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Endogenous Enforcement Institutions

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Abstract

The enforcement of contracts and property rights requires that violators are punished. However, punishments that are costly to administer may not be credible. In this paper we present a model where credible punishments depend on the social allocation of coercive power. We model society as a set of production ventures, whose members spend effort only if they can contract to share the receipts and if they are protected from external expropriation. Under decentralized enforcement, power is dispersed among the strong individuals in each venture, who are rewarded by a ruler for punishing violators. Under centralized enforcement, power is concentrated within the ruler, who directly punishes violators. By preventing violent expropriation across individuals, centralization allows to enforce the law through milder and hence more credible penalties. At the same time, centralization creates a temptation for the ruler to expropriate. Hence, centralized enforcement will be efficient when coercive power is more constrained and costly to use – for instance, due to the individuals' ability to react or to the presence of moral constraints on the use of force.

Keywords: Enforcement; Penalties; Power; Contracts; Property Rights

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1. Introduction

In a seminal paper, Coase (1960) has argued that contracts and property rights are key for economic development. At the limit, the Coase Theorem predicts that, when property rights over assets are well-defined and contracts can be enforced at low cost, individuals will negotiate efficient transactions, irrespective of the initial allocation of resources. But when are the costs of enforcing contracts "low"? And when are property rights "well-defined"?

Most of the economic literature has answered these questions in terms of adjudication costs. In that perspective, contract enforcement is limited by the ability of courts or other enforcers to interpret contractual obligations, and by the ability of the parties to produce evidence on non-compliance.[1] Similarly, the enforcement of property rights is limited by the technology available to measure the boundaries of assets over which such rights are defined (Libecap and Lueck 2011), or to generate and interpret the evidence on conflicting claims over a given asset (Arruñada 2003, 2012).

[1] The problems associated to the interpretation of formal contracts by courts have been analyzed, among others, by Schwartz and Scott (2003) and, more formally, by Battigalli and Maggi (2002). In informal contracts, the frictions that arise when parties mistakenly interpret each other's obligations have been discussed by Levin (2002) and MacLeod (2003). The costs of showing evidence on the compliance with contractual obligations to courts are at the basis of both the literature on agency and incentive contracts (see, for instance, Holmstrom 1979; Holmstrom and Milgrom 1991; Baker et al. 1994) and the literature on incomplete and relational contracts (see, for instance: Grossman and Hart 1986; Hart and Moore 1988, 2008; Klein 2000; Baker et al. 2002, 2011; Hart and Holmstrom 2010). The costs of conveying evidence of contractual breach to the enforcers also play an important role in models of reputational and community-based enforcement, such as Dixit (2003a,b) and Masten and Prufer (2011).

The importance of adjudication cannot be overestimated. However, even a perfect adjudication system will fail to enforce contracts and property rights, unless the adjudicator's rulings are backed by a credible threat of punishing violators. In many instances, penalties are costly to administer, so they will only be credible if punishers are provided with incentives to carry them out. Surprisingly enough, most of the literature abstracts from this credible-punishment problem.[2,3] Our paper fills this gap by modeling the constraints that the technology available for punishment and the allocation of coercive power within society pose to the credible uses of such power and, consequently, to the enforcement of contracts and property rights.

In the model, there are N production ventures and a ruler. Each production venture is composed by a "powerful" individual, who owns the receipts from the venture, and a "weak" individual. Both the powerful and the weak individuals' productive efforts are unobservable. Hence, revenue-sharing within each venture is necessary in order to elicit effort. However, revenue-sharing may be unsustainable ex post, for two reasons. First, once the efforts are sunk, the powerful are tempted to breach their sharing contracts with the weak and retain the whole surplus. Second, the powerful and the ruler may have a

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[2] The literature on self-enforcing contracts has focused on the termination of (or the refusal to initiate) profitable relationships as a sanction alternative to penalties. The underlying assumption is that termination following evidence of the other party's opportunism is in the interest of the terminating party, so it constitutes a credible punishment. In section 3 of this paper we show that, when penalties can be administered through an efficient technology, they may actually be more credible than the threat of termination.

[3] Two exceptions are Hirshleifer and Rasmusen (1989) and Dixit (2004). Hirshleifer and Rasmusen (1989) study the existence of cooperative equilibria in the presence of costly ostracism. Unlike us, they do not analyze the constraints that ostracism costs pose to contract enforcement. In his model of private enforcement intermediaries, Dixit (2004) assumes that punishing violations requires an upfront fixed investment by the enforcer, after which punishments can be costlessly administered. We expand on Dixit (2004) by allowing for variable punishment costs and by studying how they limit enforcement. We also expand on both Hirshleifer and Rasmusen (1989) and Dixit (2004), who restrict attention on decentralized enforcement, by studying both centralized and decentralized enforcement in a unified framework.

temptation to use the coercive power they are endowed with in order to expropriate the individuals in other ventures.

We study two institutional arrangements that may guarantee the enforcement of both contracts and property rights. The key difference between them is the allocation of power within society. Under *decentralized enforcement*, coercive power is dispersed among the principals, and the ruler acts as a mere coordinator.[4] Examples of this setting are the medieval feudal States, the international community, the traditional societies governed by customary law, and criminal organizations such as the Sicilian mafia.[5] The powerful enter a multilateral relational contract with the weak and the ruler, whereby i) both the powerful and the weak pay taxes to the ruler at the beginning of each period; ii) any powerful individual who violates the contract and property laws set by the ruler is punished by the other powerful; and iii) in exchange for their punishment services, the powerful are rewarded by the ruler through monetary transfers.[6] As a result, the set of enforceable sharing contracts and property rights is limited by the ruler's temptation not to reward the powerful individuals' punishment services, which is determined, in turn, by the cost of deterring non-compliance through penalties. The more efficient the

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[4] Other models of decentralized enforcement where the ruler acts as a mere coordinator are Milgrom et al. (1990) and, more recently, Hadfield and Weingast (2011a). Unlike us, these papers do not study how enforcement is constrained by the credibility of punishments, and the tradeoff between centralized and decentralized enforcement.

[5] On decentralized enforcement under customary law, see Aldashev et al. (2012). On enforcement in the Sicilian mafia, see Gambetta (1993). More examples of decentralized enforcement systems are discussed by Hadfield and Weingast (2011b).

[6] Examples of these monetary bonuses may be tax rebates or pardons, subsidies, and public procurement contracts. The ruler may also award "in kind" bonuses such as political and military appointments, nobility titles, licenses to engage in regulated activities, and the like. We measure both types of bonuses in monetary terms.

punishment technology, the easier to enforce contracts and deter expropriation through decentralized penalties.

Under *centralized enforcement*, coercive power is concentrated within the ruler, who directly punishes violations and collects money from the members of society to cover his punishment costs. The most obvious example of this setting is given by the modern and contemporary states, with their centralized monopoly over the use of force. By preventing the possibility that the powerful use force to expropriate each other, centralization allows to enforce the ruler's laws through milder and hence more credible penalties. The reason is that, under centralized enforcement, the penalties must only deter the powerful individuals' violation of their own sharing agreements with the weak ones, rather than violation of both the sharing agreements and the other powerful individuals' property rights, as under decentralized enforcement.

