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# Endogenous Enforcement Institutions

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**Abstract**

Enforcing contracts and property rights requires that violators are punished. However, costly punishments may not be credible. In this paper we develop a model where credible punishments are the endogenous outcome of a relational contract between citizens and the ruler on the use of force. In the model, principals hire agents to perform productive tasks, which the agents are willing to perform only if they expect principals to pay them the contracted compensation and to respect their property rights. Under decentralized enforcement, power is dispersed among the principals, who are rewarded by the ruler for punishing their peers when these violate contracts and property rights. Under centralized enforcement, power is monopolized by the ruler, who directly punishes contract violations. We show that, by preventing expropriation by the principals, centralization achieves contract enforcement through milder penalties, at the cost of creating a temptation for the ruler to violate property rights. We also study the role of the judiciary and of institutional constraints on the ruler under centralized enforcement, and we show that, while judicial verification facilitates the enforcement of contracts, constraints on the ruler facilitate the enforcement of both contracts and property rights and, therefore, have a first-order economic effect. This result explains recent evidence on the effects of political and judicial institutions on economic development (Acemoglu and Johnson 2005).

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

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# 1. Introduction

A central result in economics is that, when contracts and property rights are not enforceable due to transaction costs and political constraints, good institutions are essential for trade, investment, and growth (e.g., Coase 1937, 1960; Williamson 1975; North 1981; Acemoglu 2003). But what are the constraints on contracts and property rights that create such a demand for institutions in the first place?

Most of the literature has answered this question in terms of *adjudication* costs. In that perspective, contracts are limited by the ability of courts, or other adjudicators, to interpret contractual obligations and verify non-compliance.[1] Similarly, property rights are limited by the technology available to measure the boundaries of assets over which such rights are defined (Libecap and Lueck 2011), and to generate and interpret the evidence on conflicting claims over a given asset (Arruñada 2003).

While adjudication is clearly important, even a perfect adjudication system will fail to enforce contracts and property rights unless the adjudicator's rulings are backed by a credible threat to punish violators. When punishments are costly to administer, however,

[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 verifying compliance with contractual obligations are at the basis of both the literature on agency and incentive contracts (see, for instance, Holmstrom 1979, and Holmstrom and Milgrom 1991) 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. 1994, 2002, 2011). 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 Prüfer (2011).

they will only be credible if the punishers are provided with incentives to carry them out.[2] Despite its importance, most of the economic literature abstracts from the problem of how to make costly punishments credible, assuming instead that they will be imposed by a centralized State, or by community members, as needed.[3] We fill this gap in the literature by developing a formal model where both the credibility of punishments and the extent to which they are centralized, are endogenous, and by studying how the available coercion technology constrains and shapes the enforcement of contracts and property rights.

In our model there are N "principals", each of whom hires an "agent" to perform a task. Absent enforcement institutions, the agents will fail to spend effort for two reasons. First, once an agent's effort is sunk, his principal will be tempted not to pay him (a breach of contract). Second, another principal will be tempted to expropriate the income earned by the agent (a violation of property rights).

We assume that, while the principals live forever, the agents live only one period, and the agents who replace them cannot observe the actions taken in previous periods. In such a setting, contracts and property rights cannot be enforced through bilateral or multilateral

[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.

[3] Most of the literature on community enforcement focuses on the denial of trade as a punishment (e.g., Bendor and Mookhaerjee 1990; Greif et al. 1994; Dixit 2003; Masten and Prufer 2011). This type of punishment is credible in the sense that, if party A cheats on party B, and party C believes that party A will cheat on her too in case A and C are matched, it is in C's interest not to trade with A following A's cheating on B. Hence, there are subgame perfect equilibria where A and B cooperate and C punishes A if A cheats. However, when repeated trade between the members of a community is limited in scope, it may be desirable to supplement denial of trade with violent punishments. In that case, the notion of subgame perfection used in the literature is no longer helpful, because party C will always prefer not to incur the cost of inflicting a violent punishment on A, whether or not she expects A to cheat on her in trade. Hirshleifer and Rasmusen (1989) study the existence of cooperative equilibria in the presence of costly ostracism. Unlike us, they do not analyze how enforcement is constrained by the ostracism technology, and whether centralized or decentralized enforcement is optimal.

relationships between the principals and the agents. As an alternative, we study enforcement mechanisms based on the threat of punishment by a third party. The main difficulty with such mechanisms is that punishments are costly to administer, so the punishers will always be tempted to renege on their obligation to punish. We show that the problem of credible punishments can be solved through multilateral relational contracts between the principals, one whom is appointed as a ruler, on the use of force.

We consider two types of multilateral contracts, which differ in how coercive power is allocated within society. Under *decentralized enforcement*, which is analyzed in section 3.3, 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] To sustain decentralized enforcement, the ruler requires the principals to punish those among their peers who violate their contract with the agents or the agents' property rights. In exchange, the ruler promises to reward the punishers through discretionary bonuses.[6] If the ruler fails to reward the punishers, the multilateral contract breaks down forever after (Levin 2002), and the principals and the ruler revert to an anarchic social regime characterized by low productive effort and low income.

[4] For other models where the ruler acts as a mere coordinator, see 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.

This implies that the feasible set of contracts and property rights under decentralized enforcement is limited by the ruler's temptation not to reward the principals' punishment services, which is determined, in turn, by the cost of deterring violations through punishments. The more productive the punishment technology, the easier to enforce contracts and to deter expropriation through decentralized punishments.

In contrast, under *centralized enforcement*, which is analyzed in section 3.4, all the coercive power is concentrated within the ruler. The most obvious example of this setting is given by the modern and contemporary states, with their monopoly over the use of force. In this case, the ruler promises the principals to punish those among them who violate their contracts with the agents, and collects taxes as a reward for his punishment services. If the ruler fails to honor the punishment obligation, or if he abuses his power to expropriate the agents rather than to enforce the law, the multilateral relational contract breaks down and society reverts to anarchy, as before.

In section 3.5, we take the allocation of power as endogenous, and we show that the optimal enforcement system solves a tradeoff between credibility of punishments and expropriation. On one hand, by preventing the principals from using force to expropriate each other, centralized enforcement reduces the level of punishment that must be credibly threatened to induce a given level of effort by the agents. The reason is that, under centralized enforcement, the punishments must only deter the principals' violation of their contracts with the agents whereas, under decentralized enforcement, they must also prevent the principals' violation of the agents' property rights.

On the other hand, centralized enforcement creates a temptation for the ruler to use his overwhelming power to directly expropriate the agents (Olson 1993; Acemoglu 2003). Hence, centralized enforcement dominates when coercive power is more costly to use. This occurs for two reasons. First, an increase in the cost of using power makes it less tempting for the ruler to expropriate. Second, it increases the cost of administering punishments. This disfavors decentralized enforcement, which is more punishment-intensive then centralized enforcement.

