tier audit firm i are lower than those of the Big X audit firms. Clients in distance $c_A^{Big}/c_A \leq x \leq 1/n$, in contrast, are now audited by Big X audit firms. Thus, the costs, fees, and profit contributions of audit firm i in the period of a mandatory auditor change are given by

$$c^i \left(x \mid \frac{1}{2n} \leq x \leq \frac{1}{n} \right)_{B, T>1, t=1} = c_A \cdot x, \quad (3.44)$$

$$fee^i \left(x \mid \frac{1}{2n} \leq x \leq \frac{c_A^{Big}}{c_A} \right)_{B, T>1, t=1} = c_A^{Big}, \text{ and} \quad (3.45)$$

$$pc^i \left(x \mid \frac{1}{2n} \leq x \leq \frac{c_A^{Big}}{c_A} \right)_{B,T>1,t=1} = c_A^{Big} - c_A \cdot x. \quad (3.46)$$

The overall profit contribution of audit firm i for the period of a mandatory auditor rotation (see Figure 3.7) is

$$PC_{B,T>1,t=1}^i = \frac{(c_A - 2 \cdot n \cdot c_A^{Big})^2}{4 \cdot c_A \cdot n^2}. \quad (3.47)$$

$PC_{B,T>1,t=1}^i$ is smaller than the overall profit contribution $PC_{B,T>1,t=0}^i$ (see equation (3.43)).

Thus, the equilibrium number of mid-tier audit firms decreases in the long run. But as in the previous case, the decrease in the number of mid-tier audit firms amplifies the negative effect of the rotation on the mid-tier audit firms' profit contributions, and, over time, more and more of them are crowded out.

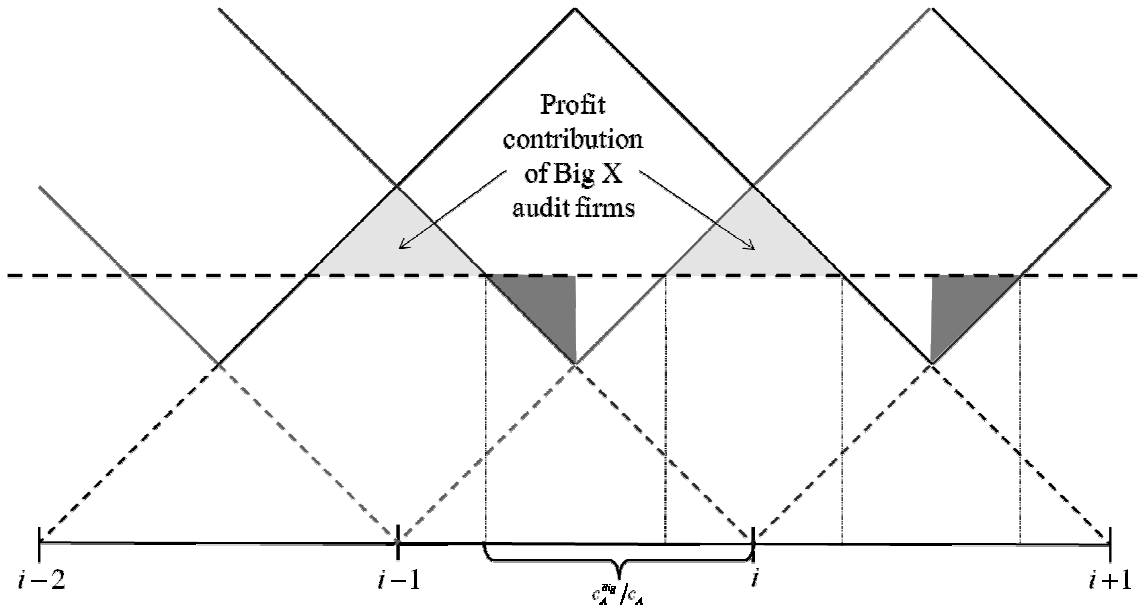


Figure 3.7: Profit contribution of mid-tier audit firm i and Big X audit firms for the case with mandatory audit firm rotation in period $t = 1$ (no learning costs)