At the same time, centralization creates a temptation for the ruler to use his overwhelming power to directly expropriate the members of society, as discussed by Acemoglu (2003). Hence, centralized enforcement is efficient when the stock of coercive power is more limited in size and costly to use – for instance, due to the individuals' willingness and ability to resist violence, or to the presence of cultural and moral constraints on the use of force. This occurs for two reasons. First, a decrease in the stock and an increase in the cost of coercive power hamper the ruler's ability to expropriate under centralized enforcement, thus making it easier for the ruler to commit not to expropriate. Second, they increase the rewards that must be guaranteed to the powerful under decentralized enforcement in order to motivate them to punish violations of the law, thus making decentralized enforcement comparatively less credible.

An implication of the model is that, when centralized enforcement is chosen but coercive power is relatively abundant and easy to mobilize, the ruler's "vertical" commitment problem (not expropriating) dominates the "horizontal" problem (punishing the powerful who breach their sharing contracts with the weak). This result has an interesting historical interpretation. It suggests that, in centralized States with substantial and relatively unbounded coercive power, the binding constraint is the State's temptation to expropriate citizens. When that is the case, imposing checks and balances on the Executive would promote investment and growth more than facilitating the enforcement of "horizontal" contracts – for instance, by improving adjudication procedures. The reason is that powerful and relatively unconstrained States can more easily commit to harsh punishments against contract breaches and, therefore, to enforce contracts even in the presence of imperfect adjudication. For the same reason, though, those States can hardly commit not to use their overwhelming power to directly expropriate their citizens. Hence, institutional changes aimed at reducing the State's power are more productive than those aimed at improving adjudication. This result is consistent with Acemoglu and Johnson (2005), who show empirically that the historical introduction of checks and balances to the Executive Power in a cross section of countries had a stronger effect on those countries' long-term economic development than the improvement of adjudication procedures.

The rest of the paper is organized as follows. Section 2 presents the model. Section 3 derives the main results on comparative enforcement institutions. Section 4 concludes.

2. The Model

2.1. Environment

Consider a society composed of 2N+1 individuals: N "powerful" (denoted by $P_1,\ldots,P_n$), N "weak" (denoted by $W_1,\ldots,W_n$), and a ruler (denoted by R). Each powerful individual P_i is engaged in a productive relationship with weak individual W_i only – that is, he does not have a relationship with any weak individual $W_j \neq W_i$. The relationships are exclusive, meaning that the powerful-weak couples do not change over time. These assumptions are without loss of generality, but they considerably simplify the model's notation.

In any given couple i, P_i and W_i contribute to production by spending *unobservable* efforts e_{Pi} and e_{Wi} at costs $C_{Pi}(e_{Pi})$ and $C_{Wi}(e_{Wi})$, respectively. As a result of these efforts, P_i and W_i generate the *observable* value $V_i(\mathbf{e}_i)$, where $\mathbf{e}_i = [e_{Pi}, e_{Wi}] \in \mathbb{R}^2$ is the effort vector for couple i. In order to insure internal solutions to the effort choice problems across couples, we assume that the function $V_i(\mathbf{e}_i)$ is increasing in $\mathbf{e}_i$ and has a negative definite Hessian matrix, and that $C_{Pi}(e_{Pi})$ and $C_{Wi}(e_{Wi})$ are increasing and convex, for any

i. All individuals live forever, and time evolves in discrete periods, denoted by $t = 1, 2, ..., \infty$.

Given that the effort vector $\mathbf{e}_i$ is unobservable, any contract designed to give proper incentives to P_i and W_i to spend effort must depend on the observable outcome $V_i(\mathbf{e}_i)$. For simplicity, we restrict attention to linear sharing contracts of the type $\gamma_i V_i(\mathbf{e}_i)$, where $\gamma_i \in [0,1]$ is the share of value produced by couple i that goes to W_i. Since the purpose of our model is to study how different enforcement institutions affect the powerful individuals' temptation to renege on the sharing contracts, assuming linear contracts is without loss of generality.

Given a sharing rule γ_i, P_i and W_i will choose their effort levels $e_{Pi}(\gamma_i)$ and $e_{Wi}(\gamma_i)$ to solve, respectively:

$$\max_{e_{Pi}} (1-\gamma_i) V_i(e_{Pi}, e_{Wi}(\gamma_i)) - C_{Pi}(e_{Pi}), \text{ and} \tag{1}$$

$$\max_{e_{Wi}} \gamma_i V_i(e_{Pi}(\gamma_i), e_{Wi}) - C_{Wi}(e_{Wi}). \tag{2}$$

It follows from (1) and (2) above that $e_{Pi}(1) = e_{Wi}(0) = 0$. Ideally, P_i and W_i would like to commit to the sharing rule γ_i^*, which solves

$$\max_{\gamma_i} V_i[\mathbf{e}_i(\gamma_i)] - C_{Pi}[e_{Pi}(\gamma_i)] - C_{Wi}[e_{Wi}(\gamma_i)]. \tag{3}$$

The effort levels in couple i under the efficient sharing rule are given by $e_{Pi}^* = e_{Pi}(\gamma_i^*)$ and $e_{Wi}^* = e_{Wi}(\gamma_i^*)$, and the resulting joint surplus is given by $S_i^* = V_i[\mathbf{e}_i^*] - C_{Pi}[e_{Pi}^*] - C_{Wi}[e_{Wi}^*]$.

A key feature of the model is that the value $V_i(\mathbf{e}_i)$ produced by any couple i directly accrues to P_i. This enables P_i to retain the whole value if he wants so and, in the absence of enforcement mechanisms, prevents him from committing to the efficient sharing rule γ_i^*. In the rest of the paper we study enforcement mechanisms that can solve this commitment problem and, that way, stimulate efficient investments and value-creation. We analyze enforcement under two different allocations of power within the society: decentralized and centralized.

When the power is *decentralized*, each powerful individual P_i has access to a coercion technology that allows him to inflict a monetary loss $L_{ij} \in \left[0, \overline{L}\right]$ on individual j at a cost $E\left(L_{ij}\right) = kL_{ij}$, where $k \in [0,1]$. The parameter $\overline{L}$ measures the endowments of coercive power, which we assume to be equal across individuals for simplicity. The assumption that $k \in [0,1]$ implies that the coercion technology is productively efficient, in the sense that inflicting a one monetary unit loss to individual j costs less than a monetary unit to individual i. When the power is *centralized*, the powerful individuals' aggregate coercive power $N\overline{L}$ is transferred to R, the ruler, who has therefore exclusive access to the coercion technology described above.

We assume throughout the model that, irrespective of whether power is centralized or decentralized, the weak individuals do not have access to any coercion technology and, therefore, are harmless. Moreover, we assume that, except for the productive efforts, the ruler observes any actions taken by the members of society – specifically, whether sharing contracts are honored, whether payments are made, and whether coercive power is used – and can communicate his information to the other individuals at zero cost. We make this assumption to fully abstract from interpretation, verification and communication costs, which have been extensively studied in the literature on contracts, and focus on the issue of credible punishments.

