Adjudication Institutions*

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Abstract

Disputes can be resolved in various ways. I study *adjudication*, the application of scarce resources by expert third-parties to determine who is to blame for disputes. Adjudication services can be provided in a competitive market or by the state. When adjudicators behave strategically, for-profit adjudicators may bias their decisions in favor of some clients in order to attract those clients' future business. State adjudicators can be more impartial because their pay does not depend on whether clients seek out their services. The state's advantage in making impartial rulings explains why the state is the dominant provider of adjudication in most modern societies.

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1 Introduction

Economic relationships do not always proceed smoothly. Relationships may result in bad outcomes, and it may not be clear even to the parties involved in the relationship who is to blame for these bad outcomes, or if they are simply due to bad luck. Disputes over who is to blame for bad outcomes in the past may disrupt future cooperation or even lead to violence or other destructive forms of conflict. In order to avoid the disruption caused by disputes, relationship partners are willing to pay for *adjudication*, that is, costly investigation to determine who is to blame for past bad outcomes. Some disputes are resolved through *for-profit adjudication*, under which entrepreneurial adjudicators provide their services for a fee in a competitive market. In most modern societies, however, the most common form of adjudication is *state adjudication*, under which the state appoints adjudicators and pays their salaries out of taxes.

At first glance, it is not obvious why the state provides adjudication. As emphasized by Landes and Posner (1979), adjudication is mostly a private good, since in most disputes the outcome of the dispute matters only for the disputants themselves. Thus, arguments for state provision based on public goods or externalities mostly do not apply to adjudication. It is also not sufficient to argue that the state is necessary to enforce penalties imposed by adjudicators. Investigation of who is to blame for disputes and enforcement of penalties can be separated, and in fact these functions are separated in most private adjudication markets. For example, under U.S. law state courts enforce the rulings of private arbitrators. An economist applying the first welfare theorem might conclude that all or nearly all adjudication services should be provided in a competitive market, and that any involvement of the state in adjudication should be limited to enforcing private adjudicators' rulings.[1]

In this paper, I argue that for-profit adjudication is subject to a form of corruption that I refer to as capture, and that the problem of capture explains why most adjudication services in modern societies are provided by the state. Capture occurs when a for-profit adjudicator promises to rule in favor of a disputant in exchange for the disputant bringing the adjudicator more dispute resolution business. Capture is distinct from bribery, which occurs when an adjudicator promises to rule in favor of a disputant in exchange for an illicit cash payment. Both for-profit and state adjudicators can be bribed, and so the problem of bribery cannot explain why state adjudication is chosen instead of for-profit adjudication. However, state adjudication can prevent capture. Because the state can raise money through taxes, the state can pay adjudicators fixed salaries regardless of how many disputants seek out their services. These low-powered incentives for state adjudicators imply that state adjudicators have no incentive to become captured. State adjudicators' immunity from capture explains why adjudication is often provided by the state.

[1] Reasoning along these lines, Friedman (1989) and Huemer (2013) argue that all adjudication should be provided privately.

For a better understanding of the problem of capture, it is helpful to consider the incentives of adjudicators in more detail. In my model, a dispute referred to an adjudicator can have one of three possible outcomes. The adjudicator can rule that either the first or the second disputant acted in a socially harmful way, in which case the guilty party pays damages to the innocent party. Alternatively, the adjudicator can rule that neither disputant behaved badly, and that the dispute was caused by bad luck, in which case neither disputant pays damages to the other. Because disputants know their own actions, and because adjudicators in my model never make mistakes, an innocent disputant who is judged to be guilty knows that the adjudicator must have been corrupted. Adjudicators thus have very strong incentives not to rule that innocent disputants are guilty, and I assume that this kind of corruption does not occur. However, an adjudicator may be able to get away with entering into a corrupt deal to rule that a guilty disputant is innocent, because the disputant's partner cannot be sure whether this ruling was the result of a corrupt deal or whether the dispute really was caused by bad luck. Adjudication is viable only if adjudicators can be deterred from these kinds of corrupt deals.

Because corruption through bribery requires an illicit payment from one disputant to the adjudicator, corruption through bribery can be deterred by detecting illicit payments to adjudicators and punishing adjudicators who accept illicit payments. Corruption through capture does not require illicit payments to adjudicators, and so corruption through capture is harder to detect and deter than corruption through bribery. The main way to detect corruption through capture is by examining adjudicators' record of past decisions. An adjudicator who frequently rules that disputes are due to bad luck may have been captured. Notice, however, that a ruling that a dispute is due to bad luck is strong evidence of capture only if the frequency of socially harmful behavior is relatively high. If socially harmful behavior is rare, then most disputes really are due to bad luck. In this case, adjudicator capture is very hard to detect. Therefore, adjudicator capture can be deterred only if the frequency of socially harmful behavior is sufficiently high. Because state adjudicators are immune from capture, state adjudication can increase welfare by reducing the frequency of socially harmful behavior below the minimum level sustainable under for-profit adjudication. On the other hand, the low-powered incentives that make state adjudicators immune from capture also make state adjudicators less likely to exert effort. The tradeoff between adjudicator effort and the frequency of socially harmful behavior determines whether for-profit or state adjudication is optimal.

I provide two sets of evidence supporting my theory. In section 2, I discuss evidence from studies of private arbitration markets in modern, developed societies. I show that clients of private arbitrators use arbitrators' past decisions to judge their impartiality, as predicted by my model. I also provide an example of capture, and I discuss how the incentive structures of state judges help to prevent capture. In section 4, I discuss historical evidence from the development of the English judicial system in the era of Magna Carta. I show that before 1154, adjudication in England was supplied primarily through a competitive, entrepreneurial market. Bias in the judicial system led to unrest, which led to the development of a centralized, state judicial system that gave low-powered incentives to adjudicators. I argue that this history is consistent with the main ideas of my model.

In the literature, the most closely related papers are Milgrom, North and Weingast (1990) and Dixit (2003) (henceforth MNWD). These papers also study third-party intermediaries who help to govern bilateral relationships and who may be corruptible. However, there are several differences between MNWD and my paper. First, the role of the intermediary in MNWD is different from the role of the intermediary in my paper. In MNWD, each party in a relationship directly observes the actions his partner takes within the relationship. The intermediary is needed to broadcast this information to the larger society. In my model, each party in a relationship only receives an imperfect signal of what action his partner has taken. The intermediary is necessary to inform the relationship parties themselves what has occurred, and the intermediary does not broadcast information to the larger society. Second, MNWD consider the possibility that the intermediary may be bribed, but they do not consider the possibility that the intermediary may be captured. Third, the way in which disputants detect intermediary corruption is different in MNWD than in my paper. In Milgrom, North and Weingast, a disputant observes intermediary corruption directly when the intermediary solicits a bribe. In Dixit, a disputant may also infer that the intermediary has been corrupted if the disputant's partner behaves badly in a relationship. However, neither Milgrom, North, and Weingast nor Dixit consider the possibility that disputants may use the past decisions of the intermediary to infer corruption.

Levy (2005) and Klement and Neeman (2013) construct models of adjudicator behavior in which adjudicators care about their reputations, as determined by their record of past decisions. In these papers, the probability distribution over the correct outcome of a dispute is given exogenously. In contrast, in my model the probability that a disputant is really guilty is an equilibrium outcome, which is determined endogenously and which may change depending on whether disputes are resolved through for-profit or state adjudication.

Finally, my paper is related to the literature on repeated games. In my model, relationship partners who do not have access to adjudication may have to use inefficient punishments in order to provide correct incentives, as in Green and Porter (1984). Providing adjudication increases welfare by giving relationship partners better signals of who is to blame for bad outcomes, as in Kandori (1992) and Fudenberg, Leving and Maskin (1994). The innovation in my model is that acquiring these improved signals is costly. I then show that agents who have access to costly adjudication can achieve more efficient cooperation by using private strategies. Private strategies in repeated games are studied in a literature pioneered by Piccione (2002) and Ely and Valimaki (2002) and culminating in the folk theorem recently proved by Sugaya (2015); within this literature my approach is most closely related to Mailath, Matthews, and Sekiguchi (2002) and Kandori and Obara (2006). I consider an environment in which Sugaya's folk theorem does not apply, so that it is not possible to achieve efficient cooperation in isolated bilateral relationships even by using private strategies. However, when relationship partners are allowed to use private strategies and also have access to a third-party adjudicator, it is possible to achieve efficient cooperation. This result helps to define the limits of cooperation in bilateral relationships and explains why third-party governance may be valuable even when all possible strategies to support cooperation are allowed.