If the number of mid-tier audit firms decreases so that $c_A^{Big} < c_A/2n$ is reached, a drop out of an additional mid-tier audit firm would not even lead to a higher market share for the remaining mid-tier audit firms. To sum up, the implementation of the mandatory audit firm rotation – in the long run – can lead to a complete crowding-out of

mid-tier audit firms. For Big X audit firms, in contrast, the implementation of mandatory auditor changes would alleviate the acquisition of clients from the segment of smaller public-interest entities, thereby increasing profits and market shares. These additional profits, however, may lead to an increase in the number of Big X audit firms. The outcome of the proposed regulation thus will strengthen Big X audit firms, but at the same time create an existential threat to mid-tier audit firms serving small and mid-sized public-interest entities, which is exactly the opposite of the aims the EU-Commission had envisaged.

3.3.5 *Audit Firm Rotation and Joint Audits*

Joint audits (i.e., audits in which two or more auditors share the audit work, issue a single audit report, and thus share responsibility for the audit) are currently not mandatory in the EU or in the USA. Today, France is the only EU Member State that requires by law joint audits for statutory audits of listed companies that publish consolidated accounts.⁹¹ Since in France there are no regulations regarding the size of the audit firms taking part in the audit consortium, the most frequent case is that two large audit firms conjointly perform the audit.

There are several reasons for the observation that – if joint audits are performed – rather large audit firms take part in the audit consortium. First, within an audit consortium, each auditor has to accept the overall responsibility for the entire audit and both auditors are jointly liable. Thus, each auditor has to have enough capacities to plan and conduct the audit in a way that they can gain reasonable assurance regarding the appropriateness of an adequate part of the total audit in order to be able to come to an informed overall assessment. Second, the presence of two auditors increases coordination costs (e.g., for defining the terms of engagement, for discussing professional issues, and for summarizing the results of audit procedures). Thus, audit fees are expected to increase.⁹² Clients, however, will expect additional value from the extra fees paid, and

⁹¹ In Denmark, joint audits have been disestablished in 2005.

⁹² See André et al. 2011, who report that audit fees of major French companies audited by two Big 4 auditors are significantly higher than Big 4 fees in the UK. For Denmark, Holm/Thinggaard 2010 observed discounts in audit fees in companies changing from joint audits to single audits. For Sweden, Haapamäki et al. 2011 found that firms opting to engage joint auditors pay significantly higher audit fees than other firms. Francis et al. 2009, in contrast, did not find evidence that French audit fees are higher under a joint audit approach than audit fees observed in other European countries. Gonthier-Besacier/Schatt 2007 observed significantly lower fees paid for a joint audit performed by two Big 4

therefore will tend to hire two large audit firms. Moreover, it could be argued that audit quality should be larger if two international audit firms are hired.⁹³ In addition, the supposition that a joint audit performed by two Big 4 auditors increases audit quality as perceived by external addressees might stand to reason.⁹⁴

In its Green Paper, the Commission, in contrast, proposed joint audits with a non-systemic firm hired as the second auditor. The idea behind this requirement was to enhance market entry of small and mid-tier audit firms, i.e., to decrease audit market concentration and to foster the growth of non-Big 4 audit firms.⁹⁵ In the currently discussed proposal, however, the Commission of the European Communities 2011b does not require joint audits, but proposes to extend the maximum duration of the audit engagement to nine years in the case of a joint audit. Thus, it seems reasonable to consider the effects of a combination of the external audit firm rotation and joint audits between a mid-tier and a Big X audit firm:

In the present model, the implementation of joint audits can indeed prevent the disadvantageous effects of a mandatory audit firm rotation in a situation where mid-tier audit firms compete against Big X audit firms with sufficiently low audit costs. If Big X and mid-tier audit firms are forced to conduct the audit together, mid-tier audit firms are prevented from being crowded out.