2.2. The case of unenforceable contracts

Before analyzing enforcement, it is useful to briefly discuss the benchmark case where contracts are not enforceable.

Decentralized power

When power is decentralized, each powerful individual P_i faces a double moral hazard problem. First, once W_i's effort has been sunk, P_i has an incentive to retain W_i's share and set $\gamma_i = 0$.[7] Second, P_i has an incentive to threaten to use his power in order to expropriate the powerful individuals in other couples. Ex ante, the prospect of contract breach within the couple induces W_i to set $e_{Ai}(0) = 0$, which is inefficient. Moreover, the prospect of expropriation from outside the couple may also induce P_i to spend an inefficiently low level of effort.

In order to derive P_i's effort choice under the threat of expropriation, we must first characterize the powerful individuals' decisions to expropriate each other after all the efforts have been sunk. In order to expropriate a share ψ_{ij} of P_j's value $V_j(\mathbf{e}_j)$, given that

[7] We assume for simplicity that P_i does not incur any cost in order to retain A_i's share. The model's results would also obtain if P_i had to incur a cost, provided that it is small enough.

all the other powerful individuals have already expropriated a share $\sum_{k\neq i}\psi_{kj}$, P_i must credibly threaten to inflict a loss L_{ij} to P_j such that P_j prefers to surrender the share $\psi_{ij}V_j(\mathbf{e}_j)$ rather than resist and suffer the loss. Formally, this implies that

$$\left(1-\psi_{ij}-\sum_{k\neq i}\psi_{kj}\right)V_j\left(\mathbf{e}_j\right)\geq\left(1-\sum_{k\neq i}\psi_{kj}\right)V_j\left(\mathbf{e}_j\right)-L_{ij}. \tag{4}$$

It follows from (4) that the minimum loss that allows P_i to expropriate P_j is $L_{ij}=\psi_{ij}V_j(\mathbf{e}_j)$. We assume that P_i can credibly threaten to inflict this loss by incurring the cost kL_{ij} upfront.[8] Given this assumption, P_i's credible expropriation vector $\boldsymbol{\psi}_{ij}=\left[\psi_{i1},...,\psi_{i,i-1},...,\psi_{i,i+1},...,\psi_{in}\right]$ solves

$$\begin{aligned}&\max_{\boldsymbol{\psi}_{ij}}\sum_{j\neq i}(1-k)\psi_{ij}V_j\left(\mathbf{e}_j\right)\\ &\text{s.t.}\quad \psi_{ij}+\sum_{k\neq i}\psi_{kj}\leq 1 \text{ for every } j.\\ &\qquad\ \sum_{j\neq i}\psi_{ij}V_j\left(\mathbf{e}_j\right)\leq\bar{L}.\end{aligned} \tag{5}$$

Assume the expropriation game (5) has a unique Nash equilibrium, and denote P_i's equilibrium expropriation vector as $\boldsymbol{\psi}_{ij}^{D0}$. Then, it is straightforward to show that the aggregate share of P_i's value that is expropriated by the other principals, denoted as $\psi_i^{D0}=\sum_{j\neq i}\psi_{ji}^{D0}$, is non-decreasing in $\bar{L}$. Anticipating this outcome, P_i will choose his effort level ex ante to solve

$$\max_{e_{Pi}}\left(1-\psi_i^{D0}\right)V_i\left(e_{Pi},0\right)-C_{Pi}\left(e_{Pi}\right). \tag{6}$$

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[8] In a military setting, this could be interpreted as moving P_i's troops next to P_j, so that P_i's extra cost of actually attacking P_j would be negligible.

Denote the solution of (6) as e_{Pi}^{D0}, and P_i's payoff in the absence of enforceable contracts as $\Pi_i^{D0} = (1-\psi_i^{D0}) V_i(e_{Pi}^{D0}, 0) + (1-k)\sum_{j\neq i}\psi_{ij}^{D0} V_j(e_{Pj}^{D0}, 0) - C_{Pi}(e_{Pi}^{D0})$. Two things are worth noticing. First, e_{Pi}^{D0} is non-increasing in $\overline{L}$. Second, since the expropriation game (5) is purely redistributive, it must be $\sum_i \Pi_i^{D0} = \sum_i\left[(1-k\psi_i^{D0}) V_i(e_{Pi}^{D0}, 0) - C_{Pi}(e_{Pi}^{D0})\right] = S^{D0}$. This implies that the total surplus in the absence of enforceable rights, S^{D0}, ultimately depends on the parameters k and $\overline{L}$. In addition, S^{D0} may also depend on the technical relation between P_i's and W_i's efforts, which affects e_{Pi}^{D0}: for a given ψ_i^{D0}, the larger (smaller) e_{Pi}^{D0}, the easier (harder) it is to substitute W_i's effort with P_i's and, therefore, the less essential W_i's effort is to produce value.

Centralized power

As under decentralized power, in the absence of enforceable contracts, each powerful individual P_i sets $\gamma_i = 0$. Moreover, R's credible expropriation vector $\boldsymbol{\psi} = [\psi_1, ..., \psi_n]$ solves

$$\begin{aligned}&\max_{\boldsymbol{\psi}} \sum_i (1-k)\psi_i V_i(\mathbf{e}_i)\\ &\text{s.t.} \quad \psi_i \leq 1 \text{ for every i, and} \\ &\qquad \sum_i \psi_i V_i(\mathbf{e}_i) \leq N\overline{L}.\end{aligned} \tag{7}$$

where ψ_i is the share of $V_i(\cdot)$ expropriated by the ruler. Denote the solution of (7) as $\boldsymbol{\psi}^{C0}$, with typical element ψ_i^{C0}. It is useful to state the following

Lemma 1: $\psi_i^{C0} = \psi_i^{D0} = \psi_i^{0}$, for every i.

Proof: by inspection of (5) and (7).

Anticipating this outcome, P_i will choose his effort level to solve

$$\max_{e_{Pi}} \left(1-\psi_i^0\right) V_i\left(e_{Pi},0\right) - C_{Pi}\left(e_{Pi}\right). \tag{8}$$

Given Lemma 1, we can denote the solution of (8) as $e_{Pi}^{C0} = e_{Pi}^{D0} = e_{Pi}^{0}$, P_i's payoff as $\Pi_i^{C0} = \left(1-\psi_i^0\right) V_i\left(e_{Pi}^0,0\right) - C_{Pi}\left(e_{Pi}^0\right) = \Pi_i^{D0} = \Pi_i^0$, the ruler's payoff as $R^{C0} = \sum_i \psi_i^0 V_i\left(e_{Pi}^0,0\right) - kN\bar{L}$, and the social surplus as $S^{C0} = R^{C0} + \sum_i \Pi_i^{C0} = S^{D0} = S^0$.

