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The Transition from Relational to Legal Contract Enforcement

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Abstract

This paper studies the transition of contract enforcement institutions. The prevalence of relational contracts, low legal quality, strong cultural preference for personalistic relationships, low social mobility, and highly unequal endowment form a cluster of mutually reinforcing institutions that hinder economic development. The cultural element per se does not necessarily reduce social welfare though it may slow down the legal development, while the real problem lies in endowment inequality and low social mobility. Thus a more equal distribution of resources may be the ultimate key to unravel the above interlocking institutions. These results are generally consistent with the empirical evidence.

JEL: O1, K49, C72.

Key Words: relational contract, legal contract enforcement, institutions, endowment inequality, economic development.

1 Introduction

Whether an economy can sustain long run economic growth depends to a large extent on whether its agents can achieve collectively efficient outcomes through voluntary exchanges. To this end, both informal relational contracts and formal legal ones may provide effective enforcement to facilitate cooperation. Though these two enforcement formats coexist in many societies for most times (Ellickson 1991, Durlauf and Fafchamps 2004), the prevalence

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of formal impersonal enforcement is often associated with developed western economies, while the heavy reliance on personalistic relationships with developing countries (Fafchamps 2002, McMillan and Woodruff 1999, Johnson et al. 2002). The transition from personal to impersonal contract enforcement is thus deemed important for economic development. The question not well understood is why some countries succeeded in making the transition while others failed.

Some studies suggest a strong cultural preference for loyal personal relationships and hence for relational contracts may be a cause of underdevelopment. For example, North (1991) argues that one reason for the economic stagnation of Latin America is the prevalence of personalistic relationships, which induce despotism, corruption, and inefficiency. He further demonstrates this using detailed evidence (North et al. 2000). A similar view is advanced by Greif (1994, 2000, 2005) who compares different contract enforcement methods in various societies. The causal view, however, is difficult to reconcile with the experiences of recently developed Asian economies under Confucian culture, namely Japan, Korean, Singapore, Hong Kong, and Taiwan. But if the presence of such a culture per se may not necessarily inhibit economic development, then what does? And how does one explain the correlation?

To answer these questions, this paper builds a simple model on how a society's contract enforcement institutions evolve. The results suggest the inequality in resource distribution may be the fundamental cause of slow legal development *and* economic backwardness. When there is huge inequality in the distribution of initial endowment among agents, a society is likely to experience a cluster of mutually reinforcing institutions including a strong cultural preference for personalistic relationships, poor legal development, prevalence of relational contracts, and low social mobility. Latin America seems to fit into this category. When the endowment is relatively equal, the cultural preference alone does not necessarily reduce the overall welfare, though it may slow down the legal development process since relational contracts have larger relative advantages in such a cultural environment, and it would gradually become weaker as legal quality improves. The East Asian countries mentioned above seem to be appropriate examples. The western developed economies, with relatively equal endowment and individualistic culture, are the implicit benchmark case, whose transition to impersonal enforcement is the fastest. These results show that "different societies are likely to have different contract enforcement institutions whose legal, social, and cultural aspects constitute a coherent interrelated system" (Greif 1997).

The intuition is as follows. Relational contracts secure cooperation by promising future gains in an established relationship, which becomes easier when people share a stronger cultural preference for loyalty. But then people are more reluctant to do business with new

partners even though they are more productive than the old ones. By contrast, impersonal legal contracts use a third party, the legal court, to deter cheating. When the legal quality is higher, it is less costly to form new partnerships and hence people are more likely to break up old, less productive partnerships.¹ This implies those who continue to engage in persistent relationships must have more productive partnerships and rely less on the legal system. The relative usage of relational versus legal contracts in a society is thus determined by the legal quality, the cultural preference, and how productive the established partnerships are relative to the new ones.

To improve contract enforcement efficiency, agents can improve legal system or cultivate cultural tastes for loyalty, both of which are useful to deter cheating and facilitate cooperation, and thus are substitutes for each other. When the distribution of projects in a society is such that more agents adopt persistent partnerships, the loyalty culture tends to be more widely cultivated, and hence people have less gain from improving legal quality. In such a case, a slow legal development may still be the social optimal choice.

