Endogenous Enforcement Institutions

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Abstract

We model the State as a self-enforcing agreement on coercion where a ruler promises to enforce contracts between traders and respect their property rights. Consistent with the rise and fall of the medieval "Law Merchant", we show that as the coercion technology evolves, it is optimal for traders to rely on the State, rather than private relationships, to enforce their contracts. In contrast, when coercion costs are high, it is optimal to privately enforce contracts even when these are verifiable by State courts. Finally, we show that improvements in the State's ability to enforce contracts may fail to increase productive exchanges when the ruler can expropriate a high share of the gains from trade—that is, secure contracts and property rights may be perfect complements. Consistent with that, we provide evidence that contracting institutions have favored economic development only in countries with sufficiently constrained rulers.

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1. Introduction

Coercive power has an ambiguous social role. On one hand, it encourages investment by enabling the punishment of predatory behavior. On the other hand, it discourages investment by permitting expropriation and theft.[1] This ambiguity between the enforcement role and the predatory role of the State (North 1981) has been sometimes described as "the fundamental political dilemma" (Weingast 1995).

In this paper we study the interaction between enforcement and predation—that is, the extent to which a State can simultaneously commit to protect contractual deals between citizens and guarantee their property rights. To do so, we develop a formal model of the State as a self-enforcing agreement over the use of force. In our model, a principal, an agent, and a ruler endowed with coercive power interact repeatedly. The principal contracts the agent to perform a task in exchange for a salary. The agent performs only if he expects the principal to pay him the promised salary, and the ruler not to expropriate it. In the absence of enforcement mechanisms neither expectation is fulfilled, and the resulting equilibrium is characterized by low productivity and income.

Since the parties interact repeatedly, better outcomes may be achieved by conditioning continuation of the relationship to the principal's and the ruler's present behavior. In particular, the principal may prefer to pay the agent today and receive higher

[1] On the economic theory of conflict and expropriation, and the related literature, see Hirschleifer (2001), Garfinkel and Skaperdas (2007), and contributions in Wärneryd (2014).

surplus in the future from the agent's increased effort, and the ruler may prefer not to overtax the agent today and collect part of the surplus through steady tax revenues in the future. This is the "private ordering" solution familiar from the literatures on relational contracts (e.g., Levin 2002, 2003), collective enforcement (e.g., North *et al*. 1990; Milgrom *et al*. 1994), and self-enforcing political institutions (e.g., Olson 1993; Weingast 1995; Acemoglu 2003; de Figueiredo and Weingast 2005).

Alternatively, the principal and the agent may create a State by appointing the ruler as an enforcer. In a State, if the principal fails to pay the agent (or equivalently, if he disobeys a court's order to pay), the ruler may increase his taxes and, in addition, he may inflict on him a costly coercive punishment (for instance, imprisonment). The ruler cannot be punished coercively, so his repeated interaction with the principal and the agent is used to prevent expropriation, as under private ordering. In addition, the repeated interaction is also used to provide the ruler with an incentive to inflict costly punishments when needed, so that the State's threat of coercion is credible.

Our analysis has two important implications. First, improvements in the coercion technology should move the optimal enforcement system from private ordering, where contracts are enforced by a threat to terminate cooperation, to the State, where contracts are enforced by a threat of coercion. This result is consistent with the fact that, in parallel with steady reductions in the cost of coercion over history (Blaydes and Chaney 2012; Onorato *et al*. 2012), the medieval private enforcement system known as Law Merchant has been gradually replaced by court-enforcement systems backed by the State's coercive power (Milgrom *et al*. 1990; Masten and Prüfer 2011).

Second, our model implies that in a State, contractual enforcement and constraints on the ruler's taxation power are complementary inputs. When the ruler decides whether to honor the social contract, he compares the short-run gains from expropriation and from shirking on enforcement to the long-term rents from cooperation. If technology, geography and other exogenous factors constrain his power to collect taxes, the ruler will be more tempted to renege on contractual enforcement than to expropriate, and vice versa. Anticipating that, the agent will increase his effort in response to improvements in contractual enforcement only if the ruler's taxation power is sufficiently constrained, so that the agent expects to appropriate at least in part the increased gains from contracting.

This result relates to an empirical puzzle uncovered by Acemoglu and Johnson (2005), who found that exogenous constraints on rulers have favored the long-run economic development of former colonies more than improvements in contractual enforcement by courts. Using the same identification strategy as Acemoglu and Johnson (2005), we investigate whether the *interaction* between the quality of court enforcement (inversely measured by procedural formalism and instrumented by legal origin) and the expropriation power of rulers (measured by an index of constraints on the Executive and instrumented by population density in the 1500s) matters for the ability of former colonies to attract foreign direct investment (FDI) and generate income (GDP per capita). We find that improvements in contractual enforcement *do increase* FDI attractiveness and GDP per capita, but only when the ruler's expropriation power is sufficiently constrained. This suggests that, consistent with previous empirical work (e.g., Djankov et al. 2002, 2003; Auer 2013), the role of contractual enforcement in affecting economic development may be more important than found by Acemoglu and Johnson (2005). At the same time,

and consistently with our theoretical predictions, our empirical results suggest that the interaction between a State's two facets (enforcer and predator) matters: contract enforcement creates incentives for investment only when property rights are sufficiently protected against rulers' predation, so that investors expect to appropriate the gains from enhanced contracting.

Our result on the interaction between enforcement and expropriation has also a normative implication, as it implies that institutional reforms and policy should concentrate on the ruler's binding incentive constraint. If the binding constraint is on expropriation, limiting the ruler's power to exact taxes is more urgent than improving courts, and vice versa. While a satisfactory explanation for the timing of institutional reforms requires country-specific studies, there is casuistic evidence consistent with our broad normative prediction. For instance, facing predatory institutions inherited from Mao's Cultural Revolution, Chinese reformers have enacted institutional reforms increasing the protection of property rights, while leaving enforcement institutions, and particularly the judiciary, relatively underdeveloped until recent times (Montinola *et al*. 1995; Weingast 1995; Xu 2011); however, numerous scholars (Peerenboom 2002; Clarke *et al*. 2008; Xu 2011) argue that to maintain China's growth in the future, it is now urgent to shift the focus of reforms on modernizing its legal institutions.

This paper reconciles three streams of economic literature. The first stream, on formal contracts, emphasizes the role of courts and the State in enforcing contractual obligations

(e.g., Williamson 1979; Djankov *et al*. 2002, 2003, Glaeser and Shleifer 2002).[2] The second stream emphasizes how self-enforcing agreements, which are sustained by the parties' interest in maintaining bilateral or multilateral relationships rather than by the threat of coercion, can generate "order without law" (e.g., Ostrom 1990; Williamson 1991; Greif *et al*. 1994; McMillan and Woodruff 1999).[3] The third stream, on self-enforcing political institutions, focuses on how the State can credibly commit not to use violence in order to expropriate citizens (Olson 1993; Weingast 1995; Acemoglu *et al*. 2001, 2002; Acemoglu 2003; de Figueiredo and Weingast 2005; Gibbons and Rutten 2007; North *et al*. 2009).

Our contribution to these literatures is twofold. First, we show that, since coercive enforcement of private contracts by the State is costly, it must be itself part of a self-enforcing agreement. This implies that State enforcement cannot be taken for granted even when contracts are perfectly verifiable, and that whether it performs better than private enforcement depends on the technology. Second, we show that in a State, the ruler's two credibility problems—respectively, as a contract enforcer and guarantor of property rights—*interact* and, therefore, should be jointly analyzed, rather than studied in isolation. When technological constraints make one of the ruler's two credibility

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[2] More generally, exogenous State enforcement is invoked by most works on incentive contracts (e.g., Holmstrom 1979; Holmstrom and Milgrom 1991), incomplete contracts (e.g., Hart and Moore 1988; Battigalli and Maggi 2002), and property rights (e.g., Grossman and Hart 1986; Arruñada 2003; Libecap and Lueck 2011).

[3] Self-enforcing agreements, alone or in combination with court-enforced agreements, have been used to study employment contracts (MacLeod and Malcomson 1989; Baker *et al.* 1994; Levin 2002, 2003), inter-firm contracts (Klein 2000; Zanarone 2013), the structure and boundaries of firms (Baker *et al.* 1999, 2002), property rights (Ellickson 1991), and enforcement by markets and communities (Klein and Leffler 1981; Bendor and Mookherjee 1990; Milgrom *et al*. 1990; Greif *et al.* 1994; Dixit 2003a, 2003b; Masten and Prüfer 2011; Hadfield and Weingast 2012a, 2012b). See Dixit (2004), Greif (2006), MacLeod (2007), and Malcomson (2013) for comprehensive reviews of these literatures.

problems binding, the other problem becomes irrelevant, so researchers and policy-makers alike should ignore it, and focus instead on the binding problem.

The rest of the paper is organized as follows. Section 2 presents the model. Section 3 analyzes private ordering. Section 4 analyzes the State. Section 5 compares the State to private ordering. Section 6 presents empirical evidence that supports some of the model's theoretical predictions. Section 7 discusses possible extensions of our work and concludes.