Nevertheless, joint audits might also have negative effects compared to the cases above (sections 3.2 and 3.3). If mid-tier audit firms' audit costs in case of a joint audit are only some constant fraction $\alpha < 1$ of the costs for audits performed by a single audit firm, the fees the audit firms can demand decrease also to this fraction of the previous fees. Thus, the overall profit contributions also decrease. Provided this decrease in the

auditors than for joint audits by a combination of a Big 4 and non-Big 4 or two non-Big 4 auditors, and Thinggaard/Kiertzner 2008 found that joint audits performed by two large audit firms reduce audit fees for larger companies, compared to audits where one auditor is dominant. Lesage et al. 2011, who investigated data from Finland, France, and Germany, did not find evidence that joint audits increase audit fees.

⁹³ Empirical evidence regarding earnings quality is mixed: For a sample of listed companies in France, Francis et al. 2009 found that the amount of income-increasing discretionary accruals decreases in the number of Big 4 auditors taking part in the joint audit. For Sweden, Haapamäki et al. 2011 report that companies voluntarily hiring joint auditors have a higher degree of earnings conservatism and a lower level of income-increasing discretionary accruals than other firms. Marmousez 2006, in contrast, found that reporting quality is lower for a combination of two Big 4 audit firms than for a joint audit by one Big 4 and one non-Big 4 audit firm. The study of Lesage et al. 2011, who analyzed data from Finland, France and Germany, does not support the notion that joint audits increase audit quality.

⁹⁴ For Finland, Karjalainen 2010 finds supporting evidence that perceived audit quality is higher for companies hiring more than one responsible auditor.

⁹⁵ The results of Piot 2007 indicate that joint audits indeed can preserve market competition.

overall profit contribution cannot be compensated by additional joint audit contracts with clients the mid-tier audit firms would not audit without the joint audit rule, the number of mid-tier suppliers would decrease. If, in contrast, the introduction of joint audits leads to relatively high profits earned from additional audit contracts in the market segment initially served exclusively by Big X audit firms, the number of mid-tier audit firms might increase. If a first-time joint audit of a Big X and a mid-tier audit firm would induce some costs for the audit firms to get familiar with each other (comparable to the learning costs in section 3.3), the problem of inefficient auditor-client matching gets even more severe than in the previous cases.

3.4 Conclusion

In its recently released proposal for a regulation regarding statutory audits of public-interest entities, the Commission of the European Communities 2011b suggests to implement the external audit firm rotation in addition to the already existent internal rotation of the key audit partners. The goals of this reform are twofold: On the one hand, the EU-Commission aims at increasing auditor independence by attenuating the economic bonding between the auditor and the client, and at giving a new auditor the chance “to take a fresh look” at the client’s financial statements. On the other hand, the EU-Commission pursues a decrease in the actually high level of audit market concentration, since the external rotation is predicted to increase the dynamism of the audit market and to alleviate the acquisition of new mandates in the segment of listed companies by mid-tier audit firms. The implementation of a mandatory audit firm rotation, however, is likely to affect the matching of auditors and clients, audit fees, audit firms’ profits, and, in the long run, the supplier concentration observed in the audit market. If these effects are neglected, the EU-Commission runs the risk of causing unintended consequences on the structure of the audit market.

Based on an analytical market matching model, this paper analyses the effects of the external audit firm rotation on the market shares of mid-tier audit firms. If the situation of an unrestricted relationship between mid-tier audit firms and their clients is regarded as the benchmark, the introduction of the mandatory audit firm rotation is predicted to increase the number of mid-tier audit firms (i.e., to decrease supplier concentration)

only if the maximum possible audit firm tenure is identical to the length of the cooling-off period. The reason is that audit fees increase because the cooling-off period inhibits offers of more cost-efficient audit firms, and thus a less specialized audit firm becomes the relevant competitor. If the more realistic case of the maximum audit firm tenure exceeding the cooling-off period is considered, the number of mid-tier audit firms active on the market is identical to the reference situation.

One argument frequently raised against the introduction of the external rotation, however, is that auditors incur start-up costs for first-time audit engagements. If the maximum audit firm tenure exceeds the cooling-off period and learning curve effects are taken into account, the model predicts that some of the actually cost-inefficient auditor-client matchings that are the result of a forced auditor change are stable for more than only the cooling-off period. As a consequence, the number of audit firms decreases, and the quality of audited financial statement worsens.