In section 4, following a recent literature that emphasizes institutional persistence (Acemoglu *et al*. 2001, 2002; Acemoglu and Johnson 2005), we abandon our assumption that the social allocation of power is endogenous. Instead, we assume that it is exogenously centralized, as in most modern and contemporary states. We then extend our baseline model of centralized enforcement to allow for two types of *moderating institutions*: the judiciary, which adjudicates disputes over contractual violations by the principals, and constraints on the ruler's executive power, which aim to turn the militias' personal loyalty towards the ruler into a loyalty towards the State's constitution and laws. We show that tighter constraints on the executive facilitate both the enforcement of contracts (by reducing the ruler's temptation to order the militias to shirk on punishment efforts) and the enforcement of property rights (by reducing the ruler's temptation to order the militias to expropriate citizens beyond the limits set by the law). On the other hand, improvements in the judiciary's ability to verify contractual violations by the principals (for instance, via leaner and less formalistic adjudication procedures) only facilitate the enforcement of contracts, without affecting the enforcement of property rights. Empirically, this leads to predict that improvements in the judicial verification of

contracts will have a second-order effect on a State's economic performance, relative to the introduction of tighter constraints on the executive power.

This result is consistent with the empirical evidence in Acemoglu and Johnson (2005). Using an instrumental variable approach, they estimate the effect on economic development of institutions that make the adjudication of contractual disputes less formalistic and of institutions that constrain the discretion of the executive power and enhance the rule of law. They find that constraints on the Executive have a strong positive effect on various indicators of economic development, whereas the degree of judicial formalism has a far less significant effect.

Our contribution in this paper is twofold. First, as mentioned above, the existing literature on third-party enforcement concentrates on verification and adjudication issues, assuming that punishments (centralized or decentralized) will eventually be imposed. We fill the gap in this literature by taking both the credibility of punishments and the extent to which they are centralized as endogenous. In contrast with the conventional wisdom, we find that third-party enforcement in centralized States is not always credible, and that an optimal third-party enforcement system is not always centralized. Our results yield novel, testable predictions on the relationship between coercion technology, allocation of power, and enforcement, and on the mediating role of judicial and political institutions.

Our second contribution is methodological. Relying on recent advances in the theory of repeated games (Levin 2002, 2003), we show that a third-party enforcement system based on punishments can be modeled as a multilateral relational contract between citizens (in our model, the long-living principals) and the ruler on the use of force. This

multilateral contract must not only insure that citizens will not be expropriated by the ruler, as in Olson (1993) and Acemoglu (2003), but also that violations of contracts and property rights by the citizens are punished. By jointly modeling these two essential safeguards we provide a simple, tractable framework that can be applied to numerous settings where third-party enforcement is essential for production and development. Examples of such settings are moral hazard problems in microfinance, the enforcement of customary law in traditional societies, and the settlement of international disputes.

The rest of the paper is organized as follows. Section 2 presents the model. Section 3 analyzes centralized and decentralized enforcement, derives comparative static predictions, and discusses their testability. Section 4 studies the role of moderating institutions (judiciary and constraints on the executive) in facilitating centralized enforcement, and discusses the related empirical literature. Section 5 concludes.

## 2. The Model

In every period, each of $N \geq 2$ identical principals hires an agent to perform a productive task. By exerting effort *e* performing his task, the agent generates utility $V(e)$ for the principal and incurs a cost $C(e)$. Unlike in standard agency models, we assume that the principals are endowed with a certain amount of coercive power. Specifically, we assume that there are N units of coercive power, and that one unit of power enables the principal who controls it to expropriate a share of wealth $\psi(o)$ from one of the agents by

exerting some offense effort *o* at cost $k^O o$.[7] We interpret a unit of coercive power as an inextricable bundle of weapons and loyal soldiers, who use the weapons as ordered by the party who controls that unit.

Throughout the paper, we consider two social allocations of coercive power: a decentralized one, where each principal controls one unit of power, and a centralized one, where one principal controls all the N units of power.[8] We assume that $V(\cdot)$, $C(\cdot)$ and $\psi(\cdot)$ are continuously differentiable and increasing, with $C(0) = \psi(0) = 0$. To insure interior solutions in the choices of both the productive effort and the offense effort, we also assume that $V(\cdot)$ and $\psi(\cdot)$ are concave, and that $C(\cdot)$ is convex.

Given the above assumptions, the efficient level of productive effort is given by

$$e^{FB} = \arg\max_{e} V(e) - C(e) > 0. \qquad (1)$$

Two forces may prevent an agent from exerting the efficient effort $e^{FB}$. First, the agent's principal will be tempted not to reward him ex post (a contract violation). Second, the other principals will be tempted to use their coercive power to expropriate the reward that the agent has obtained from his own principal (a property rights violation). If the agent anticipates either non-payment or expropriation, he will not exert any effort.[9]

[7] Formally, one unit of power is an essential input for a principal to expropriate one agent.
[8] The model's results on the comparison between centralized and decentralized enforcement would be unchanged if, under decentralized enforcement, we allowed for more asymmetric allocations of power, provided that the number of powerful principals is greater than one.
[9] The implicit assumption here is that, if a powerful principal threatens to use his coercive power to force an agent to work without any compensation, the agent will prefer not to participate – for instance, by leaving society before the end of the period.

The central question we ask in this paper is how contracts and property rights can be enforced, so that the agents will have adequate incentives to spend effort. We assume that, while the principals live forever, the agents live only one period. Hence, contracts and property rights cannot be enforced through bilateral repeated interactions between the principals and the agents. We also assume that, when the old agents are replaced by new ones at the beginning of each period, the new agents cannot observe the past history of play. As a result, the principals cannot develop reputations that help them enforce contracts and property rights.

As an alternative to bilateral and reputational enforcement, we study *third-party enforcement* mechanisms, where the principals use their coercive power to punish those among them who fail to reward their own agents, or who expropriate the other principals' agents. When third-party enforcement is credible, the agents will have incentives to spend effort in production, and value will be created. However, imposing punishments is costly, so a credible third-party enforcement system must be itself self-enforcing. Our primary concern here is how the coercion technology and the social allocation of power constrain third-party enforcement, and hence the amount of productive effort exerted by the agents.