2. A model of contracts in the shadow of coercion

2.1. Environment and technology

There are a principal, an agent and a ruler. All parties are risk-neutral, live forever, and discount next-period incomes at the common factor $1/(1+r)$. Time evolves in discrete periods. At the beginning of each period, the principal and the agent decide whether to engage in a productive relationship in the ruler's territory. If they do so, the agent may generate income $V(e) = eV$ for the principal by spending productive effort $e \in \{0,1\}$ at cost $C(e) = eC$, where $V > C$.[4] If they do not, each party may pursue alternative productive opportunities outside the ruler's territory.

The principal has an exogenous monetary income of ω_p per period, which we may interpret as the return from assets he owns outside the ruler's territory. The ruler also has

[4] All of the model's results immediately extend to the case of continuous effort.

an exogenous monetary income ω_R. We assume that ω_P and ω_R are large enough for all the monetary payments in the model to be feasible.[5]

Coercion

The ruler controls coercive power within his territory. Coercive power is exogenously given, and obeys to the following technology: by spending $\lambda(L)$ units of coercion effort, at cost $k\lambda(L)$, the ruler may inflict disutility $L \in [0, \bar{L}]$ to either the principal or the agent, where $\lambda(0) = 0$ and $\lambda'(\cdot) > 0$. The coercion cost $k\lambda(L)$ may be interpreted as the ruler's expenditure to equip and transport soldiers, maintain weapons and detain prisoners, as well as the monetary equivalent of the psychological cost suffered by the ruler for causing pain to the principal and the agent. The capacity parameter $\bar{L}$ represents the maximum disutility the ruler can inflict through coercion. At the limit, $\bar{L}$ could be the principal's and the agent's disutility from losing their life.

We assume that $L_{min} < \bar{L} < L^{max}$, where $L_{min} \equiv \frac{C}{q} - \psi V$ and $L^{max} \equiv \frac{C}{q(1-\psi)} - \frac{\psi}{1-\psi} V$.

This capacity constraint will matter for our analysis of the interaction between property rights and contract enforcement in the State (section 4), as it insures that a threat of coercive enforcement is credible only if the taxes the agent must pay to the ruler, and hence the payments he must receive from the principal to be induced to work, are low enough. We return on this in section 4, footnote 12.

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[5] The agent may also have an exogenous income. Since this plays no role in the model, we normalize it to zero.

Expropriation and punishment

Inside his territory, the ruler may use coercion to either *expropriate* or *punish*. We assume that, since the principal and the agent are both harmless, the ruler can expropriate them with a small use of coercion L^{ex} (for instance, by keeping them detained just for the short time necessary to collect their money and walk away), so that $L^{ex} \approx k\lambda\left(L^{ex}\right) \approx 0$. In contrast, punishment requires the ruler to inflict substantial pain (for instance, by detaining the principal or the agent for long), and hence to incur a coercion cost.[6]

At the same time, we assume the ruler's coercion power is subject to some constraints. First, it is prohibitively costly for the ruler to exert coercion outside his territory, so the principal's exogenous income ω_p cannot be expropriated. Second, and related, the principal and the agent may be able to transfer part of their endogenous incomes outside the ruler's territory before the ruler can expropriate them. In particular, we assume the ruler can expropriate a share $\psi \in [0,1]$ of the principal's and the agent's incomes immediately after those incomes are received (see the timeline in the next section), whereas he can expropriate nothing at later stages. The lower ψ, the more *constrained* the ruler is.

[6] Equivalently, we could assume that L^{ex}, the coercion cost incurred by the ruler to expropriate, is positive but small relative to the cost of punishing.

Information

We assume throughout the model that punishments, expropriation, and the agent's effort are publicly observed.[7] In contrast, the ruler observes whether the principal has failed to pay the promised bonus to the agent only with probability $q \in (0,1]$. We interpret q as the likelihood that the ruler *hears* a valid non-payment claim by the agent—for instance, because an unbiased judge has verified and publicly announced non-payment. Accordingly, we will often refer to q as the quality of the ruler's "judicial" technology.

Timing

In any given period s, the sequence of events is as follows:

1. The principal makes a monetary transfer t_s to the ruler (a lump-sum tax, or a subsidy if $t_s < 0$).
2. The agent spends effort e_s, incurring cost $C(e_s)$.
3. The principal pays a bonus b_s to the agent.
4. The principal receives value $V(e_s)$ from the agent's effort.
5. The principal and the agent pay income taxes $\gamma_s V(e_s)$ and $\beta_s b_s$ to the ruler, respectively, where $\gamma_s, \beta_s \in [0,1]$. The ruler may also inflict a coercive punishment L_s to the principal, the agent, or both.

[7] The ruler may observe the agent's effort directly or, more realistically, he may infer it from the realized output.

All together, the endogenous variables b_s, t_s, γ_s, β_s, and L_s, determine the distribution of surplus between the principal, the agent and the ruler, as well as the agent's incentives to work, the principal's incentives to reward the agent, and the ruler's incentives to coerce. Notice that, given our assumptions on the coercion technology, the ruler has an opportunity to expropriate the principal's subsidy (if $t_s < 0$) at stage 2, the agent's bonus b_s at stage 3, and the principal's income $V(e_s)$ at stage 5.

2.2. Non-cooperative equilibrium

Given our definitions and assumptions, we can state the following:

Proposition 1: There is a perfect public equilibrium (PPE) of the repeated game, called *non-cooperation*, where in every period: (1) the ruler expropriates a share ψ of the principal's income $V(e_s)$, and of the agent's income b_s if observed, (2) no voluntary payments are made ($t_s = b_s = \gamma_s = \beta_s = 0$), (3) the agent spends no effort ($e_s = 0$), and (4) the ruler does not inflict any coercive punishments ($L_s = 0$).[8]

Proof: Suppose the principal and the agent decide to produce in the ruler's territory at the beginning of period s. Then, given non-cooperation, the ruler's best response at stage 5 of period s is not to punish ($L_s = 0$), and the principal's and the agent's best response is to pay no income tax ($\gamma_s = \beta_s = 0$). Anticipating that, the principal's best response at stage 3 is to pay no bonus ($b_s = 0$), the agent's best response at stage 2 is to spend no effort ($e_s = 0$), and the principal's and ruler's best response at stage 1 is

[8] In a perfect public equilibrium, the players' strategies constitute a Nash equilibrium of the repeated game following any publicly observed history. See, for instance, Fudenberg et al. (1994).

to make no transfer ($t_s = 0$). If the ruler observes a deviation at stages 1 through 3, his best response is to tax the available incomes at the rate ψ. QED.

3. Non-coercive enforcement: private ordering

Since -no surplus is generated in the non-cooperative equilibrium, it is natural to ask whether more efficient outcomes can be achieved. As a benchmark, we first consider the "private ordering" solution studied by Greif *et al*. (1994) and others, where present cooperation is enforced by a threat to terminate future one.[9]

We formally define private ordering as a perfect public equilibrium of the repeated game where, in any given period *s*, (1) the principal makes a (possibly negative) monetary transfer t to the ruler, (2) the agent spends effort (e = 1), (3) the principal pays bonus b to the agent, and (4) the principal and the agent pay income taxes γV and βb to the ruler, respectively. If no deviation is publicly observed, all parties keep playing the equilibrium strategies. If any deviation is observed, all parties revert to non-cooperation forever after.[10]

For private ordering to exist, two sets of conditions must hold. First, all parties must be willing to initiate and continue in each period the multilateral relationship (i.e. the participation constraints must be satisfied):

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[9] Private enforcement is also studied by the literature on relational contracts (e.g., Baker *et al*. 1994, 2002; Levin 2002, 2003). Unlike Greif *et al*. (1994), relational contracting models do not allow for a ruler with the power to expropriate.

[10] Notice that the agent has no incentives to falsely claim non-payment of the bonus, because if he does so the ruler expropriates the principal, and the agent does not benefit from that.