3. Comparative enforcement institutions

How can the powerful individuals commit not to violate contracts and property rights and, that way, generate efficient effort and production levels? In the rest of the paper we analyze and compare the enforcement institutions that guarantee such commitment under both a decentralized and a centralized distribution of coercive power.

Under *decentralized enforcement,* each powerful individual offers to the weak individual he is matched with a sharing rule γ_i, which is enforced through a multilateral relational contract between the powerful, the weak and the ruler. According to this multilateral contract, if P_i reneges on the agreed upon sharing rule and sets $\gamma_i = 0$, or if P_i uses his power to expropriate any other powerful individual P_j, R calls upon all the powerful individuals other than P_i to inflict a punishment on P_i.[9] In this version of the

[9] A multilateral contract performs better than a set of bilateral relational contracts between P_i and W_i and between P_i and P_j, because in a multilateral contract reneging by party i on party j triggers a reversion to the

model, R is a powerless party who acts as a mere coordinator, like the law-merchant judges (Milgrom et al. 1990), international institutions such as the UN Security Council, the EU, and the WTO, (Hadfield and Weingast 2011b) and, to some extent, the kings and emperors in feudal states. As we will see momentarily, the difference between previous models of decentralized enforcement and ours is that we explicitly take into account the cost of administering punishments and how the need to incentivize punishers constraints the scope of contract enforcement and, consequently, the incentives for productive investments.

Under *centralized enforcement*, the punishment task is transferred to R, whose role thus becomes similar to that of the kings and governments in modern and contemporary states. The sharing rules agreed by each powerful-weak couple are enforced through a multilateral relational contract between the powerful individuals, the weak individuals and R, whereby R promises to punish any violation by the powerful. The difference with respect to decentralized enforcement is that now R has a temptation to use his overwhelming power to directly expropriate both the powerful and the weak.

3.1. Decentralized enforcement

Under decentralized enforcement, at time t = 0, R announces a legal code $\left[\boldsymbol{\gamma}^{D}, \boldsymbol{\psi}^{D}, \mathbf{L}^{D}\right]$, where $\boldsymbol{\gamma}^{D} = \left[\gamma_1^{D}, ..., \gamma_n^{D}\right]$ denotes the maximum sharing rules that R is willing to enforce, $\boldsymbol{\psi}^{D} = \left[\psi_{12}^{D}, ..., \psi_{1n}^{D}, ..., \psi_{n1}^{D}, ..., \psi_{n,n-1}^{D}\right]$ denotes the maximum

one-shot game by all the other parties, rather than by i and j alone, in the future periods. See Levin (2002) for the details.

expropriation levels that R is willing to tolerate, and $\mathbf{L}^D = \left[L_{12}^D, ..., L_{1n}^D, ..., L_{n1}^D, ..., L_{n,n-1}^D\right]$ denotes the penalties that will be imposed in case of violation. In any subsequent time period, for any i, the stage interaction between the powerful individuals, the weak individuals and the ruler works as follows:

1. *Contracting*. P_i makes a monetary transfer t_i^{PR} to R. After that, P_i offers a sharing rule γ_i to W_i. If W_i accepts, he makes a monetary transfer t_i^{WP} to P_i;[10]
2. *Production*. P_i and W_i choose the effort levels e_{Pi} and e_{Wi} at costs $C_{Pi}\left(e_{Pi}\right)$ and $C_{Ai}\left(e_{Wi}\right)$, respectively;
3. *Distribution and enforcement*. P_i decides whether to honor γ_i and $\boldsymbol{\psi}^D$. If P_i does not honor γ_i and $\gamma_i \leq \gamma_i^D$, or if he does not honor $\boldsymbol{\psi}^D$, R calls every other powerful individual P_j to inflict a loss L_{ji}^D on P_i. If P_i honors both γ_i and $\boldsymbol{\psi}^D$, R pays him a bonus b_i^{RP}. Finally, if P_i honors $\mathbf{L}^D$ by acting as a punisher when requested, R pays him an (off-the-equilibrium) bonus β_i^{RP};
4. *Payoffs*. P_i receives the gross payoff $\left(1-\gamma_i-\psi_i\right)V_i\left(\mathbf{e}_i\right)+\left(1-k\right)\sum_{j\neq i}\psi_{ij}V_j\left(\mathbf{e}_j\right)$ and W_i receives the gross payoff $\gamma_i V_i\left(\mathbf{e}_i\right)$, where $\psi_i = \sum_{j\neq i}\psi_{ji}$ denotes the total share of P_i's value expropriated by the other powerful individuals, as described before.

As standard in the literature, we analyze relational contracts as trigger strategy equilibria of the infinitely repeated game. Given that discretionary monetary transfers are

[10] The transfer t_i^{PR} can be interpreted as a tax, while the transfer t_i^{WP} can be interpreted as a rent paid by the weak individual to use the powerful's assets, as is common in sharecropping and franchising.

available, we can restrict attention to stationary contracts, where each party's behavior does not vary over time along the equilibrium path (Levin 2003). Hence, at time t+1 the game is identically repeated if all parties have honored the relational contract at time t. Conversely, if anyone has reneged at time t, all parties revert to the spot game in period t+1 and thereafter. As a result, P_i receives a per period payoff equal to Π_i^0, and W_i receives a payoff equal to zero. Notice that, in considering the principals' incentives to apply the penal code $\mathbf{L}^D$, we require relational contracts to be self-enforcing both on and off the equilibrium path.[11]

Before we proceed with the analysis, it is useful to characterize the short-run gains of P_i if he reneges on γ_i and $\boldsymbol{\psi}^D$ at stage 3, given that all the other powerful individuals are honoring. If P_i reneges, he will set $\gamma_i^{RD} = 0$, where the "RD" superscript stands for "reneging under decentralized enforcement". Moreover, he will use his power in order to expropriate the other powerful individuals. To simplify the notation, let $V_i = V_i\left[\mathbf{e}_i\left(\gamma_i, \psi_i\right)\right]$, $C_{Pi} = C_{Pi}\left[e_{Pi}\left(\gamma_i, \psi_i\right)\right]$, and $C_{Wi} = C_{Wi}\left[e_{Wi}\left(\gamma_i, \psi_i\right)\right]$, for every i. P_i will choose the expropriation vector $\boldsymbol{\psi}_{ij}^{RD}$ to be expropriated from principal P_j by solving

$$\begin{aligned}
&\max_{\boldsymbol{\psi}_{ij}^{RD}} \sum\nolimits_{j\neq i} (1-k)\psi_{ij}V_j \\
&\text{s.t.} \quad \psi_{ij} + \sum\nolimits_{k\neq i} \psi_{kj} \leq 1 \text{ for every j, and} \qquad (9)\\
&\qquad \sum\nolimits_{j\neq i} \psi_{ij}V_j \leq \overline{L}.
\end{aligned}$$

[11] Similar subgame-perfection assumptions are imposed in models of the interaction between formal and informal contracts (Baker et al. 1994, 2002, 2011, Zanarone 2012), where the parties renegotiate to the optimal spot formal contract once their informal relationship breaks down.