To model punishments, we assume that a principal who owns one unit of coercive power can inflict the disutility $L(\lambda)$ on another principal by exerting some punishment effort $\lambda$ at cost $k^L\lambda$.[10] We assume $L(\lambda)=0$ for $\lambda \le \underline{\lambda} < 1$, and that $L(\cdot)$ is increasing and homogeneous of degree $\tau \ge 1$ in $\lambda$ for $\lambda > \underline{\lambda}$. The parameter $\underline{\lambda} < 1$ measures the effectiveness of the defense technology that can be employed by the principal who is

[10] Again, this means that one unit of power is an essential input for a principal to punish another principal. If a principal wanted to punish two other principals, he would need two units of power, and so on.

supposed to be punished, and the homogeneity parameter $\tau \geq 1$ captures the fact that people are generally vulnerable to punishments, so their disutility increases more than proportionally in the punishment's intensity. Assume, to simplify notation, that $L(1) = 1$. Then, given homogeneity, the punishment effort necessary to inflict the disutility L is given by

$$\underline{\lambda} + \lambda(L), \tag{2}$$

where $\lambda(L) = L^{1/\tau}$ is homogeneous of degree $\frac{1}{\tau}$ in L. Since $\frac{1}{\tau} \in [0,1]$, this implies that the effort necessary to inflict the punishment L increases less than proportionally in the punishment level.

We assume throughout the model that all actions – specifically, the productive and punishment efforts *e* and $\lambda$, the expropriation effort *o*, and any monetary payments between the parties – are perfectly observed by the principals. This allows us to abstract from the verification problems that have been extensively studied in the literature on third-party enforcement, and focus on the issue of credible punishments.

# 3. Third-party enforcement as a multilateral relational contract

### *3.1. The anarchy benchmark*

We begin our analysis by briefly discussing the "anarchy" case where third-party enforcement is not available. Both when power is decentralized and when it is

centralized, each agent knows that, if he spends a positive amount of effort *e* under the promise of a bonus *b*, his principal will not pay the bonus. Anticipating that, the agent will spend zero effort, and the resulting net value produced by the interaction between a principal and his agent will be $V^A = V(0) - C(0) = V(0)$.

Depending on whether power is decentralized or centralized, the citizens' pre-existing wealth, as well as the minimal value produced, $V^A$, may be subject to expropriation by either the principals or the ruler. We assume that expropriation occurs through settlement – that is, each party knows how much the other party can credibly threaten to expropriate from him given her endowment of coercive power and the expropriation technology $\left[\psi(\cdot), k^O\right]$ and, anticipating that, spontaneously delivers the expropriable amount. Given this assumption, and given that the agents spend zero productive effort irrespective of expropriation, expropriation under anarchy is purely redistributive and, therefore, does not affect the total surplus. Hence, the total surplus under both decentralized and centralized anarchy is given by $NV^A$.

### *3.2. Third-party enforcement*

When coercive power is decentralized (*decentralized enforcement*), one of the principals, called the *ruler*, collects a tax *t* from every other principal. After the taxes have been paid, each principal offers to his agent a bonus *b*, which will be paid conditional on the agent exerting the productive effort *e*. If a principal fails to pay *b* to his agent despite good effort (a contract violation), or if he uses his coercive power to expropriate another

agent's bonus (a property rights violation), then some other principal will punish him, and the ruler will pay the punisher a bonus $\beta$ to compensate his punishment services.

When coercive power is centralized (*centralized enforcement*), third-party enforcement is similarly organized, except that the ruler has now a monopoly over power. This has three consequences. First, the principals still have discretion on whether to pay their own agents or not, but they can no longer expropriate the other principals' agents. Second, only the ruler can punish a principal who fails to pay his agent. Third, if the ruler himself decides to expropriate the agents, nobody can punish him for doing so.[11]

Following recent advances in agency theory (Levin 2002), we model the third-party enforcement mechanisms described above as *multilateral relational contracts* between the ruler and all the other principals. This implies that, if under decentralized enforcement a principal fails to perform his punishment duties, or the ruler fails to reward any of the punishers, and if under centralized enforcement the ruler fails to perform his punishment duties, or expropriates one of the agents, then the relationship between the ruler *and each of the principals* breaks down from the following period and thereafter.

Given that the agents live for one period only and cannot develop long-term relationships with the principals, the breakdown of relational contracts implies a reversion to anarchy. Moreover, the analysis in section 3.1 implies that the value produced by any given principal-agent pair under anarchy is is given by $V^A$, both when power is decentralized and when it is centralized. This will allow us to abstract from the

[11] The question of "who will guard the guardians" is a central one in political science, and dates back at least to Plato's *Republic*. In economics, the problem has been recently discussed, among others, by Barzel (1999), Acemoglu (2003), and Besley and Robinson (2009).

contentious issue of whether the allocation of power changes or not once the relational contract breaks down (Gibbons and Rutten 2007).

The reason for modeling third-party enforcement as a multilateral relational contract is that such a contract cannot perform worse, and generally performs better, than a set of bilateral contracts between the ruler and each of the principals. To understand this, note that, if the ruler fails to honor his obligations towards a principal under a multilateral contract, he will lose the future cooperation of all of them, whereas if he does so under a set of bilateral contracts, he will only lose the cooperation of the principal he cheated on (see Levin 2002 for the details).

Note that, besides participating to the punishment mechanism, the ruler acts as a coordinator throughout the model by announcing the punishments that will be imposed to the principals in case of non-payment and expropriation, by collecting the taxes and, under decentralized enforcement, by announcing and distributing the punishers' rewards.[12]

### *3.3. Decentralized enforcement*

In any period, the stage interaction between the principals, the agents and the ruler works as follows:

[12] In other models, such as Milgrom *et al*. (1990), Dixit (2004) and, more recently, Masten and Prüfer (2011) and Hadfield and Weingast (2011b), the ruler also collects information about who has cheated and communicates such information to the rest of the community. As explained before, we abstract from this role of the ruler as an information intermediary by assuming perfect public monitoring throughout the model.

1. *Contracting*. Each principal pays a tax *t* to the ruler. After that, the principal makes a take-it-or-leave-it offer to his agent, whereby he promises to pay the agent a bonus $b = C(e)$ in exchange for the effort *e*.

2. *Production*. Each agent chooses the effort level *e*, incurring the cost $C(e)$.

3. *Distribution*. Each principal (including the ruler) decides whether to pay the bonus to his own agent and whether to expropriate another principal's agent.

4. *Enforcement*. If at stage 3 a principal has failed to pay the bonus to his own agent, or if he has expropriated another agent, one of the principals will inflict a punishment L on him, and the ruler will reward the punisher by paying him a bonus $\beta$.

We characterize the most efficient level of productive effort that can be sustained under decentralized enforcement as part of a stationary, trigger-strategy equilibrium of the infinitely repeated game played by the principals and the ruler. Given that discretionary monetary transfers between the parties are available (the bonuses *b* and $\beta$ and the tax *t*), this restriction on stationary equilibria is without loss of generality (Levin 2003).