$t + \gamma V + \beta b \geq 0$ for the ruler, (1)

$(1-\gamma)V - t - b \geq 0$ for the principal, and (2)

$(1-\beta)b - C \geq 0$ for the agent. (3)

Second, and in chronological order, the ruler must be willing not to expropriate the principal's subsidy (if $t < 0$), the agent must be willing to spend effort, the principal must be willing to pay the agent's bonus, the principal and the agent must be willing to pay the income tax to the ruler, and the ruler must be willing not to expropriate the agent and the principal's incomes—that is, not to tax them more than prescribed by the equilibrium strategies (i.e. the incentive constraints must be satisfied):

$\gamma V + \beta b + \frac{1}{r}\left[t + \gamma V + \beta b\right] \geq -\psi \min\{t, 0\}$ for the ruler; (4)

$-b + \frac{1}{r}\{(1-\gamma)V - t - b\} \geq -q\left[\max\{\gamma, \psi\} - \gamma\right]V$ and (5a)

$-\gamma V + \frac{1}{r}\{(1-\gamma)V - t - b\} \geq -\psi V$ for the principal; (5b)

$-C + (1-\beta)b + \frac{1}{r}\left[(1-\beta)b - C\right] \geq 0$ and (6a)

$-\beta b + \frac{1}{r}\left[(1-\beta)b - C\right] \geq -\psi b$ for the agent; and (6b)

$\gamma V + \beta b + \frac{1}{r}\{\gamma V + \beta b + t\} \geq \max\{\psi, \beta\}b + \max\{\psi, \gamma\}V$, again, for the ruler. (7)

Summing up the participation constraints (1) through (3) yields the necessary condition $V - C \geq 0$, which is satisfied. Regarding the incentive constraints, we begin by observing that (4) is looser than (1), and hence it is not binding. Moreover, the incentive constraints are relaxed by setting $\gamma \leq \psi$, which implies that (5b) is also non-binding. Suppose now that $\beta < \psi$. Then, the relevant incentive constraint for the agent is (6a). Summing up (5a), (6a) and (7), and choosing $\beta = 0,\ b = C$ and $\gamma = \psi$, so that the resulting constraint is as loose as possible, we obtain the necessary condition:

$$(1+\psi)C \leq \frac{1}{r}(V - C), \qquad (EC^P)$$

where "EC^P" stands for "private-ordering constraint". In fact, (EC^P) is also sufficient, because provided that (EC^P) holds, setting $t = (1-\psi)V - (1+r)C$ insures that conditions (1) through (7) hold as well. Suppose now that $\beta \geq \psi$, so that the relevant incentive constraint for the agent is (6b). Summing up (5a), (6b) and (7), and choosing $\beta = \psi,\ b = \frac{C}{1-\psi}$ and $\gamma = \psi$, so that the resulting constraint is as loose as possible, we obtain the necessary condition $\frac{C}{1-\psi} \leq \frac{1}{r}(V - C)$, which is tighter than (EC^P). Hence, we can conclude that setting $\beta = 0$ is optimal, and that the relevant condition for private ordering is (EC^P).

Proposition 2: In private ordering, the agent spends effort in every period if, and only if (EC^P) holds.

In other words, private ordering requires that the present discounted value of the relationship exceed the sum of the principal's temptation not to pay the agent's bonus and the ruler's temptation to expropriate it. Proposition 2 implies that private ordering is more likely to work when the parties are patient enough (low r), and when the ruler's taxation technology is sufficiently constrained (low ψ). At the same time, private ordering does not depend on the judicial quality q, because the principal's contractual breach is punished by the agent through termination of the relationship, rather than by the ruler. Theoretically, the ruler may also punish the principal by immediately raising taxes, as allowed by condition (5a). However, for that to be a threat the principal's equilibrium tax must be lowered accordingly, which creates a temptation for the ruler to expropriate. Since the ruler punishes only when he observes breach, the reduction in the principal's reneging temptation obtained by lowering his equilibrium tax is more than offset by the corresponding increase in the ruler's temptation to expropriate.

Notice that, in private ordering, we have focused on a *stationary* equilibrium where the agent spends effort in every period, so that surplus is maximized. This restriction is without loss of generality because in a non-stationary equilibrium, the ruler's continuation payoff in any given period is smaller than the right-hand side of (EC^P), so that equilibrium must also satisfy (EC^P).[11]

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[11] Our optimal stationary equilibrium is obtained by transferring most of the continuation surplus to the ruler through the discretionary payments t and γV. By introducing an additional discretionary payment between the ruler and the agent at stage 1 of each period, and a corresponding exogenous income for the agent, one could achieve the optimal stationary equilibrium for any possible division of surplus between the principal, the agent and the ruler, provided that (EC^P) holds (MacLeod and Malcomson 1989; Levin 2003). If the agent's income were positive but constrained by limited liability, or if the principal and the ruler were constrained by limited liability, the optimal equilibrium may involve changes in the agent's effort over time—that is, it may be non-stationary (e.g., Ray 2002, Li and Matouschek 2013).

4. Coercive enforcement: the State

We now ask whether the principal, the agent and the ruler can more easily sustain cooperation by creating a *State*—that is, by appointing the ruler to coercively enforce contracts between the principal and the agent.[12]

We formally define the State as a perfect public equilibrium where, in any given period s: (1) the principal makes a (possibly negative) monetary transfer t to the ruler, (2) the agent spends effort, (3) the principal pays bonus b to the agent, and (4) the principal and the agent pay income taxes γV and βb to the ruler. As in section 3, the restriction to optimal stationary equilibria is without loss of generality.

The State differs from private ordering in that the ruler punishes the principal's and the agent's observed deviations coercively whenever possible, after which all parties continue to cooperate. In particular, if the ruler observes that the principal has failed to pay the bonus to the agent, he punishes the principal by raising the income tax from γ to ψ (if $\gamma < \psi$) and by inflicting a coercive punishment L_B.[13] If the principal fails to pay the income tax, the ruler inflicts a coercive punishment L_{PT}. Finally, if the agent fails to spend effort or to pay his income tax, the ruler inflicts punishments L_E and L_{AT}, respectively.

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[12] In modern States, contract breach is typically not followed by a coercive punishment but, rather, by a court's order imposing monetary damages. However, the court's order is itself backed by a threat of coercion: if the losing defendant has funds but does not pay damages as ordered, he can be held in contempt of court—a criminal offense—and imprisoned.

[13] We assume it is less costly to inflict disutility L through an immediate punishment in period s than through a sequence of punishments.

If the principal and the ruler fail to honor the upfront transfer t, or if the ruler expropriates the principal and the agent rather than accepting their income taxes, or if the ruler fails to punish observed deviations coercively, all parties revert to non-cooperation forever after, as under private ordering. That is because, first, if the principal does not plan to honor the initial transfer t, he will not produce in the ruler's territory in the first place, and hence he will not be subject to coercive punishments. Second, the ruler's deviations cannot be punished coercively because he has a monopoly on power (Acemoglu 2003).

We clarify below that there is no loss in assuming continuation of the State equilibrium after the principal or the agent deviate and the ruler punishes them. The reason is that continuation reduces the ruler's temptation to renege on punishments, whereas it does not increase the principal's and the agent's temptations to deviate because in equilibrium the principal and the agent receive zero payoffs (see proposition 3).

For cooperation to occur under the State, participation constraints (1) through (3), and the ruler's non-expropriation constraints (4) and (7), must still hold. The principal's and the agent's incentive constraints from private ordering are replaced by the condition that the expected coercive punishments be strong enough to deter deviations:

$$L_B \geq \frac{b}{q} - \left[\max\left(\gamma, \psi\right) - \gamma\right] V \text{ and} \tag{8a}$$

$$L_{PT} \geq -\left(\psi - \gamma\right) V \text{ for the principal; and} \tag{8b}$$

$$L_E \geq C - \left(1 - \beta\right) b \text{ and} \tag{9a}$$

$L_{AT} \geq -(\psi - \beta)b$ for the agent.[14] (9b)

In addition, coercive punishments must be feasible, and the ruler must be willing to impose them when prescribed:

$$\max(L_B, L_{PT}, L_E, L_{AT}) \leq \bar{L}, \text{ and} \tag{10}$$

$$-k\lambda\left[\max(L_B, L_{PT}, L_E, L_{AT})\right] + \frac{1}{r}\{\gamma V + \beta b + t\} \geq 0. \tag{11}$$

If the ruler's non-expropriation and punishment constraints (7) and (11) hold for some transfer t, they must hold for the maximum transfer that satisfies the principal's participation constraint (2), that is, $t = (1-\gamma)V - b$. Similarly, if the ruler's incentive constraints hold for some bonus b and punishment L_B, they must hold for the minimum values of b and L_B that satisfy the agent's participation constraint (3) and the principal's incentive constraint (8a), that is, $b = \frac{C}{1-\beta}$ and $L_B = \frac{C}{q(1-\beta)} - (\psi - \gamma)V$, respectively.

Conditions (7), (8a) and (8b) imply that it is optimal to set $\gamma \leq \psi$, and hence $L_{PT} = 0$. Condition (9a) is looser than the agent's participation constraint (3), so $L_E = 0$ is also optimal. Finally, given our assumption on the punishment capacity ($L_{min} < \bar{L} < L^{max}$), the

[14] Notice that the judicial quality q appears in condition (8a) due to our assumption that the ruler only *hears* a non-payment complaint with probability q. If the ruler heard the agent with certainty, (8a) could be relaxed by having the ruler punish the principal whenever the agent complains, even if breach has not been verified.

feasibility condition (10) implies that $\beta < \psi$ in equilibrium.[15] This implies, in turn, that (9b) is non-binding, so setting $L_{AT} = 0$ is optimal.