2 Institutional background

Before presenting my model, I provide some examples of for-profit and state adjudication, the problem of capture, and ways in which adjudication markets are organized to reduce the problem of capture through reputational incentives.

2.1 For-profit adjudication and the problem of capture

Dispute resolution through for-profit, private arbitration is common in most international commercial transactions (Dezalay and Garth 1996), as well as domestic transactions in areas such as the cotton industry (Bernstein 2001) and in employment disputes (Colvin 2011). Arbitrators receive a fee from one or both parties to the dispute. In exchange, the arbitrator determines who, if anyone, is to blame for the dispute and awards damages to be paid by the guilty party to the innocent party. As discussed in the introduction, in countries where arbitration is common arbitral awards of damages are typically enforced by national courts.

Fees for arbitrators can be substantial. For example, Dezalay and Garth describe the career of Pierre Lalive, a prominent arbitrator who is famous among other things for receiving a fee of 4.7 million British pounds (approxmiately 7.1 million U.S. dollars) for resolving a single dispute in 1993 (Dezalay and Garth 1996, p. 11).[2] Arbitrators compete for these fees. For example, the premier forum for international commercial arbitration is the International Chamber of Commerce (ICC) in Paris, but in recent years competitors such as the London Court of International Arbitration have forced the ICC to change its behavior. Dezalay and Garth (1996, p. 44) write, "The ICC, for example, has been forced to adjust its general fee schedule downward to attract business clients."

Despite their incentives to compete for fees, arbitrators are supposed to ignore these incentives when deciding how to resolve disputes. Pierre Lalive argues that arbitrators must be independent, and he defines arbitrator independence as follows: "Independence implies the courage to displease, the absence of any desire, especially for the arbitrator appointed

[2] For comparison, the salary of the chief justice of the U.S. Supreme Court in 1993 was $171,500.

by a party, to be appointed once again as an arbitrator." (Lalive 1991) The main way to determine whether an arbitrator is independent according to this definition is to analyze the arbitrator's past decisions. Bloom and Cavanaugh (1996) study the process of choosing an arbitrator through conversations with industry participants and a review of industry literature. They report that impartiality is the most important criterion for choosing an arbitrator, and that "this characteristic is usually judged by considering an arbitrator's prior decisions." (Bloom and Cavanaugh 1996, p. 411) A related desirable characteristic in an arbitrator is consistency, and Bloom and Cavanaugh define a consistent arbitrator to be an arbitrator who has reached similar conclusions in cases which are similar on the merits. Again, Bloom and Cavanaugh report that consistency is judged "by subjectively reviewing an arbitrator's previous awards to see that similar decisions were reached in similar cases." (Bloom and Cavanaugh p. 411). In markets in which potential disputants fall into clearly differentiated categories, it is possible to evaluate arbitrator independence by examining the rate at which the arbitrator decides in favor of each category of disputant. Dilts and Deitsch (1989) argue that the rate at which employment arbitrators decide in favor of labor or management can be used as a tool for evaluating arbitrator independence.

The failure of arbitrator independence and impartiality may lead to capture. An example of capture comes from the credit card arbitration industry. In the United States, most credit card contracts contain a clause under which credit card customers agree to resolve any disputes not through the courts but instead through one of two private arbitration organizations, either the American Arbitration Association or JAMS (formerly Judicial Arbitration and Mediation Services, now known only by the acronym). Fees for dispute resolution services are the primary source of revenue for these organizations.

Until 2009, there was a third credit card arbitration organization, the National Arbitration Forum (NAF). In 2006, the NAF was bought by a private equity firm, which then pursued a strategy of expanding NAF's business through aggressive marketing to banks and debt collection agencies. The marketing campaigns promised friendly treatment from NAF arbitrators. Berner and Grow (2008) describe NAF marketing materials promising banks "a marked increase in recovery rates over existing collection methods" from using the NAF. As part of this strategy, the NAF allegedly fired arbitrators who ruled in favor of consumers. Berner and Grow (2008) report that Elizabeth Bartholet, a Harvard Law School professor who worked part-time as an NAF arbitrator, was not given any further cases after she awarded $48,000 to a consumer in a collections case. A lawsuit brought by the city of San Francisco alleged that the NAF decided 99.8% of cases in California in favor of banks. The lawsuit claimed that the NAF "is actually in the business of operating an arbitration mill, churning out arbitration awards in favor of debt collectors and against California consumers." As a result of this and other lawsuits accusing the NAF of deceptive business practices, the NAF agreed to exit the credit card arbitration business in 2009.

The role of the NAF's past rulings in making the case that the NAF was captured provides an illustration of why the possibility of capture reduces welfare under for-profit adjudication. The fact that the NAF decided 99.8% of cases in favor of banks was a key piece of evidence that the NAF had been captured. But what if banks were in fact innocent in (say) 99.7% of credit card disputes? The fraction of cases in which wrongdoing occurs is an equilibrium outcome, not an exogenous parameter. In this case an NAF ruling that a bank was innocent would be only very weak evidence that the NAF was captured, and so NAF capture would be very hard to deter. More generally, it is only possible to detect and deter capture when the true frequency of socially harmful behavior is relatively high, and so for-profit adjudication cannot reduce the prevalence of socially harmful behavior below a certain level without giving adjudicators an incentive to become captured. This, I claim, is the most important problem with for-profit adjudication.

2.2 State adjudication

State adjudication is similar to for-profit adjudication, except that adjudicators are compensated through taxes collected by the state and not through fees from disputants. Because state adjudicators' salaries are funded through taxes, it is possible to give state adjudicators low-powered incentives relative to for-profit adjudicators. In particular, state adjudicators can be given salaries that are independent of the number of disputes they resolve, while for-profit adjudicators are paid per dispute. I argue that this difference in incentive structures is the most important difference between for-profit and state adjudication.

Posner (1993) notes the low-powered nature of incentives for state judges. He writes, "Almost the whole thrust of the rules governing the compensation and other terms and conditions of judicial employment is to divorce judicial action from incentives.... A federal judge can be lazy, lack judicial temperament, mistreat his staff, berate without reason the lawyers who appear before him, be reprimanded for ethical lapses, verge on or even slide into senility, be reversed all the time for elementary legal mistakes, hold under advisement for years cases that could be decided perfectly well in days or weeks, leak confidential information to the press, pursue a nakedly political agenda, and similarly misbehave in a variety of other ways that might get even a tenured civil servant or university professor fired; he will retain his office." One indication that there is not much difference between for-profit adjudication and state adjudication other than the incentive structure of the adjudicators is that for-profit adjudicators and state adjudicators are often the same people. For example, Kim (1994) discusses the practice of "rent-a-judging" under which retired state judges are hired as private arbitrators. Kim argues that the difference in incentive structures under for-profit and state adjudication affects the behavior of these "rent-a-judges". She quotes a retired state judge who took up private practice saying "some miserable son-of-a-bitch on the bench becomes the nicest guy in the world when he becomes a private judge." (Kim

1994, p. 177) Kim attributes this effect to the fact that "judges who once made their living intimidating lawyers must now go about courting them" as private judges (Kim 1994, p. 177).

Glaeser, Johnson, and Shleifer (2001) have also noted the low-powered incentives faced by state adjudicators. They argue that the purpose of low-powered incentives for state adjudicators is to prevent political bias from affecting judicial decisions. While this argument may apply to politically charged cases or cases that affect the public interest, especially cases in which the government is a party, it does not apply to the majority of cases to which the government is not a party and which affect only the interests of the disputants themselves. Thus we should seek additional explanations for low-powered incentives for state adjudicators.

I argue that one purpose of low-powered incentives for state adjudicators is to prevent capture. Because state adjudicators do not receive more fees from attracting more clients, state adjudicators have no incentive to become captured in order to attract more clients. Because state adjudicators are immune from capture, state adjudication may be able to reduce the prevalence of socially harmful behavior below the minimum level that is sustainable under for-profit adjudication. However, as Posner's quote suggests, low-powered incentives also reduce state adjudicators' incentives to exert effort, which may lead to problems such as delayed or poorly reasoned judicial decisions.

The argument that low-powered incentives for state adjudicators prevent capture also helps to illuminate the difference between capture and bribery. Low-powered incentives do nothing to prevent bribery, since state adjudicators can be bribed just as easily as for-profit adjudicators. By protecting state adjudicators from oversight and reducing the rents that state adjudicators receive from holding office, low-powered incentives may even increase the incidence of bribery. The fact that state adjudicators are nevertheless given low-powered incentives is evidence for the view that capture is a distinct and possibly more severe problem than bribery.