Stationarity implies that, at time t+1, the stage game described above is repeated if the punishers have acted as requested and if the ruler has rewarded the punishers at time t. Conversely, if anyone has reneged at time t, all parties revert to anarchy in period t+1 and thereafter. Under anarchy, the ruler will receive a per period payoff equal to $R^{AD}$, the principals other than the ruler will receive a payoff equal to $\Pi^{AD}$, and the agents will receive a payoff equal to zero.

Note once again that we do not make any assumptions on whether reversion to anarchy after the decentralized enforcement mechanism breaks down involves a reallocation of coercive power between the principals and the ruler. As we will show in a moment, the fact that the net value produced by each principal-agent pair under anarchy is $V^A$ both when power is decentralized and when it is centralized, guarantees that the enforceable effort levels are independent of the allocation of power under anarchy, and hence of the distribution of the total surplus between the principals and the ruler.

We begin our analysis of decentralized enforcement by characterizing a principal's short-run gains from failing to pay the bonus $b = C(e)$ to his agent and from expropriating the bonus received by another principal's agent. This short-run gain is given by

$$\left[1+\psi^*\left(k^O\right)\right]C(e), \text{ where} \tag{3}$$

$$\psi^*\left(k^O\right) = \psi\left(\arg\max_o\left\{\psi(o)C(e) - k^O o\right\}\right). \tag{4}$$

As before, we assume the principal and his victim settle under the credible expropriation threat in (4), so that the principal does not actually incur the expropriation cost. Allowing for costly expropriation to occur would increase the deadweight loss from lack of enforcement, and hence make the case for third-party enforcement even stronger.[13]

[13] Theoretically, more principals may simultaneously expropriate the same agent. We rule this possibility out by assuming that, when a principal decides to expropriate, he can easily verify whether an agent is already being threatened by another principal. Since the agents are identical, the principal will then continue his search until he finds an agent who is not already under threat.

Given (3), the minimum punishment necessary to deter non-payment and expropriation by any given principal is

$$L^D(e) = \left[1 + \psi^*\left(k^O\right)\right] C(e), \tag{5}$$

and the corresponding punishment effort is

$$\underline{\lambda} + \lambda^D\left(e, k^O, \tau\right) \tag{6}$$

where $\lambda^D\left(e, k^O, \tau\right) = \left\{\left[1 + \psi^*\left(k^O\right)\right] C(e)\right\}^{1/\tau}$. The punishment effort in (6) is increasing in the level of productive effort *e* to be enforced. Moreover, it is decreasing in the cost of expropriation, $k^O$, and in the productivity of the punishment technology, $\tau$, and it is increasing in the defense capacity, $\underline{\lambda}$. This is intuitive: increases in *e* (and hence in the expropriable bonus $C(e)$) and in $\underline{\lambda}$, and decreases in $k^O$, will make it more attractive for the principals to cheat on their own agents and to expropriate the other principals' agents, thus increasing the punishment efforts necessary to deter cheating. At the same time, decreases in $\tau$ will increase the effort necessary to administer a given amount of punishment.

We are now ready to compute the level of productive effort that can be achieved under decentralized enforcement. To simplify the notation, denote the ruler's and the principals' equilibrium payoffs, given effort *e*, as

$$R(e) \equiv V(e) - C(e) + (N-1)t, \text{ and} \tag{7}$$

$$\Pi(e) \equiv V(e) - C(e) - t, \text{ respectively.} \tag{8}$$

The following conditions are both necessary and sufficient for the decentralized enforcement strategies to describe a subgame-perfect equilibrium of the repeated game:

$$R(e) \geq R^{AD}; \tag{9}$$

$$\Pi(e) \geq \Pi^{AD}; \tag{10}$$

$$-k^{L}\left[\underline{\lambda} + \lambda^{D}(e, k^{O}, \tau)\right] + \beta + \frac{1}{r}\Pi(e) \geq \frac{1}{r}\Pi^{AD}, \text{ and} \tag{11}$$

$$-k^{L}\left[\underline{\lambda} + \lambda^{D}(e, k^{O}, \tau)\right] - (N-1)\beta + \frac{1}{r}R(e) \geq \frac{1}{r}R^{AD}, \tag{12}$$

where *r* is the parties' common interest rate.

Condition (9) is the ruler's participation constraint. Condition (10) describes each principal's participation constraint. Condition (11) describes each principal's incentive constraints with respect to the punishment obligation. Finally, condition (12) is the ruler's incentive constraint with respect to his obligation to both act as a punisher and reward the other principals' punishment services.

To understand condition (12), note that, for decentralized enforcement to be a subgame-perfect equilibrium, the ruler must be willing to pay the promised reward $\beta$ even in the worst-case scenario where all the N-1 principals other than the ruler simultaneously cheat – that is, they refuse to pay the promised bonus to their agents and they use their unit of coercive power to expropriate another agent..

As shown by Levin (2002, 2003), the conditions defined by (9) through (12) can be reduced to a unique condition by using the upfront tax $t$ and the punishment bonus $\beta$ to

transfer slack across the participation and incentive constraints. Without loss of generality, we can concentrate all the incentive power of the relational contract on the ruler by choosing the maximum tax *t* consistent with (10) and the minimum punishment bonus $\beta$ consistent with (11). By substituting into (9) and simplifying, we obtain

$$V(e) - C(e) \geq V^A . \tag{13}$$

By substituting into (12) and simplifying, we obtain the more restrictive decentralized enforcement condition

$$k^L \left[ \underline{\lambda} + \lambda^D \left( e, k^O, \tau \right) \right] \leq \frac{1}{r} \left( V(e) - C(e) - V^A \right). \tag{EC$^D$}$$

The left-hand side of (EC$^D$) is the ruler's average reneging temptation – that is, the temptation not to cover the punishers' per capita enforcement cost. The right-hand side is the discounted average gain from continuing with decentralized enforcement, rather than reverting to anarchy, in the future periods. If the ruler's reneging temptation is too large, or if the average gain is too small, so that (EC$^D$) does not hold, the threat to inflict a punishment $L^D(e)$ will not be credible, which implies that the principals will violate the agents' contract and property rights, which implies, in turn, that the agents will not receive the bonus $b = C(e)$ and, consequently, will not exert the effort *e*. These results are summarized by the following

**Proposition 1**: under decentralized enforcement, the agents' productive effort, $e^D$, maximizes the net value $V(e) - C(e)$, subject to (EC$^D$).

An inspection of ($EC^D$) immediately reveals that the agents' effort under a decentralized enforcement system approaches the first best level $e^{FB}$ when the punishment technology is effective (large $\tau$, small $\underline{\lambda}$, and small $k^L$), when the expropriation technology is not too effective (large $k^O$), when the agents' efforts are productive (large $V(e)-C(e)-V^A$), and when the principals and the rulers value future interactions (small $r$).