Substituting all of these values into the ruler's participation constraint (1), we obtain the necessary condition $V - C \geq 0$, which is satisfied. Substituting them into the ruler's incentive constraints (7) and (11), we obtain the following two necessary and sufficient conditions for cooperation under the State:

$$k\lambda\left\{\frac{C}{q(1-\beta)} - (\psi - \gamma)V\right\} \leq \frac{1}{r}(V - C), \text{ and} \qquad (EC^H)$$

$$(\psi - \beta)\frac{C}{1-\beta} + (\psi - \gamma)V \leq \frac{1}{r}(V - C). \qquad (EC^V)$$

Condition (EC^H) is the contract enforcement, or "horizontal", constraint, and it determines the ruler's incentive to enforce the principal-agent contract. We call it "horizontal" because both parties in the principal-agent contract lack coercive power and, therefore, are hierarchically similar. Condition "EC^V" is the non-expropriation, or "vertical" constraint, and it determines the ruler's incentive not to expropriate the principal and the agent. We call it "vertical" because the ruler has power and, therefore, he is hierarchically superior to both the principal and the agent.

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[15] Let L^* be the minimum possible punishment against principal's non-payment—that is, the value of L_B obtained by setting $\gamma = 0$. For the feasibility condition (10) to hold it must be that $L^* < L^{max}$, which cannot be true if $\beta \geq \psi$. The fact that $\beta < \psi$ in equilibrium is useful, as it guarantees that the ruler be tempted to expropriate the agent, thus creating an interaction between the ruler's contractual enforcement and non-expropriation obligations. At the same time, the fact that $\beta < \psi$ seems also realistic. If a ruler is allowed to tax income as much as he can, and if the taxation technology is sufficiently advanced, gross salaries will have to rise steeply, or else productive agents will migrate (here, the minimum bonus consistent with the agent's participation constraints tends to infinite as ψ tends to one). This will increase the principals' temptation to renege on salary payments, and hence the punishments necessary to prevent breach, thus making the ruler's enforcement promise not credible.

From the above analysis, it immediately follows that

Proposition 3: In the State, the agent spends effort in every period if, and only if (EC^H) and (EC^V) hold.

An immediate and intuitive implication of Proposition 3 is that, in the State, cooperation is more likely to exist as the coercion cost, k, decreases, and as the judicial quality, q, increases. A less immediate implication, analyzed below, regards the relative importance of the ruler's two obligations—enforcing contracts and respecting the principal's and the agent's property rights.

A decrease in the income taxes β and γ relaxes the contract enforcement constraint (EC^H)—respectively, by reducing the agent's bonus and by increasing the principal's monetary penalty following breach—but it also tightens the non-expropriation constraint (EC^V). By optimally choosing γ and β, we obtain the following

Proposition 4: (i) There is a critical coercion cost k^*, increasing in the ruler's taxation power ψ and in the judicial quality q, such that the agent's effort does not depend on the contract enforcement constraint at lower coercion costs ($k < k^*$), and (ii) there is a critical taxation power ψ^*, increasing in k and decreasing in q, such that the agent's effort does not depend on the non-expropriation constraint at lower taxation power levels ($\psi < \psi^*$).

Proof: Define $\bar{r}$ as the largest discount rate such that (EC^H) and (EC^V) hold. Part (i). Let $\gamma = \psi$ and $\beta = \beta^* \equiv 1 - \frac{C}{q\bar{L}}$, so that ($EC^V$) is loosest and ($EC^H$) tightest. For

$k \leq \left\{ (\psi - \beta^*) \frac{C}{1-\beta^*} \Big/ \lambda \left[\frac{C}{q(1-\beta^*)} \right] \right\} \equiv k^*$, (EC^V) is tighter than (EC^H), so $\bar{r}$ is maximized at $\gamma = \psi$ and $\beta = \beta^*$, and it does not depend on (EC^H). For $k > k^*$, $\bar{r}$ is maximized by lowering γ and β until $(EC^H) \equiv (EC^V)$, or until $\gamma = \beta = 0$ if (EC^V) is looser than (EC^H) at $\gamma = \beta = 0$. In that case, $\bar{r}$ does depend on (EC^H). The proof of part (ii) follows from a similar argument. QED.

Proposition 4 suggests that in a State, enforcement technology (measured by the punishment cost k and the judicial quality q) and constraints on the ruler's expropriation power (inversely measured by ψ) are complementary inputs, in the sense that increasing one does not change the agent's effort if the level of the other input is too low. When the ruler's power to exact taxes is exogenously limited (low ψ), the non-expropriation condition (EC^V) is less likely to bind ($k > k^*$). Hence, when choosing whether to spend effort, the agent worries more about his contracts with the principal being enforced (condition EC^H) than about being expropriated by the ruler (condition EC^V). The opposite is true when the ruler's power to expropriate is subject to few limits (high ψ), in which case the agent worries more about the security of his property rights than about contractual enforcement. These results are graphically summarized in Figure 1 below.

<<Place Figure 1 here>>

An implication of Proposition 4 is that marginal reductions in the enforcement cost k, and marginal improvements in the judicial quality q, can only increase the agent's effort if the ruler's taxation power is sufficiently constrained (low enough ψ), so that the

contract enforcement condition (EC^H) is binding. Figure 2 below illustrates this result. As the ruler's taxation power switches from high (Panel a) to intermediate (Panel b) to low (Panel c), (EC^H) is more and more likely to bind and, consequently, an increase in judicial quality from q to q' is more likely to increase the agent's effort. In section 6 we will discuss empirical evidence that supports this result.

<<Place Figure 2 here>>

Proposition 4 above has also a normative implication, as it implies that institutional reforms—in the sense of reforms that aim to achieve a superior equilibrium—should concentrate on relaxing the ruler's binding incentive constraint. If the binding constraint is on expropriation, limiting the ruler's power to exact taxes is more urgent than increasing judicial quality, and vice versa. This prediction seems consistent with the fact that, facing predatory institutions inherited from Mao's Cultural Revolution, Chinese reformers have enacted institutional reforms increasing the protection of property rights, while leaving enforcement institutions, and particularly the judiciary, relatively underdeveloped until recent times (Montinola *et al*. 1995; Weingast 1995; Xu 2011). However, numerous scholars (Peerenboom 2002; Clarke *et al*. 2008; Xu 2011) argue that to maintain the growth performance of China in the future, it is now urgent to shift the focus of reforms on modernizing its legal institutions. Xu 2011). We leave a more detailed analysis of the Chinese case for future work.

5. A "horserace" between enforcement institutions: the State versus private ordering

So far we have analyzed cooperation *given* the choice of using private ordering or, alternatively, the State, to enforce principal-agent contracts. But which of the two enforcement systems is preferable from an efficiency standpoint? The Folk theorem implies that multiple equilibria exist under both private ordering and the State. However, if the principal, the agent and the ruler can communicate and negotiate, they may be able to coordinate, explicitly or implicitly, on an equilibrium.

Then, a natural criterion for ranking the State and private ordering is to compare the optimal equilibria defined by Propositions 2 and 3. Since the long-term surplus from cooperation (the right-hand side of (EC^P), (EC^H) and (EC^V)) is the same under both enforcement regimes, the State dominates private ordering (in the sense that cooperation is more likely to be sustained) if, and only if the ruler's reneging temptation under the State (the maximum left-hand side among (EC^H) and (EC^V)) is smaller than the ruler's and principal's aggregate reneging temptation under private ordering (the left-hand side of (EC^P)). Proposition 4 implies that, at low coercion costs ($k \le k^*$), the reneging temptation is ψC under the State and $(1+\psi)C$ under private ordering, so the State dominates. At higher coercion costs ($k > k^*$), the reneging temptation under the State increases in k, while the reneging temptation under private ordering does not depend on k. Hence, there must be a critical $k^{**} \ge k^*$ such that private ordering dominates at higher coercion costs ($k \ge k^{**}$), and the State dominates at lower coercion costs ($k < k^{**}$). Notice

that when $k > k^*$, an increase in the taxation power ψ tightens the private ordering constraint while relaxing the State constraint, because (EC^H) is binding. This implies that k^{**} increases in ψ. These results are summarized by the following

Proposition 5: Assume that the principal, the agent and the ruler can coordinate on an optimal equilibrium. Then, there is a critical coercion cost k^{**}, increasing in the ruler's taxation power ψ, such that the State dominates private ordering at lower coercion costs ($k < k^{**}$), and private ordering dominates otherwise.

Intuitively, in private ordering the gains from cooperation must outweigh both the ruler's temptation to expropriate and the principal's temptation to breach his contract with the agent, because breach is not punished coercively. In contrast, in the State the gains from cooperation must only outweigh the ruler's temptation to expropriate or shirk on enforcement, depending on which of the two dominates. Hence, when punishment costs are low and taxation power is high, so that the ruler is tempted to expropriate but happy to enforce principal-agent contracts, it is easier to sustain cooperation in the State than in private ordering. This result is appealing from a testability viewpoint, because it predicts that overall improvements in the coercion technology (formally, decreases in k accompanied by simultaneous increases in ψ), which are easier to measure than separate improvements in punishment or taxation, will favor State enforcement over private ordering. We return on this point below.

Notice, also, that the threshold k^{**} is defined even for q = 1, that is, enforcement via private ordering may dominate State enforcement even if contract breach is perfectly verifiable by third parties. This is, in our opinion, a novel result. As discussed in the

introduction, most economic models assume that, whenever contracts are verifiable, they can easily be enforced because court orders are backed the State's coercive power. Consequently, enforcement via private ordering can only be optimal when the courts are imperfect. By explicitly modeling the ruler's coercion technology, we show that this is not necessarily the case. Coercive enforcement by the State is costly, so it must be *itself* part of a self-enforcing agreement between the contracting parties and the ruler. Hence, whether the State wins the efficiency "horserace" with private ordering does not only depend on judicial quality (parameter q), but also on the coercion technology (parameters k and ψ).