3 Model

In order to describe the problems with for-profit adjudication, I must first explain why people may be willing to pay for adjudication. I say that when relationship partners resolve disputes themselves without third-party adjudication, their relationship is governed by *self-redress*. I show how adjudication may increase welfare relative to self-redress, even when adjudication is costly. I then describe the tradeoff between for-profit and state adjudication.

3.1 Setup

There is a large population of agents. Each period, each agent is randomly matched with a partner. I assume that the population is large enough that agents do not take into account the possibility of being matched with the current partner in any future period, so that each interaction is perceived as being one-shot. I refer to agents using the male pronoun.

There are also two adjudicators, who I refer to as judges. Each judge has discount factor δ. Each agent has a preferred judge. The preferred judge is the judge whose rules and precedents correspond most closely to the agent's preferred way of doing business. Each judge is the preferred judge for half of the agents. I assume that each judge can observe the preferred judge of each agent, but I assume that agents' cannot observe their partners' preferred judges. This assumption is for simplicity; I briefly discuss the case where agents can observe their partners' preferred judges in subsection 3.5 below. At the end of each period, each agent survives with probability λ. Otherwise, the agent dies and is replaced by a new agent with the same preferred judge. I refer to judges using the female pronoun.

When two agents are matched, they enter into a transaction which can be governed either through self redress or through (for-profit) adjudication by either judge. Before the transaction takes place, each agent simultaneously announces the judge of whom he is a customer. At the same time, each agent may also announce a boycott against either judge. If both agents announce that they are customers of the same judge, and neither agent has boycotted that judge, then the transaction is governed by that judge. If either agent has boycotted the judge, then the transaction is governed by self-redress. If the two agents announce that they are customers of different judges, then there are two possibilities. Under *local for-profit adjudication*, the transaction is governed by self-redress. Under *global for-profit adjudication*, one agent is chosen at random, and the judge of whom that agent is a customer governs the transaction, unless either agent has boycotted the judge. If either agent has boycotted the chosen judge, then the transaction is governed by self-redress. Thus under global for-profit adjudication all transactions are governed by adjudication unless prevented by boycott. On the other hand, under local for-profit adjudication only transactions between customers of the same judge are governed by adjudication, and other transactions are governed by self-redress.

For simplicity, I assume that each agent always chooses to be a customer of his preferred judge, unless the agent has entered into a corrupt relationship with the other judge. An agent boycotts a judge if and only if the agent comes to believe that the judge has been corrupted by somebody else.[3] I explain both corrupt relationships and boycotts in more

[3] This assumption implies that an agent who comes to believe that a judge has been corrupted chooses self-redress to govern future transactions that would otherwise have been governed by the judge. It would perhaps be more realistic to assume that an agent who comes to believe that a judge has been corrupted chooses the other judge to govern future transactions. This assumption would yield a more complicated model, since I would have to account for the possibility that a judge could acquire customers who had come to believe that the other judge was corrupt. Although it would be more complicated, this alternative model

detail when I introduce the possibility of capture below.

If a transaction is governed through self-redress, then the transaction proceeds as follows. First, the matched agents play a prisoner's dilemma game. In the game, each agent can either act honestly (H) or cheat (C). The payoffs from each action are as follows:

	H	C
H	$1, 1$	$-b$, $1+h$
C	$1+h$, $-b$	0,0

The gain from cheating is h and the loss from being cheated is $-b$. I assume that $h - b < 1$, that is, mutual honesty is socially efficient.

After playing the prisoner's dilemma game, the agents observe a public signal $y \in Y = \{G, B\}$, where G is the good signal and B is the bad signal. I assume that

$$1 > p(G|H, H) > p(G|H, C) = p(G|C, H) > p(G|C, C) > 0$$

That is, cheating increases the probability that a bad signal is observed. However, bad signals occur with positive probability even if neither agent cheats. I interpret a bad signal as a bad outcome in a relationship, which is more likely when either agent cheats, but which may happen even if both agents are honest due to bad luck.

A bad signal is evidence that cheating occurred during the prisoner's dilemma game, but a bad signal does not provide any information about which relationship partner cheated. This signal structure expresses the idea that it is difficult for relationship partners to determine who is to blame for a bad outcome in the relationship. More formally, because there are only two outcomes, the signal structure does not satisfy Fudenberg, Levine, and Maskin's (1994) full-rank condition. As will be seen below, the difficulty of determining who is to blame for bad outcomes creates inefficiency.

After observing the signal, both agents observe the outcome of a public randomization device $\theta \in \Theta$, where θ is distributed according to some distribution $f(\theta)$. Agents then play an enforcement game, in which each agent can choose one of four actions, denoted N, P, T_i, and T_j. The payoffs in the enforcement game are as follows, with the row actions assigned to agent i and the column actions assigned to agent j:

	N	P	T_i	T_j
N	0,0	$-x, -x$	$-x, -x$	$-x, -x$
P	$-x, -x$	$-x, -x$	$-x, -x$	$-x, -x$
T_i	$-x, -x$	$-x, -x$	$-x + \epsilon, x - \epsilon$	$-x, -x$
T_j	$-x, -x$	$-x, -x$	$-x, -x$	$x - \epsilon, -x + \epsilon$

The enforcement game represents a relationship in which bad outcomes may lead to disputes, which can be resolved in either of three ways. First, a dispute can be resolved by the relationship partners doing nothing. This is the action profile (N, N) in the enforcement

would yield the same qualitative insights.

game. Second, either agent can transfer money to the other agent. If action profile (T_i, T_i) is chosen, agent i transfers $x - \epsilon$ dollars to agent j, and if action profile (T_j, T_j) is chosen, then agent j transfers $x - \epsilon$ dollars to agent i, where I assume that ϵ is a small number. Notice that by randomizing between (N, N) and (T_i, T_i) or (T_j, T_j), it is possible to create a situation in which any amount of money between 0 and $x - \epsilon$ is transferred from one agent to the other in expectation. Third, there is a punishment outcome, represented by action profile (P, P), which harms both agents. One possible interpretation is that the punishment represents ending an otherwise profitable relationship as a result of a dispute, as in Ghosh and Ray (1996), Horner (2002), and Jackson, Rodriguez-Barraquer, and Tan (2012). A more extreme interpretation is that the punishment represents a destructive conflict caused by the dispute, possibly even involving violence. For example, Boehm (1984) describes violent feuds in a variety of stateless and otherwise weakly institutionalized societies. These feuds develop out of disputes and last for years or decades, usually harming both parties to the feud. In developed societies, destructive conflict may take the form of lengthy legal battles or messy public arguments that damage the reputations of both parties to the dispute. Yared (2010) and Chassang and Padro-i-Miquel (2010) construct models in which violent conflict is a punishment outcome in a repeated game. Li and Matouschek (2013) develop a related model in which the destructive punishment outcome is interpreted as a period of conflict between labor and management in a firm.

The payoff structure of the enforcement game implies that any course of action other than punishment must be agreed upon by both agents. If the agents do not agree, then both agents receive the punishment payoff. This payoff structure can be interpreted as a simple bargaining framework in which punishment is the threat point. In this case, the transfer of x is the largest transfer that can be enforced using the exogenously given punishment technology. The assumption that the maximum transfer that either agent can make is $x - \epsilon$ rather than x simplifies the proofs.

I assume that x is a large number. This assumption abstracts from the problem of contract enforcement by assuming that agents have access to very severe punishments. The problem with these severe punishments is that they harm both parties to the dispute and are therefore inefficient. As will be seen below, the purpose of adjudication is to reduce the inefficiency associated with punishment by allowing agents to resolve disputes through money transfers rather than destructive punishments.

To summarize, in transactions governed by self-redress, the sequence of events is as follows:

1. Agents play prisoners' dilemma game.

2. Agents observe public signal.

3. Agents play enforcement game.

Under adjudication, the transaction proceeds differently. First, the judge governing the transaction is chosen. Next, both agents play the prisoner's dilemma game described above and observe the public signal. Each agent then simultaneously decides whether to sue the other. If either agent sues, then the case is brought to the judge governing the transaction. Each agent pays a cost w of litigation, and a fee f to the judge, who then observes the actions that each agent chose in the prisoner's dilemma game. The judge publicly announces these actions, although the judge may make a dishonest announcement. Finally, the agents play the enforcement game.