As an example of these comparative-static predictions, Figure 1 below shows the outcome of a decentralized enforcement system for low and high values of the punishment cost $k^L$. To understand this figure, note that the enforcement constraint ($EC^D$) can be rewritten as

$$V(e)-C(e) \geq V^A + rk^L\left[\underline{\lambda}+\lambda^D\left(e,k^O,\tau\right)\right]$$

Hence, the curve depicted in Figure 1 represents the net per capita gain from effort, $V(e)-C(e)$, and the smooth and steep lines represent the (rewritten) decentralized enforcement constraints when $k^L$ is small and large, respectively.[14] The optimal level of effort under decentralized enforcement, $e^D$, is the one that maximizes the curve $V(e)-C(e)$, under the constraint that the curve lays above the relevant line. Note that, given the expression in (6), the intercept in the enforcement constraint is increasing in $\underline{\lambda}$, the slope is increasing in $k^O$ and $\tau$, and both the slope and the intercept are increasing in $k^L$ and $r$.

[14] In the example from Figure 1 (as in the examples from figures 2 and 3), it is assumed that the cost of effort $C(e)$ is linear, and that $\tau = 1$. As a result, the enforcement constraints are linear in the level of effort.

<<Place Figure 1 here>>

### *3.4. Centralized enforcement*

Centralized enforcement works as decentralized enforcement, except that the ruler is now directly in charge of all punishments and, being his coercive power unchallenged, he has a chance to expropriate the agents in each unit. Moreover, the principals are no longer in a position to expropriate, so the only goal of punishments is to force the principals to honor their contracts with their agents by paying them the bonus $C(e)$ conditional on the agents exerting effort *e*. The minimum punishment necessary to deter contract breach by a principal is equal to $L^C(e) = C(e)$, the value of the bonus the principal is supposed to pay his agent. Consequently, the punishment effort per capita necessary to deter contract breach under centralized enforcement is given by

$$\underline{\lambda} + \lambda^C(e, \tau), \tag{14}$$

where $\lambda^C(e, \tau) = C(e)^{1/\tau}$. As under decentralized enforcement, the punishment effort is increasing in *e* and $\underline{\lambda}$, and decreasing in $\tau$. Unlike under decentralized enforcement, however, the punishment effort does not depend on the expropriation cost $k^O$, because the principals are now powerless and, therefore, they cannot expropriate.

Let $R^{AC}$ and $\Pi^{AC}$ be the ruler's and the other principals' payoffs in case centralized enforcement breaks down and the parties revert to anarchy. Then, the following conditions are both necessary and sufficient for the centralized enforcement strategies to

describe a subgame-perfect equilibrium of the repeated game: $R(e) \geq R^{AC}$;

(15)

$$\Pi(e) \geq \Pi^{AC}; \tag{16}$$

$$-C(e) + \frac{1}{r}R(e) \geq (N-1)\psi^*(k^O)C(e) + \frac{1}{r}R^{AC}, \text{ and} \tag{17}$$

$$-(N-1)k^L\left[\underline{\lambda} + \lambda^C(e,\tau)\right] + \frac{1}{r}R(e) \geq \frac{1}{r}R^{AC}. \tag{18}$$

Condition (15) is the ruler's participation constraint. Condition (16) describes the principals' participation constraints. Condition (17) is the ruler's incentive constraint with respect to the non-expropriation obligation. Finally, condition (18) is the ruler's incentive constraint with respect to the punishment obligation.

As before, we choose without loss of generality the maximum tax *t* consistent with the principals' participation constraint (16). After substituting for that into the incentive constraints (17) and (18) and simplifying, we obtain the following two enforcement conditions:

$$\frac{(N-1)}{N}k^L\left[\underline{\lambda} + \lambda^C(e,\tau)\right] \leq \frac{1}{r}\left(V(e) - C(e) - V^A\right), \text{ and} \tag{EC$^H$}$$

$$\frac{1}{N}\left[1 + (N-1)\psi^*(k^O)\right]C(e) \leq \frac{1}{r}\left(V(e) - C(e) - V^A\right), \tag{EC$^V$}$$

The expressions "EC$^H$" and "EC$^V$" stand, respectively, for "horizontal enforcement constraint" and "vertical enforcement constraint". We use these labels because constraint (EC$^H$) refers to the "horizontal" contractual relationship between the powerless principals

and their agents, whereas constraint ($EC^V$) refers to the "vertical" relationship between the powerful ruler and the agents. Specifically, condition ($EC^H$) insures that the ruler is willing to use his coercive power to punish the principals when these breach their contracts with the agents by failing to pay them a bonus, and thus guarantees that the punishment threat is credible. Condition ($EC^V$) insures that the ruler does not use his overwhelming coercive power to himself expropriate the agents. Since the right-hand sides in ($EC^H$) and ($EC^V$) are identical, only one of the two constraints will be binding.

This result is summarized in the following

**Proposition 2**: under centralized enforcement, the agents' productive effort, $e^C$, maximizes the net value $V(e)-C(e)$, subject to whichever constraint is binding between ($EC^H$) and ($EC^V$).

Whether the punishment or the expropriation constraint is binding will depend on the environment. For instance, ($EC^H$) will be binding when the punishment cost $k^L$ is high, and ($EC^V$) will be binding when the expropriation cost $k^O$ is low. As an illustration of this, Figure 2 below depicts the outcome of centralized enforcement for low and high values of $k^L$.

<<Place Figure 2 here>>

### *3.5. Endogenous allocation of power: centralized vs. decentralized enforcement*

In this section, we study the conditions that make centralized or decentralized enforcement efficient. Our results here indicate what the optimal social allocation of power would be *if* such allocation were endogenous and *if* it could be efficiently

contracted at the outset by the principals, the agents, and the ruler – that is, if one could run a fair "horserace" between enforcement institutions (Gibbons and Rutten 2007). In reality, the social allocation of power is rarely modified, and mostly as a result of external shocks, such as wars and invasions. Nevertheless, the economic efficiency of centralized or decentralized enforcement systems may have affected the switches from one State form to the other across history and, if that is the case, our model may yield testable predictions on the timing and location of such switches.

Propositions 1 and 2 imply that the system with the loosest enforcement constraint weakly dominates the other, in the sense that it generates at least as much surplus. When the principals and the ruler are patient (low values of *r*), both enforcement systems generate the first best effort $e^{FB}$. As *r* grows, the enforcement constraints become binding, so the system with the loosest enforcement constraint generates an effort level closer to the first best, and hence a greater surplus.