Application: transition from the Law Merchant to the State

Proposition 5 seems consistent with the historical evidence. From the medieval stirrup to the introduction of firearms and remotely controlled weapons (e.g., Kontler 2006; Blaydes and Chaney 2012; Onorato *et al*. 2012), there have been steady improvements in the ability of States to use coercion. In parallel, Europe has witnessed an evolution in contract enforcement methods from the medieval Law Merchant, where breaches of commercial contracts were punished by coordinated traders' boycotts, to modern State enforcement, where judicial rulings on contractual disputes between merchants are backed by the State's coercive power (Milgrom *et al*. 1990; Masten and Prüfer 2011). According to Proposition 5 in our model, by decreasing the ruler's cost of enforcing contracts via coercion, the historical improvements in military technology may have

favored enforcement of contracts by the State over the Law Merchant's non-coercive enforcement system.[16]

6. Evidence on the interaction between property rights and contract enforcement

The relative impact of constraints on the ruler's expropriation power and judicial quality on economic development has been empirically investigated by Acemoglu and Johnson (2005). On one hand, they find that former colonies that inherited stronger property rights from their colonizers developed faster. On the other hand, they find that holding property rights protection constant, colonies that inherited more flexible and effective court systems did not perform significantly better than those with more formalistic systems. Our model (Proposition 4) predicts that constraints on ruler's expropriation and judicial quality are complementary inputs, in the sense that improvements in judicial quality are more likely to increase productive effort and surplus when the ruler is constrained, and vice versa. Empirically, this implies that regressions of investment and output on measures of ruler's constraints and judicial quality, such as those in Acemoglu and Johnson (2005), should include an interaction term between these two measures of institutional quality, and that the sign of such interaction term should be positive.

[16] Another explanation, complementary to ours, has been suggested by Masten and Prüfer (2011). They argue that the evolution from local to long-distance trade may have increased the merchants' cost of verifying other merchant's violations, thus favoring State enforcement systems that do not rely on coordinated boycotts as a punishment.

To test this prediction, we re-visit the original Acemoglu and Johnson (2005) analysis of former European colonies. Along with GDP per capita, we also use another, more direct, measure of productive effort: attractiveness of a country for foreign direct investment (FDI). We construct the measure of FDI attractiveness as follows. We obtained the value of bilateral inward FDI stocks (in constant USD) of all countries worldwide, for the 1991-2005 period, from the World Investment Directory of the United Nations Conference on Trade and Development (UNCTAD). Given that for many countries and years these values are equal to zero, we add 1 to all the values. Next, we estimate the following standard gravity equation (Head and Mayer 2014):

$$\mathrm{Log}\left(1+\mathrm{InwardFDIstock}_{ijt}\right)=\alpha_{it}\mathrm{Sendingcountry}_{it}+\delta_{jt}\,\mathrm{Receivingcountry}_{jt}+X_{ij}^{'}\boldsymbol{\beta}+\varepsilon_{ijt}$$

Here, *Sending country*$_{it}$ is a country-year fixed effects for investing country i in year t, *Receiving country*$_{jt}$ is a country-year fixed effect for recipient country j in year t, X_{ij} is the vector of usual pair-specific, time-invariant gravity controls (contiguity, geographic distance, common language—official and spoken by at least 9 per cent of the population in both countries in the pair— and dummies for being in a colonial relationship, having had a common colonizer, and having been part of the same country, in the past), ε_{ijt} is the error term, and α_{it}, δ_{jt} and $\boldsymbol{\beta}$ are parameters to be estimated. Finally, we recover the estimated recipient country-year fixed effects, and calculate their means for each country in the Acemoglu-Johnson (2005) sample. This is done for two reasons: the institutional quality measures (and their instruments) are time-invariant; moreover, it is well known that annual FDI statistics can be strongly influenced by large individual deals. We denote the obtained measure as "Mean FDI attractiveness for the 1991-2005 period".

Two remarks about this measure are of order here. First, we believe that the FDI is a more direct (and thus a better) proxy for the productive effort in our model than output per capita. As noted by Dixit (2011), the quality of institutions is likely to play an important role for the FDI decisions of foreign firms, given that "when a multinational establishes a subsidiary and opens a plant in a foreign country, the whole capital stock is at risk from violations of property rights and contracts". For comparison, however, we also report the results of regressions with output per capita as the dependent variable. Second, the country fixed-effects recovered from the above gravity equation are a more accurate measure of FDI attractiveness than, for instance, the simple 1991-2005 average of FDI flows, because they avoid biases arising from larger FDI flows into countries that happen to be geographically and historically closer to large economies (see Benassy-Quere et al. (2007) and Head and Mayer (2014) for a detailed discussion of this and other related problems).

<< Place Figure 3 here >>

Figure 3 shows the histogram of our main dependent variable (mean FDI attractiveness), whereas Table 1 presents the summary statistics for our principal variables of analysis. We can see that both FDI attractiveness and log GDP per capita in 2003 (our second dependent variable) exhibit substantial variation across countries in the sample.

Panel A of Table 2 reports the results of ordinary least-squares regressions with two types of institutional quality measures as explanatory variables. In Columns 1 and 4, we look at the separate effects of tighter constraints on the ruler's expropriation power and

judicial quality on FDI attractiveness and output per capita, respectively. The measure of constraints on the ruler comes from Gurr (1997) and it is the degree of constraints on the executive branch of the government, averaged for the 1990s. As an inverse proxy for judicial quality, we use the 2004 World Bank index of procedural complexity in settling a commercial debt between private parties. We see that in both regressions, tighter constraints on the executive are associated with higher FDI attractiveness and income per capita, whereas there seems to be no statistically significant correlation between these outcome measures and judicial quality.

According to our model, however, a lack of correlation between judicial quality and outcomes may hide the heterogeneous effect of contractual enforcement depending on how constrained the ruler's expropriation power is. Consistent with that, columns 2 and 5 show that the interaction term between constraints on the ruler and judicial formalism has a negative and statistically significant coefficient. In other words (and as predicted by our model), poor contractual enforcement correlates with low FDI attractiveness and low output per capita only when the ruler's non-expropriation constraint is lax. Results in columns 3 and 6 indicate that this effect is robust (and the interaction term becomes slightly larger) once we add controls for a country's dominant religion and for whether a country is landlocked.

Clearly, we cannot interpret the above correlations as causal effects, because they suffer from the potential endogeneity of institutions. For instance, it is plausible that as the potential output of a country increases (for reasons unrelated to its institutional quality), both outside investors and citizens of the country push for improvement of its

institutional infrastructure. To overcome this endogeneity problem, we employ the identification strategy used by Acemoglu and Johnson (2005). They use UK legal origin as an instrument for the contemporary quality of contract-enforcement institutions, and population density in the colonized country in 1500s as an instrument for contemporary constraints on the executive.

The idea behind this instrumental-variables strategy is that, first, as shown by LaPorta et al. (1997, 1998) and Djankov et al. (2003), a colony is likely to inherit the legal system of its colonizer, and the British common-law legal system exhibits a considerably lower degree of legal and judicial formalism, which reduces the cost of enforcing contracts between private parties. Second, as shown by Acemoglu et al. (2001, 2002), regardless of the identity of the colonizer, colonies with higher population density in 1500s were the ones where colonizing powers imposed "extractive" institutions, with little checks and balances on expropriation of the native population, instead of settling in and creating more "inclusive" institutions.[17] Acemoglu and Johnson (2005) show that these two sets of historical measures can serve as independent instruments for the contemporary quality of contract enforcement and of the protection of private citizens against expropriation by powerful elites. Finally, following Wooldridge (2002, chapter 18) and Wooldridge (2003), we use the interaction between these two instruments as an instrument for the interaction of procedural complexity and constraints on the executive.

[17] We use log population density in 1500s (the second instrument employed by Acemoglu and Johnson 2005) instead of log settler mortality (their first instrument), in order to maximize the sample size. Indeed, if settler mortality is used as an instrument, the coefficients are consistent with the ones obtained by using population density, but statistically less significant. Similarly, due to sample-size concerns, among the proxies for the quality of legal institutions used by Acemoglu and Johnson (2005) we opt for the World Bank index of procedural complexity, rather than the index of legal formalism from Djankov et al. (2003). Overall, this gives us a sample of 69 countries instead of 51.

<< Place Tables 2A and 2B here >>

Panel B of Table 2 describes our instrumental variable estimations. Columns 7 and 8 are analogous to the original two-stage least-squares (2SLS) estimates by Acemoglu and Johnson (2005, table 4, column 2). Constraints on the executive seem to have a positive and large causal effect on countries' FDI attractiveness and output per capita (notice that the sizes of the coefficients are much larger than in the OLS regressions of columns 1 and 4). Contrarily, the degree of legal procedural complexity does not have a significant effect.