The enforcement game under adjudication can be interepreted either as describing a situation in which relationship partners must enforce judges' decisions themselves, or a situation in which judges' decisions are enforced by some other institution such as state police. Self-enforcement of adjudicator decisions occurs in many developing societies. For example, Newman (1983) describes adjudication across a variety of stateless societies. In many such societies, elders or religious leaders act as adjudicators, resolving disputes in exchange for a fee. These adjudicators often award damages to be paid by one party to the other as a condition of the resolution of the dispute. However, these awards are enforced not by the adjudicator but rather by the threat of violence inflicted by the party owed damages. Alternatively, the enforcement game can be interpreted as describing a situation in which the state inflicts punishment x on a disputant if the disputant refuses to pay the damages awarded by the judge. Since the disputant would always prefer to pay the damages, the punishment is never inflicted, and so the effect of the punishment on the disputant's partner is irrelevant.

In summary form, the sequence of events under adjudication is as follows:

1. Agents play prisoners' dilemma game.

2. Agents observe public signal.

3. Agents decide whether to sue.

4. If either agent sues, judge observes actions in prisoners' dilemma game.

5. Judge announces actions.

6. Agents play enforcement game.

Agent i's total payoff in a given period is

$$v_i = v_i^1 - \alpha_i + v_i^2$$

Here, v_i^1 is agent i's payoff in the prisoner's dilemma game, $\alpha_i \in \{w + f, 0\}$ is the amount that the agent spends on litigation costs and fees for the judge, and v_i^2 is agent i's payoff in the enforcement game.

3.2 Equilibrium under self-redress

I begin by studying equilibria under self-redress. Let $a_i^1 \in \{H, C\}$ be an action for agent i in the prisoner's dilemma game. Let $a_i^2 \in \{N, P, T_i, T_j\}$ be an action for agent i in the enforcement game. Let $A = (A^1, A^2)$ be the space of action profiles in both games. Let σ_i^1 be a (mixed) strategy for agent i in the prisoner's dilemma game and let $\sigma_i^1(a_i^1)$ be the probability that agent i chooses action a_i^1 under strategy σ_i^1. Let $\sigma_i^2(a_i^1, y, \theta)$ be a (mixed) strategy for agent i in the enforcement game and let $\sigma_i^2(a_i^2|a_i^1, y, \theta)$ be the probability that agent i chooses action a_i^2 under strategy $\sigma_i^2(a_i^1, y, \theta)$. A strategy for agent i is $\sigma_i = (\sigma_i^1, \sigma_i^2)$. A strategy profile σ is public if $\sigma_i^2(a_i^1, y, \theta) = \sigma_i^2(\hat{a}_i^1, y, \theta)$ for all i, y, θ, a_i^1, and $\hat{a}_i^1$. The outcome of a strategy profile is the distribution it induces on $A^1 \times Y \times \Theta \times A^2$. I begin with a lemma:

Lemma 1. *The outcome of any sequential equilibrium under self-redress is the outcome of an equilibrium in public strategies.*

Omitted proofs are in the appendix.

Now, define $g(a_i^1, \sigma_j^1)$ to be agent i's expected payoff in the prisoner's dilemma game when agent i chooses action a_i^1 and his partner chooses mixed action σ_j^1. Let $p(y|a_i^1, \sigma_j^1)$ be the analogous probability that signal y is realized. Let $d(\sigma_j^1) = g(C, \sigma_j^1) - g(H, \sigma_j^1)$ be the gain from cheating and define

$$L(\sigma_j^1) = \frac{p(B|C, \sigma_j^1)}{p(B|H, \sigma_j^1)}$$

Using these definitions and lemma 1, I can prove the following proposition:

Proposition 1. *In any sequential equilibrium under self-redress, the sum of the utilities achieved by the partners in any relationship cannot exceed $2v^*$, where v^* is defined by*

$$v^* = \max_{\sigma_j^1} g(H, \sigma_j^1) - \frac{d(\sigma_j^1)}{L(\sigma_j^1) - 1} < 1 \tag{1}$$

This upper bound applies regardless of the severity of punishment x.

Proposition 1 shows that the sum of agents' payoffs under self-redress is bounded strictly below the efficient sum of 2, regardless of the severity of punishment x. Briefly, the intuition for proposition 1 is as follows. In order to provide each agent with an incentive to act honestly, a punishment must be inflicted with positive probability after a bad signal. Since the bad signal does not provide any information about which agent cheated, both agents must be punished, which is inefficient. Bad signals happen with positive probability even if both agents are honest. Thus, inefficient punishments must happen on the equilibrium path. These inefficient punishments prevent agents from achieving the efficient payoff. This intuition was first developed by Green and Porter (1984).

An important special case of proposition 1 occurs when the strategy that maximizes (1) is the strategy of acting honestly with probability 1. In this case, the following strategy profile exactly achieves the upper bound on welfare in proposition 1. Both agents act honestly with probability 1 in the prisoner's dilemma game. In the punishment game, both agents choose no action after a good signal. After a bad signal, with probability ρ both agents choose to punish, where ρ is chosen so that each agent is just indifferent between acting honestly and cheating in the prisoner's dilemma game. In this case, the probability of cheating in any relationship is reduced to zero under self-redress. Nevertheless, punishment is sometimes required after bad signals.

The upper bound in proposition 1 is the same as the upper bound in lemma 1 of Kandori and Obara (2006), which itself is a generalization of the upper bound proved by Abreu, Milgrom, and Pearce (1991). Kandori and Obara study an infinitely repeated game in which the stage game is the same as my prisoner's dilemma game and in which agents observe the public signal after every iteration of the stage game. There is one difference between proposition 1 and Kandori and Obara's result. Kandori and Obara's upper bound applies only to equilibria in public strategies. They give an example of an equilibrium in private strategies that generates payoffs greater than the upper bound. Sugaya (2015) shows that in the environment studied by Kandori and Obara, it is possible using private strategies to achieve arbitrarily close to efficient payoffs for sufficiently high discount factors.[4] In contrast, my upper bound on payoffs applies to all sequential equilibria, not just equilibria in public strategies.

There are two key differences between the environment studied by Kandori and Obara and my environment which create the differences between the results of the two models. The first is that Kandori and Obara consider an infinitely repeated game while I consider a two-period game. Second, the enforcement stage of my two-period game has a special payoff structure. These different environments correspond to different forms of cooperation, each of which is important in different empirical settings.

The infinitely repeated game studied by Kandori and Obara represents a relationship in which both the creation of value and the punishment of wrongdoing take place within the context of the same transaction. The canonical example is Stigler's (1964) duopoly in which the firms cannot observe each other's prices. In this relationship, selling to the market is both each firm's method of generating profits and each firm's method of punishing the other for past misbehavior. The fact that value creation and punishment happen in the context of the same interaction generates complicated incentives when agents are allowed to use private strategies. Kandori and Obara exploit these incentives to support higher levels of cooperation than can be sustained using public strategies.

[4] In fact, Sugaya's proof applies to infinitely repeated games with private monitoring. Sugaya briefly states that his results can be extended to public monitoring games, including the public monitoring game studied by Kandori and Obara, with minor modifications. See Sugaya (2015), remark 1, pp. 10-11.

In contrast, the two-period game I consider represents a relationship in which relationship partners first interact to create value and then potentially inflict punishments as a separate step. As discussed earlier, this game can represent a situation in contracts are enforced by the threat of ending a relationship, or by the threat of some form of destructive conflict. My model suggests that adjudication is most useful in these kinds of relationships.

3.3 Equilibrium under adjudication with non-corruptible judges

I next consider equilibrium under adjudication. I begin by assuming that the judges are non-corruptible, that is, whenever any agent appeals to a judge, the judge truthfully announces the actions that were chosen in the prisoner's dilemma game.

Consider the following strategy profile. Each agent acts honestly in the prisoner's dilemma game with probability π. An agent does not sue if a good signal is observed, or if a bad signal is observed and the agent cheated in the prisoner's dilemma game. An agent sues with probability ψ if a bad signal is observed and the agent acted honestly in the prisoner's dilemma game. Because each judge is non-corruptible, if either agent sues then the judge truthfully announces the actions that were taken in the prisoner's dilemma game. If the judge announces that agent i cheated and agent j acted honestly, then both agents choose action T_i in the enforcement game, transferring $x - \epsilon$ dollars from agent i to agent j. Otherwise, both agents choose no action in the enforcement game.