Let

$$\bar{k}^{L}\left(k^{O},\underline{\lambda},\tau\right)\equiv\frac{\left[1+\left(N-1\right)\psi^{*}\left(k^{O}\right)\right]C\left(e\right)}{N\left[\underline{\lambda}+\lambda^{D}\left(k^{O},\tau\right)\right]}. \tag{19}$$

Then, we can state the following

**Proposition 3**: decentralized enforcement weakly dominates centralized enforcement ($V\left(e^{D}\right)-C\left(e^{D}\right)\geq V\left(e^{C}\right)-C\left(e^{C}\right)$) if, and only if $k^{L}\leq\bar{k}^{L}\left(k^{O},\underline{\lambda},\tau\right)$.

**Proof**: since ($EC^{D}$) is tighter than ($EC^{H}$), decentralized enforcement weakly dominates whenever ($EC^{D}$) is looser than ($EC^{V}$), and centralized enforcement weakly

dominates whenever ($EC^D$) is tighter than ($EC^V$). By inspection, one can check that ($EC^D$) is looser than ($EC^V$) if, and only if $k^L \leq \bar{k}^L\left(k^O, \underline{\lambda}, \tau\right)$. QED.

Intuitively, the punishment constraint under decentralized enforcement is tighter than under centralized enforcement because, under the latter system, the principals do not have coercive power and, therefore, do not have an opportunity to expropriate the agents in other units. Hence, the threatened per capita punishment must deter both contract and property right violations under decentralized enforcement, whereas it must only deter contract violations under centralized enforcement. On the other hand, the ruler cannot be punished under centralized enforcement, so he has a direct temptation to abuse his coercive power and expropriate the agents. As a result, when comparing the two systems, the relevant tradeoff is between punishment costs, which are maximized under decentralized enforcement, and the expropriation temptation, which is maximized under centralized enforcement.

Proposition 1, together with an inspection of (19), implies that decentralized enforcement is more likely to dominate when $k^L$ and $\underline{\lambda}$ are small, and when $\tau$ is large. This is intuitive: the credibility of decentralized enforcement is more sensitive to punishment costs than the credibility of centralized enforcement and, in turn, the total punishment cost that the ruler must be willing to reward for decentralized enforcement to be credible is smaller the smaller the marginal cost of punishment efforts, given by $k^L$, the principals' ability to resist to punishments, given by $\underline{\lambda}$, and the effort-intensiveness of the punishment technology, given by $\frac{1}{\tau}$.

Straightforward calculations also show that $\frac{\partial \bar{k}^{L}\left(k^{O}, \underline{\lambda}, \tau\right)}{\partial k^{O}} < 0$. This implies that decentralized enforcement is less likely to dominate when the cost of using power to expropriate is large, and hence when expropriation is more difficult. This result is not obvious a priori, because a reduction in the ability to expropriate relaxes both the decentralized and the centralized enforcement constraints by simultaneously reducing the punishments necessary to deter expropriation under decentralized enforcement, and the ruler's temptation to expropriate under centralized enforcement. However, the latter, *direct* effect on the ruler's temptation under centralized enforcement dominates the *indirect* effect on the punishment costs under decentralized enforcement. The reason is that we have assumed that individuals are increasingly responsive to punishments ($\tau \geq 1$), so that the punishment efforts increase less than proportionally in the penalty to be imposed. Hence, a change in the offense technology that makes expropriation harder (easier) causes a deeper reduction in the ruler's direct expropriation temptation under centralized enforcement than in the punishment costs necessary to deter expropriation under decentralized enforcement.

The above results are summarized in the following

**Proposition 4**: decentralized enforcement is more likely to dominate centralized enforcement when $k^{L}$, $\underline{\lambda}$ and $k^{O}$ are small, and when $\tau$ is large.

As an illustration of Proposition 4, Figure 3 below depicts the effect of an increase of $k^{L}$ on the choice between centralized and decentralized enforcement.

<<Place Figure 3 here>>

### *3.6. Testability*

Testing the predictions of our model, both on the performance of a given enforcement system (sections 3.3 and 3.4) and on the choice between centralized and decentralized enforcement (section 3.5), requires data on the social allocation of power (more or less centralized), on the parties' discounting of future interactions (the parameter *r*), and on the coercion technology (the parameters $k^L$, $\underline{\lambda}$ and $k^O$).

*Allocation of power*. A first dimension along which the social allocation of power has been observed to vary is the architecture of the State. In the Medieval feudal States, weapons and armies were split among several vassals, and the king was a *primus inter pares* who needed the cooperation of vassals in order to maintain internal order and confront external threats. Conversely, modern and contemporary States have been characterized by the centralization and monopolization of coercive power by a ruling individual or body, who commands a professional army trained to be loyal to him or to the institution he represents.

A second dimension along which the social allocation of power can vary is the political influence of groups other than the State, such as organized churches. Even a formally centralized State may experience some degree of power decentralization if the members of the army are divided between their loyalty to the State and its head, and their loyalty to the Church. Depending on which of these two interpretations is adopted, our model may be used to predict the evolution of State architectures from feudal to modern, and the unification or separation of Church and State.

*Discounting of future interactions*. Future interactions between the ruler and the principals are less valuable when the ruler and the political regime he represents are likely to be overthrown or replaced, and when the behavior of the ruler's successor is hard to predict. Hence, natural measures of the intertemporal discount rate $r$ are the exposure of a community's political regime to external military threats and to internal succession crises. The latter may occur when the ruler is close to death and has no heirs, and when his legitimacy is purely personal, rather than tied to the institution he represents.

*Coercion technology*: both the cost of punishment, $k^L$, and the cost of expropriation, $k^O$, have been reduced over time by improvements in the offensive military technology, such as the use of railways to transport troops and the introduction of remotely controlled weapons (Onorato *et al*. 2012). Other technological changes, such as the replacement of wooden castles with stone castles in the middle ages (Kontler 2006), or the use of barbed wire in the construction of trenches, have facilitated defense (an increase in the parameter $\underline{\lambda}$). Finally, improvements in the scope and efficiency of taxation systems (Tracy 1985; Brewer 1988) have arguably facilitated expropriation (a reduction in $k^O$).

Non-technological changes in the cost of punishment and expropriation are also possible. For instance, the emergence of ethical principles that disfavor harsh punishments, and the consequent adoption of restrictive legislation and international bans, can be seen as an (at least partially) exogenous increase in the punishment cost $k^L$. Also, the fragmentation of a society into ethnic and religious groups characterized by different norms and cultures can make a powerful individual less reluctant to expropriate or punish other members of its society, as these are likely to belong to different groups and hence to

be perceived by him as aliens. In this sense, an increase in ethnic and religious fragmentation can be interpreted as a reduction in the parameters $k^O$ and $k^L$.

# 4. Exogenous allocation of power: judicial and political institutions under centralized enforcement

Using an instrumental variable approach, Acemoglu and Johnson (2005) estimate the economic effects of institutions that facilitate the adjudication of contractual disputes and institutions that constrain the Executive power. They find that constraints on the Executive, as measured by the Polity index developed by Gurr (1999), have a strong positive effect on various indicators of economic development across countries. On the other hand, institutions facilitating the adjudication of contractual disputes, negatively measured by the degree of judicial formalism, have a far less significant effect on economic development.