In columns 9 and 10, we add an interaction term between procedural complexity and constraints on the executive (instrumented by the interaction between UK legal origin dummy and log population density in 1500s). We find that the interaction term carries a negative and statistically significant sign: in economies with strong constraints on the executive, legal procedural complexity has a negative causal effect on FDI attractiveness and per-capita output, whereas the opposite is true in countries with weak constraints on the executive. Finally, in columns 11 and 12, we observe that the above results are robust to controlling for dominant religion and whether a country is landlocked.

These findings imply that, consistent with previous empirical work (e.g., Djankov et al. 2002, 2003; Auer 2013), the long-run effect of contract enforcement institutions on economic development may be more important than suggested by Acemoglu and Johnson (2005). However, and consistently with our theoretical predictions, the quality of contract-enforcement institutions seems to matter only in those countries where property rights are sufficiently protected against expropriation by powerful rulers, so that the

ruler's incentive constraint on enforcing contracts (EC^H in the model) is not dominated by his incentive constraint on respecting property rights (EC^V in the model).

7. Conclusion

This paper has studied private contracts in the shadow of a ruler's coercion. We have shown that, in the presence of repeated interactions, a State where the ruler uses power to enforce contracts, and does not use it to expropriate the incomes that such contracts generate, can arise as a self-enforcing equilibrium. We have also shown that, when the coercion technology is effective, higher production levels are feasible under the State, where contracts are enforced by the ruler, than under private ordering, where contracts are enforced by termination of the principal-agent relationship. Finally, we have shown that in a State, enforcement technology and constraints on the ruler's taxation power are complements: improvements in the enforcement technology create private incentives to invest only when the ruler's expropriation power is sufficiently constrained, and vice versa. Our results are consistent with the patterns of foreign direct investment and GDP per capita across former colonies, and with the historical transition from the "Law Merchant" private system of contractual enforcement to the State (Milgrom *et al*. 1990; Masten and Prufer 2011).

Our model of contracts in the shadow of coercion may be extended in several directions. First, by allowing the ruler to also hire an agent, the model could be used to compare the productivity of private firms, whose owner does not have coercive power, with the productivity of public firms, whose owner—the ruler—does. In private firms, the

agent can rely on the ruler to enforce his contracts with the principal, but he is also subject to a risk of expropriation by the ruler. Conversely, in public firms, principal-agent contracts must be enforced via private ordering even when coercive enforcement is more efficient, but the threat of ruler's expropriation disappears.

The model may also be used to study the provision of incentives in firms. Given its ownership of assets and its power to terminate employment relationships and to allocate tasks and rewards (Holmstrom and Milgrom 1994), the firm may be seen as a powerful "ruler". The firm's CEO may use his power to expropriate managers and employees (for instance, by changing piece rates or withdrawing discretionary bonuses and promotions), but also to enforce internal contracts between divisional managers and their subordinates (for instance, by immediately firing a manager who fails to promote or pay the subordinate as promised, even when a replacement for the manager cannot be readily found, so that termination is costly for the firm). This may create a tradeoff between "private ordering" governance, where the promise of future rents is used to both enforce internal contracts and deter expropriation, and "State-like" firms, where future rents are used to deter expropriation while costly punishments are used to enforce internal contracts.

While these extensions are beyond the scope of the present paper, we hope to pursue them in future work.

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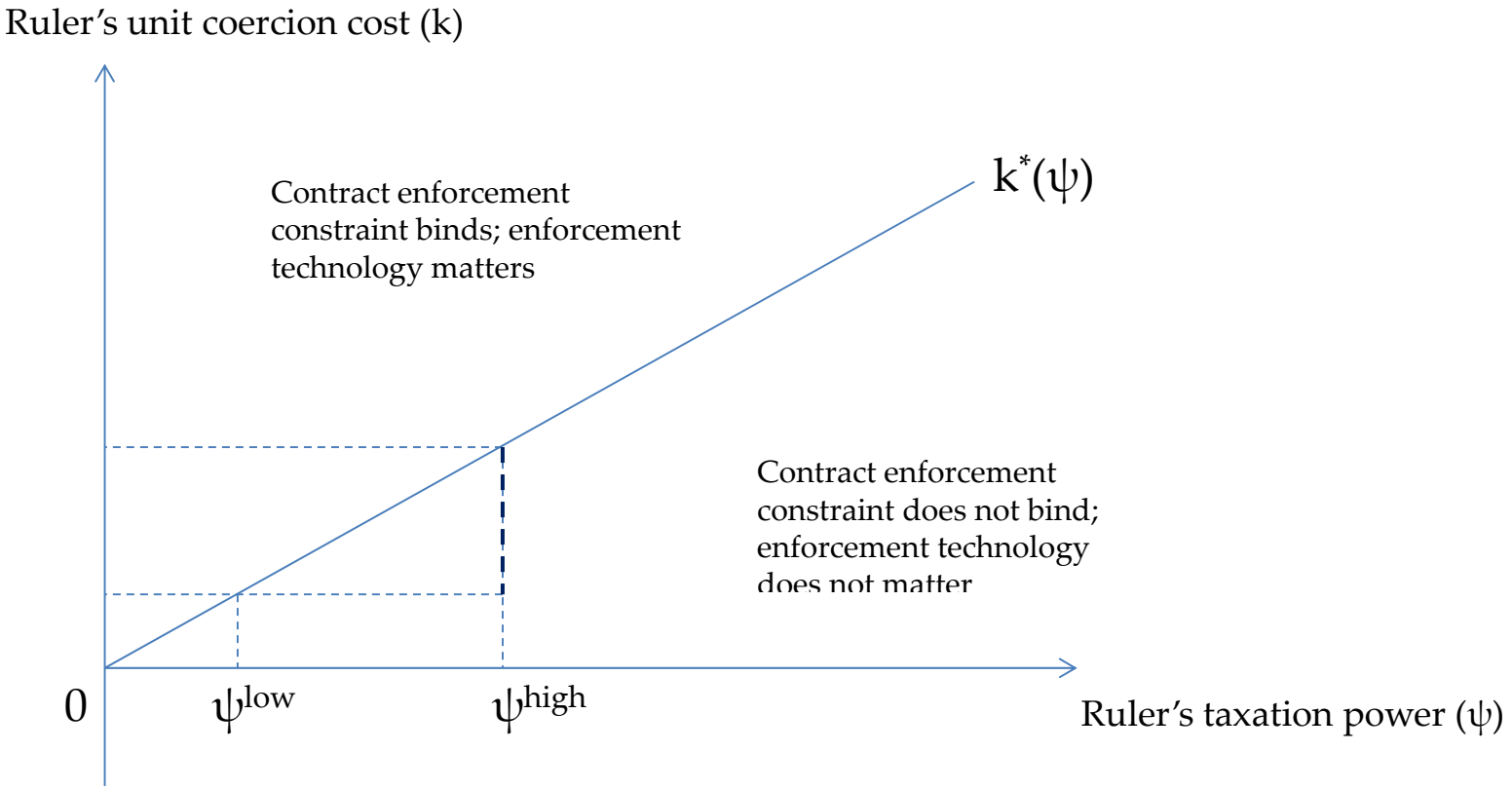
Figure 1. Complementarity between contract enforcement technology and constraints on the ruler



For coercion costs below the $k^*(\psi)$ line, the ruler's contract enforcement constraint does not bind, so the enforcement technology does not matter for efficiency. The reverse is true above the line. The bold dotted segment shows how the region where the enforcement technology does not matter expands as the ruler's taxation power ψ gets larger (Proposition 4).