The effects of the implementation of the external rotation are even more detrimental if mid-tier audit firms compete against Big X audit firms for audit contracts with mid-sized public-interest entities. Given reasonable assumptions regarding the audit costs of Big X and mid-tier audit firms, the model shows that a complete crowding-out of mid-tier audit firms by Big X audit firms is possible.

Thus, the present paper shows that the implementation of the external rotation can have adverse effects on the market shares of mid-tier audit firms. Moreover, the effects on audit quality are unfavorable. This result is the opposite of what the EU-Commission had envisaged with its proposal.

3.A Appendix

Period	$c^i(x)$ $0 \leq x \leq \underline{x}$	$fee^i(x)$ $0 \leq x \leq \underline{x}$	$c^i(x)$ $\underline{x} \leq x \leq 1/2n$	$fee^i(x)$ $\underline{x} \leq x \leq 1/2n$	$c^i(x)$ $1/2n \leq x \leq \bar{x}$	$fee^i(x)$ $1/2n \leq x \leq \bar{x}$	$c^i(x)$ $\bar{x} \leq x \leq 1/n$	$fee^i(x)$ $\bar{x} \leq x \leq 1/n$
$t=0$	$c_A \cdot x$	$(c_A + c_L) \cdot (1/n - x)$	$c_A \cdot x$	$(c_A + c_L) \cdot (1/n - x)$	$(c_A + c_L) \cdot x$		$(c_A + c_L) \cdot x$	
$t=1$					$(c_A + c_L) \cdot x$	$(c_A + c_L) \cdot (2/n - x)$	$(c_A + c_L) \cdot x$	$(c_A + c_L) \cdot (2/n - x)$
$t=2$	$(c_A + c_L) \cdot x$	$c_A \cdot (1/n - x)$	$(c_A + c_L) \cdot x$		$c_A \cdot x$	$(c_A + c_L) \cdot (1/n - x)$	$c_A \cdot x$	
$t=3$	$c_A \cdot x$	$(c_A + c_L) \cdot (1/n - x)$	$(c_A + c_L) \cdot x$	$(c_A + c_L) \cdot (1/n + x)$			$(c_A + c_L) \cdot x$	
$t=4$			$c_A \cdot x$	$(c_A + c_L) \cdot (1/n - x)$	$(c_A + c_L) \cdot x$		$(c_A + c_L) \cdot x$	$(c_A + c_L) \cdot (2/n - x)$
$t=5$	$(c_A + c_L) \cdot x$	$c_A \cdot (1/n - x)$			$(c_A + c_L) \cdot x$	$(c_A + c_L) \cdot (2/n - x)$	$c_A \cdot x$	
$t=6$	$c_A \cdot x$	$(c_A + c_L) \cdot (1/n - x)$	$(c_A + c_L) \cdot x$		$c_A \cdot x$	$(c_A + c_L) \cdot (1/n - x)$	$(c_A + c_L) \cdot x$	
$t=7$			$(c_A + c_L) \cdot x$	$(c_A + c_L) \cdot (1/n + x)$			$(c_A + c_L) \cdot x$	$(c_A + c_L) \cdot (2/n - x)$

$t=8$	$(c_A + c_L) \cdot x$	$c_A \cdot (1/n - x)$	$c_A \cdot x$	$(c_A + c_L) \cdot (1/n - x)$	$(c_A + c_L) \cdot x$		$c_A \cdot x$	
$t=9$	$c_A \cdot x$	$(c_A + c_L) \cdot (1/n - x)$			$(c_A + c_L) \cdot x$	$(c_A + c_L) \cdot (2/n - x)$	$(c_A + c_L) \cdot x$	
$t=10$			$(c_A + c_L) \cdot x$		$c_A \cdot x$	$(c_A + c_L) \cdot (1/n - x)$	$(c_A + c_L) \cdot x$	$(c_A + c_L) \cdot (2/n - x)$
$t=11$	$(c_A + c_L) \cdot x$	$c_A \cdot (1/n - x)$	$(c_A + c_L) \cdot x$	$(c_A + c_L) \cdot (1/n + x)$			$c_A^s \cdot x$	
$t=12$ equiv. $t=0$	$c_A \cdot x$	$(c_A + c_L) \cdot (1/n - x)$	$c_A \cdot x$	$(c_A + c_L) \cdot (1/n - x)$	$(c_A + c_L) \cdot x$		$(c_A + c_L) \cdot x$	
$t=13$ equiv. $t=1$	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...

