University of Antwerp
Faculty of Business and Economics

DEPARTMENT OF ECONOMICS

Conflicts of interest, ethical standards, and competition in legal services

Jan Bouckaert & Johan Stennek

UNIVERSITY OF ANTWERP
Faculty of Business and Economics
City Campus
Prinsstraat 13, B.226
B-2000 Antwerp
Tel. +32 (0)3 265 40 32
www.uantwerpen.be

FACULTY OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

Conflicts of interest, ethical standards, and competition in legal services

Jan Bouckaert & Johan Stennek

RESEARCH PAPER 2022-002
APRIL 2022

University of Antwerp, City Campus, Prinsstraat 13, B-2000 Antwerp, Belgium
Research Administration – room B.226
phone: (32) 3 265 40 32
e-mail: joeri.nys@uantwerpen.be

The research papers from the Faculty of Business and Economics are also available at www.repec.org (Research Papers in Economics - RePEc)

D/2022/1169/002

Conflicts of Interest, Ethical Standards, and Competition in Legal Services*

Jan Bouckaert
University of Antwerp

Johan Stennek
University of Gothenburg

April 8, 2022

Abstract

We study how the legal profession manages representational conflicts of interest. Such conflicts arise when the same law firm represents clients with adverse interests. They may compromise the legal process, ultimately jeopardizing social welfare. We argue that current ethical standards, emphasizing disqualification over Chinese walls, may actually worsen the clients' situation. Instead, the clients' interests are today mainly protected by law firms being small. Despite low market concentration, law firms enjoy high earnings as representational conflicts create negative network externalities at the firm level. These profits are not eroded even in the long run as entry occurs through firm splitups.

JEL: K40, L13, L22, L44, L84

Keywords: law firms; professional services; dual representation; representational conflicts of interest; ethical standards; Chinese walls; recusals; negative network externalities; competition; self-regulation

*We are grateful for comments from Mathias Dewatripont, Pierre Régibeau, Michael Rubens, Stefan Rutten, Geert Van Moer and seminar participants at Cambridge, CRESSE, Hanken, Swerie 2021, and Université Libre de Bruxelles. Corresponding addresses: jan.bouckaert@uantwerpen.be and johan.stennek@economics.gu.se.

1 Introduction

Attorneys have an ethical duty of loyalty to all their clients. This duty may be undermined by representational conflicts of interest, which arise when the same lawyer represents two or more clients with adverse interests. Privileged information may then be used contrary to the client's interests. As a consequence, clients may refrain from sharing information that is vital for an efficient solution to their matters. Serving two masters may also impair the attorneys' work incentives, as actions appreciated and rewarded by one client may be punished by the other. If the conflicts are sufficiently severe, attorneys and even their entire law firm may choose to recuse themselves. Recusals are, however, associated with their own problems. They restrict the client's right to counsel of their own choice, delay the resolution of the matters, and subject the clients to higher costs. To ease this tradeoff, law firms can raise Chinese walls. By taking the cost to fence off conflicted attorneys within the firm, law firms may be able to represent both sides with less harm. Today the legal industry deals with conflicts of interest through self-regulation. Professional organizations such as the American Bar Association prescribe ethical standards for how lawyers should manage conflicts (ABA, 2021). The default is disqualification. This is more true with current clients, especially in directly adverse matters, and certainly when there is litigation.

Representational conflicts are surprisingly common (see section 2). And, as they impose great costs on law firms and restrain their growth, they are an important determinant of market structure. More importantly, as legal services constitute an essential part of the legal infrastructure on which the entire economy is built, the way law firms manage these conflicts may have far-reaching consequences for economic and social welfare.[1] Therefore, the purpose of this paper is to analyze how representational conflicts of interest affect both the structure and the performance of the market for legal services.

Our first contribution is to develop a simple model of representational conflicts. It is outlined in section 3. The model also describes how Chinese walls and standards of disqualification affect the clients' burden of representational conflicts. Sections 4 and 5 study how the demand for legal services depends on representational conflicts and how law firms set their prices. Our first result provides the seed for all further insights. Representational conflicts of interests give rise to negative network externalities among the clients within the same law firm (Proposition 1). These negative externalities arise both when the law firm engages in dual representation, e.g. due to information leakage, and

[1] It is the job of lawyers in private practice to guide their clients through the legal system. Thereby, they play an important role for the protection of property rights and the enforcement of contracts, which is crucial for both efficient investments and for long-term contracting (Williamson, 1995). According to North (1990, pp. 54-59), the inability to supply low cost enforcement of contracts is the most important source of stagnation in developing countries. In developed countries, well-specified bodies of law together with agents such as lawyers, arbitrators and mediators are essential parts of effective judicial systems where the merits of the case rather than private payoffs determine the outcomes.

when it recuses itself, e.g. due to the costs of finding a new law firm. Moreover, clients who are represented by a larger law firm are exposed to more conflicts. Therefore, they prefer a smaller firm to a larger firm if their prices and qualities are the same. It follows that law firms may only attract a few new clients by reducing their prices or improving their quality. Consequently, representational conflicts is a source of market power (Proposition 2). Law firms enjoy markups and higher earnings as a result of conflicts of interest.

We study what ethical rules the legal profession adopts to manage representational conflicts of interest in Section 6. A Chinese wall reduces the probability that dual representation will cause severe harm for the clients. A standard of disqualification sets an upper limit on how much harm the law firm tolerates before it recuses itself. A firm's ethical rules constitute a quality of its legal services. As a higher quality attracts more clients, the firms may voluntarily adopt such rules in their pursuit of profits. We first ask how the law firms would set their ethical standards unilaterally, i.e. absent a bar association. While the law firms would then set their ethical standards to compete for clients, their incentives would nevertheless not be well-aligned with their clients' preferences. In particular, the individual law firms would have weak incentives to reduce the clients' burden of representational conflicts (Proposition 3). They are too reluctant to recuse themselves from dual representation, as fewer representations lowers revenues. They are too reluctant to build costly Chinese walls, as that reduces their markups. This finding provides a rationale for some form of regulation. Next we turn attention to the current practice of self-regulation. We show that if a bar association maximizes the sum of profits of all its members, it would impose a strict common standard of disqualification (Proposition 4). When recusals are mandatory, Chinese walls are redundant. This prediction does appear to match the rules adopted by bar associations across North America and Europe, as the default is indeed disqualification. This result suggests that the bar associations' ethical rules may be interpreted as a device to reduce competition among their members.

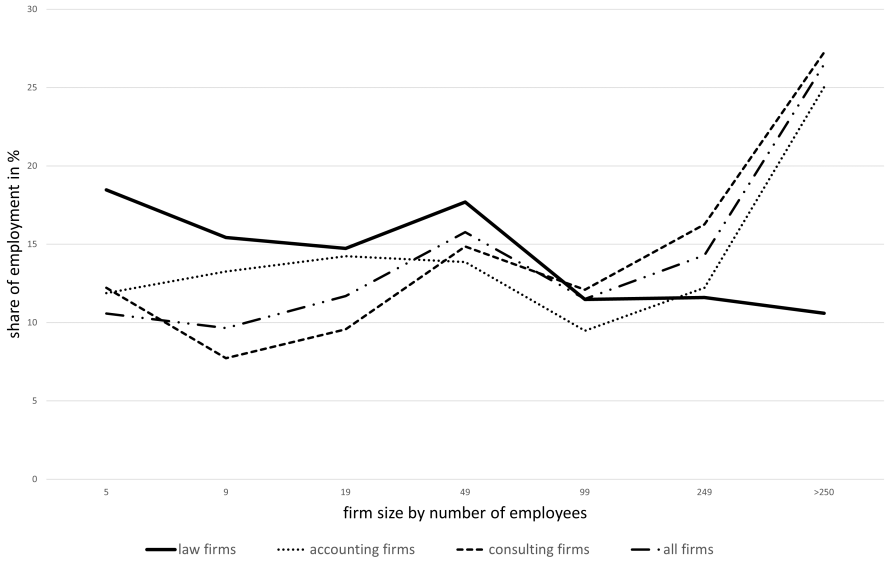
Representational conflicts of interest and the market structure are mutually dependent. This is the topic of section 7. We demonstrate that conflicts of interest limit the ability of high-quality law firms to poach clients from their rivals. While the industry's stars are able to charge premium fees, they will not expand their market share by much (Proposition 5). Moreover, evidence suggests that *de novo* entry is difficult as experience and reputation are crucial to build a client base. New law firms are therefore commonly formed by entrepreneurial partners leaving larger practices to go it alone. We thus focus on the incentives for breakups and mergers. We show that representational conflicts reduce the law firms' incentives to merge, prompt splitups and lead to a fragmented market structure. Despite this fragmentation, law firms may earn strictly positive profits in the long-run (Proposition 6). When a new firm's resources must be mustered from within an imperfectly competitive industry, rather than from the outside, current rents make part of their opportunity cost and therefore serve as a barrier to entry.

We evaluate market performance from the clients' perspective in section 8. We show that the clients would be better off if every law firm were to decide on its own ethical standards, rather than having the strict standard of disqualification imposed by the bar association. Absent a bar association, the clients would pay lower prices. More surprisingly, the clients' burden of representational conflicts would be lower, which is contrary to the very rationale for regulation (Proposition 7). These findings cast doubt on the current practice of self-regulation by the legal profession.

Taken together, the results of this paper suggest the following conclusion. Market fragmentation, not ethical standards, may be the most important mechanism by which the legal profession today serves to reduce the clients' burden of representational conflicts.

The results of this paper contribute to the understanding of some stylized facts about the legal services industry, including the key characteristic of self-regulation: a strict standard of disqualification. A second fact is that the market for legal services indeed is fragmented, perhaps contrary to common perception. Figure 1 compares law firms

Figure 1: Firm size distribution in professional services industries in the US.



to accounting and consulting, as well as all professional services firms. It displays the proportion of employees working in firms of different sizes, ranging from below 5 employees to above 250.[2] Only 10% of all lawyers work in firms with at least 250 employees. This is far below the average of other professional services industries. In consulting services the corresponding figure is 25%. In fact, there is a negative relationship between the size of law firms and their share of employment, whereas other professional services industries

[2]The figure is based on 2017 Census data, 4-digit NAICS within 54, containing Professional, Scientific, and Technical services. It includes a.o. Legal Services (among which the vast majority consists of law firms); Accounting, Tax Preparation, Bookkeeping, and Payroll Services; Management, Scientific, and Technical Consulting Services.

display the opposite pattern.[3] A third striking fact is the high average earnings among lawyers. Rosen (1992) interprets the high earnings along the lines of human capital theory, as a compensation for the high costs of training. We show that the market power that is necessary for lawyers to recoup their investments partly stems from the negative network externalities associated with representational conflicts. In addition, our analysis of market structure suggests that earnings may even exceed the level necessary to recoup the high training costs.

Despite the special importance of the legal profession, it has not received much attention in the economics literature. In her review, Hadfield (2021) concludes that the current literature provides "little insight into an increasingly critical question: how well do our markets for law and legal services function in producing the basic legal infrastructure needed to achieve goals of economic and social welfare?" Our contribution is to scrutinize how well the legal profession deals with representational conflicts of interests. We let ethical conduct be a "quality of service" that the clients care about. We ask whether it is in the firms' best interest to supply this quality, if their interest is to maximize profit. In reality, most lawyers are presumably motivated by a mix of desires, including their own profit but also a wish to do good for their clients. An important future step would therefore be to include these good intentions, perhaps modeled as an intrinsic motivation for ethical conduct. Ethics-as-quality would clearly remain as an important component of the problem, but additional mechanisms would be uncovered.[4]

2 A primer on representational conflicts of interest

Typology of representational conflicts The prototypical example of a concurrent conflict of interest would be a lawyer representing both the plaintiff and the defendant in the same litigation. But representational conflicts of interest arise under a much broader set of circumstances. They are a ubiquitous feature of the market for legal services (Shapiro, 2002 and Shapiro, 2003). Conflicts of interest also arise when a single lawyer represents multiple defendants or multiple plaintiffs. While the defendants have a common interest to argue that no damage has occurred, they may wish to put the blame on each other, once damage has been proved. Representational conflicts also arise in transactional matters, as when the same lawyer represents both the buyer and the seller in the same deal. While both parties have a common interest in maximizing their joint surplus, they have opposite interests in the division of that surplus.

[3] Another possible reason for the market to be unconcentrated is that in many jurisdictions, except for the UK, ownership of law firms is restricted to licensed lawyers, limiting their access to outside capital (Winston and Karpilow, 2016).

[4] Shleifer (2004) argues that ethical conduct is a normal good and that increased competition reduces incomes and therefore diminishes ethical conduct. Dewatripont and Tirole (2020) focus on consequentialist ethics and argue that competition may diminish ethical conduct due to a "replacement effect." If a firm refrains from exploiting child labor, it may well be outcompeted by one that does not.

Conflicts may also arise across unrelated matters. If a law firm represents an employee in a matter with her employer, the same law firm may not be able to also represent that employer in an acquisition matter, as that may impair the law firm's loyalty to the employee. Lawyers may also promote a specific position, e.g. a particular interpretation of the law, in the representation of a client that is incompatible with the interests of other clients who are not parties to the matter, nor have any direct stake in it (positional conflicts).

Conflicts do not only arise with regard to current clients (concurrent conflicts), but also with regard to former clients (sequential or successive conflicts). The information obtained when assisting a client to structure one deal may be leaked to the client's competitor also at a later stage. And even when two parties enjoy a perfectly harmonious relationship for the moment, conflicts may well develop over time.

Of great importance for our analysis is the fact that conflicts also extend beyond the individual lawyers and taint his or her colleagues working for the same firm (imputed conflicts).

Client harm Dual representation may harm the clients' interests for many different reasons. First, as discussed in the legal literature (Epstein, 1991; Steinberg and Sharpe, 1990), privileged information may be used against a client's interests. An advisor may even forward damaging information from one client to another, especially when the other client is regarded as the more lucrative side of the conflict.[5] Second, a client may also not trust her advisor with information that is crucial for the quality of advice when there is even the slightest chance that it could be used as evidence against her.[6] Third, an advisor's incentive to gather information may be impaired when representing both parties. This follows from the rationale for advocacy.[7]

[5]Corporate clients may share private information e.g. about their demand and technology with their attorneys. The attorneys may have an incentive to later forward (sell) this information to their other clients that are active in the same industry. And while each client gains from receiving the competitor's private information, this gain may well be lower than the loss from having their own information revealed to their competitors. The literature on information-sharing in oligopoly has demonstrated various conditions under which quid pro quo information exchange harms competing firms (see e.g. Vives, 1984; Gal-Or, 1985, 1986). Moreover, Villas-Boas (1994) analyzes how advertising agencies may sell such information to their clients. If so, dual representation causes net harm.

[6]Information exchange is more informative when the goals of the client and the attorney are more aligned (Crawford and Sobel, 1982).

[7]Dewatripont and Tirole (1999) address whether opposing causes should be investigated by a single information collector rather than competing advocates. If rewards for collecting information are based on the final decision, and provision of evidence is costly, a unique information collector's reward is identical when delivering two equally opposing pieces of evidence or none at all. As a result, a single information collector has a conflict of interest since he is less willing to collect costly, hard evidence. In contrast, competing advocates have incentives to win and therefore to collect costly evidence rather than none. Therefore, the client's willingness to pay for a competing advocate is higher than for a single information collector. In our context, the plaintiff and the defendant therefore prefer to hire non-conflicted attorneys to defend their cause. It appears that this mechanism is not discussed in the ABA model rules. Representational conflicts of interest can also be regarded as an instance of a common agency problem

Disqualification and Chinese walls[8] The most direct way to solve conflicts of interests, is for law firms to drop clients, for example by withdrawing from an active matter or terminating the relationship. However, dropping clients, perhaps the less lucrative (the so-called "hot potato doctrine"), does not eliminate harm. The clients are then denied their own first choice of counsel. Termination of the relationship may even be regarded as a form of disloyalty towards the client and therefore unethical behavior. Moreover, the costs incurred by the clients from being dropped may be large, including costs of finding new counsel and delays in the resolution of the matter.[9]

A possible way to avoid disqualification is to raise a Chinese wall. The wall aims to only disqualify the lawyers with privileged information. Thereby, non-conflicted attorneys in the same firm can represent the other side. There are several procedures to fence off conflicted lawyers. The different teams may be physically separated and they may be prohibited from having any contacts with the other representation, banning relevant discussions. Firms may install a file access management system restricting access to files. Tainted attorneys may be excluded from receiving any share of the fees received from the other side. The law firm may even be geographically separated into different legal entities.[10]

A Chinese wall does not solve all issues, however. If implemented in good faith, it may be effective in reducing information leakage. Work-incentives may still be hampered though. Simply knowing that other lawyers in the same firm represent the opposite side may distort incentives. There is also an issue of credibility. Even if it were possible for the management of a law firm to isolate different lawyers effectively, it might be tempting to not actually implement such a strict standard.[11]

Managing representational conflicts also give rise to considerable red tape and costs within the law firms themselves. Shapiro (2003) reports that some law firms turn away a third to a half of all new cases because of conflicts of interest. Law firms also devote substantial resources to identify, avoid and resolve conflicts of interests. Senior partners

(Bernheim and Whinston, 1984).

[8]For more extensive descriptions, we refer to University of Pennsylvania Law Review (1980), Shapiro (2003) and Griffiths-Baker and Moore (2011).

[9]Disqualification may even give rise to litigation, as illustrated by a high-profile case from 2020. Two companies, Revolaze and Gap, were involved in a matter concerning a patent. Revolaze was represented by Dentons U.S. while Gap was represented by Dentons Canada. Dentons was disqualified after Gap accused Dentons U.S. for its access to confidential and privileged information to its detriment. Revolaze then initiated a malpractice action and sued Dentons U.S. claiming that it suffered harm from the necessary and costly retention of a new counsel, resulting in a settlement below its true value. (RevoLaze LLP vs. Dentons US LLP et al., case number CV 16861410, in the Court of Common Pleas, Cuyahoga County, Ohio.)

[10]Such a Swiss Verein firm structure is also practiced in the UK as "Company Limited by Guarantee" and in continental Europe as "European Economic Interest Grouping".

[11]In the US, Chinese walls are more easily accepted within large firms than within small firms (see e.g. New York Law Journal, 2016). Judges, the argument goes, have more confidence in the effectiveness of a Chinese wall in a large law firm that operates across the whole country as opposed to a small-sized firm where all attorneys know each other well. In the UK, Chinese walls are more accepted than in the US.

may spend considerable time in internal conflicts committees. Electronic databases of current and previous clients and their matters are built. Internal conflicts arise between partners as their compensation is tied to their ability to recruit new clients, which may be hampered by other partners' work. Chinese walls impede communication within the firm and make it difficult to staff cases with adequate expertise. Firms implicated in previous conflicts of interest or that have lax self-regulatory procedures can find themselves virtually uninsurable. In fact, Ames and Gough (2020) report that conflicts of interest is the most common alleged legal malpractice error.

In sum, conflicts of interest impose a burden on the clients, either as a result of direct harm or as a result of disqualification. The firms may reduce but not eliminate this burden by selecting appropriate standards for disqualification and by raising Chinese walls. However, doing so, comes at substantial costs.