Figure 2a. Improvements in the judicial technology under an unconstrained ruler

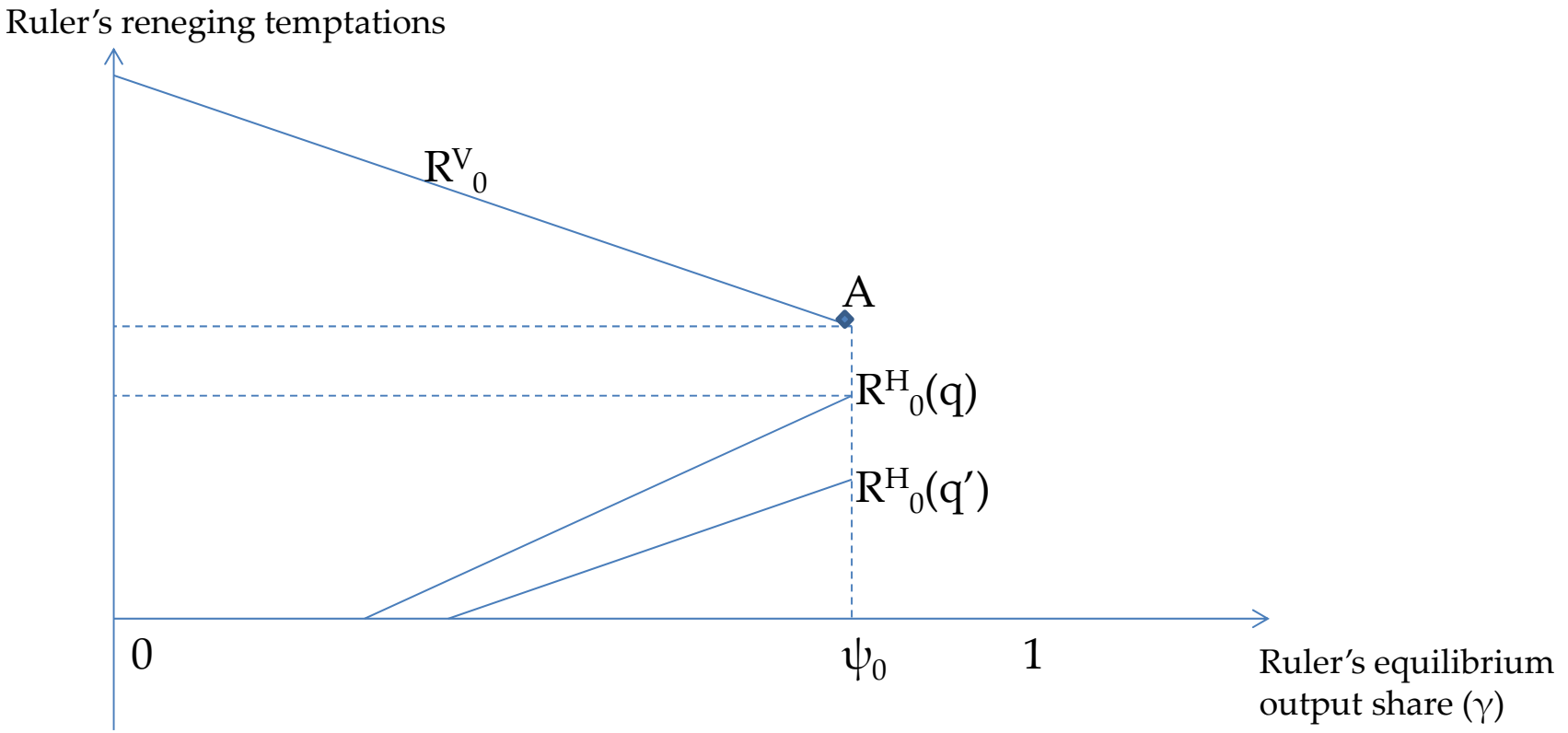


Figure 2a depicts the equilibrium in settings where only the non-expropriation constraint of the Ruler binds, whereas the contract enforcement constraint is slack. The condition for this is that the ruler's temptation not to enforce, R^H, is below his temptation to expropriate, R^V, even for $\gamma=\psi_0$ (i.e. under maximum expropriation allowed), so that setting $\gamma=\psi_0$ is optimal. For any discount rate, an exogenous improvement in judicial quality (i.e., a switch from q to q') does not change the equilibrium point A, because it does not relax the ruler´s binding constraint.

Figure 2b. Improvements in the judicial technology under a moderately constrained ruler

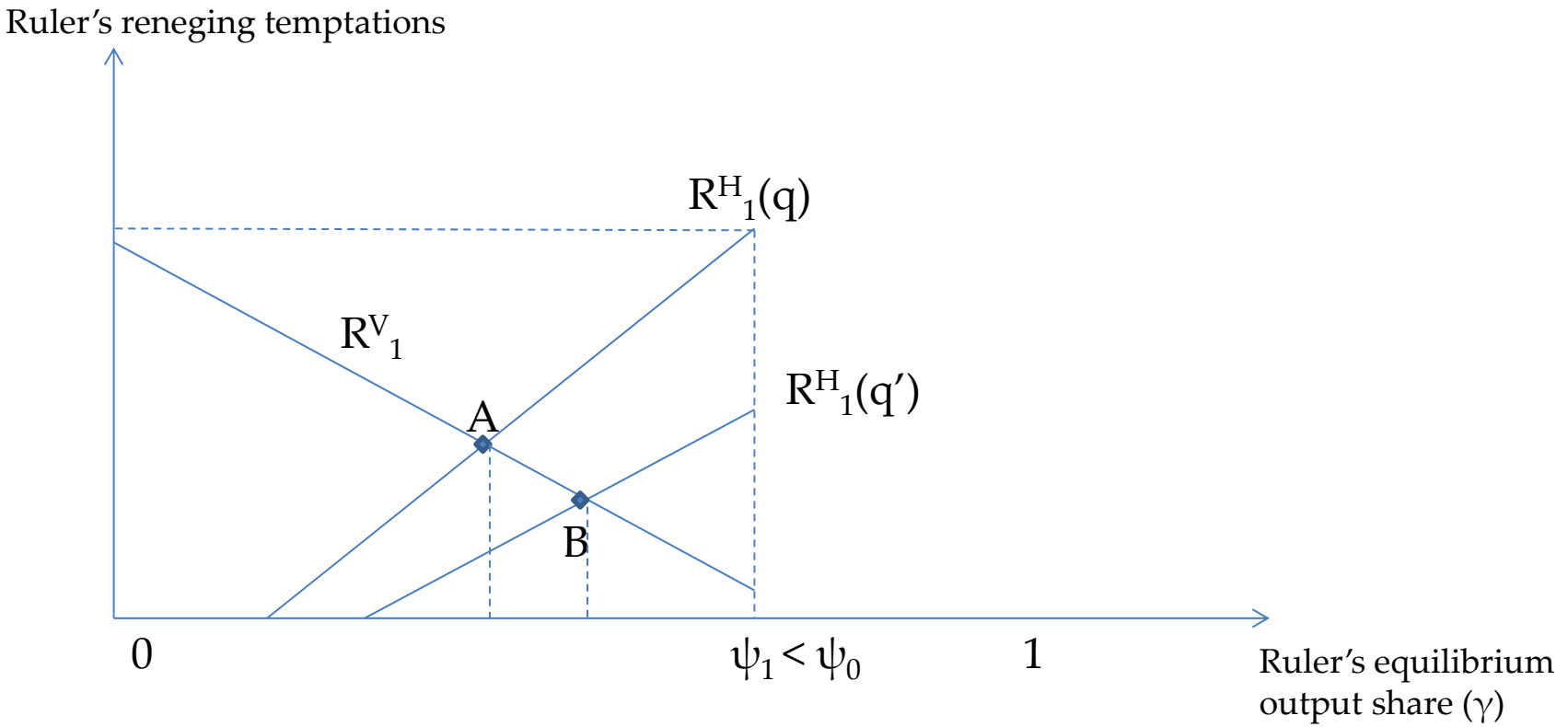


Figure 2b depicts the equilibrium in settings where both the non-expropriation and the contract enforcement constraints of the Ruler bind. The conditions for this are that (1) R^H is above R^V for $\gamma=\psi_1$, so that setting $\gamma < \psi_1$ is optimal, and (2) R^H is below R^V for $\gamma=0$, so that there is a γ such that $R^H=R^V$. At intermediate levels of the discount rate, an exogenous improvement in the judicial technology (i.e., a shift from q to q') moves the equilibrium from point A to the more efficient point B because it relaxes one of the ruler´s two binding constraints.

Figure 2c. Improvements in the judicial technology under a highly constrained ruler