Table 3.1: Mandatory audit firm rotation ($T > 1$): Audit fees and audit costs for clients located in different regions (only mid-tier audit firms are present, audit firms incur start-up costs)

Legend:

Clients are audited	Audit firm is not allowed to audit clients	Audit firm is allowed to audit clients, but competitor is hired
---------------------	--	---

Period	$pc^i(x)$ $0 \leq x \leq \underline{x}$	$pc^i(x)$ $\underline{x} \leq x \leq 1/2n$	$pc^i(x)$ $1/2n \leq x \leq \bar{x}$	$pc^i(x)$ $\bar{x} \leq x \leq 1/n$
$t=0$	$c_A \cdot (1/n - 2x) + c_L \cdot (1/n - x)$	$c_A \cdot (1/n - 2x) + c_L \cdot (1/n - x)$		
$t=1$			$2 \cdot (c_A + c_L) \cdot (1/n - x)$	$2 \cdot (c_A + c_L) \cdot (1/n - x)$
$t=2$	$c_A \cdot (1/n - 2x) - c_L \cdot x$		$c_A \cdot (1/n - 2x) + c_L \cdot (1/n - x)$	
$t=3$	$c_A \cdot (1/n - 2x) + c_L \cdot (1/n - x)$	$(c_A + c_L) \cdot 1/n$		
$t=4$		$c_A \cdot (1/n - 2x) + c_L \cdot (1/n - x)$		$2 \cdot (c_A + c_L) \cdot (1/n - x)$
$t=5$	$c_A \cdot (1/n - 2x) - c_L \cdot x$		$2 \cdot (c_A + c_L) \cdot (1/n - x)$	
$t=6$	$c_A \cdot (1/n - 2x) + c_L \cdot (1/n - x)$		$c_A \cdot (1/n - 2x) + c_L \cdot (1/n - x)$	
$t=7$		$(c_A + c_L) \cdot 1/n$		$2 \cdot (c_A + c_L) \cdot (1/n - x)$
$t=8$	$c_A \cdot (1/n - 2x) - c_L \cdot x$	$c_A \cdot (1/n - 2x) + c_L \cdot (1/n - x)$		
$t=9$	$c_A \cdot (1/n - 2x) + c_L \cdot (1/n - x)$		$2 \cdot (c_A + c_L) \cdot (1/n - x)$	
$t=10$			$c_A \cdot (1/n - 2x) + c_L \cdot (1/n - x)$	$2 \cdot (c_A + c_L) \cdot (1/n - x)$
$t=11$	$c_A \cdot (1/n - 2x) - c_L \cdot x$	$(c_A + c_L) \cdot 1/n$		
$t=12$	$c_A \cdot (1/n - 2x) + c_L \cdot (1/n - x)$	$c_A \cdot (1/n - 2x) + c_L \cdot (1/n - x)$		
$t=13$	...	...	...	...
...	...	...	...	...