Self-regulation Today law firms do not adopt their ethical standards unilaterally. Instead, bar associations adopt a common set of ethical standards for all their members. In the US, licensed attorneys must comply with the rules of their state bar association, most of which are based on the ABA Model Rules (Loughrey, 2011). In addition, American courts have given the bar associations' codes the force of law (Harvard Law Review, 1981).[12]

The ethical duty of undivided loyalty is considered the cornerstone of the relationship between attorneys and their clients. According to ABA Model Rule 1.7 the default is disqualification. Representation is prohibited if one client will be directly adverse to another client or there is a significant risk that the representation of one or more clients will be materially limited by the lawyer's responsibilities to another client. Representation is therefore impossible if the lawyer cannot reasonably conclude that there will be provision of competent and diligent representation.

The ABA imposes strict standards by presuming that a law firm suffers from "shared confidence" or "imputed conflict of interest" among all its attorneys. In other words, if a lawyer, associated to a particular law firm, is found ineligible to advice a client because of a conflict of interest, all lawyers from that law firm become ineligible too.

The ABA rules nevertheless allow dual representation under specific conditions. The clients' informed consent is not enough. To be consentable, the lawyer must reasonably believe that each client will get competent and diligent representation. The representation must also not involve litigation or other proceedings before a tribunal. In addition, precautions must be taken to safeguard the clients' interests. To do so, law firms must "screen" the conflicted lawyer by erecting the necessary ethical (Chinese) walls that serve as information barriers within the organization to prevent communication that could lead

[12]In the UK, it is the Solicitors Regulation Authority that prescribes ethical rules. Similarly, the Council of Bars and Law Societies of Europe issue a Code of Conduct for European Lawyers.

to conflicts of interests.[13]

Current debate on ethical standards There is an ongoing debate within the legal profession about the strictness of the rules for disqualification. This debate partly reflects two different models of professional ethics (Harvard Law Review, 1981). On the one hand, big law firms appeal to the libertarian model (or contract model). They request more opportunities especially for sophisticated clients, such as corporations with in-house counsel, to waive conflicts in advance, particularly with regard to conflicts of interest in unrelated matters. On the other hand, the fiduciary model emphasizes the informational asymmetry between the clients and their lawyers, requiring a higher degree of responsibility from the law firms.

Law firms in the US and the UK have taken several initiatives to deregulate conflicts of interest (Loughrey, 2011). Part of the reason is that the number of big law firms has increased and that lawyers are poached more often by rivals. As a result, conflicts of interest have become more frequent and complex (Busby and Bashman, 1996; Griffiths-Baker, 2002; Griffiths-Baker and Moore, 2011). According to Loughrey (2011), the ABA has so far resisted the lobbying efforts by the industry. In contrast, the UK regulation was relaxed, as large law firms have succeeded to convince the Solicitors Regulatory Agency that doing so benefits the clients. In the rest of Europe, lawyers are permitted to act in unrelated matters with sophisticated clients, such as big corporations with access to in-house legal expertise.

3 Model

There is a unit mass of clients. Each client has a bilateral legal matter with every other client. A legal matter may be a transaction between a buyer and a seller, or a dispute to be settled through a court procedure. There are $N \geq 2$ symmetric law firms offering legal services to the clients. A unit of service, called a representation, is to assist one of the two clients with the legal aspects of one such bilateral matter. Each client is listed with one law firm (single-homing) and each law firm provides services only to its own listed clients. Conflicts of interest therefore only arise in matters between two parties that are listed with the same law firm.

When a law firm represents only one side of a matter, we refer to it as "single representation." A client's willingness to pay for single representation is V, which is constant across all legal matters. The client's consumer surplus per representation is therefore $V - p_i$, if her firm charges the price p_i.

When a law firm represents both sides of the same matter, we refer to it as "dual

[13]See the ABA's Rule 1.7 Conflict of Interest: Current Clients - Comment.

representation." We represent all forms of harm by their monetary equivalent, $H \geq 0$.[14] We let the harm H from dual representations be different across legal matters. For simplicity, harm in any matter is an independent draw from a cumulative distribution function $F(H)$. We let a firm charge the same price p_i per representation, independent of whether it is a single or dual representation.[15] Thus, when there is dual representation, each client's surplus is $V - H - p_i$.

Lawyers are bound by two sets of ethical standards to deal with conflicts of interests. The first set of ethical standards, called the *standard of attorney disqualification*, determines when the firm will recuse itself. As we represent all kinds of harm by their monetary equivalent, a firm's standard of disqualification can be represented by a single threshold. The firm takes on the representation if harm is lower than the threshold, i.e. if $H \leq A_i$. Otherwise it recuses itself.[16]

Alas, recusal is not a panacea for conflicts of interest. By recusing itself, the firm restricts the client's right to counsel of its own choice, an important ethical principle in itself. In fact, when a law firm recuses itself, both clients must go elsewhere for legal advice in that matter. Representing one side, when the other side is still listed would not remove conflicts of interest.[17] Recusal delays the resolution of the matter and subjects the client to higher costs. To simplify the model, we let the utility of the outside option be zero, and assume that the clients then choose to not seek representation.[18]

The second set of standards concerns the management of the representational conflicts that arise when a firm decides to represent both sides of the same matter. These standards are referred to as a *Chinese wall*. The more a firm aims to reduce harm, i.e. the higher

[14]We present a micro-foundation for harm in Appendix A. The model could be used to also include benefits from dual representation by allowing $H < 0$. Gains from having a single lawyer may result from cost sharing or when access to both sides' information enables to find better solutions, e.g. as in mediation.

[15]We have not encountered evidence that law firms charge a different price per hour depending on whether there is single or dual representation.

[16]We thus assume that the firm immediately realizes that the other side is one of the firm's clients and also that the firm observes the extent of the potential harm. In reality, law firms often have to actively investigate if there is a conflict, especially if the conflict is with previous clients. Often the level of harm becomes apparent only after the firm has worked on the matter for some time. Moreover, harm is probably not assessed in terms of a monetary equivalent. It may not even be assessed directly. The standard of disqualification is a set of administrative procedures that in the end leads to a decision on representation. The key feature is that these procedures succeed to distinguish between matters with low or high harm, as if there is a threshold.

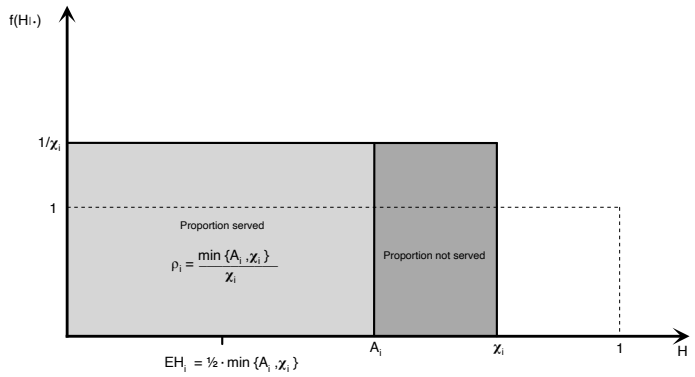
[17]After a merger between two law firms, Squire Sanders and Patton Boggs, the merged firm did no longer want to represent Patton Boggs' client, Tate & Lyle. It wished, however, to continue to represent a group of US sugar companies that were suing Tate & Lyle. The latter asked a federal judge to disqualify Squire Patton Boggs from working for the sugar companies. The Court threw Squire Patton Boggs off the case (Washington Post, February 17, 2015).

[18]This assumption simplifies the analysis by avoiding multi-homing issues. An alternative interpretations is that the clients seek representation from firms in other markets, as defined by geography or specialization. Indeed, Koppel (2010) reports that the big blue-chip law firms could not represent the plaintiffs suing banks following the 2008 financial crisis, as they were all conflicted. The plaintiffs then turned to small or mid-sized law firms, not specializing in the banking sector.

the Chinese wall it wants to erect, the more complicated it will be to abide by the rules. Staffing cases will become more complicated and internal communication will be impaired. To model this, we represent all "efforts" to reduce harm by a single variable e_i. We let more effort shift the harm distribution in the sense of first-order stochastic dominance. That is, $e_i > e_i'$ implies $F(H|\, e_i) \geq F(H|\, e_i')$ for all H. A simple example is that the Chinese wall reduces harm by the same proportion in all matters. In short, according to this model, a Chinese wall shifts the entire harm distribution, while the standard of disqualification truncates it.

To enable us to derive closed form solutions, we let harm be uniformly distributed, as illustrated by Figure 2. Absent ethical standards, H is uniformly distributed over the

Figure 2: The effect of the ethical standards when harm is uniformly distributed.



unit interval, as indicated by the dotted line. With a Chinese wall, H is distributed over the interval $[0, \chi_i]$, where the maximum harm, $\chi_i \leq 1$, is smaller the higher the effort is. We let $\rho_i = \frac{\min\{A_i, \chi_i\}}{\chi_i} \in [0, 1]$ denote the share of matters between two listed clients in which the firm is acting. This share is illustrated by the light grey area in the figure.[19]

We will let firms set χ_i and ρ_i rather than e_i and A_i, which would be equivalent. For short, we refer to the maximum harm χ_i as the Chinese wall and the probability of acting ρ_i as the standard of disqualification. It should be noted, however, that a *stricter* ethical standard is associated with a *lower* χ_i and a *lower* ρ_i.

We say that the standard of disqualification is binding if $\rho_i < 1$ and that it is non-binding otherwise. We let $E\{H_i\} = \frac{1}{2} \cdot \min\{A_i, \chi_i\} = \frac{1}{2} \cdot \rho_i \cdot \chi_i$ denote expected harm in a matter with dual representation. Even the most carefully designed Chinese wall cannot eliminate all harm. To represent this, we restrict the choice of Chinese walls to $\chi_i \in \left[\underline{\chi}, 1\right]$ where $\underline{\chi} > 0$. This limitation may also be taken to represent the credibility issues referred

[19] A simple example is that H represents the damage when information is leaked. Absent a Chinese wall, information will leak with certainty and cause a damage of 1. The benefit of a Chinese wall is to lower the probability of a leak to $\chi_i \leq 1$. Then, harm in expected terms is uniformly distributed over $[0, \chi_i]$. The firm recuses itself if the probability of a leak is too high.

to in the primer. In particular, if Chinese walls are not credible, they would have no bite, meaning that $\underline{\chi} = 1$.

A firm's cost to provide one client with legal advice in one matter is given by $C(\chi_i) = C + c \cdot (1 - \chi_i)$. We assume that this cost is the same for single and dual representation. This means that a higher Chinese wall increases the cost for both single and dual representations. While this is primarily a simplifying assumption, single representations will be made more complicated by a wall. The firm's problems with conflicts-checks, staffing and internal communication affect all its matters. We let $c < 1$ to ensure that the cost of a Chinese wall is lower than the maximum harm. In addition, having a standard of disqualification gives rise to a fixed cost for harm assessment, but it does not affect the cost of handling the matters actually taken on. In the interest of clarity, we set this fixed cost to zero.

We first investigate what ethical standards the individual firms would set, if these decisions were to be taken unilaterally. Next we consider the actual practice of self-regulation, with a bar association imposing ethical standards *common* to all attorneys. Comparing these two versions of our model clarifies what role the bar association fills. There are two differences between unilateral ethical standard-setting and industry self-regulation. First, the decision makers have different objectives. Individual law firms maximize their own profits while the bar association aims to maximize the sum of profits of all their members. Second, the timing is different, as described by Table 1. The bar association's standard-setting is a time-consuming procedure.[20] It is also clear that the bar's common rules are known by all law firms. As a result, firms take the bar's ethical standards as a given when setting their prices. In contrast, individual law firms would be able to change their standards with much less delay. In the model, we therefore let individual law firms set their standards at the same time as they set their prices. In contrast, the bar association prescribes standards before the firms set their prices.

Table 1: Decision-makers and timing

<table>
<tr><th></th><th>bar association
(stage 1)</th><th>law firms
(stage 2)</th><th>clients
(stage 3)</th><th>clients
(stage 4)</th></tr>
<tr><td>unilateral adoption
of ethical standards</td><td>-</td><td>(p_i, χ_i, ρ_i)</td><td rowspan="2">select
law firm</td><td rowspan="2">demand for
representations</td></tr>
<tr><td>ethical self-
regulation by the bar</td><td>(χ, ρ)</td><td>p_i</td></tr>
</table>

If the standards are prescribed by the bar association, they are enforceable by the association itself, for example through disciplinary sanction such as suspension or disbarment of attorneys. There is also civil liability and outside enforcement by the courts. If

[20]The ABA's first Model Code were the 1908 Canons of Professional Ethics (last amended in 1963), then followed by the adoption of the Model Code of Professional Responsibility in 1969. The Model Rules of Professional Conduct were adopted by the ABA House of Delegates in 1983, see American Bar Association (2013).

the standards were to be decided by each firm individually, they would be appended to the contracts with their clients and made legally binding for the firms.

The clients make two decisions. First, the clients select their law firms. They know all the firms' prices and ethical standards, and therefore their harm distributions.[21] Second, the clients ask their law firms for representation when legal matters arise. A client can tell when her law firm also represents the other side in a matter. One reason is that such dual representation requires informed and written consent by the lawyer. A client can not, however, assess harm before the matter is completed. But as the clients observe the firm's ethical standards, they can compute the expected harm.[22]

In both versions of the model, we analyze it backwards to establish a subgame perfect equilibrium. We confine attention to symmetric equilibria.

4 Demand

We let m_i be the number of clients listed with firm i. As there is a unit mass of clients, this is also the firm's market share.

Demand for representation A client listed with law firm i demands single representation if $p_i \leq V$ and dual representation if $p_i \leq V - E\{H_i\}$. We restrict attention to equilibria where clients also demand dual representation. Thus, a firm with m_i listed clients gets to work on

$$k_i = m_i \cdot (1 - m_i) + \int_0^{\min\{A_i, \chi_i\}} 2 \cdot \left(\tfrac{1}{2} \cdot m_i^2\right) \cdot \chi_i^{-1} \cdot dH$$

representations. The first term is the number of single representations. The second term is the number of dual representations. The numeral 2 signifies that the firm will represent both parties and $\frac{1}{2} \cdot m_i^2$ is the expected number of matters where both sides are listed with firm i.

Lemma 1. *A firm with m_i listed clients and price $p_i \leq V - EH_i$ has a demand for representation given by*

$$k_i = m_i - (1 - \rho_i) \cdot m_i^2. \tag{1}$$

The key property of this Lemma is that the firm's demand for representation k_i does not increase proportionally to the firm's client base m_i if the firm recuses itself from some dual representations ($\rho_i < 1$). It should be clear that the firms' incentives to compete for clients is reduced by a binding standard for disqualification.

[21] A possible interpretation is that the current generation of clients observe the distribution of harm inflicted on the previous generation.

[22] Even if the law firm assesses harm already before it accepts to represent both sides in the same matter, we assume that it cannot credibly communicate this information to its clients. Such information is not verifiable.

Demand for listing A client's expected utility when choosing advisory firm i with m_i clients and price $p_i \leq V - EH_i$ is given by

$$EU_i = (1 - m_i) \cdot (V - p_i) + m_i \cdot \int_0^{\min\{A_i, \chi_i\}} (V - H - p_i) \cdot \frac{1}{\chi_i} \cdot dH.$$

The first term represents the expected utility from single representations and the second term from dual representations. After simplification, the expected utility can be rewritten as

$$EU_i = (V - p_i) - \theta\,(p_i, \chi_i, \rho_i) \cdot m_i, \tag{2}$$

where

$$\theta\,(p_i, \chi_i, \rho_i) \equiv \underbrace{(V - p_i) \cdot (1 - \rho_i)}_{\text{coverage effect}} + \underbrace{E\,\{H_i\} \cdot \rho_i}_{\text{harm effect}} \geq 0, \tag{3}$$

is the client's burden of representational conflicts. The burden is firm-specific and determined by the firm's own policy (p_i, χ_i, ρ_i). The burden has two parts. The term $(V - p_i) \cdot (1 - \rho_i)$ represents a *coverage effect*: the client is sometimes denied representation by the attorney of his or her own choice whenever there is a binding standard of disqualification, $\rho_i < 1$. The term $E\,\{H_i\} \cdot \rho_i = \left(\frac{1}{2} \cdot \rho_i \cdot \chi_i\right) \cdot \rho_i$ represents a *harm effect*: the client is exposed to harm whenever the standard of disqualification permits some dual representation, $\rho_i > 0$.

A key property of the market for legal services is that the client's burden of representational conflicts constitutes a *negative network externality*. The expected utility of being listed with an advisory firm, depends on the share of other clients being represented by that firm, ${}^{dEU_i}/_{dm_i} = -\theta\,(p_i, \chi_i, \rho_i) < 0$. A client who selects a firm with a larger client base, will have a larger share of matters with clients belonging to the same law firm. The client will both be denied representation more often and be exposed to harm in more matters. In sum:

Proposition 1. *The market for legal services is characterized by negative network externalities among the clients of the same law firm. If two law firms have identical prices and ethical standards, clients listed with the firm having more clients are denied representation by the attorney of their own choice in more matters (coverage effect) and are inflicted harm in more matters (harm effect).*

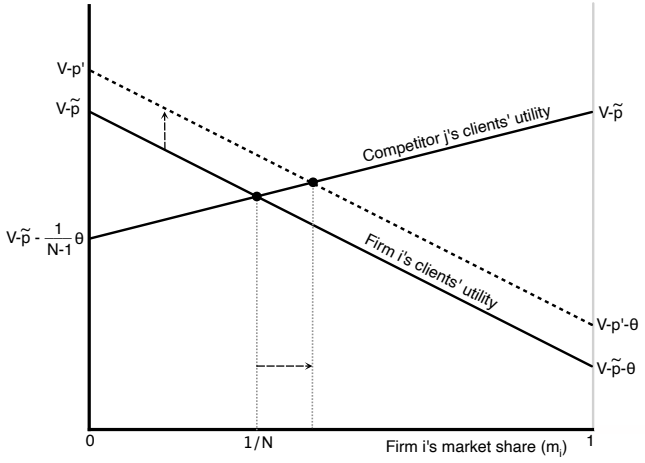
As a result of the network externalities, the clients' choices of law firms are interdependent. Thus, the firms' residual demand functions are equilibrium entities. In particular, the clients' equilibrium choices equalize the utility across all firms that have strictly positive demand $m_i > 0$. That is, there exists some value ψ such that

$$EU_i = (V - p_i) - \theta\,(p_i, \chi_i, \rho_i) \cdot m_i = \psi \tag{4}$$

for all firms. If two firms would provide different levels of utility, the clients would start to reposition themselves, moving from the firm with lower utility to a firm with higher utility. This would reduce the utility difference between the two firms.

We illustrate the demand equilibrium in Figure 3, with firm i's market share on the

Figure 3: Equilibrium demand.



horizontal axis. Consider a symmetric situation when all firms charge the same price, $\tilde{p}$, and adopt the same ethical standards, so that they have an identical strictly negative network externality $-\theta < 0$. Then, firm i's clients' utility is given by $EU_i = (V - \widetilde{p}) - \theta \cdot m_i$, which is the solid downward-sloping line. Competitor j's clients' utility is given by $EU_j = (V - \widetilde{p}) - \theta \cdot (1 - m_i) \cdot \frac{1}{N-1}$, which is the upward-sloping line. At the intersection, the clients' utilities are equalized, which happens at $m_i = \frac{1}{N}$. Figure 3 immediately reveals two important features of the model. The first is that the negative network externalities give rise to a less than perfectly elastic firm demand. To see this, let firm i reduce its price from $\tilde{p}$ to p'. Then, firm i's clients' welfare increases, as illustrated by the upward shift of firm i's utility-curve (the dotted line). Some of the competitors' clients will then start moving to firm i. This process continues until client welfare is the same in all firms. This is illustrated by the new intersection. Moreover, the smaller the negative network externality is, the flatter the two utility curves are, and the larger is the effect of firm i's price reduction on its market share. The second feature is that lower concentration leads to a more price-elastic demand. With more firms in the market, competitor j's utility-line is flatter. (It has a higher intercept, but reaches the same point at $m_i = 1$.) Then, a given price reduction increases firm i's market share more. The reason is that the competitor's clients' utility is less sensitive to changes in m_i, or expressed differently, a larger change in m_i is required to increase their utility.