Problems may arise when high income agents who engage in persistent relationships, labeled the elites, wield dominant political power so that relevant institutions are shaped to their wish. This is more likely to happen when the endowment distribution is highly unequal.² Since the elites have much less incentive to improve the overall legal quality, the investment in legal system under elite ruling is necessarily lower than the social optimal level. Responding to the lower legal quality, agents have to use relational contracts more often, and thus they would invest more in the cultural preference for loyalty. But this further reduces the incentives to improve legal quality. In such a society, we often observe low social mobility and non-democratic political scheme which preserve the privileges of the elites, as well as an incompetent legal system, a strong personalistic culture, and the prevalence of relational contracts, which together stagnate economic development and make it easier to maintain the elite ruling. Since these social, political, legal, and cultural elements are reinforcing each other, they form an organic system of contract enforcement institutions that may be difficult to change by piecemeal reforms. The ultimate cure for all these symptoms of underdevelopment, however, may lie in policies that make the initial distribution of endowment more equal and increase social mobility.

The paper contributes to the literature by providing a formal analysis of how contract

¹Johnson, McMillan and Woodruff (2002) provide empirical evidence consistent with these results: “Trust in existing suppliers may make entrepreneurs reluctant to purchase from new suppliers. ... The development of legal institutions brings indirect efficiency gains, by lowering entry barriers, in addition to direct efficiency gains through strengthening confidence in contracts.”

²When the endowment is more evenly distributed, it is difficult for a few elites to maintain dominance, and hence institutions are developed to reflect, to a larger extent, the aggregate social welfare.

enforcement institutions evolve over time and differ across societies. In a related study, Greif (2005) proposes a similar conceptual framework where markets and political institutions coevolve through a dynamic interplay between contract enforcement institutions and coercive constraint institutions. That paper has a vast coverage of relevant issues, which are difficult to be hammered into a formal model. Another closely related study is Sobel (2006); a version of its basic model is adopted in the current paper to analyze the comparative advantages of different enforcement institutions. Li (2003) also briefly compares informal relational contracts with formal legal institutions in the context of East Asian miracles and crisis. Dixit (2003) explores how the relative advantage of an informal multilateral enforcement versus external enforcement changes as trade expands. None of these studies endogenizes the legal quality.

The paper proceeds as follows. In section 2, a repeated matching game is analyzed, which provides the micro foundation for studying the transition from relational to legal contracts in section 3. Some implications and evidence are discussed in section 4. The final section concludes the paper. All proofs are relegated to the appendix.

2 The Basic Model: Relational versus Legal Contracts

2.1 The Model Setup

There is a continuum of agents. They are originally randomly matched to play a two-player repeated game. In each period, a match continues if both players agree to participate, and it breaks up if either one wishes so. A match can be either fresh or stale. In a fresh match, agents play the prisoner's dilemma described below, where the standard conditions $b > a > 0$, $d > 0$, and $2a > b - d$ are assumed. A match is always fresh in the initial period; in each period afterwards while the match is not broken up, it remains fresh with probability ρ , and it becomes stale with probability $1 - \rho$. Stale matches remain so as long as the match continues, providing a payoff $l \in [0, a]$ to both players in each period.

| | | |
|-----------|-----------|-----------|
| | cooperate | defect |
| cooperate | (a, a) | $(-d, b)$ |
| defect | $(b, -d)$ | $(0, 0)$ |

There is no information transmission across matches. Agents know the quality of their current match, the past actions of their own and their partners within the match. They cannot access information about the past actions of any other agents. Since the population of agents is large, we neglect the possibility that any two agents have met before. Unmatched agents can find a new partner without cost.

In each period of a fresh match, an agent’s strategy specifies an action in the above PD game followed by a decision of whether to continue or break the partnership. In a stale match, agents only need to consider the latter decision. Agents choose strategies to maximize the discounted sum of their stage-game payoffs, net of contracting costs if any, where the common discount factor is $\delta \in (0, 1)$. The paper focuses on subgame perfect equilibrium outcomes, where an agent discontinues a partnership only if doing so gives him a better payoff than otherwise.