Given this strategy profile, an agent is indifferent between acting honestly and cheating if

$$\pi[1-(2\psi-\psi^2)p(B|H,H)(f+w)]+(1-\pi)[-b+\psi p(B|H,C)(x-\epsilon-f-w)] = \pi[1+h-\psi p(B|C,H)(x-\epsilon+f+w)] \tag{2}$$

An agent is indifferent between suing and not suing, given that a bad signal is observed and that the agent act honestly himself, if

$$p(a_j^1 = C|B, a_i^1 = H)(x-\epsilon) - (f+w) = 0 \tag{3}$$

Here $p(a_j^1 = C|B, a_i^1 = H)$ is the posterior probability that an agent's partner cheated, given that there was a bad signal and that the agent himself acted honestly. A set of probabilities π and ψ that solve (2) and (3) is an equilibrium. Solving for π and ψ, some tedious algebra shows that as $t \to \infty$, the probability π that an agent acts honestly approaches 1 and the probability ψ that an agent sues approaches 0. An agent's expected utility u in this equilibrium is half of the total surplus, that is

$$u = \frac{1}{2}\{\pi^2[2-(2\psi-\psi^2)p(B|H,H)(2f+2w)]+2\pi(1-\pi)[1+h-b-\psi p(B|H,C)(2f+2w)]\} \tag{4}$$

As π approaches 1 and ψ approaches 0, u approaches 1. The following proposition follows immediately:

Proposition 2. *If judges are non-corruptible, then for all $\eta > 0$, there exists $\underline{x}$ such that for all $x \geq \underline{x}$, there exists an equilibrium under adjudication in which the expected utility achieved by an agent i in each relationship is at least $1 - \eta$.*

That is, given a non-corruptible judge, it is possible to achieve arbitrarily close to efficient cooperation, even after accounting for the cost of litigation and judge's fees. The reason is that as damages $x - \epsilon$ awarded by the judge become large, both the probability that either agent cheats and the probability that an agent sues after a bad signal approach zero, which implies that the probability that the cost of litigation and the judge's fee are paid approaches zero. This result contrasts with the inefficiency of cooperation under self-redress and explains why people might be willing to pay for for-profit adjudication.

The intuition behind proposition 2 is similar to the intuition in Fudenberg, Levine, and Maskin (1994). Fudenberg, Levine and Maskin show that when agents can determine (at least in a statistical sense) who is to blame for bad outcomes in a relationship, it is possible to achieve efficient cooperation using a strategy profile in which the agent who appears to be to blame transfers value to the agent who appears to be innocent. Proposition 2 extends this intuition to the case in which determining who is to blame for a bad outcome is possible but costly.

One difference between Fudenberg, Levine, and Maskin and proposition 2 is that the equilibrium used to prove proposition 2 is an equilibrium in private strategies, since an agent's decision about whether to sue depends both on the public signal and his action in the prisoners' dilemma game. In contrast, Fudenberg, Levine, and Maskin consider only equilibria in public strategies. I conjecture that there does not exist an equilibrium in public strategies that yields efficent cooperation under adjudication, even for arbitrarily large x. However, I have not been able to prove this conjecture.

It is interesting to compare proposition 2 with the literature in law and economics on optimal damages for accidents. Polinksy and Shavell (1998), summarizing a large literature, argue that welfare is maximized when the party responsible for an accident pays damages to the victim equal to the harm caused multiplied by the reciprocal of the probability that the harm is detected. Since Polinsky and Shavell take the probability that harm is detected to be fixed, their argument implies an upper bound on damages in litigation. This argument does not take into account the fact that in equilibrium, the probability that a lawsuit is filed and hence that harm is detected is endogenous and depends on the expected damages. After taking all equilibrium effects into account, as in my model, welfare is maximized with arbitrarily large damages. This result is reminiscent of Becker's (1968) finding that crime is optimally deterred with extremely severe punishments combined with a low probability of arrest and conviction.

Given the result in proposition 2, it is somewhat puzzling that extremely large damages are not observed empirically in all lawsuits. Two factors not included in my model may explain limited damages. First, litigants may have limited liability and so they may not be able to make arbitrarily large transfers. Second, litigants may be risk averse, in which case very large transfers reduce *ex ante* welfare for all potential litigants.

The results so far ignore the possibility that judges might act strategically. Strategic behavior by judges may prevent agents from achieving efficient cooperation as described in proposition 2. I study this possibility next.

3.4 Corruptible judges: bribery

One way in which judges might act strategically is by accepting bribes. Suppose that under adjudication agents follow the strategy profile described in the previous section, except that prior to announcing a ruling, a judge may accept a bribe from either agent in exchange for announcing that the agent acted honestly when the agent in fact cheated.[5] An agent who cheats and is sued is willing to pay a bribe of up to $x - \epsilon$ if the judge announces that the agent acted honestly. I assume that illicit payments to judges are detected with probability q by the larger society, perhaps by a regulatory or law-enforcement agency charged with preventing corruption. Judges who are caught accepting bribes are no longer able to judge cases, and are also subjected to an additional punishment z, which may be a concrete punishment such as imprisonment or a less tangible punishment such as the loss of social status. Let ϕ be the probability that a match governed by adjudication generates a lawsuit, where ϕ is defined by

$$\phi = \pi^2(2\psi - \psi^2)p(B|H,H) + 2\pi(1-\pi)\psi p(B|H,C).$$

Suppose that each judge expects to govern $N/2$ matches in each period. Then a judge refuses a bribe offer in a given period if

$$(1-\delta)(x - \epsilon - qz) \leq q\delta N\phi f. \tag{5}$$

Inequality (5) summarizes well-known arguments about how to prevent bribery, explored in more depth in Besley and Mclaren (1993), Mookherjee and Png (1995), and Acemoglu and Verdier (2000). Bribery is more likely if the transfer $x - \epsilon$ paid by a guilty agent to an innocent agent is larger. Bribery can be deterred using the exogenous punishment by increasing the probability q that an illicit payment is detected, or by increasing the severity

[5] In principle, a judge could also accept a bribe from an agent to rule that the agent's partner cheated when the partner really acted honestly. Because the partner knows his own action, the partner knows that the judge has been bribed if the judge rules against him. The partner is also likely to complain about being victimized in this way, and so this kind of bribery is easier to detect than the kind of bribery described in the text. I assume that if the kind of bribery described in the text can be deterred, then this second kind of bribery can be deterred as well.

z of the punishment. Bribery can also be deterred using an efficiency wage by increasing the legal fee f for adjudication services, by increasing the number of fees $N\phi$ that a judge expects to receive each period, by increasing the probability q that an illicit payment is detected, or by increasing the judge's discount factor δ. These methods deter bribery by increasing the value to the judge of being able to continue to judge cases and receive legal fees in the future.

Proposition 2 requires arbitrarily large transfers $x - \epsilon$ between agents in order to achieve efficiency. Since the no-bribery constraint (5) constrains the maximum transfer, the no-bribery constraint may reduce the efficiency of relationships under adjudication. However, the no-bribery constraint can also be relaxed by making qz arbitrarily large, and increasing qz has no impact on the efficiency of relationships under adjudication. Thus, in societies in which qz is sufficiently large, the possibility of bribery under adjudication does not prevent agents from achieving nearly efficient cooperation.

3.5 Corruptible judges: capture

The more interesting way in which judges may act strategically is through what I refer to as capture. Capture occurs when, immediately after agents become matched, a judge secretly promises an agent that in the prisoner's dilemma game, the judge will announce that the agent acted honestly even if the agent in fact cheats. In return, the agent promises to become the judge's customer if the agent was not planning to do so anyway. I assume that an agent who captures a judge cheats with probability 1 instead of probability $(1 - \pi)$ in the prisoner's dilemma game, and sues with probability 0 regardless of the public signal.

Capture can happen in either of two ways. First, a judge can become captured by an agent who prefers the judge and who would have been the judge's customer even in the absence of a corrupt relationship. In this case the judge benefits because the agent becomes more likely to cheat, which in turn increases the probability that the transaction will lead to a lawsuit. I refer to this kind of capture as internal capture. Second, a judge can become captured by an agent who does not prefer the judge and who would have been the customer of the other judge in the absence of a corrupt relationship. In this case, the judge benefits both by acquiring a new customer for the period and by increasing the probability of a lawsuit in the newly acquired transaction. I refer to this kind of capture as external capture. Since a judge profits more from external capture than internal capture, if external capture is not profitable for the judge then internal capture is not profitable either. For this reason, in this section I consider the conditions under which a judge would prefer not to be externally captured. External capture is possible only if, as I assume, agents cannot observe which judge their partners prefer. If agents could observe their partners' preferred judges, then an agent would know that the judge had been captured if his partner announced that he was a customer of a judge other than his preferred judge. Internal capture is possible whether or not agents observe their partners' preferred judges, and so the assumption that agents do not observe their partners' preferred judges is not crucial for the qualitative conclusions of my model.