Denote by $\overline{\theta} = \left[\frac{1}{N} \cdot \sum_{j=1}^{N} \theta_j^{-1}\right]^{-1}$ the harmonic mean externality among all firms.

Lemma 2. *Let all firms have strictly negative network externalities $-\theta_j < 0$. Then, for any firm with positive demand,*

$$m_i = \tfrac{1}{N} \cdot \left[1 + \sum_{j=1}^{N} \frac{p_j - p_i}{\theta_j}\right] \cdot \tfrac{\overline{\theta}}{\theta_i}. \tag{5}$$

The proof is relegated to the Appendix B.1.[23]

Recall that a firm's ethical standards can be viewed as qualities of its legal services. Clearly, any differences in ethical standards between firms may give rise to *vertical product differentiation*. If firm i's network externality is low compared to the competitors' externalities (high $\overline{\theta}/\theta_i$), then firm i's demand is high. The reason is that a firm with a smaller network externality, i.e. lower client burden, provides the clients with superior quality. More surprisingly, the firms' ethical rules also have effects akin to *horizontal product differentiation*. This is revealed by the expression within the squared brackets. If the other firms have small network externalities (low θ_j), then firm i's demand is price elastic. The reason is that a large share of firm i's current customers could migrate to firm j without "congesting" it, if firm i would increase its price. The different firms' services then become better substitutes.

5 Prices

Firm i's profit is given by the product of the markup and the number of representations,

$$\pi_i = (p_i - C(\chi_i)) \cdot k_i. \tag{6}$$

Whenever there are negative network externalities, the demand and profit functions are differentiable and the first-order condition is given by

$$\frac{d\pi_i}{dp_i} = k_i + (p_i - C_i) \cdot \frac{dk_i}{dm_i} \cdot \frac{dm_i}{dp_i} = 0. \tag{7}$$

Using $\frac{dk_i}{dm_i} = 1 - 2 \cdot (1 - \rho_i) \cdot m_i$ and since $\frac{dm_i}{dp_i}$ is given by equation (21), the first-order condition can be rewritten as

$$p_i = C(\chi_i) + \frac{\theta_i + \frac{1}{N-1} \cdot \overline{\theta}_{-i}}{1 - 2 \cdot (1 - \rho_i) \cdot m_i} \cdot m_i. \tag{8}$$

[23] When (at least) one firm adopts the strictest possible standard of disqualification $\rho_i = 0$ and charges the maximum price $p_i = V$, it does not have negative network externalities, i.e. $\theta_i = 0$. Then, the demand functions for all firms are different, as described by Lemma 9. As this will never occur in equilibrium, it is relegated to Appendix B.1.3.

In a symmetric equilibrium, with $\rho_i = \rho$ and $\chi_i = \chi$ for all i, the common price is characterized by

$$p = C(\chi) + \frac{N}{(N-2+2\cdot\rho)\cdot(N-1)}\cdot\theta, \tag{9}$$

where $\theta = (V-p)\cdot(1-\rho) + \frac{1}{2}\cdot\rho^2\cdot\chi$. Clearly, the presence of market power is associated with the presence of negative network externalities.

In Appendix B.2, we demonstrate that the first-order condition, equation (7), defines a unique symmetric equilibrium price $\widetilde{p}(\chi,\rho,N)$ for all symmetric ethical standards.[24] To ensure that $\widetilde{p}(\chi,\rho,N)$ is the unique equilibrium price, we invoke a notion of stability where a price p is stable if each firm has an incentive to deviate slightly from any other commonly set nearby price p' *towards* p.

Proposition 2. *Consider a symmetric equilibrium with* $\rho \in [0,1]$ *and* $\chi \in \left[\underline{\chi},1\right]$. *There is a unique stable equilibrium price*

$$\widetilde{p}(\chi,\rho,N) = (1-\lambda)\cdot V + \lambda\cdot C(\chi) + \eta\cdot E\{H\}, \tag{10}$$

where $\lambda(\rho,N) \in [0,1]$ *and* $\eta(\rho,N) \geq 0$ *and* $E\{H\} = \frac{1}{2}\cdot\rho\cdot\chi \geq 0$. *While there is a positive markup, the price is sufficiently low that clients also demand dual representation,*

$$\widetilde{p}(\chi,\rho,N) \in (C(\chi), V - E\{H\}].$$

The markup (i) increases with market concentration, (ii) decreases with the Chinese wall (lower χ*), and (iii) increases with the standard of disqualification (lower* ρ*).*

The comparative statics can be explained as follows. First, note that when there are many competing firms, each firm serves a small share of the market. It follows that the negative network externality plays a less important role. Clients do not bother too much about conflicts of interest. The opposite happens when the number of competing firms is low. Then, each firm serves a considerable share of the market and the negative network externality becomes important. Clients prefer a small firm to a large firm even when its price is higher. Second, if the firms build higher Chinese walls, the negative network externalities are reduced. Firm demand then becomes more price elastic resulting in lower pricing power. Third, a stricter common standard of disqualification increases market power. The main reason is that a stricter standard (lower ρ) increases the network externalities (higher θ), which follows from the reduced coverage. Of course, a stricter standard also benefits the clients by reducing expected harm, but this effect is dominated. This is easy to see when ρ is low. Then the expected harm is low both since the firms take on few dual representations and since the harm in each dual representation is low.

[24] In fact, even though that the first-order condition (equation (7)) is derived under the assumption that all firms have negative network externalities, the function $\widetilde{p}(\chi,\rho,N)$ applies also when $N=2$ and $\rho=0$, in which case $\widetilde{p}(\chi,0,2) = V$ so that there are no network externalities.

6 Ethical standards

In this section we analyze what ethical standards the firms would adopt if they were to make these decisions unilaterally. Thereafter, we investigate the outcome of self-regulation by the bar association. We start with a useful benchmark, however. What ethical standards should the law firms adopt to minimize their clients' burden of representational conflicts?

6.1 Clients' burden

The standard of disqualification involves a trade-off from the client's perspective. While a strict standard reduces harm from dual representation, it comes at the cost of lower coverage, denying clients to be represented by an attorney of their own choice. The first derivative is given by $\frac{\partial \theta_i}{\partial \rho_i} = -(V - p_i) + \rho_i \cdot \chi_i$, where the first term represents the coverage effect and the second is the harm effect. The net effect may be positive or negative. A softer standard benefits the clients if the price is sufficiently low or the Chinese wall is sufficiently high. The standard of disqualification minimizing the clients' burden is characterized by $\frac{\partial \theta_i}{\partial \rho_i} = 0$ or $\rho_i = 1$, i.e. $\rho_i^* = \min\left\{\frac{V-p_i}{\chi_i}, 1\right\}$ for a given price and Chinese wall.[25]

A higher Chinese wall (lower χ_i) reduces the clients' burden ($\frac{\partial \theta_i}{\partial \chi_i} = \frac{1}{2} \cdot \rho_i^2 \geq 0$), as it reduces harm in dual representations. That is, at a given price, the maximum wall minimizes the clients' burden, whenever the firm engages in some dual representation.

6.2 Unilateral adoption

To analyze the firms' unilateral adoption of standards, we begin with a technical Lemma. This lemma ensures that there will be negative network externalities in equilibrium when the firms adopt standards unilaterally. As a result, the firms' demand functions are characterized by Lemma 2.

Lemma 3. *Let the firms set their ethical standards unilaterally. There are negative network externalities ($-\theta < 0$) in any symmetric equilibrium.*

In order to have a symmetric equilibrium without network externalities, all firms must impose the maximally strict standard of disqualification $\rho = 0$ *and* charge the maximum price $p = V$. In the proof (Appendix B.3.1) we demonstrate that each firm has an incentive to deviate from such an outcome. In particular, it is profitable for a firm to soften the standard of disqualification in combination with a negligible price reduction to

[25] If the firm charges a higher price, the clients' burden of conflicts of interest is reduced, as a higher price reduces the client's harm from recusals. Still, a higher price does reduce overall client welfare (equation (2)).

keep demand unaffected. Softening the standard of disqualification has a positive first-order effect on profit. It introduces (consentable) dual representations for the deviating firm and each new representation delivers a markup of $V - C$. The necessary reduction of the price (to keep demand unaffected) is only a second-order effect when $\rho = 0$. The reason is that (i) while a softer standard increases harm to the clients, this only occurs in a very small proportion of representations when $\rho \approx 0$, and (ii) while a softer standard increases the share of representations where the clients suffer harm, the expected harm is very low when $\rho \approx 0$.

6.2.1 Standard of disqualification

As the firm's profit is given by $\pi_i = (p_i - C(\chi_i)) \cdot k_i$, the effect of the standard of disqualification on profit is given by

$$\frac{d\pi_i}{d\rho_i} = (p_i - C(\chi_i)) \cdot \frac{dk_i}{d\rho_i}. \tag{11}$$

Any firm with a positive markup, therefore sets its standard of disqualification to maximize its number of representations k_i given by equation (1). The effect of the standard of disqualification on the number of representations is described by

$$\frac{dk_i}{d\rho_i} = \frac{\partial k_i}{\partial \rho_i} + \frac{\partial k_i}{\partial m_i} \cdot \frac{\partial m_i}{\partial \rho_i}. \tag{12}$$

The standard of disqualification thus determines the number of representations directly, by affecting the number of representations for any given customer base m_i (the first term), and indirectly, by affecting the size of the client base (the second term). We will start the analysis by examining the indirect effect.

To increase the size of its client base, the firm should align the standard of disqualification to the clients' preferences.[26] In particular, the effect of the standard of disqualification on the client base is given by

$$\frac{\partial m_i}{\partial \rho_i} = \frac{1}{\theta_i + \frac{1}{N-1} \cdot \bar{\theta}_{-i}} \cdot \left[m_i \cdot \left(\frac{V - p_i}{\chi_i} - \rho_i \right) \cdot \chi_i \right],$$

as shown in Lemma 8 in the appendix. The factor within square brackets represents how the marginal representation affects client utility when the standard is softened. Thus, this indirect effect, taken separately, suggests that a profit-maximizing firm should set the standard of disqualification that minimizes the clients' burden, $\rho_i^* = \min\left\{\frac{V-p_i}{\chi_i}, 1\right\}$.

The direct effect, in contrast, is unambiguously positive. By equation (1), any firm with a positive market share $m_i > 0$, increases its number of representations by softening

[26] Note that a larger customer base results in more matters to handle, that is $\frac{\partial k_i}{\partial m_i} > 0$. Otherwise, the firm would benefit from increasing its price, as revealed by equation 7.

its standard of disqualification, i.e.

$$\frac{\partial k_i}{\partial \rho_i} = m_i^2 > 0.$$

Thus, the direct effect, taken separately, suggests that the firm should never recuse itself from any dual representation, i.e. to set $\rho_i = 1$. More generally, the positive direct effect implies that the firm will never set a stricter standard than the one preferred by the clien13ts. Expressed differently, the loss of representations is the firm's cost of setting a binding standard of disqualification.

To find the net effect, it is useful to first rewrite equation (11) as[27]

$$-\frac{d\pi_i}{d\rho_i} \cdot \frac{1}{k_i} = \frac{\partial m_i / \partial \rho_i}{\partial m_i / \partial p_i} - (p_i - C(\chi_i)) \cdot \frac{\partial k_i}{\partial \rho_i} \cdot \frac{1}{k_i}. \tag{13}$$

The first term reveals that the firm's marginal benefit of a higher quality (on a per-case-basis) is that it can increase its price without losing clients.[28] Expressed differently, it represents the clients' marginal willingness to pay for a stricter standard. The second term reveals that the firm's marginal cost of a stricter standard is the loss of markup when the firm recuses itself. After substitution of the demand derivatives we conclude:

Lemma 4. *A firm sets its standard of disqualification less strict than the one minimizing its clients' burden, $\rho_i \geq \rho_i^*$. It is given by $\rho_i = \min\left\{\frac{V - C(\chi_i)}{\chi_i}, 1\right\}$.*

See Appendix B.3.2) for a proof.

6.2.2 Chinese wall

The effect of a firm's Chinese wall on profit is described by the first derivative,

$$\frac{d\pi_i}{d\chi_i} = (p_i - C(\chi_i)) \cdot \frac{dk_i}{dm_i} \cdot \frac{dm_i}{d\chi_i} - C'(\chi_i) \cdot k_i.$$

Given that the firm sets the optimal price, the markup is given by $p_i - C(\chi_i) = -k_i / \left(\frac{dk_i}{dm_i} \cdot \frac{dm_i}{dp_i}\right)$, so that

$$-\frac{d\pi_i}{d\chi_i}\frac{1}{k_i} = \frac{dm_i / d\chi_i}{dm_i / dp_i} - c, \tag{14}$$

where $-C'(\chi_i) = c$ is the firm's marginal cost of increasing the wall and $\frac{dm_i/d\chi_i}{dm_i/dp_i}$ is the firm's marginal value. The marginal value is the firm's ability to increase its price, as

[27] We use equation (12) to rewrite equation (11) as $\frac{d\pi_i}{d\rho_i} = (p_i - C(\chi_i)) \cdot \frac{\partial k_i}{\partial \rho_i} + (p_i - C(\chi_i)) \cdot \frac{\partial k_i}{\partial m_i} \cdot \frac{\partial m_i}{\partial \rho_i}$. Given that the firm adjusts its price to maximize profit, as in equation (7), the markup is given by $p_i - C(\chi_i) = -k_i / \left(\frac{dk_i}{dm_i} \cdot \frac{dm_i}{dp_i}\right)$. Thus, the marginal profit of increasing the standard $(-d\rho_i)$ per representation (k_i) is given by equation (13).

[28] Differentiating demand, shows that $\left.\frac{dp_i}{d\rho_i}\right|_{dm_i=0} = \frac{\frac{\partial m_i(p_i, \rho_i, \chi_i)}{\partial \rho_i}}{\frac{\partial m_i(p_i, \rho_i, \chi_i)}{\partial p_i}}$.

a result of the improved Chinese wall, while keeping the client base fixed. Expressed differently, it is the clients' marginal willingness to pay for a Chinese wall.

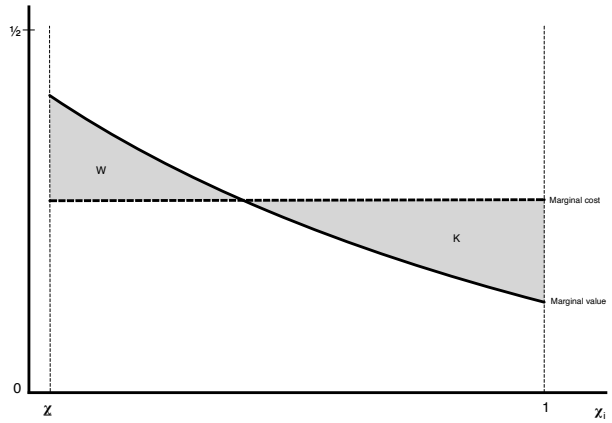
Using the demand derivatives, given by equations (21) and (22) in the appendix, the marginal value of the Chinese wall can be rewritten as

$$\frac{dm_i/d\chi_i}{dm_i/dp_i} = \frac{m_i \cdot \rho_i}{(1-m_i)+m_i \cdot \rho_i} \cdot \left(\tfrac{1}{2} \cdot \rho_i\right) \in \left[0, \tfrac{1}{2}\right],$$

which is the product of the share of dual representations and the change in expected harm, $\frac{\partial E\{H\}}{\partial \chi_i} = \frac{1}{2} \cdot \rho_i$. Thus, the marginal value of a firm's Chinese wall is related to its standard of disqualification and its market share. The marginal value is zero if the firm has the strictest standard of disqualification ($\rho_i = 0$), as then there are no dual representations. If the firm acts in all dual representation ($\rho_i = 1$), the marginal benefit is $\frac{1}{2} \cdot m_i$, which is the product of the probability of a dual representation, m_i, and the associated expected harm, $\frac{1}{2}$, avoided by the wall. The marginal value of the Chinese wall is increasing with the firm's market share. Clearly, at the extreme, the marginal value of a Chinese wall is negligible for a firm with a tiny market share, i.e. $\frac{dm_i}{d\chi_i}/\frac{dm_i}{dp_i} \approx 0$ if $m_i \approx 0$, as the proportion of dual representations is then very small.[29]

An important property of Chinese walls is that the firm's marginal value of the wall is increasing with the wall (lower χ_i). This is proved in Appendix B.3.3 and described by the solid line of Figure 4. The reason is that the firm's client base is increasing in the

Figure 4: Optimal Chinese Wall



height of the Chinese wall. Figure 4 illustrates a situation when the "first brick" of the wall costs more than it gives while the "last brick" gives more than it takes. Clearly, the firm will build the highest possible wall if the area W is larger than the area K and no wall otherwise.

[29] Also note that the marginal value of a Chinese wall depends on the competitors' policies, but only indirectly via the market share. Thus, if firm j would reduce its price or increase its Chinese wall, thereby reducing firm i's market share, firm i's marginal value of building a wall goes down. Chinese walls are therefore strategic substitutes.

Lemma 5. *A firm sets its Chinese wall lower than the one minimizing its clients' burden, $\chi_i \geq \underline{\chi}$. It is either the highest wall, $\chi_i = \underline{\chi}$, or no wall at all, $\chi_i = 1$.*

The advantage of the constant marginal cost function is its simplicity and that it allows us to focus on the implications of the increasing marginal value of Chinese walls. Our result, however, would remain also with a moderately increasing marginal cost function.

6.2.3 Overall equilibrium

To establish an equilibrium, we allow the firms to deviate in all their three instruments (p_i, χ_i, ρ_i) at the same time, taking into account that they are all interdependent. To simplify, we focus on a situation where all dual representations are socially valuable, so that recusals are socially inefficient in all matters, i.e. $V - C \geq 1$. Then, the standard of disqualification is independent of χ_i and p_i:

Lemma 6. *If all dual representations are socially valuable ($V - C \geq 1$), the firms never recuse themselves ($\rho_i = 1$).*

To see this, note that when $V - C \geq 1$, it follows that $V - C(\chi_i) \geq \chi_i$ and thus $\frac{V - C(\chi_i)}{\chi_i} \geq 1$. Thus, it is optimal for the firm to set $\rho_i = 1$ independent of χ_i.

Next, we ask if there can exist a symmetric equilibrium with no walls, given that all firms act in all dual representation matters ($\rho = 1$). To answer this question, we allow a deviating firm to change both its Chinese wall and its price at the same time. We define $\underline{c}(N) = \left(\frac{1}{N-1}\right) \cdot \left(1 - \sqrt{\frac{1}{N}}\right)$, with $\underline{c}'(N) < 0$.

Lemma 7. *Let all firms act in all dual representations ($\rho = 1$). Let all firm i's competitors charge $\tilde{p}(1, 1, N)$ and build no wall ($\chi_j = 1$). Then, firm i's best response is to also build no wall and charge $\tilde{p}(1, 1, N)$ if, and only if, $c \geq \underline{c}(N)$.*

The proof (see Appendix B.3.5) allows firm i to adjust its price optimally (according to equation (8)) for any choice of χ_i. That is, even though the firm charges a higher price with a costly wall, and even if the market share may go up, it still prefers to not build the wall as its markup goes down too much. Intuitively, when there are many firms in the market, each firm serves a small share of the market, and the share of dual representations is small. Then, the clients are not willing to pay a premium for a Chinese wall.