It is straightforward to check that, for any i and j, $\psi_i^{RD} = \sum_{j\neq i} \psi_{ji}^{RD}$ is non-decreasing in $\overline{L}$. Moroever, we have the following

Lemma 2: $\psi_i^{RD} = \psi_i^0$.

Proof: by inspection of (5) and (9).

Denote the per period payoffs of any powerful individual P_i and any weak individual A_i who honor the relational contract as

$$\Pi_i^{PD} = (1-\gamma_i-\psi_i)V_i + (1-k)\sum_{j\neq i}\psi_{ij}V_j - C_{Pi} + t_i^{WP} + b_i^{RP} - t_i^{PR} \text{ and}$$

$$\Pi_i^{WD} = \gamma_i V_i - C_{Wi} - t_i^{WP}.$$

Moreover, assume for the moment that $\gamma_i = \gamma_i^D$ for every i. Then, given the timeline described above, R chooses $\boldsymbol{\gamma}^D$, $\boldsymbol{\psi}^D$ and $\mathbf{L}^D$ to solve

$$\max_{\boldsymbol{\gamma},\boldsymbol{\psi},\mathbf{L}} \sum_i \left(t_i^{PR} - b_i^{RP}\right) \equiv R^D$$

Subject to

$$R^D \geq 0; \qquad (10)$$

$$\Pi_i^{PD} \geq \Pi_i^0 \text{ for every i;} \qquad (11)$$

$$\Pi_i^{WD} \geq 0 \text{ for every i;} \qquad (12)$$

$$\left(1-\gamma_i-\psi_i\right)V_i+\left(1-k\right)\sum_{j\neq i}\psi_{ij}V_j+b_i^{RP}+\frac{1}{r}\Pi_i^{PD}\geq\left(1-\psi_i\right)V_i$$
$$+\left(1-k\right)\sum_{j\neq i}\psi_{ij}^{RD}V_j \qquad (13)$$
$$-\sum_{j\neq i}L_{ji}+\frac{1}{r}\Pi_i^0 \text{ for every i,}$$

$$-\sum_{j\neq i}kL_{ij}+\beta_i^{RP}+\frac{1}{r}\Pi_i^{PD}\geq\frac{1}{r}\Pi_i^0 \text{ for every } i\,, \qquad (14)$$

$$-\sum_i b_i^{RP}+\frac{1}{r}R^D\geq 0\text{, and} \qquad (15)$$

$$-\sum_i \beta_i^{RP}+\frac{1}{r}R^D\geq 0\,. \qquad (16)$$

Condition (10) is R's participation constraint. Conditions (11) and (12) are P_i's and W_i's participation constraints, respectively. Condition (13) is P_i's incentive constraint with respect to $\boldsymbol{\gamma}^D$ and $\boldsymbol{\psi}^D$. Condition (14) is P_i's incentive constraint with respect to $\mathbf{L}^D$. Condition (15) is R's incentive constraint with respect to the equilibrium bonus b_i^{RP}. Finally, condition (16) is R's incentive constraint with respect to the off-the-equilibrium bonus β_i^{RP}.

As shown by Levin (2002, 2003), conditions (10) through (16) can be reduced to a unique condition by using the monetary payments to transfer slack across the participation and incentive constraints. We separately consider the case where incentives are provided without imposing penalties and the case where penalties are imposed.

Case 1: Decentralized enforcement without penalties

Assume R sets $\mathbf{L}^{D} = \mathbf{0}$ and and $\beta_i^{RP} = 0$ for every i. We can concentrate all the incentive power of the relational contract on R by choosing, for every i the maximum upfront transfers t_i^{PR} and t_i^{WP} consistent with P_i's and W_i's participation constraints (11) and (12), and the minimum bonus b_i^{RP} consistent with P_i's incentive constraint (13). This implies that

$$t_i^{PR} = (1-\gamma_i)V_i + (1-k)\sum_{j\neq i}\psi_{ij}V_j - C_{Pi} + b_i^{RP} - \Pi_i^{D0},$$

$t_i^{WP} = \gamma_i V_i - C_{Wi}$, and

$$b_i^{RP} = \gamma_i V_i + (1-k)\sum_{j\neq i}\left(\psi_{ij}^{RD} - \psi_{ij}\right)V_j .$$

Substituting into R's participation constraint (10) we obtain

$$S = \sum_i\left[(1-k\psi_i)V_i - C_{Pi} - C_{Wi}\right] \geq S^0 . \tag{17}$$

Substituting into R's incentive constraint (15) we obtain

$\sum_i\left[\gamma_i V_i + (1-k)\sum_{j\neq i}\left(\psi_{ij}^{RD} - \psi_{ij}\right)V_j\right] \leq \frac{1}{r}\left(S - S^0\right)$, which can be rewritten as

$$\sum_i\left[\gamma_i + (1-k)\left(\psi_i^0 - \psi_i\right)\right]V_i \leq \frac{1}{r}\left(S - S^0\right). \tag{18}$$

Since (18) is tighter than (17), (18) is the unique necessary and sufficient condition for the multilateral contract to be self-enforcing. We can therefore conclude that, when the sharing rule agreed by P_i and W_i coincides with the maximum enforceable one

($\gamma_i = \gamma_i^D$ for every i), R will choose $\boldsymbol{\gamma}^D$ and $\boldsymbol{\psi}^D$ to maximize the total surplus S, subject to (18). This implies that $\gamma_i^D \in \left[0, \gamma_i^*\right]$ and $\psi_i^D \in \left[0, \psi_i^0\right]$, with $\gamma_i^D = \gamma_i^*$ and $\psi_i^D = 0$ for every i when r is so low that (18) is non-binding, and $\gamma_i^D = 0$ and $\psi_i^D = \psi_i^0$ for every i when r is so high that there are no $\gamma_i^D > 0$ and $\psi_i^D < \psi_i^0$ consistent with (18).

It remains to be shown whether the sharing rule agreed by P_i and W_i coincides with the maximum enforceable one. Without loss of generality, assume P_i makes a take-it-or-leave-it offer to W_i. Given the formula for t_i^{WP}, and given that P_i pays t_i^{PR} before making the offer, P_i will choose γ_i to solve

$$\max_{\gamma_i} V_i - C_{Pi} - C_{Wi}$$

subject to the enforcement constraint $\gamma_i \leq \gamma_i^D$. The solution is given by $\min\left\{\gamma_i^*, \gamma_i^D\right\}$. We know from the analysis of R's problem above that R will choose $\gamma_i^D = \gamma_i^*$ whenever feasible, so we can conclude that P_i will offer to W_i the best contract consistent with the law – that is, $\gamma_i = \gamma_i^D$ for every i.