Capture does not involve any illicit payments to judges, and so unlike bribery, capture cannot be deterred by detecting and punishing illicit payments. However, it may be possible to deter capture through reputational incentives for judges. Suppose that if an agent sues and loses (that is, if the judge announces that the agent's partner acted honestly), then with probability r the agent concludes that the judge is corrupt and boycotts the judge in all future transactions.[6] Judges may then avoid capture in order to avoid losing customers who will pay fees in the future.[7]

Given the strategy profile outlined in section 3.3, agents sometimes sue and lose, even if no judge is ever corrupt. Therefore, boycotts happen with positive probability. However, because boycotting agents sometimes die and are replaced with non-boycotting agents, there exists a steady state fraction of boycotting agents which is less than one. I assume that the population of agents is large enough that the fraction of agents who boycott either judge in any given period can be approximated by this steady state. Under global for-profit adjudication, suppose that among the agents who prefer a judge, a steady state fraction γ_s do not boycott the judge in each period. Suppose that among the agents who do not prefer a judge, a steady state fraction γ_o do not boycott that judge in each period. Under local for-profit adjudication, suppose that among the agents who prefer a judge, a steady state fraction γ_ℓ do not boycott that judge in each period.

In order to find more explicit expressions for γ_s and γ_o, let ϕ_d to be the probability that a transaction governed by adjudication results in a lawsuit in which the judge announces that the actions taken in the prisoner's dilemma game were (H, C) or (C, H), assuming that all players follow the strategy profile outline in section 3.3. (The d in ϕ_d stands for a lawsuit with "damages".) Let ϕ_n be the analogous probability that a transaction results in a lawsuit in which the judge announces that the actions taken in the prisoner's dilemma game were (H, H). Then we have

$$\phi_d = 2\pi(1-\pi)\psi p(B|H, C) \tag{6}$$

$$\phi_n = \pi^2(2\psi - \psi^2)p(B|H, H) \tag{7}$$

Under global for-profit adjudication, in any given period, the probability that an agent is governed by the judge he prefers, given that he has not boycotted that judge, is $(\frac{1}{2}\gamma_s + \frac{1}{4}\gamma_o)$.

[6] This reputation mechanism could be microfounded in a model in which judges are either non-corruptible or corruptible, and in which a judge's behavior provides a signal of her type.

[7] Since capture increases the probability that an agent cheats, and hence the probability of a bad signal in a relationship, an agent may also consider receiving a bad signal to be evidence of capture. Dixit (2003) considers a similar mechanism as a way to detect bribery. I do not pursue this possibility, since the evidence in section 2 suggests that in real adjudication markets, people use arbitrators' past decisions and not the outcomes of their past transactions with relationship partners as a way to judge arbitrator neutrality.

Thus the probability that an agent starts boycotting the judge he prefers in a given period is

$$\xi_s = \left(\frac{1}{2}\gamma_s + \frac{1}{4}\gamma_o\right)\phi_n r \tag{8}$$

Similarly, the probability that an agent is governed by the judge he does not prefer in a given period, given that he has not boycotted that judge, is $\frac{1}{4}\gamma_s$. Thus the probability that an agent starts boycotting the judge he does not prefer in a given period is

$$\xi_o = \frac{1}{4}\gamma_s\phi_n r \tag{9}$$

Finally, under local for-profit adjudication, the probability that an agent is governed by the judge he prefers in a given period, given that he has not boycotted that judge, is $\frac{1}{2}\gamma_\ell$. Thus the probability that an agent starts boycotting the judge he prefers in a given period is

$$\xi_\ell = \frac{1}{2}\gamma_\ell\phi_n r \tag{10}$$

For each $k \in \{s, o, \ell\}$, γ_k then solves the Markov steady state equation:

$$\begin{bmatrix}\gamma_k & 1-\gamma_k\end{bmatrix}\begin{bmatrix}(1-\xi_k)\lambda + 1 - \lambda & \xi_k\lambda \\ 1-\lambda & \lambda\end{bmatrix} = \begin{bmatrix}\gamma_k & 1-\gamma_k\end{bmatrix} \tag{11}$$

Examination of (8) through (11) yields the following lemma, which I use below:

Lemma 2.

$$\frac{1}{2}\gamma_\ell > \frac{1}{4}\gamma_s$$

Now consider each judge's income stream. Let a dynasty consist of a first agent, a second agent who replaces the first agent when the first agent dies, and so on. I will calculate the value of the income stream that a judge receives from each dynasty. Under global for-profit adjudication, let V_s be the value to a judge of a dynasty in which the current agent prefers the judge and has not boycotted the judge. Let V_o be the analogous value of an dynasty in which the current agent does not prefer the judge and has not boycotted the judge. Under local for-profit adjudication, let V_ℓ be the value of a dynasty in which the current agent prefers the judge and has not boycotted the judge. Let V_s^b, V_o^b, and V_ℓ^b be the analogous values of dynasties in which the current member has boycotted the judge. Then I write

$$V_s = \left(\frac{1}{2}\gamma_s + \frac{1}{4}\gamma_o\right)\left\{(\phi_d+\phi_n)(1-\delta)f + \delta V_s + \phi_n\delta\lambda r(V_s^b - V_s)\right\} + \left(1-\frac{1}{2}\gamma_s - \frac{1}{4}\gamma_o\right)\delta V_s \tag{12}$$

$$V_o = \frac{1}{4}\gamma_s\left\{(\phi_d+\phi_n)(1-\delta)f + \delta V_o + \phi_n\delta\lambda r(V_o^b - V_o)\right\} + \left(1-\frac{1}{4}\gamma_s\right)\delta V_o \tag{13}$$

$$V_\ell = \frac{1}{2}\gamma_\ell\left\{(\phi_d+\phi_n)(1-\delta)f + \delta V_\ell + \phi_n\delta\lambda r(V_\ell^b - V_\ell)\right\} + \left(1-\frac{1}{2}\gamma_\ell\right)\delta V_s \tag{14}$$

$$V_s^b = \delta(1-\lambda)V_s + \delta\lambda V_s^b \tag{15}$$

$$V_o^b = \delta(1-\lambda)V_o + \delta\lambda V_o^b \tag{16}$$

$$V_\ell^b = \delta(1-\lambda)V_\ell + \delta\lambda V_\ell^b \tag{17}$$

Under global for-profit adjudication, a judge can achieve the greatest profit from capture with the lowest probability of losing future revenue if she agrees to be captured by an agent who does not prefer her and has not boycotted her, and who is currently matched with a partner who also does not prefer her and has not boycotted her. Let ϕ_c be the probability that the agent who does not capture the judge sues. Then I can write

$$\phi_c = (1-\pi)\psi p(B|H,C). \tag{18}$$

A judge prefers not to become captured rather than to be captured for one period if

$$\phi_c(1-\delta)f \leq \frac{1}{2}\phi_c\delta\lambda r\left(V_o - V_o^b\right) \tag{19}$$

The left hand side of (19) is the immediate gain from becoming captured: with probability $(1/2)\phi_c$, the judge receives a fee f from each of two agents who would not have paid the judge a fee otherwise. The right hand side of (19) is the future cost from becoming captured: with probability $(1/2)\phi_c\lambda r$, the agent who did not capture the judge boycotts the judge, causing a loss of future revenue $V_o - V_o^b$. Solving (13) and (16) for V_o and V_o^b, plugging these values into (19), and rearranging yields that under global for-profit adjudication a judge prefers not to become captured if

$$\frac{2}{\delta\lambda r} \leq \frac{\frac{1}{4}\gamma_s(\phi_d+\phi_n)}{1-\delta\lambda\left(1-\frac{1}{4}\gamma_s\phi_n r\right)} \tag{20}$$

Under local for-profit adjudication, a judge can achieve the greatest profit from capture if she agrees to become captured by an agent who does not prefer her and who has not boycotted her who is currently matched with a partner who does prefer her and has not boycotted her. A judge prefers not to become captured rather than to be captured for one period if

$$\phi_c(1-\delta)f \leq \frac{1}{2}\phi_c\delta\lambda r\left(V_\ell - V_\ell^b\right). \tag{21}$$

This inequality is very similar to (19). Solving (14) and (17) for V_ℓ and V_ℓ^b and plugging these into (21) yields that under local for-profit adjudication a judge prefers not to become captured if

$$\frac{2}{\delta\lambda r} \leq \frac{\frac{1}{2}\gamma_\ell(\phi_d+\phi_n)}{1-\delta\lambda\left(1-\frac{1}{2}\gamma_\ell\phi_n r\right)} \tag{22}$$

The following proposition summarizes the previous discussion:

Proposition 3. *Global for-profit adjudication is an equilibrium if q, f, and z are sufficiently large to deter bribery and if*

$$\frac{2}{\delta\lambda r} \leq \frac{\frac{1}{4}\gamma_s(\phi_d+\phi_n)}{1-\delta\lambda\left(1-\frac{1}{4}\gamma_s\phi_n r\right)}$$