The first part of following proposition summarizes our results above. The second part provides a description of the overall equilibrium. We say that a firm has no ethical standards if it acts in all dual representations and does not build a Chinese wall.

Proposition 3. *If the firms were to set their ethical standards unilaterally, they would not minimize their clients' burden of representational conflicts: standards of disqualification would be too soft and Chinese walls too low.*

Let all dual representations be socially valuable. Then, there is an equilibrium without ethical standards if there are sufficiently many firms. There is no other symmetric equilibrium if the maximum Chinese wall is sufficiently high.

To prove that an equilibrium exists when $V - C \geq 1$, recall that we first considered the choice of standard of disqualification, when the firm adjusts its price optimally. Under suitable conditions, it turned out that a firm's unilateral choice is to never recuse itself, i.e. $\rho_i = 1$, independent of the Chinese wall. Second, we considered the choice of Chinese wall, when the firm adjusts its price optimally, under that assumption that $\rho_i = 1$. But, as $\rho_i = 1$ is optimal independent of χ_i, we need not consider any further deviations.[30] The proof of the last part of the proposition is relegated to appendix B.3.4. There, we demonstrate that there is no symmetric equilibrium with Chinese walls, if the maximum Chinese wall is sufficiently high. In particular, we study the model as $\underline{\chi} \to 0$, meaning that $\underline{\chi}$ is an (almost) perfect wall, with (almost) no harm. If two or more firms would build perfect Chinese walls, they would compete *à la* Bertrand: their prices would be equal to marginal cost and they would earn no profits. The reason is that the Chinese walls eliminate all negative network externalities. Then, it would be better for one firm to remove its wall and reduce its price. As the firm's cost is lowered, its markup goes up.

We view Chinese walls and standards of disqualification as qualities of legal services. When acting unilaterally, the firms set their ethical standards partly as a means to compete for clients. Their incentives are not perfectly aligned with their clients' interests, however. The firms prefer weaker standards of disqualification than their clients, since otherwise they forego revenues.[31] The reason for not building Chinese walls, contrary to clients' preferences, is that they are costly and reduce markups.

In an equilibrium without ethical standards, the source of market power is the harm effect. In particular, the markup is given by $\tilde{p}(1,1,N) - C = \frac{1}{N-1} \cdot E\{H\}$, where $E\{H\} = \frac{1}{2}$. Intuitively, a firm can only attract a few new clients by reducing its price slightly, as the clients will suffer harm more often in the firm with the lower price.[32]

6.3 Bar Association

If law firms were to act unilaterally, they would not necessarily minimize the clients' burden of conflicts of interests. It may even be that they would not adopt any ethical standards. As a result, there is a rationale for regulation. In actual practice, there is

[30] Even in duopoly, an equilibrium without ethical standards exists, if Chinese walls are sufficiently costly. However, in concentrated markets, at least some firms will have some ethical standards if $V - C < 1$ or $c < \underline{c}(N)$.

[31] In equilibrium, however, this divergence of interests between the firm and its clients vanishes, since the clients wish to have full coverage, given our assumption that $V - C \geq 1$.

[32] It turns out that our assumption of enforceable unilateral ethical rules is not critical. There will be no ethical rules, either because they are not enforceable or because the firms decide not to adopt them.

self-regulation. The lawyers' professional associations, i.e. the bar associations, prescribe a common set of ethical standards for all their members.

There are two differences between unilateral standard-setting and industry self-regulation. First, there is a difference in objectives. While individual firms set their standards to maximize their own profits, the bar association sets the common standards (χ, ρ) to maximize the sum of profits of all its members, given by

$$\Pi(\chi, \rho) = N \cdot [\widetilde{p}(\chi, \rho, N) - C(\chi)] \cdot k(\rho)$$

where each firm has $k(\rho) = \frac{1}{N} - (1-\rho) \cdot \frac{1}{N^2}$ representations, and where the unique subgame perfect equilibrium price equals $p = \widetilde{p}(\chi, \rho, N)$ as given by equation (10). Second, the timing is different, as the bar associations' decisions are slower. As a result, firms take the bar's ethical standards as a given when setting their prices. These two differences give rise to two distinct anti-competitive effects, which we refer to as *internalization* and *commitment*. To isolate the internalization effect, we first ask what standards the bar association would impose, if its decision were to be taken simultaneously with the firms' price setting. Expressed differently, we ask what standards the bar association would set at given prices.

At given prices, self-regulation would simply mean that the bar association eliminates the firms' competition for clients by means of ethical standards. That is, the bar association can internalize that one firm's gain of clients is another firm's loss. At given prices, the bar association would not prescribe any Chinese walls as those only lead to higher costs. Formally, $\frac{\partial \Pi(\chi,\rho)}{\partial \chi} = -\frac{\partial C(\chi)}{\partial \chi} \cdot N \cdot k(\rho) > 0$. At given prices, the bar association also does not prescribe any recusals, as those would only lead to fewer representations. Formally, $\frac{\partial \Pi(\chi,\rho)}{\partial \rho} = [\widetilde{p} - C(\chi)] \cdot N \cdot \frac{\partial k(\rho)}{\partial \rho} > 0$. Thus, at given prices, the bar association has even weaker incentives for adopting any ethical standards than the individual firms have themselves. However, as the decentralized outcome may be a corner solution – already void of ethical standards – the bar association's decision may coincide with the firms'.

In actual practice, self-regulation also means that the bar association imposes its standards before the firms set their prices. The ethical standards then serve as a commitment device. As a consequence, the bar association sets the standards to reduce price competition. From Proposition 2, the equilibrium price is decreasing in the Chinese wall, as Chinese walls reduce the negative network externalities. Thus, the decision not to impose Chinese walls remains intact. In contrast, from Proposition 2, a stricter standard of disqualification increases market power. This gain from increased markups dominates the loss of representations, meaning that the bar association prescribes the strictest possible standard if $V - C$ is large enough.[33] In that event law firms must not offer dual

[33] In the proof, we show that $V - C \geq \frac{7}{6}$ is sufficient. We conjecture, however, that $V - C \geq 1$ is a necessary and sufficient condition for $\rho = 0$ to be optimal for all $N \geq 2$. This stronger result is suggested by plotting aggregate profit as a function of ρ for various values of N and $V - C$.

representations.

Proposition 4. *The bar association imposes a binding standard of disqualification ($\rho < 1$) and may even impose the strictest standard of disqualification ($\rho = 0$). It does not prescribe Chinese walls.*

The proof is relegated to Appendix B.4.

In an equilibrium with the strictest standard of disqualification, the source of market power is the coverage effect. In particular, the markup is given by $\widetilde{p}(1,0,N) - C = \frac{N}{(N-2)\cdot(N-1)+N} \cdot (V - C)$. The reason is that a firm can only attract a few new clients by reducing its price slightly, as the clients will suffer from not being represented in more matters.

Proposition 4 appears to be an extreme representation of actual policy. The bar associations do appear to impose strict standards of disqualification, rather than using Chinese walls to deal with conflicts of interest. This is especially true in directly adverse matters, particularly when there is litigation. In some countries, such as Sweden, the bar explicitly forbids the use of Chinese walls.[34] Our result suggests that these ethical standards may be interpreted as a device to reduce competition and to maximize the profits of the associations' members.

7 Market structure and earnings

The legal services industry is remarkably unconcentrated.[35] At the same time, law is one of the most highly paid professions. Average earnings are high but earnings are also highly concentrated (Rosen, 1992).[36] The current section explains how representational conflicts contribute to fragment the legal services market, while preserving market power and high earnings, especially for the "stars."

[34]In fact, many law firms, especially the larger ones with more conflicts, find the ABA's standards of disqualification too strict (Loughrey, 2011).

[35]The vast majority of all law firms are very small, single establishment enterprises. The median US lawyer has only one colleague (American Bar Foundation, 2005) and the average law firm has fewer than four lawyers (Garicano and Hubbard, 2009). In the UK, more than 80 percent of all lawyers work in firms with at most four lawyers. There are of course also large law firms and they keep getting bigger. Today, the number of attorneys housed by the largest US and UK law firms ranges from 1,000 to over 4,500 (National Law Journal 500 survey, 2021). Still, the ten largest US law firms in 2020 represent only 9% of the total industry revenues and about 2% of the employees in the legal services industry. As shown by figure 1, the entire firm size distribution differs significantly between legal services and other professional services. For example, the Big Four in the accounting services represent 57% of the total industry revenues and about 15% of the auditors and accountants in the sector.

[36]Rosen provides evidence that human capital theory and an efficient assignment of cases to talent are part of the explanations.

7.1 Size distribution of firms

This section describes how representational conflicts limit the law firms' ability to grow large by offering superior quality, while at the same time allowing the stars to charge a premium for their services.

To simplify the analysis, we take quality differences to be exogenous. We also let the negative network externality be an exogenously given parameter, common to all firms. One may think of this as an equilibrium where all firms set the same ethical standards $\rho_i = \rho$ and $\chi_i = \chi$. Moreover, with $\rho = 1$, the network externality does not depend on price. These simplifying assumptions correspond to the outcome with decentralized standard-setting and provide a conservative assessment of the network externality when standards are set by the bar association.

In particular, let client utility in firm i be given by $u_i = V_i - p_i - \theta \cdot m_i$, where V_i is the firm-specific quality and $\theta = \frac{1}{2} \cdot \chi$ is the common network externality. Then, firm i's equilibrium demand is given by[37]

$$m_i = \frac{1}{n} + \frac{1}{n} \cdot \sum_{j=1}^{n} \frac{(V_i - p_i) - (V_j - p_j)}{\theta}.$$

The firm's profit is given by $\pi_i = (p_i - c) \cdot m_i$, as $k_i = m_i$ when $\rho = 1$. Let " $\bar{}$ " represent the average over firms. Then, the equilibrium prices are given by $p_i = c + \frac{1}{n-1} \cdot \theta + \frac{n}{2 \cdot n - 1} \cdot \left(V_i - \bar{V}\right)$, or expressed as deviations from the mean

$$p_i - \bar{p} = \frac{n}{2 \cdot n - 1} \cdot \left(V_i - \bar{V}\right). \tag{15}$$

The equilibrium market shares are then given by $m_i = \frac{1}{n} + \frac{1}{\theta} \cdot \frac{n-1}{2 \cdot n - 1} \cdot \left(V_i - \bar{V}\right)$, or

$$m_i - \bar{m} = \frac{1}{\theta} \cdot \frac{n-1}{2 \cdot n - 1} \cdot \left(V_i - \bar{V}\right). \tag{16}$$

Clearly, firms with higher quality charge higher prices and also sell more.[38] However:

Proposition 5. *Negative network externalities reduce the high-quality firms' ability to grow and outcompete their low-quality rivals. In contrast, the high-quality firms' ability to charge higher prices than their low-quality rivals is not affected by the network externalities.*

All else equal, the size distribution of firms is more compressed in a market with more

[37] Thus, with an exogenous parametric θ, our demand system reduces to an N-firm version of the Hotelling demand system.

[38] Focusing on a symmetric distribution of qualities, let $V^{max} - \bar{V} = V - V^{min} = \triangle$. Then, in order for the firm with the lowest quality to be viable, we need $\theta \geq \underline{\theta} \equiv \frac{n \cdot (n-1)}{2 \cdot n - 1} \cdot \triangle$.

pronounced representational conflicts:

$$E\left(m_i - \bar{m}\right)^2 = \tfrac{1}{\theta^2} \cdot E\left(V_i - \bar{V}\right)^2 / 4.$$

This is indeed what the evidence suggests (see footnote 35).[39]

7.2 Mergers and splitups

When setting up a new law firm, the main entry barrier is the need to employ already qualified lawyers (Competition & Markets Authority, 2016). For instance, a new UK law firm must have at least one person with at least three years of post-qualification experience. Most professional-liability insurers will want five years of experience.[40] Consequently, new law firms are indeed mainly formed by entrepreneurial partners leaving larger practices to go it alone (Rab, Jenkins and Yarrow, 2013; The Law Society Gazette, 2019). Sauer (1998) finds that lawyer job mobility in the US is low across sectors, such as business, solo operations, and non-elite and elite private law firms. For example, 85 percent of those who work in an elite law firm 15 years after graduation also started out in such an establishment. A possible interpretation is that in order to occupy a senior position (e.g. partner) in elite law firms, one first needs to build the experience there. Expressed differently, to build a new law firm, the essential resources, i.e. lawyers/partners, are primarily mustered from within the sector itself. In fact, such law firm splitups appear to be relatively frequent (Terry, 1988). Thus, *de novo* firm entry, set up by lawyers outside of the law firm industry, such as corporate lawyers or government employees, is rare as experience and reputation are crucial for building a client base.

For these reasons, we focus on the incentives for splitups rather than de novo entry. Similarly, we will focus on the firms' incentives for mergers rather than exits, as a force towards a more concentrated market structure. The reason is that in our model, the firms do not have any incentives to exit.

To study market concentration, we let all firms have the same quality. We let there be a fixed population of lawyers that have sufficient experience and reputation to act as (equity) partners. These lawyers can form at most L minimal partner teams. A minimal partner team is the minimum number of partners needed to run a law firm efficiently. This sets an upper limit on the number of law firms that can be formed, i.e. $N \leq L$. The number L of partner teams may be large, however. We also acknowledge the possible existence of scale economies by letting there be a fixed cost $F \geq 0$ in each firm. We analyze how this set of minimal partner teams will organize themselves into law firms.

[39] We refer to Appendix C for avenues for further empirical predictions on the firm size distribution.

[40] Although relatively unexperienced lawyers may in theory set up their own practices, insurance companies would consider such a practitioner a high risk and would therefore demand a compelling business case to grant the necessary insurance required to stay in practice (Rab, Jenkins and Yarrow, 2013).

We focus on symmetric equilibria so that each law firm has L/N minimal partner teams, but we disregard the integer problem.

Mergers almost exclusively involve only two firms at a time, and we therefore confine attention to two-firm mergers, as is also the standard in the merger literature. To study the incentives for splitups, we focus on symmetric splitups, where the current partners split up in two groups of equal size. When the bar association sets the strictest standard of disqualification, we find that:

Proposition 6. *Law firms have no incentives to merge if fixed costs are small. Rather, they have an incentive to break up until the market is maximally fragmented. Still, the law firms earn strictly positive profits also in the long run equilibrium. splitups reduce the clients' burden of representational conflicts.*

With a small fixed cost, most of the gain from a merger comes from the reduction in competition. Post-merger prices go up for both the insiders and the outsiders (Proposition 2). The loss from a merger is a reduction of the merging parties combined market share and their combined number of representations, i.e. $k(N-1) < 2 \cdot k(N)$. This loss is due to representational conflicts. Combining the two firms' client bases into one single larger client base creates *new* conflicts of interests within the merged entity. As a consequence, a fraction of the merging firms' clients will leave for competing firms. How many clients the merged entity will lose depends on the degree of market concentration. In a market with only three law firms, the merging firms' clients can only move to one outsider. As that firm will quickly congest, only few clients will actually leave the merged firm. In contrast, the clients' benefit from moving to another firm is larger with numerous outsiders. As it turns out, however, *the conflicts-of-interest effect dominates the anti-competitive effect, independent of the number of firms* ($N \leq L$). Thus, as shown in Appendix B.6, with a small fixed-cost saving, firms have no incentive for mergers. They will rather split up until all law firms have the minimal number of partners needed for efficient operations, i.e. $N = L$. Expressed differently, with small fixed costs, the industry will be maximally fragmented.[41]

When the number of minimal partner teams is large enough, or fixed costs are more substantial, the equilibrium market structure is not maximally fragmented, i.e. $N < L$. Then, firms do not engage in further splitups because it would be unprofitable to do so.

Law firms earn strictly positive profits in the long-run equilibrium, independent of whether the market is maximally fragmented or not (Appendix B.6). Clearly, the opportunity for firms to enter the market (by way of splitups) does limit equilibrium profits

[41] Actually, a single partner has stronger incentives to break out than a group of partners, suggesting that this is what should be observed in reality. However, when fixed costs are small, the incentives for symmetric splitups are sufficiently strong to guarantee that $N = L$. Then, our focus is not restrictive. There can be no splitups beyond this point. When fixed costs are not trivial, the focus on symmetric splitups underestimates the incentives for splitups. However, the spirit of our conclusions would be unaffected. In particular, the firms would make supra-normal profits in the long run.

somewhat, as every splitup leads to a lower price and to a lower market share for every firm. This limit on profit is not, however, as strict as the limit associated with *de novo* entry – which is the usual zero-profit condition. To see why, note that it is not profitable to enter by way of splitup, even if the new firm would earn a positive profit, i.e. even if $\pi(N+1) > F$, when

$$\pi(N+1) < F + \tfrac{1}{2} \cdot [\pi(N) - F]. \tag{17}$$

The second term of the right hand side of equation (17) shows that the loss of rents earned by the lawyers in their current firms is an opportunity cost of forming a new firm through splitup. Current rents therefore work as a barrier to entry.

Proposition 6 stands in sharp contrast to standard oligopoly models with price competition, where mergers are always profitable. That result hinges on the merged entity continuing to sell the "varieties" produced by the independent entities. In our model, merging law firms lose the "Chinese wall" that by construction surrounds the previously separate firms. This loss is reminiscent of a loss of one variety of the good in a regular market. As a result, the merged entity will be indistinguishable from, and equally large as, its non-merged competitors.[42]

Merger activity between US law firms offers supportive evidence for our insight. On a total and growing number of 400K-450K law firms in the period 2007-2020, the annual number of mergers and acquisitions in the US is pretty low, and varied from 39 to 115. Around 80% of the merger activity between law firms combines a small firm of 2 to 20 lawyers with another firm that has at least twice as many lawyers (Altman Weil, 2017, 2020). Only 13% of the mergers arises between firms that share the same city, 30% share the same state, whereas almost 60% is between different States. Mergers between two large firms are the exception and if they happen, they are mostly international. Most merger activity thus results from geographic extension into a separate market, so that the effect on the negative network externality is most probably negligible.

Indeed, large law firms, like *Dentons*, *Baker McKenzie* and others, with thousands of attorneys, have become big by acquiring many smaller law firms. These big law firms operate globally under a single brand name, though consist of separate legal (regional or local) entities, i.e. Swiss Vereins. This legal construction is meant to act as a substitute for maintaining Chinese walls between the different entities. By doing so, big firms want to reduce the mitigating effects on firm growth from representational conflicts of interest.

[42]The relevance of this mechanism, that mergers require firms to drop clients, is illustrated by the merger between Squire Sanders and Patton Boggs (see footnote 17 above). In fact, conflicts of interest may indeed hinder otherwise profitable mergers. For example, at the end of 2020, Nelson Mullins Riley & Scarborough LLP, a 800+ attorneys US law firm, announced its intentions to merge with Redgrave LLP to produce the largest and most comprehensive information law practice in the US. In the beginning of 2021, the parties called off the merger as they learned of conflicts of interest with key clients (Zach, 2021). Dropping clients as a merger remedy is difficult as lawyers owe a duty of loyalty towards every client (Daly, 2002).