Case 2: Decentralized enforcement with penalties

Suppose, now, that R sets $b_i^{RP} = 0$ for every i and then chooses the mildest vector of punishments $\mathbf{L}^D$ consistent with the powerful individuals' incentive constraints in (13). After setting t_i^{WP} and t_i^{PR} as before, we obtain that

$$\sum_{j \neq i} L_{ji} = \gamma_i V_i + (1-k) \sum_{j \neq i} \left(\psi_{ij}^{RD} - \psi_{ij}\right) V_j \text{ for every i.}$$

Then, the minimum off-the-equilibrium bonus β_i^{RP} consistent with (14) is given by $\beta_i^{RP} = k\sum_{j\neq i} L_{ij} = \sum_{j\neq i} L_{ji} = \gamma_i V_i + (1-k)\sum_{j\neq i}\left(\psi_{ij}^{RD} - \psi_{ij}\right)V_j$. Substituting this into (16) and simplifying, we obtain the unique enforcement condition

$$k\sum_i\left[\gamma_i + (1-k)\left(\psi_i^0 - \psi_i\right)\right]V_i \leq \frac{1}{r}\left(S - S^0\right), \qquad (EC^D)$$

where EC^D stands for "decentralized enforcement constraint".

Notice that the right-hand side of (EC^D) is identical to the right-hand side of (18), whereas the left-hand side is smaller. This is due to the fact that $k \in [0,1]$, that is, the punishment technology is efficient. This proves the following

Proposition 1: when the punishment technology is efficient, decentralized enforcement with penalties dominates decentralized enforcement without penalties.

The intuition is simple: when the punishment technology is efficient, rewarding the powerful individuals for honoring the social contracts is more expensive than rewarding the powerful individuals for punishing violators. Hence, punishing violators through penalties will expand the frontier of enforcement possibilities.

Proposition 1 provides a rationale for why many observed enforcement systems are based on the threat of penalties, rather than on the promise of future rewards. Moreover, the analysis behind Proposition 1 shows that, while in most economic models contracts are either enforced by courts, through the threat of unlimitedly strong penalties, or by the parties and the community, through the threat of withdrawing future rewards, in fact both enforcement systems obey the same logic. Enforcement must be credible both when it is provided via penalties and when it is provided via rewards, and the credibility of both penalties and rewards rests on some form of relational agreement between the members of a community, perhaps mediated by a coordinator or a ruler. As shown by Proposition 1, whether penalties or rewards are a more effective enforcement mechanism depends on which one can be credibly sustained at a lower cost – that is, on the cost of deterring contractual breach through coercion.

3.2. Centralized enforcement

Under centralized enforcement, at time t = 0, R announces a legal code $\left[\boldsymbol{\gamma}^{C}, \boldsymbol{\psi}^{C}, \mathbf{L}^{C}\right]$. The vector $\boldsymbol{\gamma}^{C}$ is defined as before. Since the powerful individuals have transferred all of their power $N\overline{L}$ to R, they cannot punish or expropriate each other, as they did under decentralized enforcement. However, R can use his overwhelming power to both punish and expropriate the (formerly) powerful individuals.[12] Hence, the vectors $\boldsymbol{\psi}^{C} = \left[\psi_1^{C}, ..., \psi_n^{C}\right]$ and $\mathbf{L}^{C} = \left[L_1^{C}, ..., L_n^{C}\right]$ denote, respectively, the maximum share of the value produced by each couple value that R can expropriate and the punishment that R will inflict to each powerful individual for breaching the sharing rule agreed with the weak individual he is matched with.

By the same arguments used for decentralized enforcement, we can restrict attention to the case where the powerful individuals are punished for not complying with the agreed upon sharing rule and the sharing rule coincides with the maximum legally

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[12] We keep calling the individuals $P_1, \ldots, P_n$ "powerful" because, even under centralized enforcement, they maintain the ability to deny the weak individuals $W_1, \ldots, W_n$ their promised share of the output.

enforceable one. Hence, in any subsequent time period, the stage interaction between the powerful individuals, the weak individuals and the ruler works as follows:

1. *Contracting*. P_i makes a monetary transfer t_i^{PR} to R. After that, P_i offers a sharing rule γ_i^C to W_i. If W_i accepts, he makes a monetary transfer t_i^{WP} to P_i;
2. *Production*. P_i and W_i choose the effort levels e_{Pi} and e_{Wi} at costs $C_{Pi}\left(e_{Pi}\right)$ and $C_{Wi}\left(e_{Wi}\right)$, respectively;
3. *Distribution and enforcement*. P_i decides whether to set $\gamma_i = \gamma_i^C$ and R decides whether to set $\boldsymbol{\psi} = \boldsymbol{\psi}^C$. If P_i sets $\gamma_i \neq \gamma_i^C$, R decides whether to inflict a loss $L_i = L_i^C$ on P_i;
4. *Payoffs*. P_i receives the gross payoff $\left(1-\gamma_i-\psi_i\right)V_i\left(\mathbf{e}_i\right)$, W_i receives the gross payoff $\gamma_i V_i\left(\mathbf{e}_i\right)$, and R receives the gross payoff $(1-k)\sum_i \psi_i V_i$.

As before, the game is identically repeated at time t+1 if all parties honor the relational contract at time t. Conversely, if anyone reneges at time t, all parties revert to the spot game in period t+1 and thereafter.

Before we proceed with the analysis, it is useful to characterize the short-run gains of R if he reneges on $\boldsymbol{\psi}^C$ at stage 3. If R reneges, he will set $\boldsymbol{\psi}^{RC}$, where the “RC” superscript stands for “reneging under centralized enforcement”. It follows from the previous analysis that, if R decides to renege, he will choose $\boldsymbol{\psi}^{RC}$ to solve

$$\max_{\boldsymbol{\psi}} \sum_i (1-k)\psi_i V_i$$
$$\text{s.t.} \quad \psi_i \le 1 \text{ for every i} \qquad (19)$$
$$\sum_i \psi_i V_i \le N\overline{L}.$$

Program (19) is identical to program (7). Therefore, it follows from Lemma 2 that $\psi_i^{RC} = \psi_i^0$ for every i.

Denote the per period payoffs of any powerful individual P_i and any weak individual W_i who honor the relational contract as

$$\Pi_i^{PC} = (1-\gamma_i-\psi_i)V_i - C_{Pi} + t_i^{WP} - t_i^{PR} \text{ and}$$

$$\Pi_i^{WC} \equiv \gamma_i V_i - C_{Wi} - t_i^{WP}.$$

Then, given the timeline described above, R chooses $\boldsymbol{\gamma}^C$, $\boldsymbol{\psi}^C$ and $\mathbf{L}^C$ to solve

$$\max_{\boldsymbol{\gamma},\boldsymbol{\psi},\mathbf{L}} \sum_i \left((1-k)\psi_i V_i + t_i^{PR}\right) \equiv R^C$$

Subject to

$$R^C \ge 0; \qquad (20)$$

$$\Pi_i^{PC} \ge \Pi_i^0 \text{ for every i}; \qquad (21)$$

$$\Pi_i^{WC} \ge 0 \text{ for every i}; \qquad (22)$$

$$(1-\gamma_i-\psi_i)V_i + \frac{1}{r}\Pi_i^{PC} \ge (1-\psi_i)V_i - L_i + \frac{1}{r}\Pi_i^0 \text{ for every i}, \qquad (23)$$

$$-k\sum_i L_i + \frac{1}{r}R^C \ge 0, \text{ and} \qquad (24)$$

$$\left(1-k\right)\sum_i \psi_i V_i + \frac{1}{r} R^C \geq \left(1-k\right)\sum_i \psi_i^0 V_i . \qquad (25)$$

Condition (20) is R's participation constraint. Conditions (21) and (22) are P_i's and W_i's participation constraints, respectively. Condition (23) is P_i's incentive constraint. Condition (24) is R's incentive constraint with respect to the punishment schedule $\mathbf{L}$. Finally, condition (25) is R's incentive constraint with respect to the expropriation schedule $\boldsymbol{\psi}$.