In particular, we study two types of enforcement institutions that enable agents to cooperate. One is an informal relational contract where players spend the first several periods of a relationship getting the reservation utility 0 and then start cooperating. By refraining from getting higher payoffs in the initial periods, players are essentially building up their relationship that can stand against future cheating. When players do not break up even when the match becomes stale, they are in an *informal persistent (IP)* relationship; when they do break up, they are in an *informal good-weather (IG)* relationship since they stay together only when the match is fresh.

The other type of enforcement is to sign a formal legal contract mandating cooperation starting from the first period of a match. If a pair of players each takes cost c to write a contract, the court identifies cheating when it occurs with probability $Q(c, q)$, where q denotes the general quality of the legal system. Assume $Q_c, Q_q > 0$, $Q_{cc}, Q_{qq} \leq 0$, and $Q_{cq} \geq 0$. When a cheating is verified by the court, each agent gets zero payoff. Depending on whether to continue or break up in a stale match, agents can choose between a *formal persistent (FP)* contract and a *formal good-weather (FG)* contract respectively. These four varieties of relationships are summarized in the following table.

| | <u>Persistent match</u> | <u>Good-weather match</u> |
|-------------------------------------|-------------------------|---------------------------|
| | (continue when stale) | (break up when stale) |
| <u>Informal relational contract</u> | IP | IG |
| <u>Formal legal contract</u> | FP | FG |

The timing of this stage game can be summarized as follows. Players randomly pair with each other. Subject to mutual agreement, partners choose a relationship among the four options IP, IG, FP, and FG, and then behave accordingly. A match breaks up automatically once an unexpected cheating is detected. Players exiting from an old relationship then randomly form new matches and the same action sequence described above follows. The sections below show these contracts are indeed subgame perfect equilibrium, and analyze how agents adopt different contracts.

2.2 Informal Relational Contracts IP and IG

When there is no cheating problem so that players can start cooperating from the first period of a match, each player gets a value of $V_P = a + \delta[\rho V_P + (1 - \rho)\bar{l}]$ from a persistent relationship IP, where $\bar{l} = \frac{l}{1-\delta}$ is the discounted payoff of a stale match, and the subscript P denotes a *persistent* relationship. Solving V_P we get

$$V_P = \frac{a + \delta(1 - \rho)\bar{l}}{1 - \delta\rho}, \quad (1)$$

which is achieved in IP after certain periods of costly relationship building. Note V_P increases in l . The value of cooperation in a good-weather relational contract IG, V_{IG} , however, does not depend on l since players break up when the match is stale. Accordingly, the relationship building cost in IG is also different from that of IP. The choice between these two relational contracts IP and IG is determined by their net payoffs V_{0P} and V_{0G} , respectively, as proved in the following lemma.

Lemma 1 (i) *There exists a unique l_* such that players choose IP if $l > l_*$, IG if $l < l_*$, and are indifferent between IP and IG when $l = l_*$, where*

$$l_* \equiv \frac{a - b(1 - \delta\rho)}{\delta\rho}. \quad (2)$$

(ii) *The value and relation-building cost of IP and IG are, respectively,*

$$V_{0P} \equiv V_P - c_{IP} = \frac{\rho l_* + (1 - \rho)\bar{l}}{1 - \delta\rho}, \quad (3)$$

$$c_{IP} = \frac{a - \rho l_* - (1 - \rho)l}{1 - \delta\rho}, \quad (4)$$

$$V_{0G} \equiv V_{IG} - c_{IG} = \bar{l}_*, \quad (5)$$

$$c_{IG} = \frac{b - a}{\delta\rho}, \quad (6)$$

where $\bar{l}_* \equiv \frac{l_*}{1-\delta}$. Both V_{0G} and c_{IG} are independent of l , while $V_{0P} > V_{0G}$ and $c_{IP} < c_{IG}$ hold for any $l > l_*$.

Since a persistent relationship will continue even when the match goes stale, the continuation value of IP increases in l , and hence it needs a lower relationship-building cost c_{IP} to achieve cooperation when l is higher. So c_{IP} decreases in l . In contrast, the cost c_{IG} in IG does not depend on l , and it equals c_{IP} only when $l = l_*$. That is, when $l < l_*$ a stale match is so unproductive that it is better to break it up and meet a new partner, which is exactly the arrangement of an IG. So $c_{IG} = \frac{b-a}{\delta\rho}$ is the highest cost and $V_{0G} = \bar{l}_*$ is the lowest return for using these two relational contracts. See figures 1 and 2 for illustration.