Finally, negative network externalities may also explain why we observe a higher market concentration in the UK – the second largest country for legal services in the world – where disqualification rules have become less stringent (Loughrey, 2011). In particular, the ten largest law firms in the UK now represent about 40% of the total industry turnover (Statista, 2022), and the 60 largest law firms employ almost 30% of all solicitors with a practice certificate in England and Wales (The Law Society, 2018). Moreover, in contrast to the US, the total number of UK firms has gone down (by almost 10% since 2010) and firm size distribution has shifted significantly to the advantage of bigger firms.[43]

8 Client welfare

We now compare the outcome when a bar association imposes the strictest standard of disqualification to the outcome when the firms set no ethical standards for themselves. We focus on the clients' welfare. We will decompose client welfare into two parts, namely the price the clients pay and their burden of representational conflicts.

Price It is straightforward to verify that the price is higher when the bar association sets the ethical standards than it would be if the law firms could set them unilaterally. In particular, with the strictest standard of disqualification, $\widetilde{p}\,(1,0,N) > \tilde{p}\,(1,1,N)$. To gain some intuition, it is helpful to rewrite equation (7) as a modified inverse elasticity rule,

$$p_i - C_i = -\underbrace{\left(\frac{dk_i}{dm_i}\cdot\frac{m_i}{k_i}\right)^{-1}}_{\text{representations}}\cdot\underbrace{\left(\frac{dm_i}{dp_i}\cdot\frac{1}{m_i}\right)^{-1}}_{\text{customer base}}.$$

A price reduction increases the customer base, which in turn increases the number of representations. While the price elasticity of the customer base could be larger or smaller if the firms could set their own ethical standards,[44] the representations effect is decisive. As the firms would never recuse themselves, if they could set their own ethical standards, the number of representations would increase significantly for any increase in the customer base. As a result, the firms would have more incentives to reduce price.

[43] From 2010 to 2022, as a percentage of all law firms, sole practitioners have decreased from 37% to 19%, partnerships from 33% to 13%, limited liability partnerships slightly increased from 11% to 15%, whereas incorporated law companies have significantly increased from 17% to 52%.

[44] When the bar association imposes a strict standard of disqualification, switching to another firm due to a price reduction is costly for the client as it leads to lower coverage. The loss is $V - p$. When firms set the standards, switching to another firm due to a price reduction is costly for the client, as it leads to more harm. The loss is $\frac{1}{2}$. If the market is fragmented, price is low and the coverage effect is considerable. Then, the price elasticity is lower in the centralized case.

Clients' burden Lawyers agree to become their clients' representatives.[45] They are supposed to use their legal knowledge and superior information about a matter to act in the best interest of their clients, even when doing so is costly for themselves. It obliges each law firm engaging in dual representation to e.g. ensure that information is not leaked from one client to the other. It also obliges each law firm to recuse itself from dual representation whenever the harm from e.g. information leakages would exceed a reasonable level. We take this fiduciary duty to mean that the lawyers have a responsibility to set their ethical standards to minimize their clients' burden of representational conflicts. This will be our benchmark for assessing ethical conduct.

Recall that the equilibrium utility is given by $EU(\chi, \rho \mid p, N) = (V-p) - \theta(p, \chi, \rho) \cdot \frac{1}{N}$, where the second term is the clients' burden. As the burden depends on the price, we must adjust for the difference in price, in order to keep the decomposition. We do so by imposing the same price $\check{p}(N)$. Then, a switch to the ethical standards set by the firms changes client utility by

$$\begin{aligned} EU(1,1 \mid \check{p}(N), N) - EU(1,0 \mid \check{p}(N), N) &= [\theta(\check{p}(N), 1, 0) - \theta(\check{p}(N), 1, 1)] \cdot \tfrac{1}{N} \\ &= \left[(V - \check{p}(N)) - \tfrac{1}{2}\right] \cdot \tfrac{1}{N}. \end{aligned}$$

The first term, $V - \check{p}(N)$, represents that the clients will enjoy increased coverage. The second, that the clients suffer harm, which in expectation equals $\frac{1}{2}$. This measure is obviously contingent on the choice of a reference price $\check{p}(N)$. The reason is that the utility loss due to limited coverage depends on the price. Natural reference prices include $\check{p}(N) = \tilde{p}(1,1,N)$ and $\check{p}(N) = \widetilde{p}(1,0,N)$ or any price in between. Improved coverage dominates if the reference price is low, $\check{p}(N) \leq V - \frac{1}{2}$. This condition is met for N large enough, as $\lim_{N\to\infty} \check{p}(N) = C$ and $V - C > \frac{1}{2}$.[46]

Points (i) and (ii) summarize these insights. The proof of (iii) is relegated to Appendix B.5.

Proposition 7. *If every law firm were to decide on its own ethical standards, rather than having the strict standard of disqualification imposed by the bar association:*

(i) The clients would pay a lower price.

(ii) The clients' burden of representational conflicts would be lower, if the market is fragmented.

[45] Legal services are not provided under sales contracts. That is, the lawyers and their clients do not agree on complete descriptions of the services to be rendered. A possible interpretation is instead that legal services are provided under so-called seller-employment contracts (Bolton and Dewatripont, 2005). Such a contract gives the seller the authority to decide exactly what the services will consist of. It also gives the seller the opportunity to take these decisions to maximize his or her own utility. However, contracts for legal services are different, as the lawyers are supposed to protect their clients' best interests.

[46] In particular, using $\tilde{p}(1,1,N) = C + \frac{1}{N-1} \cdot \frac{1}{2}$ and $\check{p}(N) = \widetilde{p}(1,0,N) = V - \frac{(N-2)\cdot(N-1)}{(N-2)\cdot(N-1)+N} \cdot (V-C)$ proves the proposition. In fact, the burden would be reduced for all N if we use $\tilde{p}(1,1,N)$ as a reference price and for all $N \geq 4$ (or even $N \geq 3$ if $V - C$ is not too small) if we use $\widetilde{p}(1,0,N)$ as a reference price.

(iii) The clients' expected utility would be higher.

In short, the bar association causes higher prices but more importantly it also fails to serve the higher purpose of helping its members to meet their fiduciary duties. Its ethical standards hurt the clients, even if they would not increase the prices.[47]

Another benchmark is to set both the ethical standards and the prices to maximize client welfare, conditional on firms breaking even. Clearly, prices would be set equal to cost. More interestingly, there would be no binding standards of disqualification and firms would build maximum walls if $c < \frac{1}{2 \cdot N}$ and no walls otherwise. The intuition is clear. Since prices are low, the clients wish to be represented by their law firm even when there is dual representation. They would, however, benefit from Chinese walls in concentrated markets, since then a large share of representations are dual.

9 Concluding remarks

We leave many topics for future research. One key issue for understanding law firms is the effectiveness and credibility of Chinese walls. There are some reasons to suspect that Chinese walls are easier to organize in large law firms compared to smaller ones (New York Law Journal, 2016). There should for instance be a lower risk of at least accidental information leakages between lawyers working in physically separate offices. It may also be easier for a few large firms to build reputations for actually sticking to the rules of the walls (Ribstein, 1998). If so, our analysis underestimates the law firms' incentives to grow large, were they to set their ethical standards unilaterally.

Representational conflicts may actually be even more important than we acknowledge. For example, we have assumed that the harm from representational conflicts is relatively low. In particular, harm is low enough that dual representation is socially efficient in all matters, even absent Chinese walls ($H < 1 < V - C$). Moreover, in our analysis of unilateral adoption of ethical rules, we have focused on markets with many law firms, which implies that conflicts arise less often. We conjecture that, without these assumptions, individual firms would have more incentives to use both Chinese walls and to impose binding standards of disqualification. Our conclusion that the bar association sets a too strict standard of disqualification would remain intact, however.

It appears likely that representational conflicts also constitute an important determinant of law firm specialization, e.g. by area of law such as corporate law or competition

[47] In fact, one may even show that the optimal outcome from the clients' perspective is to have no ethical standards, if the market is sufficiently unconcentrated. In concentrated markets, the clients would be well-served by some form of ethical standards. In particular, the clients would be even better off with mandatory Chinese walls, if the market is concentrated and $c < \frac{1}{2}$. At the extreme, for a duopoly with $V - C = 1$, the optimal ethical standard is to either build Chinese walls or to set a binding standard of disqualification $\rho \in (0, 1)$. Moreover, the binding standard of disqualification would be preferred if the cost of building the wall is high.

law, by industry such as insurance or banking, or by representing either defendants or plaintiffs. A prevailing view of the field boundaries of law firms is that they are client centered. As clients have a demand for one-stop shopping this view suggests that law firms should provide a wide range of services. However, Garicano and Hubbard (2009) show that law firms tend to specialize. They explain specialization as a way to limit transaction costs within the firm: It may be difficult for lawyers with different specialization to communicate. An alternative, client centered, interpretation is that specialization could be a way to reduce conflicts of interests. Having more fields implies having more customers, adding more conflicts. This reasoning also suggests that there may be a tradeoff between scale and scope, when keeping firm size small to avoid representational conflicts. This interpretation is supported by Garicano's and Hubbard's finding that it is litigation-related services (where representational conflicts are more sensitive) that tend to be supplied by field-specialized law firms. Interestingly, however, while specialization may reduce representational conflicts of interests, it may also increase price competition, which in turn would actually favor increased concentration. To take these steps the model of the network structure would need to be enriched e.g. by adding different types of clients, or allowing clients to join more than one law firm ("multi-homing").[48]

Representational conflict of interests also arise in other corporate service industries (Shapiro, 2003). Examples include when a business strategy consultant, executive search consultant, accounting firm or advertising agency advises organizations that compete with one another. Similar conflicts of interests may also arise when media firms sell ads and even when two competitors share the same supplier of, say, raw materials. Similar to the legal industry, the auditing industry association, the Institute of Internal Auditors, prescribes rules on how to handle conflicts of interest and provides its members with standards and guidance with respect to integrity, objectivity, and confidentiality. These rules appear to be less strict, however, than those of the ABA. An interesting topic for future research is to explain this difference in strictness.

More generally, we believe that firms in a large variety of markets are plagued by negative network externalities among their customers. Firms with limited capacities may require longer waiting times when attracting more customers, just to mention one example. Our model of firm demand may provide a convenient work-horse, also for studying competition in such markets. While research on negative network externalities *at the level of the market* (such as traffic congestion) appears common, research on such negative network externalities *at the level of firms* appears utterly scarce.

[48]That law firms need to recuse themselves from representing some prospective clients also provokes strategic behavior among clients. That is, a client may seek representation from different law firms ("multi-homing") as a way to prevent them from representing matters against her. In response, law firms may ask their clients to do one-stop shopping (Van Houtte, 2015).

References

[1] Altman Weil, 2017, 10 Years of Law Firm Mergers & Acquisitions, a Special Report from Altman Weil MergerLine 2007-2016.

[2] Altman Weil, 2020, Law Firm Mergers & Acquisitions, Altman Weil MergerLine.

[3] American Bar Association, 2013, *A Legislative History: The Development of the ABA Model Rules of Professional Conduct, 1982-2013*, ABA Book Publishing, ISBN 9781627223850, pp. 951.

[4] American Bar Association, 2021, *Model Rules of Professional Conduct, 2021 Edition*, ABA Book Publishing, 1 August 2021.

[5] American Bar Foundation, 2005*, The U.S. Legal Profession in 2005, The Lawyer Statistical Report*, Chicago, Illinois.

[6] Ames and Gough, 2020, *Lawyers' Professional Liability Claims Trends: 2020.*

[7] Bernheim, B. Douglas, and Michael D. Whinston, 1986, Common agency, *Econometrica*, 53, 923-942.

[8] Bolton, Patrick, and Mathias Dewatripont, 2004, Contract theory, MIT press.

[9] Busby, Leonard A., and Howard J. Bashman, 1996, Conflicts of Interest in Large Law Firms, *Litigation*, 23(1), 25–71.

[10] Competition & Markets Authority, 2016, Legal services market study, Final report.

[11] Crawford, Vincent P. and Joel Sobel, 1982, Strategic Information Transmission. *Econometrica*, 50(6), 1431-1451.

[12] Daly, Mary, 2002, Don't get burned by a hot potato client, *The New York Legal Ethics Reporter,* October.

[13] Dewatripont, Mathias and Jean Tirole, 1999, Advocates, *Journal of Political Economy* 107(1), 1-39.

[14] Dewatripont, Mathias and Jean Tirole, 2020, The Morality of Markets and the Nature of Competition, *mimeo.*

[15] Epstein, Richard A., 1991, The Legal Regulation of Lawyers' Conflicts of Interest, *Fordham Law Review*, 60, 579-593.

[16] Gal-Or, Esther, 1985, Information Sharing in Oligopoly, *Econometrica*, 53, 2 (March), 329-343.

[17] Gal-Or, Esther, 1986, Information Transmission – Cournot and Bertrand Equilibria, *Review of Economic Studies*, LIII, 85-92.

[18] Garicano, Luis and Thomas N. Hubbard, 2009, Specialization, Firms, and Markets: The Division of Labor within and between Law Firms, *The Journal of Law, Economics, & Organization*, 25(2), 339-371.

[19] Griffiths-Baker, Janine E., 2002, *Serving Two Masters: Conflicts of Interest in the Modern Law Firm*. Bloomsbury Publishing.

[20] Griffiths-Baker, Janine E., and Nancy J. Moore, 2011, Regulating Conflicts of Interest in Global Law Firms: Peace in Our Time, *Fordham Law Review*, 80, 2541-2569.

[21] Hadfield, Gillian K., 2021, Legal Markets, *Journal of Economic Literature*, forthcoming.

[22] Harvard Law Review, 1981, Developments in the Law: Conflicts of Interest in the Legal Profession, *Harvard Law Rev*iew, 94(6), 1244-1503.

[23] Koppel, Nathan, 2010, Conflicts force Big Law Firm to Lose Clients, *Wall Street Journal*, April 7.

[24] Loughrey, Joan, 2011, Large Law Firms, Sophisticated Clients, and the Regulation of Conflicts of Interest in England and Wales, *Legal ethics*, 14(2), 215-238.

[25] National Law Journal 500 Survey, 2021, https://www.law.com/nationallawjournal/2021/06/23/the-nlj-500-our-2021-survey-of-the-nations-largest-law-firms.

[26] New York Law Journal, 2016, Big Firm/Small Firm–Size matters for Attorney Disqualification, 256, N° 32.

[27] North, Douglas, 1990, Institutions, Institutional Change and Economic Performance (Political Economy of Institutions and Decisions. Cambridge: Cambridge University Press.

[28] Rab, Suzanne; Cloda Jenkins and George Yarrow, 2013, Understanding barriers to entry, exit and changes to the structure of regulated legal firms, Final Report, December 2013.

[29] Ribstein, Larry E., 1998, Ethical Rules, Agency Costs, and Law Firm Structure, *Virginia Law Review*, Nov., 1998, Vol. 84, No. 8, Symposium: The Law and Economics of Lawyering, 1707-1759.

[30] Rosen, Sherwin, 1992, The market for lawyers. *The Journal of Law and Economics*, 35(2), 215-246.

[31] Sauer, Robert M., 1998, Job Mobility and the Market for Lawyers, *Journal of Political Economy*, 106(1), 147-171.

[32] Shapiro, Susan P., 2002, *Tangled loyalties: conflict of interest in legal practice*. University of Michigan Press.

[33] Shapiro, Susan P., 2003, Bushwhacking the Ethical High Road: Conflict of Interest in the Practice of Law and Real Life, *Law & Social Inquiry*, Winter, 2003, Vol. 28, No. 1 (Winter, 2003), pp. 87-268.

[34] Shleifer, Andrei. 2004. Does Competition Destroy Ethical Behavior?, *American Economic Review, Papers and Proceedings,* 94, 414-418.

[35] Steinberg, Marc I. and Timothy U. Sharpe, 1990, Attorney Conflicts of Interest: The Need for a Coherent Framework*, Notre Dame Law Review*, 66(1), 1-37.

[36] Terry, Laurel, 1988, Ethical Pitfalls and Malpractice Consequences of Law Firm Breakups, *Temple Law Review*, 61, 1055-112.

[37] The Law Society, 2018, Trends in the solicitors' profession. Annual Statistics Report 2017.

[38] The Law Society Gazette, 2019, Hundreds of new firms predicted to set up in 2020.

[39] University of Pennsylvania Law Review, 1980, The Chinese Wall Defense to Law-Firm Disqualification, *University of Pennsylvania Law Review*, 128, 677-715.

[40] Van Houtte, Johan, 2009, Conflicts of Interest in Law Firms in Belgium. *Legal Ethics*, 12(2), 207-228.

[41] Villas-Boas, J. Miguel, 1994, Sleeping with the Enemy: Should Competitors Share the Same Advertising Agency? *Marketing Science*, 13(2), 190-202.

[42] Vives, Xavier, 1984, Duopoly Information Equilibrium: Cournot and Bertrand, *Journal of Economic Theory*, 34, 71-94.

[43] Williamson, Oliver E., 1995, The Institutions and Governance of Economic Development and Reform, In Michael Bruno and Boris Pleskovic, eds., *Proceedings of the Annual World Bank Conference on Development Economics 1994*. Washington, D.C.: World Bank.

[44] Winston, Clifford, and Quentin Karpilow, 2016, "Should the US eliminate entry barriers to the practice of law? Perspectives shaped by industry deregulation." *American Economic Review, Papers and Proceedings,* 106(5) 171-76.

[45] Zach, Warren, 2021, Nelson Mullins, Redgrave Call Off Merger Due to Client Conflicts, The American Lawyer, https://www.law.com/americanlawyer.

A A micro-foundation for harm

Dewatripont and Tirole (1999) demonstrate that decisions by a central authority, such as a court, will be based on more information if all interest groups are represented by competing advocates than if a non-partisan procedure is used. In our model, this mechanism implies that both clients are harmed by dual representation *in expected terms*, under certain conditions.

Consider a buyer and a seller with a long-term contract to exchange a fixed amount of some good. The good has two possible designs, $d \in \{d_B, d_S\}$. The buyer's profit is denoted by $\pi_B(d, \theta)$ and the seller's profit is $\pi_S(d, \theta)$, where θ is the state of the world. One may think of d_B as high quality, favored by the buyer, and d_S as low quality, favored by the seller. That is $\pi_B(d_B, \theta) > \pi_B(d_S, \theta)$ and $\pi_S(d_S, \theta) > \pi_S(d_B, \theta)$ in all states of nature. Sometimes an unforeseen contingency arises. In particular, there are two (types of) unforeseen states, $\theta \in \{\theta_B, \theta_S\}$, with conditional probabilities p_B and $p_S = 1 - p_B$, such that design d_B maximizes the joint surplus in state θ_B while design d_S maximizes the joint surplus in state θ_S. That is, $\pi_B(d_i, \theta_i) + \pi_S(d_i, \theta_i) > \pi_B(d_j, \theta_i) + \pi_S(d_j, \theta_i)$ with $i \neq j$. The contract prescribes that the two parties should use the design maximizing the joint surplus, also in the event of an unforeseen contingency. But since the two parties have divergent interests, they need a court to help interpret the contract. Thus, it is for the court to select the design, $d \in \{d_B, d_S\}$, to maximize the joint surplus of the two parties. If the court makes the correct decision (prescribing the design maximizing the joint surplus) with probability q, the buyer's expected profit, given an unforeseen state of the world, is

$$E\pi_B = [p_B \cdot \pi_B(d_B, \theta_B) + p_S \cdot \pi_B(d_S, \theta_S)] - (1 - q) \cdot [p_B \cdot G_B - p_S \cdot L_B]$$

where $G_B = \pi_B(d_B, \theta_B) - \pi_B(d_S, \theta_B) > 0$ is is the buyer's gain from winning the case when being right (arguing for d_B in state θ_B) and $L_B = \pi_B(d_B, \theta_S) - \pi_B(d_S, \theta_S) > 0$ is the buyer's loss from losing the case when being wrong (arguing for d_B in state θ_S).