We can concentrate all the incentive power of the relational contract on R by choosing, for every i, the maximum upfront transfers t_i^{PR} and t_i^{WP} consistent with P_i's and W_i's participation constraints (21) and (22), and the minimum punishment L_i consistent with P_i's incentive constraint (23). This implies that

$$t_i^{PR} = \left(1-\psi_i\right) V_i - C_{Pi} - C_{Wi} - \Pi_i^0 ,$$

$$t_i^{WP} = \gamma_i V_i - C_{Wi} \text{, and}$$

$$L_i = \gamma_i V_i .$$

After substituting the payments and punishments above into (24) and (25) and simplifying, we obtain the following two alternative enforcement conditions:

$$k\sum_i \gamma_i V_i \leq \frac{1}{r}\left(S - S^0\right) \text{, and} \qquad (EC^{HC})$$

$$\left(1-k\right)\sum_i \left(\psi_i^0 - \psi_i\right) V_i \leq \frac{1}{r}\left(S - S^0\right) . \qquad (EC^{VC})$$

The expressions "EC^{HC}" and "EC^{VC}" stand, respectively, for "horizontal enforcement constraint" and "vertical enforcement constraint" under centralized enforcement. In adopting this language, we follow Acemoglu and Johnson (2005), who distinguish between "horizontal" contracts between citizens (in our model, P_i and W_i) and "vertical" contracts between citizens and the elites (in our model, the ruler R).

3.3. Comparison

Given the above analysis, we can state the following

Proposition 2: The credible penalties necessary to deter violations by the powerful individuals are milder under centralized than under decentralized enforcement.

Proof: The left-hand side of (EC^D) is larger than that of (EC^{HC}) while the right-hand sides are identical, so (EC^{HC}) is a looser condition than (EC^D). QED.

The intuition behind Proposition 2 is simple: in order to sustain a punishment system under decentralized enforcement, the penalties must be sufficiently high to deter both the powerful individuals' breach of the sharing rules agreed with the weak individuals and their breach of other powerful individuals' property rights. In contrast, under centralized enforcement, the penalties only need to deter breach of the sharing rules, because the powerful individuals lack the coercive power necessary to expropriate each other.

While centralized enforcement makes it easier to sustain a credible punishment system, it also provides the ruler with an incentive to directly expropriate the citizens (the "vertical" constraint EC^{VC}). Since the right-hand sides of EC^{HC} and EC^{VC} are identical, the binding constraint under centralized enforcement is the vertical one if, and only if the left-hand side of EC^{VC} is greater than the left-hand side of EC^{HC}, that is, if

$$\sum_i \left(\psi_i^0 - \psi_i\right) V_i > k \sum_i \gamma_i V_i \ . \qquad (26)$$

The term ψ_i^0 is non-decreasing in $\overline{L}$, so condition (26) is more likely to be satisfied when the power endowment $\overline{L}$ is large and the parameter describing the cost of punishment, k, is small. We are now ready to state the following

Proposition 3: Under centralized enforcement, the binding enforcement constraint is the "vertical" constraint EC^{VC} when $\overline{L}$ is large enough and k is small enough.

Proof: by inspection of (26).

By comparing the enforcement constraints under decentralized and centralized enforcement, we can also state the following

Proposition 4: The set of enforceable contracts is larger under centralized than under decentralized enforcement when $\overline{L}$ is small enough and k large enough.

Proof: Suppose that $\overline{L}$ is small enough and k large enough that condition (26) above does not hold. Then, (EC^{HC}) is binding under centralized enforcement, and we know from Proposition 2 that, when (EC^{HC}) is binding, the set of enforceable contracts is larger under centralized enforcement. Suppose, in contrast, that (26) holds, so (EC^{VC}) is binding. Then, the set of enforceable contracts is larger under centralized enforcement when (EC^{D}) is tighter than (EC^{VC}), that is, when $\sum_i \left(\frac{k}{1-k}\gamma_i - (1-k)\left(\psi_i^0 - \psi_i\right) \right) V_i > 0$. This condition is more likely to hold the smaller $\overline{L}$ and the larger k. QED.

When $\overline{L}$ is small, the aggregate temptation to illegally expropriate P_i diminishes for every i. This loosens both R's aggregate temptation to expropriate under centralized enforcement, given by $(1-k)\sum_i \left(\psi_i^0 - \psi_i\right) V_i$ in the left-hand side of EC^{VC}, and the aggregate cost of punishing expropriation under decentralized enforcement, given by $k(1-k)\sum_i \left(\psi_i^0 - \psi_i\right) V_i$ in the left-hand side of EC^{D}. However, the latter effect is smaller than the former because $k \in [0,1]$.

4. Conclusion

Our model contributes to the debate on law-enforcement institutions in several ways. First, it offers a coherent theory of centralized versus decentralized enforcement, where the costs and benefits of each institutional form originate from the same force – namely, the allocation of coercive power within society. We show that a centralized allocation of power prevents horizontal expropriation between powerful individuals and, therefore, requires a milder punishment system, which is cheaper for the State to sustain. On the other hand, centralized enforcement also creates a temptation for the State to expropriate citizens, thus creating a "vertical" commitment problem (Acemoglu 2003). Hence, centralized enforcement works better when coercive power is more costly to use – for instance, due to the individuals' ability to react, or to cultural and moral constraints to the use of force.

This result constitutes an innovation on most existing works, which assume that enforcement is exogenously "stronger" when administered by a central authority with a monopoly on the use of force. When analyzing decentralized enforcement, these works typically assume that a central authority is either absent for exogenous reasons, or suffers from an informational disadvantage when adjudicating disputes. In contrast, our result implies that, depending on the amount of coercive power available in a society and on the cost to use it for punishment purposes, enforcement may be stronger under either centralized or decentralized enforcement (Proposition 4).

Our model also provides a theoretical explanation for Acemoglu and Johnson's (2005) empirical results on the comparative importance of "horizontal" and "vertical" institutions. Using an instrumental-variable approach, Acemoglu and Johnson (2005) show that the institutions preventing (vertical) expropriation of citizens by the State affect a country's long-term economic development more than the institutions preventing (horizontal) expropriation of citizens by each other. Examples of the former would be checks and balances on the Executive. Examples of the latter would be efficient judicial institutions guaranteeing the enforcement of contracts (La Porta et al. 1999; Djankov et al. 2002) and the *in rem* enforcement of property rights (Arruñada 2003).