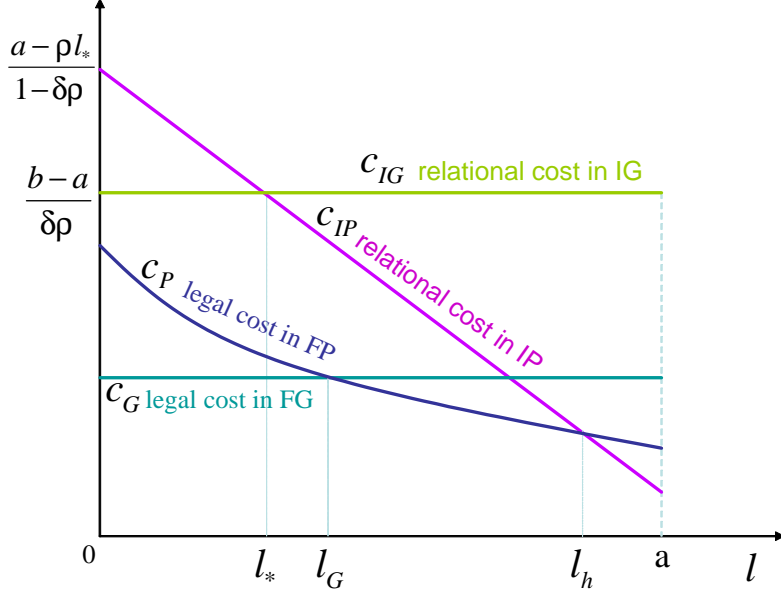


Figure 1: The relationship between legal contract costs and relationship building costs

2.3 Formal Legal Contracts FP and FG

Suppose there exists a legal system to enforce formal contracts. We investigate agents' choices between legal contracts FP and FG to achieve cooperation. The results are proved in the following lemma and illustrated in figures 1 and 2.

Lemma 2 (i) *The minimum legal cost is c_G in a formal good-weather contract FG, and c_P in a formal persistent contract FP. Players stay in a stale match when the legal contract cost is above $c_S = \frac{a-l}{1-\delta\rho}$. The threshold costs c_G , c_P and c_S are determined by, respectively,*

$$bQ(c_G, q) + \delta\rho c_G = b - a, \quad (7)$$

$$bQ(c_P, q) + \delta c_P = \delta c_{IP}, \quad (8)$$

where $\frac{\partial c_G}{\partial q} < \frac{\partial c_P}{\partial q} < 0$, $\frac{\partial^2 c_G}{\partial q^2}, \frac{\partial^2 c_P}{\partial q^2} > 0$, $\frac{\partial c_P}{\partial l} < 0$, and $\frac{\partial c_G}{\partial l} = 0$.

(ii) *For any legal quality q , there exists a unique l_G such that players choose FP if $l > l_G$, FG if $l < l_G$, and are indifferent between FP and FG when $l = l_G$, where*

$$l_G = a - (1 - \delta\rho)c_G \quad (9)$$

and it is increasing and concave in q . The net value of FG,

$$V_G - c_G = \frac{l_G}{1 - \delta} \equiv \bar{l}_G, \quad (10)$$

is independent of l , while the net value of FP, $V_P - c_P$, strictly increases in l .