Now, we represent Dewatripont and Tirole's result by letting the court to make the correct decision with probability q_E when both parties have single representation (advocates) and with a smaller probability $q_I < q_E$ when there is dual representation (non-partisan). Thus, the harm resulting from dual representation is given by

$$H_B = (q_E - q_I) \cdot [p_B \cdot G_B - (1 - p_B) \cdot L_B].$$

Similarly, for the seller, the harm resulting from dual representation is

$$H_S = (q_E - q_I) \cdot [p_S \cdot G_S - (1 - p_S) \cdot L_S].$$

Thus, if the expressions in the two square brackets are positive, there is harm (in expected terms) to both parties from dual representation. In particular, if $G_i > L_i$ for both parties and if the probability of being right is relatively equal, both parties expect gains from more information and, reversely, harm from less. (Efficiency only guarantees that $G_i > L_j$. Thus, the expected harm is positive to at least one party, but not necessarily to both.)[49]

B Proofs

B.1 Demand

B.1.1 Proof of Lemma 2

The demand functions $m_i(p, \chi, A)$ are implicitly defined by the equilibrium conditions

$$\sum_{i=1}^{N} m_i = 1, \tag{18}$$

and

$$EU_i = (V - p_i) - \theta_i \cdot m_i = \psi, \qquad \forall i, \tag{19}$$

where ψ is the equilibrium level of utility, and equal across all firms. Assume that $\theta_i > 0$ for all firms, and that the firms' policies are sufficiently similar so that all firms have positive demand. Use equation (19) to solve for firm j's market share $m_j = \frac{(V-p_j)-\psi}{\theta_j}$. Recall that

$$\overline{\theta} = \left[\tfrac{1}{N} \cdot \sum_{j=1}^{N} \theta_j^{-1}\right]^{-1}. \tag{20}$$

Summing all the market shares $\sum_{j=1}^{N} m_j = \sum_{j=1}^{N} \frac{(V-p_j)-\psi}{\theta_j} = 1$, and solving for the common utility level $\psi = \frac{1}{N} \cdot \left[\sum_{j=1}^{N} \frac{(V-p_j)}{\theta_j} - 1\right] \cdot \overline{\theta}$. Substituting back into firm i's market share $m_i = \frac{V-p_i}{\theta_i} + \left[\frac{1}{N} - \frac{1}{N} \cdot \sum_{j=1}^{N} \frac{V-p_j}{\theta_j}\right] \cdot \frac{\overline{\theta}}{\theta_i}$, which may be rearranged to $m_i = \frac{1}{N} \cdot \left[1 + \sum_{j=1}^{N} \frac{p_j - p_i}{\theta_j}\right] \cdot \frac{\overline{\theta}}{\theta_i}$.

[49] It may be objected that the two parties could specify different prices depending on the design. Thus, let the buyer's profit be $\pi_B = U(d, \theta) - r$ and the seller's profit be $\pi_S = r - C(d, \theta)$. And let the agreed price be r_B or r_S depending on the design. The problem is that sometimes an unforeseen contingency arises in which the choice of the design has a major impact on both the production cost and on the user's value. Then, the two parties have diverging interests, that is the seller prefers (d_S, r_S) over (d_B, r_B) knowing that the cost difference is larger than the price difference, i.e. $C(d_B, \theta) - C(d_S, \theta) > r_B - r_S$, while the buyer prefers (d_B, r_B) knowing that the utility difference is larger than the price difference, i.e. $U(d_B, \theta) - U(d_S, \theta) > r_B - r_S$. Note that setting $r_B > r_S$ reduces the risk that the two parties will have diverging interests. But, increasing the price difference, e.g. by setting a very high r_B, implies that the buyer may go bankrupt in some states. Moreover, even if the conflict resolution mechanism with some probability is successful in determining whether $C(d_B, \theta) - C(d_S, \theta) > U(d_B, \theta) - U(d_S, \theta)$, this information is not sufficient for entrusting the court to determine the price freely. Thus, it will be r_B or r_S.

B.1.2 Demand derivatives when all firms have negative network externalities $-\theta_i < 0$

Lemma 8. *Assume $-\theta_j < 0$ for all firms j and consider a firm with $m_i \in (0,1)$. Then:*

$$\frac{dm_i}{dp_i} = -\frac{1}{\theta_i + \frac{1}{N-1}\cdot\overline{\theta}_{-i}} \cdot [1 - m_i \cdot (1-\rho_i)] < 0, \tag{21}$$

$$\frac{dm_i}{d\chi_i} = -\frac{1}{\theta_i + \frac{1}{N-1}\cdot\overline{\theta}_{-i}} \cdot m_i \cdot \tfrac{1}{2} \cdot \rho_i^2 \leq 0, \tag{22}$$

$$\frac{dm_i}{d\rho_i} = -\frac{1}{\theta_i + \frac{1}{N-1}\cdot\overline{\theta}_{-i}} \cdot m_i \cdot \left[-\left(\frac{V-p_i}{\chi_i}\right) + \rho_i\right] \cdot \chi_i, \tag{23}$$

where

$$\overline{\theta}_{-i} = \left[\frac{1}{N-1}\sum_{j\neq i}\theta_j^{-1}\right]^{-1},$$

is the (harmonic) mean externality for firm i's competitors. The effect of a change in firm j's strategy $s_j \in \{p_j, \chi_j, A_j\}$ on firm i's demand is given by

$$\frac{dm_i}{ds_j} = -\frac{dm_j}{ds_j} \cdot \frac{1}{N-1} \cdot \frac{\overline{\theta}_{-j}}{\theta_i}, \qquad \forall i \neq j. \tag{24}$$

Proof. To find the derivatives of demand with respect to changes in the firm's own strategy $s_i \in \{p_i, \chi_i, \rho_i\}$, we differentiate the equilibrium conditions (18)

$$\frac{dm_i}{ds_i} + \sum_{j\neq i}\frac{dm_j}{ds_i} = 0,$$

and (19) for the competitors,

$$\frac{dm_j}{ds_i} = -\frac{d\psi}{ds_i}\cdot\theta_j^{-1}, \qquad \forall j \neq i.$$

After substitution of the competitors' reactions into the equation (18), we have

$$\frac{d\psi}{ds_i} = \frac{dm_i}{ds_i}\cdot(N-1)^{-1}\cdot\overline{\theta}_{-i}.$$

First, consider a change in firm i's price. Then, differentiating equation (19) for firm i

$$-\left[1 + \frac{d\theta_i}{dp_i}\cdot m_i + \theta_i \cdot \frac{dm_i}{dp_i}\right] = \frac{d\psi}{dp_i}$$

and substituting for the effect on the equilibrium utility ψ, we find that

$$\frac{dm_i}{dp_i} = -m_i \cdot \frac{N-1}{(N-1)\cdot\theta_i + \overline{\theta}_{-i}} \cdot \left[\frac{1}{m_i} + \frac{d\theta_i}{dp_i}\right].$$

Using $\frac{d\theta_i}{dp_i} = -(1-\rho_i)$,

$$\frac{dm_i}{dp_i} = -\frac{1}{\theta_i + \frac{1}{N-1}\cdot\overline{\theta}_{-i}} \cdot [1 - m_i \cdot (1-\rho_i)] < 0,$$

where the inequality comes from $m_i < 1$ and $\rho_i \geq 0$.

Second, consider a change in firm i's Chinese wall. Then, differentiating equation 19 for firm i

$$-\theta_i \cdot \frac{dm_i}{d\chi_i} - \frac{d\theta_i}{d\chi_i} \cdot m_i = \frac{d\psi}{d\chi_i}$$

and thus

$$\frac{dm_i}{d\chi_i} = -\frac{(N-1)}{(N-1)\cdot\theta_i + \overline{\theta}_{-i}} \cdot m_i \cdot \frac{d\theta_i}{d\chi_i}$$

where $\frac{d\theta_i}{d\chi_i} = \frac{1}{2}\cdot\rho_i^2$.

Third, consider a change in firm i's standard of disqualification. Then, differentiating equation 19 for firm i

$$-\theta_i \cdot \frac{dm_i}{d\rho_i} - \frac{d\theta_i}{d\rho_i} \cdot m_i = \frac{d\psi}{d\rho_i},$$

i.e.

$$\frac{dm_i}{d\rho_i} = -\frac{1}{\theta_i + \frac{1}{N-1}\cdot\overline{\theta}_{-i}} \cdot m_i \cdot \frac{d\theta_i}{d\rho_i}.$$

where $\frac{d\theta_i}{d\rho_i} = -(V - p_i) + \rho_i \cdot \chi_i$.

Finally, to find the derivatives of firm i's demand with respect to changes in another firm's strategy $s_j \in \{p_j, \chi_j, A_j\}$, we differentiate the equilibrium conditions 18 and 19 so that

$$\frac{dm_j}{ds_j} + \sum_{k\neq j} \frac{dm_k}{ds_j} = 0,$$

$$\frac{dm_k}{ds_j} = -\frac{d\psi}{ds_j}\cdot\theta_k^{-1}, \qquad \forall k \neq j.$$

Substituting the competitors' reactions into the equation summing all market shares to one, we have

$$\frac{d\psi}{ds_j} = \frac{dm_j}{ds_j}\cdot(N-1)^{-1}\cdot\overline{\theta}_{-j}.$$

After substitution

$$\frac{dm_i}{ds_j} = -\frac{dm_j}{ds_j}\cdot\frac{1}{N-1}\cdot\frac{\overline{\theta}_{-j}}{\theta_i}, \qquad \forall i \neq j.$$

□

B.1.3 Demand when some firms do not have negative network externalities ($-\theta_i = 0$)

Consider now the possibility that at least one firm i does not have negative network externalities, i.e. $\theta_i = (V - p_i) \cdot (1 - \rho_i) + \left(\frac{1}{2} \cdot \rho_i \cdot \chi_i\right) \cdot \rho_i = 0$, which happens only if firm i adopt the strictest possible standard of disqualification $\rho_i = 0$ and charge the maximum price $p_i = V$. When selecting a firm without network externalities, a client's utility equals zero independent of the firm's market share. We assume that all firms without network externalities have the same market share. Then, numbering firms in order of increasing θ_i:

Lemma 9. *Assume that $\theta_i = 0$ and $m_i > 0$ for $i = 1, ..., N'$ where $1 \leq N' \leq N$. Then, for any firm with $\theta_i > 0$ and positive market share*

$$m_i(p, \chi, \rho) = \frac{V - p_i}{\theta_i}, \tag{25}$$

and any firm with $\theta_i = 0$

$$m_i(p, \chi, \rho) = \frac{1}{N'} \cdot \left[1 - \sum_{j=N'+1}^{N} \frac{V - p_j}{\theta_j}\right]. \tag{26}$$

To prove this, recall that the clients' utility when selecting a firm with $\theta_i = 0$ is given by $EU_i = (V - p_i) - \theta(p_i, \chi_i, \rho_i) \cdot m_i = \psi = 0$. Then, for any firm with $\theta_i > 0$, use the equilibrium condition $(V - p_i) - \theta_i \cdot m_i = \psi = 0$ to solve for the market share. The market share of a firm without network externalities follows from the symmetry assumption and that the sum of market shares equals one.

Demand derivatives Assume that $\theta_i = 0$ for $i = 1, ..., N'$ and $1 \leq N' \leq N$. First recall that any firm with $\theta_i = 0$ has market share

$$m_i(p, \chi, \rho) = \left[1 - \sum_{j=N'+1}^{N} \frac{V - p_j}{\theta_j}\right] \cdot \frac{1}{N'}.$$

Note that such a firm's market share does not depend on the firm's own policy. Second recall that any firm with $\theta_i > 0$ has market share

$$m_i(p, \chi, \rho) = \frac{V - p_i}{\theta_i} = \frac{V - p_i}{(V - p_i) \cdot (1 - \rho_i) + EH_i \cdot \rho_i} \geq 0.$$

Note that such a firm has

$$\frac{dm_i(p, \chi, \rho)}{dp_i} = -\frac{EH_i \cdot \rho_i}{\theta_i^2} \leq 0,$$

with strict inequality if $m_i \in (0,1)$ i.e. $\rho_i > 0$,

$$\frac{dm_i(p,\chi,\rho)}{d\rho_i} = \frac{V-p_i}{\theta_i^2} \cdot \left[\frac{V-p_i}{\chi_i} - \rho_i\right] \cdot \chi_i,$$

$$\frac{dm_i(p,\chi,\rho)}{d\chi_i} = -\frac{V-p_i}{\theta_i^2} \cdot \tfrac{1}{2} \cdot \rho_i^2 \leq 0.$$

Also note the marginal value of the Chinese wall is well defined also when $\rho_i = 0$, as $\frac{dm_i(p,\chi,\rho)}{d\chi_i} / \frac{dm_i(p,\chi,\rho)}{dp_i} = \frac{V-p_i}{\chi_i}$.

B.2 Prices

We start out by defining the price function $\widetilde{p}(\chi,\rho,N)$ and showing that it is a stable equilibrium for all $N \geq 2$ and $\rho \geq 0$. To do so, we first demonstrate that if $N \geq 3$ or $\rho > 0$ (excluding only $N = 2$ and $\rho = 0$), then $\widetilde{p}(\chi,\rho,N)$ is a symmetric equilibrium. Second, we demonstrate if $\rho = 0$, then $p = V$ is a symmetric equilibrium. Third, noting that there are two equilibria whenever $N \geq 3$ and $\rho = 0$, we demonstrate that $p = \widetilde{p}(\chi,0,N)$ is a stable equilibrium, while $p = V$ is not stable. Only for $N = 2$ and $\rho = 0$, is $p = V$ stable. Since $\widetilde{p}(\chi,0,2) = V$, we conclude that $\widetilde{p}(\chi,\rho,N)$ is a stable equilibrium also when $N = 2$ and $\rho = 0$.

We conclude the proof with comparative statics and demonstrating that $\widetilde{p}(\chi,\rho,N) \leq V - E\{H\}$, implying that the clients demand for dual representations.

Definition of $\widetilde{p}(\chi,\rho,N)$ and its relation to network externalities For any (χ,ρ) and $N \geq 2$, let

$$\widetilde{p}(\chi,\rho,N) = \lambda \cdot C(\chi) + (1-\lambda) \cdot V + \eta \cdot E\{H\},$$

where

$$\lambda(\rho,N) = \frac{(N-2+2\cdot\rho)\cdot(N-1)}{(N-2+2\cdot\rho)\cdot(N-1)+N\cdot(1-\rho)} \in [0,1],$$

$$\eta(\rho,N) = \frac{N\cdot\rho}{(N-2+2\cdot\rho)\cdot(N-1)+N\cdot(1-\rho)} \geq 0,$$

and

$$E\{H\} = \frac{1}{2}\cdot\rho\cdot\chi.$$

Lemma 10. *Assume that all firms set χ, ρ and $\widetilde{p}(\chi,\rho,N)$.*

If $N = 2$ and $\rho = 0$, then $\widetilde{p}(\chi,\rho,N) = V$ and $\theta = (V-p)\cdot(1-\rho) + \frac{1}{2}\cdot\chi\cdot\rho^2 = 0$.

If $N \geq 3$ or $\rho > 0$, then $\widetilde{p}(\chi,\rho,N) < V$ and $\theta = (V-p)\cdot(1-\rho) + \frac{1}{2}\cdot\chi\cdot\rho^2 > 0$.

Proof. Substituting for $\lambda(\rho,N)$, $\eta(\rho,N)$ and $E\{H\}$, the price can be rewritten as

$$\widetilde{p}(\chi,\rho,N) = V - \frac{(N-2+2\cdot\rho)\cdot(N-1)\cdot(V-C(\chi)) - N\cdot\rho\cdot\frac{1}{2}\cdot\rho\cdot\chi}{(N-2+2\cdot\rho)\cdot(N-1)+N\cdot(1-\rho)}.$$

Clearly, $\widetilde{p}(\chi, 0, 2) = V$.

To prove the second point, note that $\widetilde{p}(\chi, \rho, N) < V$ if and only if

$$(N - 2 + 2 \cdot \rho) \cdot (N - 1) \cdot (V - C(\chi)) > N \cdot \rho \cdot \frac{1}{2} \cdot \rho \cdot \chi.$$

As, by assumption, $N - 2 + 2 \cdot \rho > 0$, the condition can be rewritten as

$$V - C(\chi) > \frac{N \cdot \frac{1}{2} \cdot \rho^2}{(N - 2 + 2 \cdot \rho) \cdot (N - 1) \cdot} \cdot \chi.$$

This condition is satisfied as $V - C(\chi) \geq \chi$ and

$$\frac{N \cdot \frac{1}{2} \cdot \rho^2}{(N - 2 + 2 \cdot \rho) \cdot (N - 1)} < 1,$$

i.e.

$$\frac{1}{2} \cdot \rho^2 < (N - 2 + 2 \cdot \rho) \cdot \frac{N - 1}{N}.$$

The latter condition is satisfied as the right hand side is minimized when $N = 2$, in which case the condition reduces to $\rho < 2$. Note that $\theta > 0$ as $\chi > 0$. □

1. Equilibrium with negative network externalities

Lemma 11. *Let all firms have the same ethical standards, ρ and χ. Assume that $\rho > 0$. Then, $\widetilde{p}(\chi, \rho, N)$ is a symmetric equilibrium price for all $N \geq 2$.*

Proof. As $\rho > 0$, every firm has a negative network externality, independent of what price it charges, i.e. $-\theta_i = -\left[(V - p_i) \cdot (1 - \rho) + \frac{1}{2} \cdot \chi \cdot \rho^2\right] < 0$, as $\chi > 0$. Thus, firm i's market share $m_i > 0$ is given by 2, which is continuously differentiable in price, with $\frac{dm_i}{dp_i} < 0$.

There exists some highest price $p_i^{max} \leq V$ such that firm i has a strictly positive market share, $m_i > 0$ and thus $k_i > 0$, if and only if $p_i < p_i^{max}$. The maximum price is given by $p_i^{max} = \min\left\{\frac{1}{N-1} \cdot \left[1 + \sum_{j \neq i} \frac{p_j}{\theta_j}\right] \cdot \overline{\theta}_{-i}, V\right\}$. When all other firms set the same price $p' \geq C(\chi)$ they have the same externality $\theta' > 0$ and

$$p_i^{max} = \min\left\{p' + \frac{1}{N - 1} \cdot \theta', V\right\} > C(\chi).$$

Thus, firm i will set a price $p_i \in (C(\chi), p_i^{max})$ to both have a strictly positive markup and a strictly positive demand.