In what follows, we show that our model of third-party enforcement can explain the different economic effects of these two types of institutions, as observed by Acemoglu and Johnson (2005). In terms of power allocation, modern States, including those in the Acemoglu and Johnson (2005) sample, have primarily adopted centralized systems, where coercive power is monopolized by a government that commands a professional army. Moreover, the centralized allocation of power and the political and economic institutions of these states have been found to be quite rigid and persistent over time (Acemoglu *et al*. 2001, 2002). To take that into account, we focus here on the centralized enforcement model from section 3.4.

To incorporate institutions that facilitate the adjudication of contractual disputes into the model, we assume that, when a principal fails to pay the promised bonus to his agent, a judge must verify contract breach and call for a punishment to be imposed on the cheaer. We also assume that verification is successful with probability *q*, and unsuccessful with probability *1-q*. Under this assumption, a principal who breaches his contract with the agent escapes punishment with probability *1-q* and, therefore, the minimum punishment that must be threatened to deter contract breach is given by $\frac{C(e)}{q}$.

We interpret *q* as a measure of the discretion that the law gives to the judge in admitting evidence to the trial, and the ease with which a cheated agent can produce the required evidence. More formalistic legal system are more likely to constrain the judges' discretion and to burden plaintiffs with higher evidence-collection costs and, therefore, they will be characterized by higher values of *q*.

To model constraints on the Executive, we assume that, by granting a constitution, the ruler can transfer the loyalty of the militias he control (1 loyal soldier per unit of coercive power) from his person to the State's laws. The clearer the constitutional separation between the law and the ruler's will, the higher the probability *p* that the ruler will be disobeyed by his militias in case he gives them orders that are inconsistent with the law.[15] In our model of centralized enforcement, a higher level of *p* implies that the ruler will be less likely to prevent his militias from performing their punishment duties in case of

[15] For instance, the constitution may state that armed militias are bound by the law, and that the law is enacted by a body, such as an elected assembly, which is independent from the ruler.

contract breach, and also less likely to persuade them to use weapons in order to expropriate the agents.

Given the measures of institutional quality *p* and *q*, the horizontal and vertical enforcement constraints ($EC^H$) and ($EC^V$) can be rewritten, respectively, as

$$\frac{(1-p)(N-1)}{N} k^L \left[\underline{\lambda} + \lambda^C(e,q,\tau)\right] \le \frac{1}{r}\left(V(e) - C(e) - V^A\right), \text{ and} \tag{20}$$

$$\frac{1-p}{N}\left[1 + (N-1)\psi^*\left(k^O\right)\right] C(e) \le \frac{1}{r}\left(V(e) - C(e) - V^A\right), \tag{21}$$

where $\lambda^C(e,q,\tau) = \left[\frac{C(e)}{q}\right]^{1/\tau}$.

Clearly, an increase in *p* makes both condition (20) and condition (21) looser, whereas an increase in *q* makes condition (20) looser without affecting (21). Hence, for intermediate values of the interest rate *r*, an increase in *p* is always productive, whereas an increase in *q* is productive only if the horizontal constraint is binding – that is, if condition (20) is tighter than condition (21). Moreover, it immediately follows from an inspection of (20) and (21) that the horizontal constraint is binding if, and only if

$$k^L > \frac{\left[1 + (N-1)\psi^*\left(k^O\right)\right] C(e)}{\underline{\lambda} + \left[\frac{C(e)}{q}\right]^{1/\tau}} \equiv \underline{k}^L\left(q, k^O, \underline{\lambda}, \tau\right).$$

These results are summarized by the following

**Proposition 5**: assume the principals and the ruler are moderately patient (intermediate values of *r*), so that the first best cannot be achieved ($e^C < e^{FB}$). Then,

tighter constraints on the Executive (a larger $p$) increase social surplus, whereas easier verification of contractual disputes (a larger $q$) increases social surplus if, and only if $k^L > \underline{k}^L\left(q, k^O, \underline{\lambda}, \tau\right)$.

Note that $\underline{k}^L\left(q, k^O, \underline{\lambda}, \tau\right)$ is increasing in the parameters $k^O$ and $\tau$, and decreasing in the parameter $\underline{\lambda}$. Then, Proposition 5 implies that institutions facilitating the adjudication of contractual disputes are unproductive whenever the coercion technology favors punishment and expropriation over defense (low $k^L$, $k^O$ and $\underline{\lambda}$, high $\tau$).

Empirically, Proposition 5 implies that, if one compares the performance of the two types of institutions across countries, the average effect of constraints on the Executive on economic development will be larger than the effect of improvements in the adjudication of contractual disputes as long as there is a subset of countries where the coercion technology favors punishment and expropriation over defense (formally, where $k^L > \underline{k}^L\left(q, k^O, \underline{\lambda}, \tau\right)$). This is consistent with the empirical results in Acemoglu and Johnson (2005).

The intuition behind Proposition 5 is the following. Constraints on the Executive make it harder for the ruler to use coercive power in a manner that is inconsistent with the law. This improves both the "horizontal" enforcement of the principal-agent contracts, by reducing the ruler's expected present gain from attempting to shirk on his punishment obligations in case the principals fail to pay their agents, and the "vertical" protection of the agents' property rights, by reducing the ruler's expected present gain from attempting to expropriate them. In contrast, a quicker and more efficient adjudication of contractual

disputes solely affects the horizontal enforcement of contracts, but does not affect the ruler's incentives to expropriate. As a result, the economic effect of adjudication quality is of second order, relative to the effect of constraints on the executive.

# 5. Conclusion

This paper has studied third-party enforcement as a multilateral relational contract between the members of a community and their ruler on the use of force. When bilateral contractual relationships and reputational mechanisms are weak, third-party enforcement must be backed by the threat of punishments that are costly to administer. This creates a credibility problem: if the punishers have no incentives to punish and the members of society anticipate it, contracts and property rights will not be respected, and productive efforts will not be undertaken. Our analysis has shown that the possibility to lose future rents from ruling over a productive society can induce the ruler to guarantee third-party enforcement. The extent to which this "relational" third-party enforcement is credible depends on the effectiveness of the coercion technology, and on whether power is centralized or dispersed. While the conventional wisdom is that a central monopoly on the use of force facilitates enforcement and improves social order, we have shown that this is not always the case. The model offers several predictions on the optimal social allocation of coercive power, on the effect of the coercion technology on enforcement and economic performance, and on the role of judicial and political institutions. Some of these predictions are consistent with the existing empirical evidence. The other predictions are potentially testable, and we hope to bring them to the data in future work.