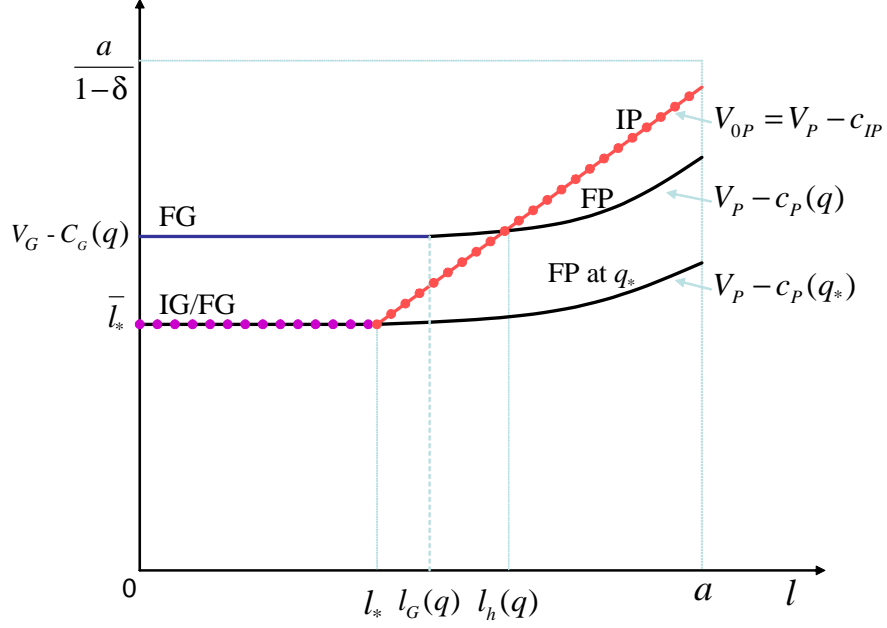


Figure 2: The values of contracts IG, FG, IP, and FP at some $q > q_*$

The intuition is as follows. c_G and c_P are the minimum costs of using legal contracts FG and FP, respectively, to enforce cooperation starting from the first period of a match. Using legal contracts becomes cheaper when the legal quality improves, which is why both c_G and c_P decrease in q . Whether to break up or continue a stale match again depends upon how productive the stale match is. When the productivity l is higher, players need less outside incentive to continue their relationship. So c_P decreases in l while c_G is independent of it, where the two are equal when $l = l_G(q)$ given any legal quality q . Actually l_G is the threshold productivity level around which the ranking of FG and FP also changes. Note when the legal quality q is higher, l_G is higher so that FG becomes more widely used and its return \bar{l}_G is also higher.

2.4 Choices between Relational and Legal Enforcement

The above analysis shows that players with higher productivity l are more likely to establish persistent relationships in both relational and legal contracts, and the legal contracts are adopted more often when the quality of legal system is higher. The optimal choice among the four contract options turns out to depend on both l and q .

Since the threshold productivity level l_G strictly increases in legal quality q while l_* is

independent of it, there exists a unique q_* where these two coincide:

$$l_G(q_*) = l_*.$$

But this condition implies, together with results in Lemma 2, $c_G(q_*) = c_P(l_*, q_*) = \frac{b-a}{\delta\rho} = c_{IG}$. That is, when $q = q_*$, the legal cost c_G is exactly equal to the highest relational cost c_{IG} . In this case $Q(c_{IG}, q_*) = 0$ and it does not matter whether cheating is detected, since the contract cost c_{IG} itself is already high enough to forbid any cheating. Since $l = l_G$ means indifference between FP and FG, $l = l_*$ means indifference between IP and IG, and $l_G(q_*) = l_*$ means indifference between FG and IG, players with l_* are indifferent among all four types of contracts under legal quality q_* . So (l_*, q_*) is the common point where the four contracts meet. See figure 3 for illustration.

Since a persistent relationship yields the same maximum value V_P , the choice between IP and FP depends on which is cheaper to enforce. For any $q > q_*$, define l_h such that players are indifferent between IP and FP:

$$c_P(l_h, q) = c_{IP}(l_h) \Leftrightarrow l_h = \frac{a - \rho l_* - (1 - \delta\rho)c_P}{1 - \rho}. \quad (11)$$

So projects with $l > l_h$ would continue to use IP until the legal quality is above \bar{q} , which is determined by (11) when $l_h = a$. The detailed choices among the four types of contracts are proved in the following proposition.