Firm i's profit is given by $\pi_i = (p_i - C(\chi_i)) \cdot k_i$ which is continuously differentiable over the interval $(C(\chi), p_i^{max})$. The optimal price is characterized by the first-order condition, $\frac{d\pi_i}{dp_i} = k_i + (p_i - C_i) \cdot \frac{dk_i}{dm_i} \cdot \frac{dm_i}{dp_i} = 0$. Since $k_i > 0$ and $\frac{dm_i}{dp_i} < 0$, the firm will set a price such that $\frac{dk_i}{dm_i} = 2 \cdot \left[\frac{1}{2} - (1 - \rho_i) \cdot m_i\right] > 0$. Substituting for $\frac{dk_i}{dm_i}$ and $\frac{dm_i}{dp_i}$, the first-order

condition can be solved for price, $p_i = C(\chi_i) + \frac{\theta_i + \frac{1}{N-1}\cdot\overline{\theta}_{-i}}{\frac{1}{m_i} - 2 + 2\cdot\rho_i}$. In a symmetric equilibrium, $p = C(\chi) + \frac{N}{(N-2+2\cdot\rho)\cdot(N-1)} \cdot \theta$ where $\theta = (V-p)\cdot(1-\rho) + \left(\frac{1}{2}\cdot\rho\cdot\chi\right)\cdot\rho$. Solving for the price gives $\widetilde{p}(\chi,\rho,N)$ as stated in the Lemma. □

Lemma 12. *Let all firms have the same ethical standards, ρ and χ. Assume that $\rho = 0$. Then, $\widetilde{p}(\chi,\rho,N)$ is a symmetric equilibrium price for all $N \geq 3$.*

Proof. Assume that all firms $j \neq i$ charge the same price $p' \in [C(\chi), V)$, so that they all have negative network externalities, i.e. $\theta' = (V-p')\cdot(1-\rho) + \left(\frac{1}{2}\cdot\rho\cdot\chi\right)\cdot\rho = V - p' > 0$. Then, whenever $p_i < V$, firm i's market share $m_i > 0$ is given by 2, which is continuously differentiable in price, with $\frac{dm_i}{dp_i} < 0$. By the same reasoning as above (when $\rho > 0$) firm i's optimal price is characterized by the first-order condition. Thus, $\tilde{p}(\chi,0,N)$ is a symmetric equilibrium price. As $\tilde{p}(\chi,0,N) < V$ whenever $N \geq 3$, there are indeed negative network externalities. □

2. Equilibrium with no network externalities

Lemma 13. *Let all firms have the same ethical standards, $\rho = 0$ and χ. Then, $p = V$ is a symmetric equilibrium price.*

Proof. Assume that all other firms charge the same price $p_j = V$. Then, there are no network externalities, i.e. $\theta_j = 0$, as $\rho = 0$. If firm i charges the same price, $m_i = \frac{1}{N}$ and its profit is given by $\pi_i = (V-C)\cdot k_i = (V-C)\cdot\frac{1}{N}\cdot\left[1-\frac{1}{N}\right] > 0$. If firm i deviates to set $p_i < V$, it will corner the market

$$m_i = \frac{V-p_i}{\theta_i} = \frac{V-p_i}{V-p_i} = 1.$$

But, then, the deviating firm has to recuse itself in every dual representation, as $\rho = 0$. Thus, the deviation is not profitable. In particular, $k_i = m_i\cdot[1-m_i] = 0$ and the profit is $\pi_i = 0$. Thus, $p_i = V$ is a symmetric equilibrium for all N. □

3. Equilibrium selection by stability Above we have shown that $\widetilde{p}(\chi,\rho,N)$ is an equilibrium if $N \geq 3$ or $\rho > 0$ and that $p = V$ is an equilibrium if $\rho = 0$. However, since $\widetilde{p}(\chi,0,2) = V$, we conclude that $\widetilde{p}(\chi,\rho,N)$ is an equilibrium for all $N \geq 2$ and $\rho \geq 0$. Moreover, we have two different equilibria whenever $\rho = 0$ and $N \geq 3$. To select one, we use the following stability criterion.

Definition 1. Let (p,χ,ρ) be a symmetric equilibrium. Let $\tilde{\pi}_i(p_i,p')$ be firm i's profit when all firms set ρ and χ, firm i charges p_i and all other firms charge the same price $p' \in (C,V)$ which is near the equilibrium price p. We say that the equilibrium is *stable* if $p' < p \Rightarrow \frac{d\tilde{\pi}_i(p',p')}{dp_i} > 0$ and $p' > p \Rightarrow \frac{d\tilde{\pi}_i(p',p')}{dp_i} < 0$. Note that the derivative is well-defined since all prices are below V so that there are negative network externalities.

Lemma 14. *Let all firms have the same ethical standards, $\rho = 0$ and χ. Then, $p = \widetilde{p}(\chi, 0, N)$ is stable for all N, while $p = V$ is only stable for $N = 2$.*

Proof. To prove that $\tilde{p}(\chi, 0, N)$ is stable, let $\tilde{\pi}_i(p_i, p')$ be firm i's profit when all firms set ρ and χ, firm i charges p_i and all other firms charge the same price $p' \in [C(\chi), V)$. Firm i's first-derivative is

$$\frac{d\tilde{\pi}_i(p_i, p')}{dp_i} = k_i + (p_i - C(\chi)) \cdot \frac{dk_i}{dm_i} \cdot \frac{dm_i}{dp_i}.$$

Using $k_i = m_i \cdot [1 - m_i]$ and $\frac{dk_i}{dm_i} = [1 - 2 \cdot m_i]$, and evaluate at $p_i = p'$,

$$\frac{d\pi_i(p', p')}{dp_i} = \frac{N \cdot (V - p') - (N - 2) \cdot (N - 1) \cdot (p' - C(\chi))}{(V - p')} \cdot \frac{N - 1}{N^3}.$$

Note that $\frac{d\tilde{\pi}_i(p', p')}{dp_i} \geq 0$ if and only if $p' \leq \widetilde{p}(\chi, 0, N)$. Expressed differently, if all other firms set $p' < (>) \widetilde{p}(\chi, 0, N)$, then each individual firm has an incentive to increase (decrease) its price slightly towards $\widetilde{p}(\chi, 0, N)$.

Also note that $\widetilde{p}(\chi, 0, N) < V$ if and only if $N \geq 3$. When $N = 2$, both firms have an incentive to increase price whenever $p_1 = p_2 < V$.

However, since $V > \widetilde{p}(\chi, 0, N)$ when $N > 2$, a small deviation by the competitors to $p_j = V - \varepsilon > \widetilde{p}(\chi, 0, N)$ would induce firm i to charge an even lower price. The equilibrium is not stable. □

Comparative statics

Lemma 15. *The equilibrium markup is strictly positive. It is strictly decreasing in the number of firms and tends to zero as the number of firms increases without bound. The markup is strictly decreasing in the height of the Chinese wall (decreasing in χ) and strictly increasing in the strictness of the standard of disqualification (decreasing in ρ).*

Proof. The markup is given by

$$\widetilde{p}(\rho, \chi, N) - C(\chi) = \frac{1}{(N - 2 + 2 \cdot \rho) \cdot \frac{N-1}{N} + (1 - \rho)} \cdot [(1 - \rho) \cdot (V - C(\chi)) + \rho \cdot E\{H\}]. \tag{27}$$

First, note that $\widetilde{p}(\rho, \chi, N) - C(\chi) > 0$. To see this, note that since $N - 2 + 2 \cdot \rho > 0$, the first factor is well-defined and strictly positive. The second factor, within square brackets, is also strictly positive as $E\{H\} > 0$ unless $\rho = 0$ and $V - C(\chi) > 0$. Second, note that $\widetilde{p}(\rho, \chi, N) - C(\chi)$ is decreasing in N since $(N - 2 + 2 \cdot \rho) \cdot \frac{N-1}{N}$ is increasing in N. Moreover, $\lim_{N \to \infty} [p(\rho, \chi, N) - C(\chi)] = 0$. Third, the markup is decreasing in the height of the Chinese wall (increasing in χ) since

$$\frac{\partial(\widetilde{p}(\rho, \chi, N) - C(\chi))}{\partial \chi} = (1 - \rho) \cdot c + \tfrac{1}{2} \cdot \rho^2 > 0.$$

Fourth, the markup is increasing in the standard of disqualification (decreasing in ρ) since

$$\frac{\partial\left(\text{denominator}\right)}{\partial\rho}=2\cdot\frac{N-1}{N}-1\geq 0$$

and

$$\frac{\partial\left(\text{numerator}\right)}{\partial\rho}=-\left(V-C\left(\chi\right)\right)+\rho\cdot\chi\leq 0$$

where the inequality follows from $V-C\left(\chi\right)\geq\chi\geq\chi\cdot\rho$. □

Clients demand dual representations

Lemma 16. *Clients benefit from dual representations, as* $\widetilde{p}\left(\chi,\rho,N\right)\leq V-E\left\{H\right\}$.

Proof. This condition is fulfilled if

$$\widetilde{p}\left(\chi,\rho,N\right)=\left(1-\lambda\right)\cdot V+\lambda\cdot C\left(\chi\right)+\eta\cdot E\left\{H\right\}\leq V-E\left\{H\right\}$$

i.e.

$$\lambda\cdot\left(V-C\left(\chi\right)\right)\geq\left(\eta+1\right)\cdot E\left\{H\right\},$$

i.e.

$$V-C\left(\chi\right)\geq\left[1+\frac{1}{\left(N-2+2\cdot\rho\right)\cdot\frac{N-1}{N}}\right]\cdot\tfrac{1}{2}\cdot\chi\cdot\rho.$$

The right hand side is maximized by setting $N=2$. Then

$$V-C\left(\chi\right)\geq\left(\rho+1\right)\cdot\tfrac{1}{2}\cdot\chi.$$

which is fulfilled since $V-C\left(\chi\right)\geq\chi\geq\left(\rho+1\right)\cdot\frac{1}{2}\cdot\chi$. □

B.3 Ethical standards

B.3.1 Negative network externalities in symmetric equilibrium

This section proves that, when firms set their ethical standards unilaterally, there are negative network externalities in a symmetric equilibrium (Lemma 3). In order to have a symmetric equilibrium without network externalities, all firms must impose the maximally strict standard of disqualification $\rho=0$ *and* charge the maximum price $p=V$. If the firms refuse dual representations, they would build no wall, $\chi=1$. Thus, suppose all firms set $\left(p_i,\chi_i,\rho_i\right)=\left(V,1,0\right)$ so that $\theta=\left(V-p\right)\cdot\left(1-\rho\right)+\frac{1}{2}\cdot\chi\cdot\rho^2=0$. Then, firm i will have market share $m_i=\frac{1}{N}$ and profit $\pi_i=\left(V-C\right)\cdot\frac{N-1}{N^2}$. If firm i deviates to $p_i<V$ or $\rho_i>0$, it will have market share $m_i=\frac{V-p_i}{\theta_i}$. We consider deviations in price and standard of disqualification that keeps the firm's demand constant, i.e. $m_i=\frac{V-p_i}{\left(V-p_i\right)\cdot\left(1-\rho_i\right)+\frac{1}{2}\cdot\rho_i^2}=\frac{1}{N}$,

meaning that the firm's deviation in price as a function of its deviation in standard is given by

$$p_i = V - \frac{\frac{1}{2} \cdot \rho_i^2}{N - 1 + \rho_i}.$$

Notice that a softer standard (higher ρ_i) requires a lower price, since

$$\frac{dp_i}{d\rho_i} = -\frac{N - 1 + \frac{1}{2} \cdot \rho_i}{(N - 1 + \rho_i)^2} \cdot \rho_i \leq 0.$$

However, at $\rho_i = 0$, the derivative is zero. Thus, a small deviation in the standard of disqualification will only have a second-order effect on price. The deviating firm i's profit is given by $\pi_i = (p_i - C(\chi_i)) \cdot k_i$ where $k_i = m_i \cdot [(1 - m_i) + \rho_i \cdot m_i]$, thus $\pi_i = (p_i - C(\chi_i)) \cdot [N - 1 + \rho_i] \cdot \left(\frac{1}{N^2}\right)$. It follows that $\frac{d\pi_i}{d\rho_i} = (p_i - C(\chi_i)) \cdot \left(\frac{1}{N^2}\right) > 0$ at $\rho_i = 0$.

B.3.2 Standard of disqualification

To prove Lemma (4), we substitute the demand-derivatives, i.e. $\frac{dm_i/d\rho_i}{dm_i/dp_i} = \frac{m_i \cdot \left[-\left(\frac{V - p_i}{\chi_i}\right) + \rho_i\right] \cdot \chi_i}{[1 - m_i \cdot (1 - \rho_i)]}$, and $\frac{\partial k_i}{\partial \rho_i} \cdot \frac{1}{k_i} = \frac{m_i^2}{m_i - (1 - \rho_i) \cdot m_i^2}$ into equation (13) to get

$$-\frac{d\pi_i}{d\rho_i} \cdot \frac{1}{k_i} = \frac{m_i \cdot \left[-\left(\frac{V - p_i}{\chi_i}\right) + \rho_i\right] \cdot \chi_i}{[1 - m_i \cdot (1 - \rho_i)]} - (p_i - C(\chi_i)) \cdot \frac{m_i}{1 - (1 - \rho_i) \cdot m_i}.$$

After simplification

$$-\frac{d\pi_i}{d\rho_i} \cdot \frac{1}{k_i} = \left[\rho_i - \frac{V - C(\chi_i)}{\chi_i}\right] \cdot \frac{\chi_i}{1 - (1 - \rho_i) \cdot m_i} \cdot m_i. \tag{28}$$

It follows that an interior solution is characterized by $\rho_i = \frac{V - C(\chi_i)}{\chi_i}$ and that $\rho_i = 1$ if $\frac{V - C(\chi_i)}{\chi_i} \geq 1$.

B.3.3 Chinese wall

To prove Lemma 5 and in particular that the marginal value of the Chinese wall is increasing in the wall (lower χ_i), note that $\frac{d\left(\frac{dm_i/d\chi_i}{dm_i/dp_i}\right)}{d(m_i)} = \frac{\rho_i^2}{[1 + m_i \cdot (1 - \rho_i)]^2} \cdot \frac{1}{2} \geq 0$ and that the firm's client base is increasing in the height of the Chinese wall (lower χ_i). As the marginal cost is constant (or not too convex), the firm either builds a wall or does not build it at all.

B.3.4 Non-existence of equilibrium

Lemma 17. *If $\underline{\chi}$ is small enough, at most one firm builds a maximum Chinese wall.*

The proof has two steps. First, we note that if two or more firms build perfect Chinese walls ($\chi_i = \underline{\chi} \to 0$), they compete à la Bertrand (assuming $\rho_j = 1$ for all firms). Their

prices are then equal to marginal cost ($p_i \to C + c$) and they earn no profits ($\pi_i \to 0$). To see this, note that firm i's equilibrium price (equation 8) is characterized by

$$p_i = C(\chi_i) + m_i \cdot \left[\theta_i + \frac{1}{N-1} \cdot \overline{\theta}_{-i}\right],$$

where all firms have $\theta_j = (V - p_j) \cdot (1 - \rho_j) + \left(\frac{1}{2} \cdot \rho_j \cdot \chi_j\right) \cdot \rho_j = \frac{1}{2} \cdot \chi_j$. Let $N_0 \geq 1$ be the number of competitors that build a perfect wall so that $N - 1 - N_0$ is the number of firms that build no wall. Then

$$\overline{\theta}_{-i} = \left[\frac{1}{N-1} \sum_{j \neq i} \theta_j^{-1}\right]^{-1} = \frac{1}{2} \cdot \frac{(N-1) \cdot \underline{\chi}}{N_0 + (N - 1 - N_0) \cdot \underline{\chi}},$$

with $\lim_{\underline{\chi} \to 0} \overline{\theta}_{-i} = 0$ whenever $N_0 \geq 1$. Moreover,

$$p_i = C(\chi_i) + m_i \cdot \left[\chi_i + \frac{\underline{\chi}}{N_0 + (N - 1 - N_0) \cdot \underline{\chi}}\right] \cdot \frac{1}{2},$$

so that $\lim_{\underline{\chi} \to 0} (p_i - C_i) = 0$ if also i builds a perfect wall.

Second, to prove the lemma, assume the opposite, that there is an equilibrium in which two or more firms build a perfect Chinese wall and have positive sales. Then, they charge price equal to (actually close to) marginal cost, $p_i = C + c$. In these firms, there are no negative network externalities, and clients have expected utility

$$EU_i = V - C - c.$$

As we consider an equilibrium, any firm pursuing some other policy (with positive sales) offers the same expected utility to its clients. Assume now that one of the firms with a Chinese wall, called j, deviates and removes the wall and charges a low but strictly positive markup $p_j = C + \varepsilon$.Firm j will then attract a client base m_j defined by

$$EU_j = \left[V - C - \varepsilon - \tfrac{1}{2} \cdot m_j\right] = V - C - c = EU_i,$$

i.e. $m_j = 2 \cdot (c - \varepsilon) > 0$. Since both the market share and the markup are positive, the deviation is profitable, which is a contradiction.

B.3.5 Equilibrium with no ethical standards

This section proves that there exists an equilibrium with no ethical standards (Proposition 3). In particular, $c \geq \underline{c}(N) \equiv \left(\frac{1}{N-1}\right) \cdot \left[1 - \sqrt{\frac{1}{N}}\right]$ is necessary and sufficient to ensure that it is unprofitable for a firm to deviate by building a Chinese wall and adjusting (increasing) its price.

Through out this proof, we let all competitors $j \neq i$ be passive ($\rho_j = 1$ and $\chi_j = 1$) and charge the equilibrium price, $\tilde{p}(1,1,N) = C + \frac{1}{N-1} \cdot \frac{1}{2}$, implying $\theta_j = \frac{1}{2}$ and $\overline{\theta}_{-i} = \frac{1}{2}$.

When firm i deviates in its Chinese wall, we allow it to adjust its price optimally. Firm i's optimal markup is given by equation (8), i.e. $p_i - C(\chi_i) = \frac{\theta_i + \frac{1}{N-1} \cdot \overline{\theta}_{-i}}{\frac{1}{m_i} - 2 + 2 \cdot \rho_i}$. Using $\overline{\theta}_{-i} = \frac{1}{2}$ and $\theta_i = (V - p_i) \cdot (1 - \rho_i) + \left(\frac{1}{2} \cdot \rho_i \cdot \chi_i\right) \cdot \rho_i$ and solving for the markup,

$$p_i - C(\chi_i) = \frac{(V - C(\chi_i)) \cdot (1 - \rho_i) + \frac{1}{2} \cdot \rho_i^2 \cdot \chi_i + \frac{1}{N-1} \cdot \frac{1}{2}}{1 - (1 - \rho_i) \cdot m_i} \cdot m_i.$$

Firm i's market share is given by by equation (5), i.e. $m_i(p, \chi, \rho) = \frac{1}{N} \cdot \left[1 + \sum_{j=1}^{N} \frac{p_j - p_i}{\theta_j}\right] \cdot \frac{\overline{\theta}}{\theta_i}$. Using the equilibrium price and $\overline{\theta} = \left[\frac{1}{N} \cdot \sum_{j=1}^{N} \theta_j^{-1}\right]^{-1}$,

$$m_i = \frac{\frac{1}{N-1} - c \cdot (1 - \chi_i) - (p_i - C(\chi_i))}{\left[(V - C(\chi_i)) \cdot (1 - \rho_i) + \frac{1}{2} \cdot \rho_i^2 \cdot \chi_i + \frac{1}{N-1} \cdot \frac{1}{2}\right] - (p_i - C(\chi_i)) \cdot (1 - \rho_i)}.$$

As the market share and the optimal price are interdependent, solving the system of two equations yields

$$m_i = \frac{1}{2} \cdot \frac{\frac{1}{N-1} - c \cdot (1 - \chi_i)}{(V - C(\chi_i)) \cdot (1 - \rho_i) + \frac{1}{2} \cdot \rho_i^2 \cdot \chi_i + \frac{1}{N-1} \cdot \frac{1}{2}},$$

and

$$p_i - C(\chi_i) = \frac{\left[(V - C(\chi_i)) \cdot (1 - \rho_i) + \frac{1}{2} \cdot \rho_i^2 \cdot \chi_i + \frac{1}{N-1} \cdot \frac{1}{2}\right] \cdot \left[\frac{1}{N-1} - c \cdot (1 - \chi_i)\right]}{\left[(V - C(\chi_i)) \cdot (1 - \rho_i) + \frac{1}{2} \cdot \rho_i^2 \cdot \chi_i + \frac{1}{N-1} \cdot \frac{1}{2}\right] - (1 - \rho_i) \cdot \frac{1}{2} \cdot \left[\frac{1}{N-1} - c \cdot (1 - \chi_i)\right]} \cdot \frac{1}{2}.$$

Firm i's profit is given by $\pi_i = (p_i - C(\chi_i)) \cdot m_i \cdot [1 - (1 - \rho_i) \cdot m_i]$. As $\rho_i = 1$,

$$m_i = \frac{\frac{1}{N-1} - c \cdot (1 - \chi_i)}{\chi_i + \frac{1}{N-1}},$$

and

$$p_i - C(\chi_i) = \frac{1}{2} \cdot \left[\frac{1}{N-1} - c \cdot (1 - \chi_i)\right].$$

One may note that a higher wall (lower χ_i) increases the market-share (whenever $c < \frac{1}{N}$) but makes the firm charge a lower markup.