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**Figure 1. Decentralized enforcement: an increase in the punishment cost makes the enforcement constraint tighter**

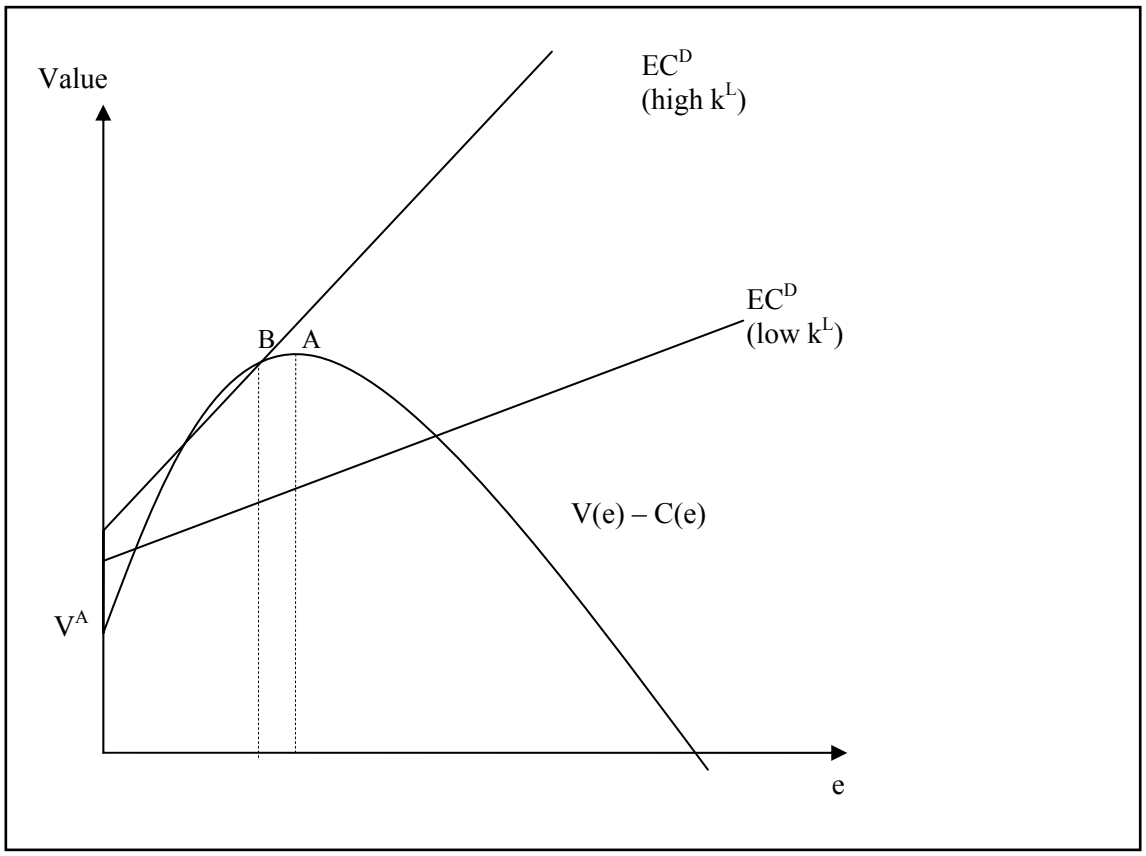

**Figure 2. Centralized enforcement: an increase in the punishment cost switches the binding constraint from $EC^V$ to $EC^H$**

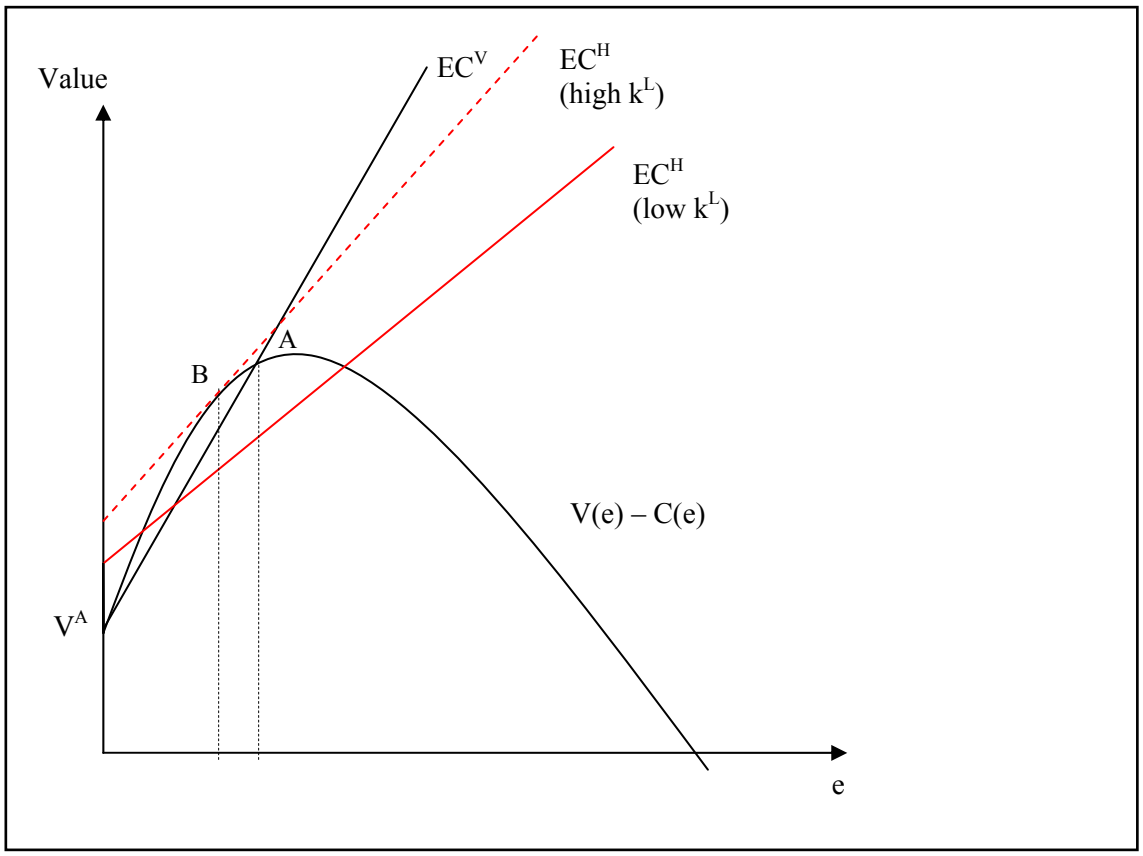

**Figure 3. An increase in the punishment cost switches the optimal enforcement system from decentralized to centralized**