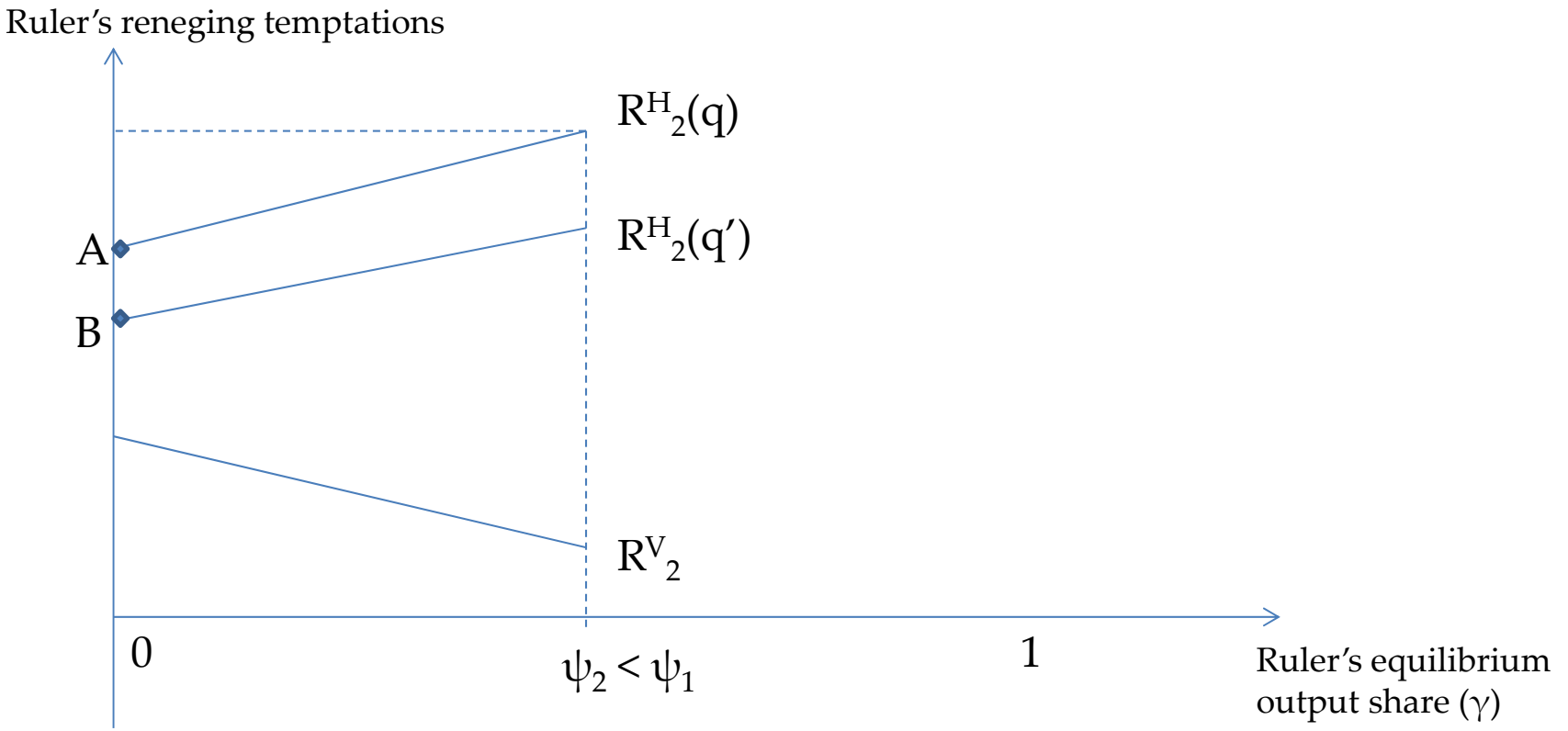


Figure 2c depicts the equilibrium in settings where only the contract enforcement constraints of the Ruler binds. The condition for this is that R^H is above R^V even for γ=0, so that setting γ=0 is optimal. At intermediate levels of the discount rate, an exogenous improvement in the judicial technology (i.e., a shift from q to q′) moves the equilibrium from point A to the more efficient point B because it relaxes the ruler´s only binding constraint.

Figure 3. Histogram of the measure of mean FDI attractiveness, 1991-2005

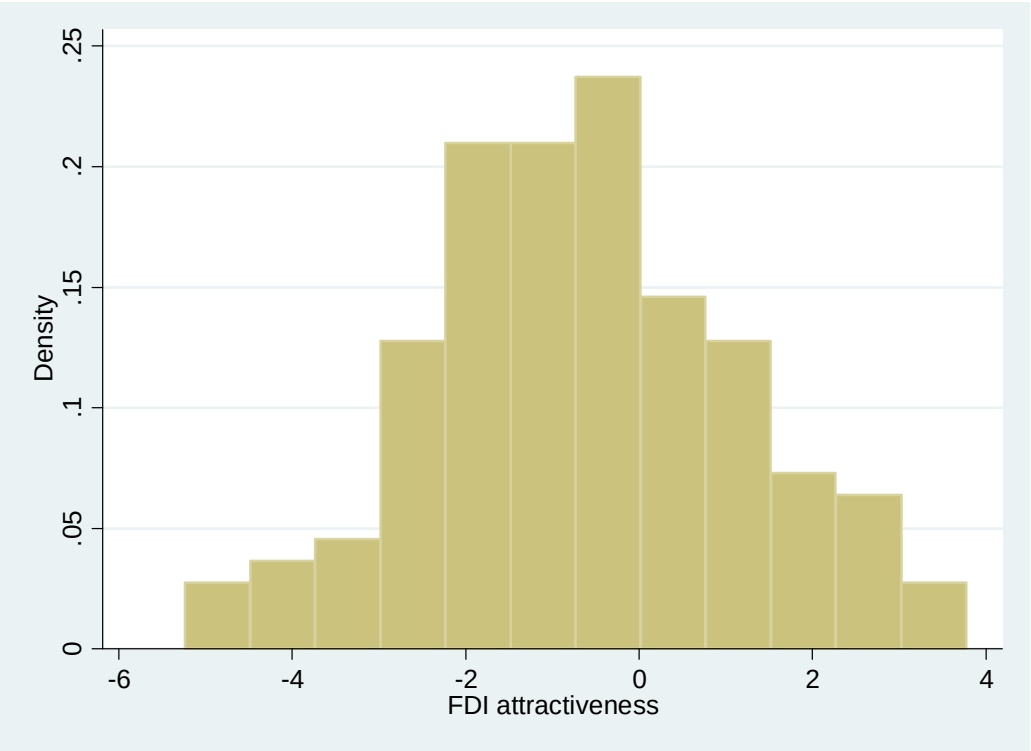


Table 1. Summary statistics of main variables

Variable	Number of observations	Mean	Standard deviation	Min	Max	Percentiles	
						10%	90%
Mean FDI attractiveness, 1991-2005	85	-0,59	1,80	-4,97	3,78	-3,32	3,52
Log GDP per capita, 2003	88	6,91	1,42	4,44	10,47	4,78	10,09
Constraints on the executive, average 1990s	87	4,28	1,86	1,00	7,00	1,00	7,00
Index of legal procedural complexity	70	5,94	1,54	2,90	9,03	2,92	8,19
British legal origin	88	0,39	0,49	0,00	1,00	0,00	1,00
Log population density in 1500s	84	0,53	1,61	-3,83	4,61	-2,44	3,22

Table 2. Effect of non-expropriation and enforcement institutions on FDI attractiveness and income per capita

Panel A: OLS results

	(1)	(2)	(3)	(4)	(5)	(6)
	FDI attractiveness, mean 1991-2005	FDI attractiveness, mean 1991-2005	FDI attractiveness, mean 1991-2005	Log GDP per capita, 2003	Log GDP per capita, 2003	Log GDP per capita, 2003
Constraints on executive (avg. for 1990s)	0.226	1.048	1.256	0.454	0.974	1.070
	(0.130)*	(0.446)**	(0.515)**	(0.074)***	(0.256)***	(0.254)***
Legal institutions: Procedural complexity	-0.099	0.605	0.730	-0.050	0.395	0.355
	(0.132)	(0.413)	(0.500)	(0.092)	(0.187)**	(0.183)*
Interaction term		-0.145	-0.183		-0.092	-0.122
		(0.076)*	(0.092)*		(0.040)**	(0.042)***
Catholics as % of population in 1980			-0.002			0.011
			(0.012)			(0.007)
Muslims as % of population in 1980			-0.006			0.003
			(0.012)			(0.008)
Protestants as % of population in 1980			-0.021			-0.010
			(0.021)			(0.016)
Dummy for landlocked country			-0.252			-1.041
			(0.715)			(0.273)***
Constant	-0.985	-4.985	-5.184	5.162	2.633	3.093
	(0.979)	(2.426)**	(2.759)*	(0.611)***	(1.191)**	(1.296)**
Observations	67	67	66	69	69	68
R-squared	0.06	0.11	0.13	0.34	0.38	0.52

Notes: Robust standard errors in parentheses; * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 2. Effect of non-expropriation and enforcement institutions on FDI attractiveness and income per capita

Panel B: 2SLS results

	(7)	(8)	(9)	(10)	(11)	(12)
	FDI attractiveness, mean 1991-2005	Log GDP per capita, 2003	FDI attractiveness, mean 1991-2005	Log GDP per capita, 2003	FDI attractiveness, mean 1991-2005	Log GDP per capita, 2003
Constraints on executive (avg. for 1990s)	1.043	1.064	4.984	4.888	5.645	4.542
	(0.377)***	(0.288)***	(2.270)**	(2.066)**	(2.422)**	(2.363)*
Legal institutions: Procedural complexity	0.359	0.183	4.204	3.896	4.102	2.365
	(0.289)	(0.216)	(2.239)*	(1.944)**	(1.637)**	(1.405)*
Interaction term			-0.809	-0.787	-0.929	-0.756
			(0.433)*	(0.380)**	(0.418)**	(0.419)*
Catholics as % of population in 1980					0.006	0.043
					(0.032)	(0.026)
Muslims as % of population in 1980					-0.017	0.003
					(0.013)	(0.010)
Protestants as % of population in 1980					-0.090	-0.087
					(0.053)*	(0.052)*
Dummy for landlocked country					0.562	-0.560
					(0.832)	(0.551)
Constant	-7.392	1.048	-26.272	-17.155	-24.540	-8.115
	(2.779)***	(2.129)	(11.917)**	(10.651)	(9.934)**	(8.139)
Observations	66	68	66	68	66	68
Instruments	UK legal origin; Log population density in 1500	UK legal origin; Log population density in 1500	UK legal origin; Log population density in 1500; interaction between them	UK legal origin; Log population density in 1500; interaction between them	UK legal origin; Log population density in 1500; interaction between them	UK legal origin; Log population density in 1500; interaction between them

Notes: Robust standard errors in parentheses; * significant at 10% level, ** significant at 5% level, *** significant at 1% level.