Proposition 1 *When $q \leq q_*$, players use IG if $l \leq l_*$, and IP if otherwise. When $q > q_*$, players use FG if $l \leq l_G$, FP if $l \in (l_G, l_h]$, and IP if $l > l_h$ and $q \leq \bar{q}$. Players in the boundary cases are indifferent between alternative choices. l_h is increasing and concave in q , where $l_h = l_* = l_G$ at $q = q_*$, and $l_h > l_G$ at $q > q_*$.*

In summary, when the quality of legal system is high enough ($q > q_*$), the informal contracts are replaced by formal legal contracts for all good-weather relations and for persistent ones except those with the most productive stale matches ($l > l_h$). And FG becomes more popular than FP as the legal quality q increases, which increases the values of the bottom projects that suffer large negative productive shocks when a match goes stale.³ The usage of FP, however, will not disappear as long as the legal cost is positive; actually only at the limit case where $c_G = c_P = 0$ and $l_G = a$, FP stops to be used.

It is obvious that the gain from a better legal system differs across projects. Players with the most productive projects $l > l_h$ rely exclusively on informal persistent relationships

³Actually, the average income goes up and the income inequality goes down when the legal quality q is higher, since all players using FG get the same income \bar{l}_G which increases in q , and the proportion of players adopting FG also increases in q .

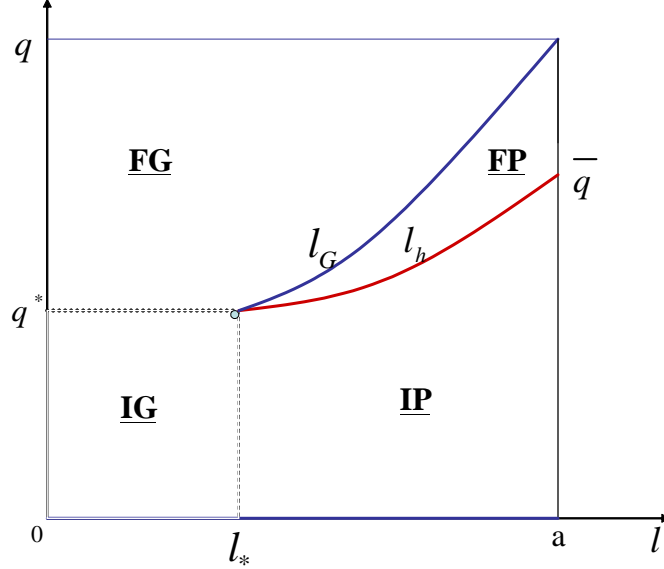


Figure 3: Optimal contracts dependent on project productivity l and legal quality q

rather than formal legal contracts, who thus do not benefit from a better legal system as long as the legal quality is below \bar{q} . Players with $l \in (l_G, l_h]$ use formal legal contracts to maintain persistent relationships and hence are better off with higher legal quality, but less so than the bottom players with the least productive projects $l \leq l_G$ who rely exclusively on the legal system for contract enforcement. So in general, those with high l projects rely more on informal and persistent relationships and hence have less to gain from an improved legal system.

2.5 The Effects of Cultural Preference

Suppose there exists a cultural preference that gives each player a psychological payoff $\alpha \geq 0$, in addition to the material payoff l , in each period one stays in a stale match. Since it also reduces the relation-building cost in a persistent relationship, more agents would use it relative to good-weather ones. The detailed adjustment of the basic model to α is summarized by the following corollary.

Corollary 1 *When there is a cultural preference α for persistent relationships, the relevant payoffs and costs for good-weather matches do not change, while those for persistent relationships are changed in the way that l is replaced by $l + \alpha$, where $\frac{\partial^2 c_P}{\partial q \partial \alpha} < 0$. The thresholds l_* , l_G and l_h are each reduced by α so that more projects use informal and persistent relationships.*

3 Investment in Legal Quality

We are now in a position to endogenize the quality of legal system and study how contract enforcement institutions may evolve from relational contracts to the increasing usage of legal contracts. Suppose there are infinite generations of agents. Each generation lives one period and each agent brings up one child. Players are homogeneous in all aspects except l , the productivity of a stale match that indicates the quality of project.⁴ The distribution of l in the population follows $F(\cdot)$ and remains the same for all generations. When a match between players with projects l_i and l_j goes stale, its productivity is $\tau l_i + (1 - \tau)l_j$, where $\tau \in (0, 1)$. Given that l is observed ex ante and there is no searching cost, perfectly assortative matching will happen where a player forms a match only with somebody who has the same l . We assume there are enough agents for each l so that the possibility of two agents meeting more than once can still be ignored.⁵