Table 3.2: Mandatory audit firm rotation ($T > 1$): Profit contributions earned from clients located in different regions (only mid-tier audit firms are present, audit firms incur start-up costs)

Legend:

Clients are audited	Audit firm is ~~not allowed~~ to audit clients	Audit firm is allowed to audit clients,
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					but competitor is hired
Period	PC^i $0 \leq x \leq \underline{x}$	PC^i $\underline{x} \leq x \leq 1/2n$	PC^i $1/2n \leq x \leq \bar{x}$	PC^i $\bar{x} \leq x \leq 1/n$	$PC^i_{L,T=2}$
$t=0$	$\frac{1}{2} \cdot \frac{(c_A + 2c_L) \cdot c_A}{(2c_A + c_L) \cdot n^2}$	$\frac{3}{8} \cdot \frac{c_L^2}{(2c_A + c_L) \cdot n^2}$			$\frac{1}{4} \cdot \frac{2c_A + 3c_L}{n^2}$
$t=1$			$\frac{1}{4} \cdot \frac{(c_A + c_L) \cdot c_L \cdot (4c_A + c_L)}{(2c_A + c_L)^2 \cdot n^2}$	$\frac{(c_A + c_L) \cdot c_A^2}{(2c_A + c_L)^2 \cdot n^2}$	$\frac{1}{2} \cdot \frac{c_A + c_L}{n^2}$
$t=2$	$\frac{1}{2} \cdot \frac{c_A^2}{(2c_A + c_L) \cdot n^2}$		$\frac{1}{8} \cdot \frac{c_L^2}{(2c_A + c_L) \cdot n^2}$		$\frac{1}{4} \cdot \frac{4c_A^2 + c_L^2}{(2c_A + c_L) \cdot n^2}$
$t=3$	$\frac{1}{2} \cdot \frac{(c_A + 2c_L) \cdot c_A}{(2c_A + c_L) \cdot n^2}$	$\frac{1}{2} \cdot \frac{(c_A + c_L) \cdot c_L}{(2c_A + c_L) \cdot n^2}$			$\frac{c_A^2 + 3c_A c_L + c_L^2}{(2c_A + c_L) \cdot n^2}$
$t=4$		$\frac{3}{8} \cdot \frac{c_L^2}{(2c_A + c_L) \cdot n^2}$		$\frac{(c_A + c_L) \cdot c_A^2}{(2c_A + c_L)^2 \cdot n^2}$	$\frac{1}{4} \cdot \frac{8c_A^3 + 8c_A^2 c_L + 6c_A c_L^2 + 3c_L^3}{(2c_A + c_L)^2 \cdot n^2}$
$t=5$	$\frac{1}{2} \cdot \frac{c_A^2}{(2c_A + c_L) \cdot n^2}$		$\frac{1}{4} \cdot \frac{(c_A + c_L) \cdot c_L \cdot (4c_A + c_L)}{(2c_A + c_L)^2 \cdot n^2}$		$\frac{1}{2} \cdot \frac{4c_A^3 + 6c_A^2 c_L + 5c_A c_L^2 + c_L^3}{(2c_A + c_L)^2 \cdot n^2}$
$t=6$	$\frac{1}{2} \cdot \frac{(c_A + 2c_L) \cdot c_A}{(2c_A + c_L) \cdot n^2}$		$\frac{1}{8} \cdot \frac{c_L^2}{(2c_A + c_L) \cdot n^2}$		$\frac{1}{4} \cdot \frac{4c_A^2 + 8c_A c_L + c_L^2}{(2c_A + c_L) \cdot n^2}$
$t=7$		$\frac{1}{2} \cdot \frac{(c_A + c_L) \cdot c_L}{(2c_A + c_L) \cdot n^2}$		$\frac{(c_A + c_L) \cdot c_A^2}{(2c_A + c_L)^2 \cdot n^2}$	$\frac{2c_A^3 + 4c_A^2 c_L + 3c_A c_L^2 + c_L^3}{(2c_A + c_L)^2 \cdot n^2}$
$t=8$	$\frac{1}{2} \cdot \frac{c_A^2}{(2c_A + c_L) \cdot n^2}$	$\frac{3}{8} \cdot \frac{c_L^2}{(2c_A + c_L) \cdot n^2}$			$\frac{1}{4} \cdot \frac{4c_A^2 + 3c_L^2}{(2c_A + c_L) \cdot n^2}$