Local for-profit adjudication is an equilibrium if q, f, and z are sufficiently large to deter bribery and if

$$\frac{2}{\delta\lambda r} \leq \frac{\frac{1}{2}\gamma_\ell(\phi_d+\phi_n)}{1-\delta\lambda\left(1-\frac{1}{2}\gamma_\ell\phi_n r\right)}$$

If $\phi_d = 0$, then (20) and (22) reduce to

$$2 \leq \frac{\theta\delta\lambda r}{1-\delta\lambda+\theta\delta\lambda r}. \tag{23}$$

Here either $\theta = \frac{1}{4}\gamma_s\phi_n$ for inequality (20) or $\theta = \frac{1}{2}\gamma_\ell\phi_n$ for inequality (22). Notice that the right hand side of (23) is always less than 1, so (23) cannot be satisfied for any parameter values. Therefore I can state the following corollary to proposition 2:

Corollary 1. *Neither local for-profit adjudication nor global for-profit adjudication can be an equilibrium unless ϕ_d is sufficiently large.*

The following are some implications of proposition 4:

1. For-profit adjudication is more likely to be an equilibrium if the judge's discount rate δ, the probability that an agent survives λ, and the probability that an agent boycotts a judge after losing a lawsuit r are large. This is intuitive. A judge who becomes captured for a period receives larger fees in that period while increasing the probability that she will be boycotted in the future. A judge is less likely to make this tradeoff if she has a larger discount factor, or if the boycott is more likely or more long lasting. An alternative interpretation of the discount factor is that it represents the expected length of time between lawsuits by a given agent. This may explain why capture is a problem in the credit card market, as described in section 2. While banks

are involved in credit card disputes frequently, consumers are involved in credit card disputes only rarely, which may make credit card arbitrators more willing to enter into corrupt deals with banks at the expense of consumers.

2. The judge's fee f does not appear in (20) or (22). This implies that unlike bribery, capture cannot be prevented through an efficiency wage by increasing the legal fee paid to judges. This is because an increase in the fee increases the cost of losing a customer due to boycott, but also increases the benefit of becoming captured. These effects exactly cancel out, implying that changing the fee does not affect the judge's incentive to become captured.

3. Lemma 2 implies that whenever (20) is satisfied, (22) is also satisfied. Therefore, whenever global for-profit adjudication is an equilibrium, local for-profit adjudication is also an equilibrium. However, the converse is not true, and local for-profit adjudication may be an equilibrium even if global for-profit adjudication is not. This may explain why for-profit adjudication seems to work best in small, relatively homogeneous industries such as the cotton industry, and in relatively narrow classes of disputes such as disputes over international commercial contracts or employment disputes. In these kinds of disputes, all parties to the dispute may be more likely to prefer the same adjudicator. In contrast, in more general classes of disputes the disputants may be more likely to have different preferences over adjudicators, and in these kinds of disputes for-profit adjudication may work less well.

4. Corollary 1 states that in order to prevent capture, the equilibrium probability of a lawsuit in which damages are awarded ϕ_d must be sufficiently large. In turn, this means that the probability π that each agent acts honestly in each relationship must be sufficiently small. The intuition is that a captured judge fails to award damages in cases where damages should be awarded. If damages should in fact be awarded in only a very small fraction of cases, then it is very hard to distinguish between captured judges and honest judges and so judges have a very strong incentive to become captured.

5. As damages $x-\epsilon$ approach infinity, ϕ_d approaches zero. Thus, corollary 1 implies that there is an upper bound $x-\epsilon$ on the size of damages that can be awarded under for-profit adjudication. This upper bound, which I refer to as the no-capture constraint, is in addition to the upper bound on $x-\epsilon$ imposed by the no-bribery constraint described in the previous subsection.

3.6 State adjudication

Under state adjudication, the state appoints adjudicators and pays them fixed salaries funded out of taxes. In the model, state adjudication can be represented as a situation in which the judge's fee f is equal to 0, but in which each judge receives a fixed salary s as long as she is employed. It is still possible to bribe a judge under state adjudication. In fact, if the judge's salary s under state adjudication is less than her expected per-period fees $qN\phi f$ under for-profit adjudication, as appears to be the case in practice, the judge may be more willing to accept bribes under state adjudication. However, when $f = 0$, capture is impossible. Removing the no-capture constraint under state adjudication may allow state adjudicators to impose higher damages then for-profit adjudicators, reducing the frequency of cheating in relationships and increasing welfare. However, state adjudication may also reduce judges' incentives to exert (unmodeled) effort, leading to lower quality or delayed decisions, as state judges do not need to compete to attract clients. The tradeoff between these mechanisms determines whether state adjudication or for-profit adjudication is optimal.

One empirically testable prediction of this argument is that in comparable cases, damages awarded by state courts should be larger than damages awarded by private arbitrators. There is some evidence supporting this hypothesis. Bernstein (2001) finds that the rules of private arbitrators in the cotton industry are designed in a way that is likely to yield lower damage estimates than the rules used in courts. Colvin (2011) studies employment disputes, and compares damages in cases decided through private arbitration to cases decided in courts. He finds that damages are lower in cases decided through arbitration. More research is needed in this area.

4 Impartiality and State Adjudication

I have argued that states provide adjudication services because, by offering low-powered incentives to adjudicators, states are able to provide more impartial adjudication than can be provided in the market. In this section, I illustrate this mechanism by discussing the history of the English judicial system in the era of Magna Carta.

In the immediate aftermath of the Norman conquest in 1066, jurisdiction in England was divided between the king's court and a large number of local courts controlled by local lords and clergy (Hudson 1996). The most economically significant function of these courts was to resolve disputes over land. A litigant with a land dispute could appeal either to a local court or the royal court for a fee. These fees were substantial. Bartlett (2000, p. 168) describes the cost of bringing a lawsuit over the inheritance of a knight's fee, a standard unit of land. The court fee for bringing such a lawsuit was approximately half of a year's income from the land. Some of these cases were resolved through true adjudicative methods such as sworn testimony or the presentation of written documents. However, the most important form of dispute resolution was trial by combat, in which the disputants, or sometimes their hired champions, would fight to determine the winner of the case (Hudson 1996, p. 111). In other cases disputants bypassed the courts entirely and resolved their disputes through extrajudicial violence (Hudson 1996, p. 120).

The king was believed to be the "fount of justice", and the most important land disputes were resolved in the royal court. The provision of adjudication services yielded a significant portion of the king's revenues. In 1130, 12% of the king's revenue derived from "the profits of justice", primarily court fees from land disputes (Bartlett 2000, p. 159). This figure is comparable to the 14% of revenue derived from taxation.[8] Henry II, who reigned from 1154 to 1189, reformed the royal justice system, probably motivated by his desire to attract more judicial business from the local courts (Hudson 1911). His most important reform was to institute trials by juries who were charged with investigating the merits of a case. This reform had several effects. First, it significantly increased both the number of cases brought to the royal courts and the king's revenue from the provision of adjudication services (Barratt 2007). The profits of justice averaged 15.7% of the king's revenue during the reign of Henry's successor Richard I from 1189 to 1199 (Barratt 2001) and 20.3% of the king's revenue during the reign of Richard's successor John from 1199 to 1215 (Barratt 1996).[9] Second, the reform extended access to justice to a much wider range of social classes, including the relatively poor. Hudson (1996, p. 234) writes that under Henry the rich complained that "near rustics were bringing royal writs." Third, the reform led to the decline of the local courts. Hudson (1996, p. 219) writes, "That honorial [that is, local] courts declined in part because of the Angevin reforms seems undeniable." Finally, after the reform trial by jury largely replaced trial by combat (Brand 2007).

Despite the popularity of Henry's reforms, there was discontent among the nobility because the royal justice system was perceived as being biased, especially under John. A common complaint was that John "sold justice", pressuring juries to rule in favor of litigants who were able to pay the highest fees (Bartlett 2000, p. 63). One reason for this problem was that John lost most of his French possessions in 1204, and so he was personally present in England to a much greater extent than his predecessors. John's presence allowed him to take a greater personal interest in litigation than his predecessors, and, as Hudson (1996, p. 221) writes, "Some of his involvement must [have] stem[med] from a desire not for justice

[8]The largest component of the king's revenue, 40%, was profits from the king's own lands, known as the royal demesne. A further 16% of revenue was derived from feudal payments from other land owners. (Feudal dues included payments owed to the king when his vassals married or inherited land, and the king's right of wardship, under which the king was entitled to the revenues of lands owned by minor children until they reached adulthood.) It seems that the primary occupation of medieval kings was as private landlords, and that they pursued governance activities, including both taxation and adjudication, as a kind of side business.