To earn a profit, the firm must set $\frac{1}{N-1} - c \cdot (1 - \chi_i) \geq 0$, i.e.

$$\chi_i \geq 1 - \frac{1}{N-1} \cdot \frac{1}{c}.$$

The profit is given by

$$\pi_i = \frac{1}{2} \cdot c^2 \cdot \frac{\left[\chi_i - \left(1 - \frac{1}{N-1} \cdot \frac{1}{c}\right)\right]^2}{\chi_i + \frac{1}{N-1}}.$$

The first derivative is given by

$$\frac{\partial \pi_i}{\partial \chi_i} = \frac{\left[\chi_i - \left(1 - \frac{1}{N-1} \cdot \frac{1}{c}\right)\right]}{\left[\chi_i + \frac{1}{N-1}\right]^2} \cdot \left[\chi_i + 2 \cdot \frac{1}{N-1} + \left(1 - \frac{1}{N-1} \cdot \frac{1}{c}\right)\right]$$

The second derivative is given by

$$\frac{\partial^2 \pi_i}{\partial \chi_i^2} = \frac{2}{\left[\chi_i + \frac{1}{N-1}\right]^3} \left(1 + \frac{1}{N-1} - \frac{1}{N-1} \cdot \frac{1}{c}\right)^2 > 0,$$

so that the optimal decision is either to build a perfect Chinese wall or none at all.

First, consider that the lower extreme is $\chi_i = 1 - \frac{1}{N-1} \cdot \frac{1}{c} > 0$. As the lower option gives zero profit while $\chi_i = 1$ gives a positive profit, the firm sets $\chi_i = 1$. Second, consider that $0 \geq 1 - \frac{1}{N-1} \cdot \frac{1}{c}$, i.e. $\frac{1}{N-1} \geq c$, so that the lower extreme is $\chi_i = 0$. Then, no wall is better if

$$\frac{1}{2} \cdot c^2 \cdot \frac{\left[1 - \left(1 - \frac{1}{N-1} \cdot \frac{1}{c}\right)\right]^2}{1 + \frac{1}{N-1}} \geq \frac{1}{2} \cdot c^2 \cdot \frac{\left[0 - \left(1 - \frac{1}{N-1} \cdot \frac{1}{c}\right)\right]^2}{0 + \frac{1}{N-1}}.$$

Rewriting the inequality to ensure that both terms that are raised to the power of two are positive,

$$\left[\frac{1}{N-1} \cdot \frac{1}{c}\right]^2 \geq N \left[\frac{1}{N-1} \cdot \frac{1}{c} - 1\right]^2.$$

Thus

$$\left[1 - \frac{1}{\sqrt{N}}\right] \frac{1}{N-1} \leq c.$$

Thus, a deviation is unprofitable if $c > \frac{1}{N-1}$ or $c < \frac{1}{N-1}$ and $\frac{1}{N-1}\left[1 - \frac{1}{\sqrt{N}}\right] \leq c$. Thus, the binding constraint is $\frac{1}{N-1}\left[1 - \frac{1}{\sqrt{N}}\right] \leq c$.

B.4 The bar association sets the standards

This section proves proposition 4, that the bar association imposes a binding standard of disqualification ($\rho < 1$) but does not prescribe Chinese walls ($\chi = 1$). Moreover, it sets $\rho = 0$ if $V - C \geq \frac{7}{6}$. Recall that the aggregate profit is given by $N \cdot \pi = [\widetilde{p}(\chi, \rho, N) - C(\chi)] \cdot [N - 1 + \rho] \cdot \frac{1}{N}$. Substituting for the equilibrium price,

$$N \cdot \pi = \frac{\left[(1-\rho) \cdot (V - C(\chi)) + \frac{1}{2} \cdot \chi \cdot \rho^2\right] \cdot (N - 1 + \rho)}{[N - 2 + 2 \cdot \rho] \cdot (N-1) + N \cdot (1-\rho)}$$

Removing a Chinese wall both saves on cost and increases the markup, i.e.

$$\frac{\partial (N \cdot \pi)}{\partial \chi} = \frac{\left[(1-\rho) \cdot c + \frac{1}{2} \cdot \rho^2\right] \cdot [N - (1-\rho)]}{[N - 2 \cdot (1-\rho)] \cdot (N-1) + N \cdot (1-\rho)} > 0.$$

Substitute for the optimal wall ($\chi = 1$), aggregate profit is

$$N \cdot \pi(\rho) = \frac{\left[(1-\rho)\cdot(V-C) + \frac{1}{2}\cdot\rho^2\right]\cdot(N-1+\rho)}{[N-2+2\cdot\rho]\cdot(N-1)+N\cdot(1-\rho)}. \tag{29}$$

Note that $N \cdot \pi(0) = \frac{(V-C)\cdot(N-1)}{(N-2)\cdot(N-1)+N}$ and $N \cdot \pi(1) = \frac{\frac{1}{2}}{N-1}$. Thus, $\rho = 0$ is always preferred to $\rho = 1$ since $V - C \geq \frac{1}{2} \cdot \frac{(N-2)\cdot(N-1)+N}{(N-1)^2}$ as $V - C \geq 1$ and $\frac{1}{2} \cdot \frac{(N-2)\cdot(N-1)+N}{(N-1)^2} \leq 1$. This proves that the bar association will always impose a binding standard of disqualification.

However, it may be that some interior value $\rho \in (0,1)$ is even better.

First, consider the case when $N = 2$. Then

$$N \cdot \pi(\rho) = \frac{\left[(1-\rho)\cdot(V-C) + \frac{1}{2}\cdot\rho^2\right]\cdot(1+\rho)}{2}$$

with first derivative

$$N \cdot \pi'(\rho) = \rho \cdot \frac{-2\cdot(V-C)+1+\frac{3}{2}\cdot\rho}{2}$$

and second derivative

$$N \cdot \pi''(\rho) = \frac{-2\cdot(V-C)+1+3\cdot\rho}{2}$$

so that $N \cdot \pi'(\rho) = 0$ when $\rho = 0$ and $\rho = \frac{4}{3}\cdot\left(V - C - \frac{1}{2}\right)$ where the latter is a minimum since,

$$N \cdot \pi''\left(\frac{4}{3}\cdot\left(V-C-\frac{1}{2}\right)\right) = \frac{[2\cdot(V-C)-1]}{2} > 0.$$

Next, we consider the case when $N \geq 3$. Then, $\pi'(\rho) \leq 0$ for $\rho \in (0,1)$. To prove this, we write 29 as $N \cdot \pi(\rho) = \frac{\text{numerator}(\rho)}{\text{denominator}(\rho)}$ and note that

$$\frac{\partial \text{denominator}}{\partial \rho} = N - 2 > 0$$

and

$$\frac{\partial \text{numerator}(\rho)}{\partial \rho} = -(N-2)\cdot(V-C) - [2\cdot(V-C)-(N-1)]\cdot\rho + \frac{3}{2}\cdot\rho^2.$$

Note

$$\frac{\partial \text{numerator}(0)}{\partial \rho} = -(V-C)\cdot(N-2) < 0$$

$$\frac{\partial \text{numerator}(1)}{\partial \rho} = -[(V-C)-1]\cdot N + \frac{1}{2} \leq 0 \Longleftrightarrow 1 + \frac{1}{2\cdot N} \leq (V-C).$$

The latter condition is satisfied for all $N \geq 3$ if $\frac{7}{6} \leq (V-C)$. Then, as numerator(ρ) is quadratic and convex, $\frac{\partial \text{numerator}(\rho)}{\partial \rho} \leq 0$ for $\rho \in (0,1)$.

B.5 Client Welfare

To prove proposition 7, take $N \geq 2$ as given and let firms set their prices. Then client welfare equals

$$EU(\chi, \rho) = (V - \widetilde{p}) - \left[(V - \widetilde{p}) \cdot (1 - \rho) + \left(\tfrac{1}{2} \cdot \rho \cdot \chi\right) \cdot \rho\right] \cdot \frac{1}{N},$$

where $\widetilde{p}(\chi, \rho, N) = \lambda \cdot C(\chi) + (1 - \lambda) \cdot V + \eta \cdot E\{H\}$. Thus

$$EU(\chi, \rho) \cdot N = \lambda \cdot [N - 1 + \rho] \cdot (V - C - c) + \left[\left(\lambda \cdot c - \eta \cdot \tfrac{1}{2} \cdot \rho\right) \cdot (N - 1 + \rho) - \tfrac{1}{2} \cdot \rho^2\right] \cdot \chi.$$

With decentralized decisions, $\rho = 1$ and $\chi = 1$. Then, $\lambda = 1$ and $\eta = \frac{1}{N-1}$ and

$$EU(1, 1) = (V - C) - \tfrac{1}{2} \cdot \tfrac{2 \cdot N - 1}{N \cdot (N-1)}.$$

With centralized decision, $\rho = 0$ and $\chi = 1$. Then, $\lambda = \frac{(N-2) \cdot (N-1)}{(N-2) \cdot (N-1) + N}$ and $\eta = 0$ and

$$EU(1, 0) = \frac{(N - 2) \cdot (N - 1)}{(N - 2) \cdot (N - 1) + N} \cdot \frac{N - 1}{N} \cdot (V - C).$$

Decentralized decisions are preferred if $EU(1, 1) > EU(1, 0)$, i.e.

$$V - C > \frac{1}{2} \cdot \frac{2 \cdot N - 1}{(N - 1)} \cdot \frac{[(N - 2) \cdot (N - 1) + N]}{[(N - 2) \cdot (N - 1) + N] \cdot N - (N - 2) \cdot (N - 1)^2}.$$

It is straightforward to show that the right-hand side is lower than one, for any number of firms. Thus, since $V - C \geq 1$ the inequality is satisfied for all $N \geq 2$.

Consider now the possibility that $\rho = 1$ and $\chi = 0$. Then, $\lambda = 1$ and $\eta = \frac{1}{N-1}$ and $EU(0, 1) = V - C - c$. Note that $EU(0, 1) > EU(1, 1)$ if $V - C - c > (V - C) - \frac{1}{2} \cdot \frac{2 \cdot N - 1}{N \cdot (N-1)}$ i.e. $c < \frac{1}{2} \cdot \frac{2 \cdot N - 1}{N \cdot (N-1)}$. The right hand side falls from $\frac{3}{4}$ towards zero as N increases from 2 without bound. Thus, if $c < \frac{1}{2}$, the inequality is satisfied for N sufficiently small.

B.6 Market structure

To prove Proposition 6, we first derive the equilibrium market structure. Next, we characterize the firms' profits in long-run equilibrium. Recall that that there exists a fixed number of experienced partners that can be divided into L minimal partner teams, which implies that the number of firms is bounded by $N \leq L$.

Mergers In a market with N law firms, two firms will not merge their operations if their combined profit per partner team is reduced, i.e. $\frac{\pi(N-1) - F}{\frac{2 \cdot L}{N}} \leq \frac{\pi(N) - F}{\frac{L}{N}}$, which simplifies to the standard condition

$$\frac{\pi(N - 1) - F}{2} \leq \pi(N) - F.$$

Recall that, in a symmetric equilibrium, each firm earns a profit $\pi = (\widetilde{p}(\chi, \rho, N) - C(\chi)) \cdot k$, where $k = \frac{1}{N} \cdot \left[\left(1 - \frac{1}{N}\right) + \rho \cdot \frac{1}{N}\right]$. When the ethical standards are decided by the bar association, there is the strictest standard of disqualification and no Chinese walls, so that $\widetilde{p}(0, 1, N) - C = \frac{N}{(N-2)\cdot(N-1)+N} \cdot (V - C)$ and $k = \frac{1}{N} \cdot \left(1 - \frac{1}{N}\right)$. Then, each of the N firms earns a profit

$$\pi(N) = (V - C) \cdot \frac{1}{N} \cdot \frac{N-1}{(N-1)^2 + 1}. \tag{30}$$

Thus, a two-firm merger is unprofitable if

$$2 \cdot \frac{1}{N} \cdot \frac{N-1}{(N-1)^2 + 1} - \frac{1}{N-1} \cdot \frac{N-2}{(N-2)^2 + 1} \geq \frac{F}{V - C}. \tag{31}$$

Plotting the left hand side reveals the following conclusions. If $\frac{F}{V-C} > 0$ is small, then there exists some N^M such that two-firm mergers are profitable if and only if $N > N^M$.

Splitups Similarly, a symmetric splitup is unprofitable if $\pi(N+1) - F \leq \frac{1}{2} \cdot [\pi(N) - F]$, i.e. if

$$2 \cdot \frac{1}{N+1} \cdot \frac{N}{N^2 + 1} - \frac{1}{N} \cdot \frac{N-1}{(N-1)^2 + 1} \leq \frac{F}{V - C}. \tag{32}$$

Plotting the left hand side reveals the following conclusions. If $\frac{F}{V-C} > 0$ is small, then there exists some $N^B < N^M$ such that symmetric splitups are profitable if and only if $N < N^B$.

Equilibrium market structure Disregarding the constraint on the number of available minimal partner teams, i.e. $N \leq L$, the firms' incentives for mergers and splitups are summarized in the table, where $+$ indicates that a merger or splitup is profitable. With sufficiently many minimal partner teams, L, any number of firms $N \in \left[N^B, N^M\right]$

	$N < N^B$	$N = N^B$	$N^B < N < N^M$	$N = N^M$	$N^M < N$
Merger	-	-	-	0	$+$
Splitup	$+$	0	-	-	-

would thus be stable.

However, plotting the left hand sides of inequalities (32) and (31) reveals that N^B and $N^M > N^B$ increase monotonically without bound, as $\frac{F}{V-C} \to 0$. It follows that for $\frac{F}{V-C}$ small enough, $L < N^B < N^M$. Thus, as $N < L$, firms have an incentive to break up independent of the current market structure. It follows that, with small fixed costs $\frac{F}{V-C}$, there will be $N = L$ law firms in long-run equilibrium.

Equilibrium profit Let $N^* \leq L$ be the equilibrium market structure. A two-firm merger is not profitable in a market with N^* firms if $\pi(N^* - 1) - F \leq 2 \cdot [\pi(N^*) - F]$.

This condition is equivalent to

$$\pi\left(N^{*}\right)-F\geq\pi\left(N^{*}-1\right)-\pi\left(N^{*}\right)>0,$$

where the last inequality is due to the fact that $\pi\left(N-1\right)>\pi\left(N\right)$ for all N. Thus, long-run equilibrium profits must be strictly positive.

C Firm Size distribution

It follows from Proposition 6 that if we could observe prices and sales, one could empirically infer what the negative network externality is, as $\frac{p_i-\bar{p}}{m_i-\bar{m}}=\theta\cdot\frac{n}{n-1}$. But, while the number of lawyers may be a good proxy for sales, we do not have data on prices. A possible substitute is to use data on revenues instead. The firm's equilibrium revenues, $R_i=p_i\cdot m_i$, expressed in terms of devations from the mean are given by

$$R_i-\bar{R}=\left[\frac{1}{\theta}\cdot\tfrac{n-1}{2\cdot n-1}\cdot c+\tfrac{2}{2\cdot n-1}+\frac{1}{\theta}\cdot\tfrac{n\cdot(n-1)}{(2\cdot n-1)^{2}}\cdot\left(V_i-\bar{V}\right)\right]\cdot\left(V_i-\bar{V}\right),\tag{33}$$

where the first factor within brackets is strictly positive for all firms (as $\theta\geq\underline{\theta}$).

Clearly, equation 16 defines sales as a strictly increasing and differentiable function $h\left(\cdot\right)$ of the stochastic variable quality, $m_i-\bar{m}=h\left(V_i-\bar{V}\right)$. Likewise equation 33 defines revenue as a strictly increasing and differentiable function $g\left(\cdot\right)$ of quality, $R_i-\bar{R}=g\left(V_i-\bar{V}\right)$. It is therefore straightforward to compute the density function for sales and revenues. In particular, if quality is distributed with probability density $f_V\left(V_i-\overline{V}\right)$, the probability density function for sales is given by

$$f_m\left(m_i-\bar{m}\right)=f_V\left(h^{-1}\left(m_i-\bar{m}\right)\right)\cdot\frac{dh^{-1}\left(m_i-\bar{m}\right)}{d\left(m_i-\bar{m}\right)}$$

where

$$\frac{dh^{-1}\left(m_i-\bar{m}\right)}{d\left(m_i-\bar{m}\right)}=\theta\cdot\frac{2\cdot n-1}{n-1}.$$

Thus, for a given distribution of quality, the distribution of sales is more concentrated the more important the negative network externality is. In particular, the variance of sales is lower. Similarly, the probability density function for revenue is given by

$$f_R\left(R_i-\bar{R}\right)=f_V\left(g^{-1}\left(R_i-\bar{R}\right)\right)\cdot\frac{dg^{-1}\left(R_i-\bar{R}\right)}{d\left(R_i-\bar{R}\right)}$$

where

$$\frac{dg^{-1}\left(R_i-\bar{R}\right)}{d\left(R_i-\bar{R}\right)}=\frac{1}{\frac{1}{\theta}\cdot\frac{n-1}{2\cdot n-1}\cdot c+\frac{2}{2\cdot n-1}+2\cdot\frac{1}{\theta}\cdot\frac{n\cdot(n-1)}{(2\cdot n-1)^{2}}\cdot\left(V_i-\overline{V}\right)}.$$

For a uniform quality distribution, f_V is a constant and the revenue distribution f_R is skewed to the right. The distribution of revenues is less skewed the more pronounced the negative network externality is. In the limit, as $\theta \to \infty$, also the revenue distribution is uniform. More generally, the revenue-distribution is more skewed to the right (or less skewed to the left) than the underlying quality distribution. This difference is decreasing in the negative network externality. In sum:

Proposition 8. *All else equal, the larger the negative network externalities are, we find that (1) the size distribution of firms as measured by sales has a lower variance, and (2) the size distribution of firms as measured by revenues is less skewed to the right.*

Therefore, comparing the properties of the size distribution of firms across different markets may be informative about differences in the importance of negative network externalities across these markets. The conclusions are at best indicative, as also the underlying quality distribution may differ.[50]

[50]While these conclusions are derived here in a model with negative network externalities, similar conclusions would be derived in other oligopoly models where competition is affected by other factors than network externalities.