Consistent with the empirical findings of Acemoglu and Johnson (2005), our Proposition 3 shows that, in a State that commands a substantial amount of coercive power (large values of the parameter $\bar{L}$) and has access to an efficient punishment technology (small values of the cost-of-punishment parameter k), the binding commitment problem is the vertical one. The reason is that, when coercive power is abundant and relatively easy to mobilize, the State's temptation to save on the cost of punishing violations to horizontal agreements tends to be small, while the State's temptation to use the coercive power to directly expropriate citizens tends to be large. In such a setting, the decisive institutional change to improve investment and economic development would be one that increases the State's vertical commitment power – for instance, via tighter checks and balances on the Executive.

Finally, our model provides a rationale for why enforcement of the law, even when decentralized, is normally backed by the threat of penalties, rather than the promise of rewards (Proposition 1). We show that penalties are a cheaper means to enforce the law when the punishment technology is efficient – that is, when one monetary unit spent administering penalties generates a greater or equal monetary loss on the punished party. Intuitively, this is because an enforcement system based on incentives needs to compensate people for not violating the law, whereas a system based on penalties needs to reward the parties endowed with coercive power for incurring the cost to administer penalties that are sufficient to deter violations of the law. Rewarding the punishment of non-compliance is cheaper than rewarding compliance when the punishment technology is efficient.

References

ACEMOGLU, D., (2003), “Why Not a Political Coase Theorem? Social Conflict, Commitment, and Politics,” *Journal of Comparative Economics* 31: 620-652.

ACEMOGLU, D., and S. JOHNSON, (2005), “Unbundling Institutions,” *Journal of Political Economy* 113: 949-995.

AGHION, P., and J. TIROLE, (1997), “Formal and Real Authority in Organizations,” *Journal of Political Economy* 105: 1-29.

ALDASHEV, G., I. CHAARA, J.-P. PLATTEAU and Z. WAHHAJ, (2012), “Using the Law to Change the Custom,” *Journal of Development Economics* 97: 182–200.

ARRUÑADA, B., (2003), “Property Enforcement as Organized Consent,” *Journal of Law, Economics and Organization* 19: 401-444.

ARRUÑADA, B., (2012), *Foundations of Impersonal Exchange: The Theory and Policy of Contractual Registries*. University of Chicago Press, Chicago (forthcoming).

BAKER, G., R. GIBBONS and K. J. MURPHY, (1994), “Subjective Performance Measures in Optimal Incentive Contracts,” *Quarterly Journal of Economics* 109: 1125-1156.

BAKER, G., R. GIBBONS, and K. J. MURPHY, (2002), “Relational Contracts and the Theory of the Firm,” *Quarterly Journal of Economics* 117: 39-83.

BAKER, G., R. GIBBONS, and K. J. MURPHY, (2011), “Relational Adaptation,” Marshall School of Business Working Paper.

BATTIGALLI, P., and G. MAGGI, (2002), “Rigidity, Discretion, and the Cost of Writing Contracts,” *American Economic Review* 92: 798-817.

BATTIGALLI, P., and G. MAGGI, (2008), “Costly Contracting in a Long-Term Relationship,” *RAND Journal of Economics* 39: 352-377.

COASE, R., (1960), “The Problem of Social Cost,” *Journal of Law and Economics* 3: 1-44.

DIXIT, A., (2003a), “On Modes of Economic Governance,” *Econometrica* 71: 449-481.

DIXIT, A., (2003b), "Trade Expansion and Contract Enforcement," *Journal of Political Economy* 111: 1293-1317.

DIXIT, A., (2004), *Lawlessness and Economics*, Princeton, NJ: Princeton University Press.

DJANKOV, S., R. LA PORTA, F. LOPEZ-DE-SILANES, and A. SHLEIFER, (2002), "The Regulation of Entry," *Quarterly Journal of Economics* 117: 1-37.

ELLICKSON, R., (1991), *Order without Law: How Neighbors Settle Disputes*, Cambridge, MA: Harvard University Press.

GAMBETTA, D., (1993), *The Sicilian Mafia. The Business of Private Protection*, Cambridge, MA: Harvard University Press.

GREIF, A., (1993), "Contract Enforceability and Economic Institutions in Early Trade: The Maghribi Traders' Coalition," *American Economic Review* 83: 525-548.

GREIF, A., (2006), "*Institutions and the Path to the Modern Economy: Lessons from Medieval Trade*, New York: Cambridge University Press.

GREIF, A., P. MILGROM, and B. WEINGAST, (1994), "Coordination, Commitment, and Enforcement: The Case of the Merchant Guild," *Journal of Political Economy* 102: 745-776.

GROSSMAN, S., and O. Hart, (1986), "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration," *Journal of Political Economy* 94: 691-719.

HADFIELD, G., and B. WEINGAST, (2011a), "What is Law? A Coordination Account of the Characteristics of Legal Order," *Journal of Legal Analysis*, forthcoming.

HADFIELD, G., and B. WEINGAST, (2011b), "Collective Punishment: A Coordination Account of Legal Order," University of Southern California Working Paper.

HIRSHLEIFER, D., and E. RASMUSEN, (1989), "Cooperation in a Repeated Prisoners' Dilemma with Ostracism," *Journal of Economic Behavior and Organization* 12: 87-106.

HOLMSTROM, B., (1979), "Moral Hazard and Observability," *Bell Journal of Economics* 10: 74-91.

LA PORTA, R., F. LOPEZ-DE-SILANES, A. SHLEIFER, and R. VISHNY, (1999), "The Quality of Government," *Journal of Law, Economics and Organization* 15: 222-279.

LEVIN, J., (2002), "Multilateral Contracting and the Employment Relationship," *Quarterly Journal of Economics* 117: 1075-1103.

LEVIN, J., (2003), "Relational Incentive Contracts," *American Economic Review* 93: 835-857.

LIBECAP, G., and D. LUECK, (2011), "The Demarcation of Land and the Role of Coordinating Property Institutions," *Journal of Political Economy* 119: 426-467.

MACLEOD, B., (2007), "Reputations, Relationships, and Contract Enforcement," *Journal of Economic Literature* 45: 595-628.

MASTEN, S., and J. PRUFER, (2011), "On the Evolution of Collective Enforcement Institutions: Communities and Courts," Tilburg University Working Paper.

MILGROM, P., D. NORTH, and B. WEINGAST, (1990), "The Role of Institutions in the Revival of Trade: The Law Merchant, Private Judges, and the Champagne Fairs," *Economics and Politics* 2: 1-23.

WILLIAMSON, O., (1975), *Markets and Hierarchies: Analysis and Antitrust Implications*. New York, NY: Free Press.

WILLIAMSON, O., (1991), "Comparative Economic Organization: The Analysis of Discrete Structural Alternatives," *Administrative Science Quarterly* 36: 269-296.

ZANARONE, G., (2012), "Contract Adaptation under Legal Constraints," *Journal of Law, Economics and Organization*, forthcoming, doi: 10.1093/jleo/ews005.