[9]These figures combine Barratt's estimates of the revenue from "justice" and "eyre". The eyre was an itinerant court that heard local cases.

but for financial benefit."

The perception that John's courts were biased may have contributed to the precipitous decline in John's revenue from justice in 1213 and 1214 (Barratt 1996). Grievances about the biases of royal justice were also among the core complaints leading to the baronial rebellion against John in 1215, which forced John to make various concessions to the barons in Magna Carta. The barons did not demand the return of judicial power from the royal court to the local courts. In fact, the barons demanded an increase in the scope and power of the royal courts. In clause 17 of Magna Carta, the barons demanded that John create a fixed royal court to hear cases at Westminster, and in clause 18 the barons demanded that John send royal justices to hear cases in each county four times per year. This latter demand was such a large increase in the scope of the royal courts that it proved impractical, and later issues of Magna Carta required only that the king send royal justices to each county once per year. As Bartlett (2000, p. 63) puts it, "The rebels of 1215 did not want less royal justice but more." At the same time, the barons demanded that John take measures to insulate the justice system from his personal control. Clause 17 creating a fixed royal court was one of these measures; the fixed court removed justice from the household of the king, which travelled around the country. The other measure was clause 24, which required that executive officers of the king ("sheriffs, constables, coroners, or other royal officials") could not simultaneously hold appointment as royal justices. The overall effect of these demands was to create for the first time a separation between the judicial and the revenue-raising aspects of the royal administration. "Magna Carta sometimes implicitly, sometimes explicitly demanded a separation of finance and justice" (Hudson 1996, p. 227).

The changes in the justice system created by Magna Carta further strengthened the royal courts' monopoly on adjudication and condemned the local courts to a "slow, lingering death" (Brand 1992, p. 29). However, the power of the king to influence the judicial system was constrained by another major consequence of Magna Carta, the development of a legal profession. By the middle of the thirteenth century trials were presided over by expert, salaried judges and argued by professional lawyers, unlike under the Henry II when lawyers did not exist and judges were legal amateurs who also served the king in other ways (Brand 1992). While the profits of justice continued to flow to the English kings, the actual administration of justice was increasingly carried out by agents who were not the residual claimants of these profits.

The development of the English state and legal system during the medieval period is consistent with all of the main features of my model. English society before Henry II was a society in which disputes were resolved partially through (violent) self-redress and partially through a market for adjudication with multiple lords and the king competing to provide adjudication services. Henry's reforms increased the accuracy of the royal courts, attracting dispute resolution business away from the local courts and increasing welfare by reducing violence. However, personal control of the royal courts by the king allowed the king to be captured by wealthy disputants, especially under John. John's barons revolted, demanding a royal justice system that was more extensive but also a more insulated from financial incentives and hence more impartial. As a result, English justice developed from a for-profit system with competition between different entrepreneurial adjudicators into a system dominated by state-appointed professional adjudicators with relatively weak incentives.

5 Conclusion

In this paper, I have developed a model of dispute resolution through adjudication, which I have used to understand why adjudication is sometimes provided in a competitive market and sometimes by the state. I argue that because the state can use its power of taxation to give low-powered incentives to adjudicators, the state is able to provide more impartial adjudication than the market. Impartial state adjudication can increase welfare by reducing the prevalence of socially harmful behavior below the minimum level sustainable under for-profit adjudication. This mechanism explains why the state is the dominant provider of adjudication in most modern societies.

Standard arguments in economics suggest that the state can improve on outcomes under anarchy by enforcing contracts and property rights, by providing public goods, and by correcting externalities. The literature on state development, such as Besley and Persson (2009), has discussed how states have invested in these capabilities. There has been much less focus in the literature on understanding how states developed the capacity to provide impartial adjudication of disputes. Further research on this process may provide new insights into the the development of legal institutions and the rule of law.

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A Proofs

A.1 Proof of Lemma 1

Consider a sequential equilibrium strategy profile σ. Let $\bar{A}^1$ be the set of action profiles in the prisoner's dilemma game that can be chosen with positive probability in the equilibrium. Since $p(y|a_i^1, a_j^1) > 0$ for all y, a_i^1, a_j^1, then regardless of the action agent i chooses in the prisoner's dilemma game, agent i must believe with positive probability that agent j chose a_j^1 for each $a_j^1 \in \bar{A}_j^1$ and that agent j did not choose any $a_j^1 \notin \bar{A}_i^j$. Suppose that $\sigma_j^2(N|a_j^1, y, \theta) > 0$ for at least one $a_j^1 \in \bar{A}_j^1$. Then agent i's unique best response to y,θ is N. In turn, this implies that agent j's unique best response to y, θ is N. Applying this argument to both agents implies that if either agent chooses N with positive probability after choosing any action $a_i^1 \in \bar{A}_i^1$ and observing signal y, θ, then each agent must choose N with probability 1 after observing signal y, θ. The same argument applies to actions T_i and T_j. Conversely, if any agent i chooses P with positive probability after choosing $a_i^1 \in \bar{A}_i^1$ and observing signal y, θ, then both agents must choose P with probability 1 after choosing $a_i^1 \in \bar{A}_i^1$ and observing any signal y, θ. Thus, for all i, all y and all $a_i^1 \in \bar{A}_i^1$ and $\hat{a}_i^1 \in \bar{A}_i^1$, $\sigma_i^2(a_i^1, y, \theta) = \sigma_i^2(\hat{a}_i^1, y, \theta)$. I define $\sigma_i^2(y, \theta) = \sigma_i^2(a_i^1, y, \theta)$ for all $a_i^1 \in \bar{A}_i^1$.

Since $p(y|a_i^1, a_j^1) > 0$ for all y, a_i^1, a_j^1, given any information agent i must believe that agent j chose an action in $\bar{A}_j^1$ with probability 1. Therefore, agent i must believe that agent j will choose action $\sigma_j^2(y, \theta)$ after observing signal y, θ. Note that $\sigma_i^2(y, \theta)$ is a best response for agent i to $\sigma_j^2(y, \theta)$.

Now, for each i define $\hat{\sigma}_i^1 = \sigma_i^1$ and $\hat{\sigma}_i^2(a_i^1, y, \theta) = \sigma_i^2(y, \theta)$ for all a_i^1. Consider the strategy profile $\hat{\sigma} = (\hat{\sigma}_i, \hat{\sigma}_j)$. When $a_i^1 \in \bar{A}$ and $\bar{a}_i$, $\hat{\sigma}$ is identical to σ, and $a_i^1 \in \bar{A}_i^1$ with probability 1 for all i, so $\hat{\sigma}$ and σ have the same outcome. Because $\hat{\sigma}_i^2(a_i^1, y, \theta)$ is a best response for agent i to y, θ, $\hat{\sigma}$ is an equilibrium. Finally, $\hat{\sigma}$ is a public strategy profile. This completes the proof.

A.2 Proof of Proposition 1

The proof is very similar to the proof of lemma 1 in Kandori and Obara (2006). Suppose that action profile σ^1 is played in the prisoner's dilemma game in some *public* equilibrium. Let v_i^y be agent i's payoff in the enforcement game if signal y is observed. If H is chosen with probability greater than 0, then we have

$$v_i = g(H, \sigma_j^1) - (v_i^G - v_i^B)p(B|H, \sigma_j^1) + v_i^G \tag{24}$$

$$v_i \geq g(C, \sigma_j^1) - (v_i^G - v_i^B)p(B|C, \sigma_j^1) + v_i^G \tag{25}$$

(25) is satisfied with equality if agent i mixes between H and C in equilibrium. Rearranging (24) and (25) and noting that $v_i^G + v_j^G \leq 0$ yields

$$v_i + v_j \leq g(H, \sigma_j^1) + g(H, \sigma_i^1) - \frac{d(\sigma_j^1)}{L(\sigma_j^1) - 1} - \frac{d(\sigma_i^1)}{L(\sigma_i^1) - 1} \tag{26}$$

In turn, (26) immediately implies that the sum of payoffs in any public equilibrium is less than $2v^*$, where v^* is defined by

$$v^* = \max_{\sigma_j^1} g(H, \sigma_j^1) - \frac{d(\sigma_j^1)}{L(\sigma_j^1) - 1}. \tag{27}$$

Finally, lemma 1 states that the outcome of every equilibrium is the outcome of a public equilibrium, which implies that the upper bound in (27) is an upper bound on payoffs for all equilibria.