$t=9$	$\frac{1}{2} \cdot \frac{(c_A + 2c_L) \cdot c_A}{(2c_A + c_L) \cdot n^2}$		$\frac{1}{4} \cdot \frac{(c_A + c_L) \cdot c_L \cdot (4c_A + c_L)}{(2c_A + c_L)^2 \cdot n^2}$		$\frac{1}{2} \cdot \frac{4c_A^3 + 14c_A^2c_L + 9c_Ac_L^2 + c_L^3}{(2c_A + c_L)^2 \cdot n^2}$
$t=10$			$\frac{1}{8} \cdot \frac{c_L^2}{(2c_A + c_L) \cdot n^2}$	$\frac{(c_A + c_L) \cdot c_A^2}{(2c_A + c_L)^2 \cdot n^2}$	$\frac{1}{4} \cdot \frac{8c_A^3 + 8c_A^2c_L + 2c_Ac_L^2 + c_L^3}{(2c_A + c_L)^2 \cdot n^2}$
$t=11$	$\frac{1}{2} \cdot \frac{c_A^2}{(2c_A + c_L) \cdot n^2}$	$\frac{1}{2} \cdot \frac{(c_A + c_L) \cdot c_L}{(2c_A + c_L) \cdot n^2}$			$\frac{c_A^2 + c_Ac_L + c_L^2}{(2c_A + c_L) \cdot n^2}$
$t=12$	$\frac{1}{2} \cdot \frac{(c_A + 2c_L) \cdot c_A}{(2c_A + c_L) \cdot n^2}$	$\frac{3}{8} \cdot \frac{c_L^2}{(2c_A + c_L) \cdot n^2}$			$\frac{1}{4} \cdot \frac{2c_A + 3c_L}{n^2}$
$t=13$	...	...	...	...	
...	...	...	...	...	

Table 3.3: Mandatory audit firm rotation ($T > 1$): Overall profit contributions (only mid-tier audit firms are present, audit firms incur start-up costs)

Legend:

Clients are audited	Audit firm is ~~not~~ allowed to audit clients	Audit firm is allowed to audit clients, but competitor is hired
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Erklärung

Ich versichere hiermit, dass ich die vorliegende Arbeit mit dem Titel

**Audit Market Regulation, Supplier Concentration, and the
Quality of Audited Financial Statements**

ohne unzulässige Hilfe Dritter und ohne Benutzung anderer als der angegebenen Hilfsmittel angefertigt habe. Die aus anderen Quellen direkt oder indirekt übernommenen Daten und Konzepte sind unter Angabe der Quelle gekennzeichnet. Weitere Personen, insbesondere Promotionsberater, waren an der inhaltlich materiellen Erstellung dieser Arbeit nicht beteiligt.⁹⁶ Die Arbeit wurde bisher weder im In- noch im Ausland in gleicher oder ähnlicher Form einer anderen Prüfungsbehörde vorgelegt.

Konstanz, 23. Juli 2012

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⁹⁶ Siehe hierzu die Abgrenzung auf der folgenden Seite.

Abgrenzung

Kapitel 1, *Auditing, Consulting, and Audit Market Concentration*, entstammt einer gemeinsamen Arbeit mit Frau Prof. Dr. Ulrike Stefani (Universität Konstanz) und basiert auf meiner Idee. Das Modell wurde von mir erarbeitet. Eine erste Version des Artikels entstammt meiner Hand und wurde gemeinsam überarbeitet.

Kapitel 2, *The Interdependence between Audit Market Structure and the Quality of Financial Reporting: The Case of Non-Audit Services*, entstammt ebenfalls einer gemeinsamen Arbeit mit Frau Prof. Dr. Ulrike Stefani. Die Idee zur Modellerweiterung durch ein strategisches Spiel kam von Frau Prof. Dr. Ulrike Stefani, die Modellierung habe ich geleistet. Eine erste Version des Artikels entstammt meiner Hand und wurde gemeinsam überarbeitet.

Ich versichere hiermit, dass ich Kapitel 3, *The Effects of Audit Firm Rotation on the Structure of the Audit Market*, ohne unzulässige Hilfe Dritter und ohne Benutzung anderer als der angegebenen Hilfsmittel angefertigt habe.

Konstanz, 23. Juli 2012

(Christopher Bleibtreu)