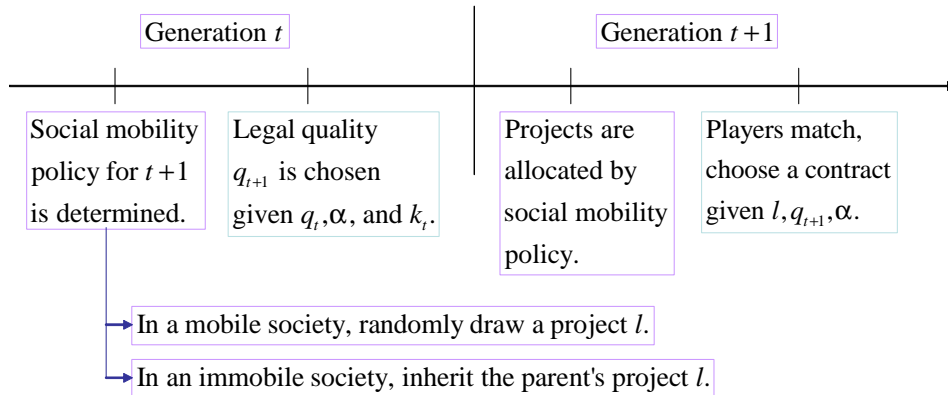


Figure 4: The timeline of legal investment

The time line of legal development is illustrated in figure 4. In the initial generation, projects are randomly assigned to agents; the subsequent allocation of projects in every generation $t + 1$ follows the social mobility policy determined by the previous generation t . For simplicity we only consider two mobility choices: a *mobile society* policy under which each agent randomly draws a project $l \sim F(\cdot)$, and a *rigid society* policy where the project is inherited from the parent. The interest group who has the dominant economic power

⁴Presumably, one can also model heterogeneity of b , a , and ρ among agents. l is chosen mainly because of its crucial role in the choice of different contract enforcement formats. Furthermore, it can be interpreted as individual human capital or some valuable asset that can be inherited across generations, while the other elements are more likely to fall beyond the control of individuals.

⁵For example, l may take only finite number of values.

gets its favorite policy implemented.

Then the legal quality q_{t+1} is chosen to maximize the joint welfare of the immediate children in the dominant interest group, if there is conflict of interests.⁶ The cost function of legal investment is $C(q_{t+1}, q_t)k_t^{-1}$, where $C_1 > 0$, $C_2 < 0$, $C_{11} > 0$, and $C_{12} \leq 0$. Technological conditions that may affect the cost of improving legal quality are captured by k_t , which is exogenously determined and increasing over time. The initial legal quality is zero so that all agents use informal relational contracts in the beginning.

When generation $t + 1$ grows up and replaces the old one, each player draws a project randomly from the distribution if in a mobile society, or inherits the parent's project if in a rigid society. Then they play a reduced form of the matching game in the basic model, where one gets a payoff V_{0P} , $V_P - c_P$, V_{0G} , or $V_G - c_G$ if the chosen contract is IP, FP, IG, and FG respectively, taking as given q_{t+1} and α .⁷ Then they decide on the social mobility policy and the legal quality for the next generation $t + 2$, and the same sequence of choices as above is repeated.

3.1 The Benchmark: Legal Development in a Mobile Society

In the benchmark case of a mobile society, the allocation of projects is random in all generations. Since children of the same cohort have the same expected welfare, there is no conflict of interests regarding the public investment in legal quality, which coincides with the social optimal choice.

Since a low quality legal system is too costly to be useful, a society will not start its legal development process until it can establish one with high enough quality $q_{t+1} > q_*$. Then based on Proposition 1, we can calculate the aggregate values of using FG, FP, and IP, which are, respectively,

$$\begin{aligned}\pi_{FG}(q_{t+1}) &= F(l_{G,t+1})(V_{G,t+1} - c_{G,t+1}), \\ \pi_{FP}(q_{t+1}) &= \int_{l_{G,t+1}}^{l_{h,t+1}} (V_P - c_{P,t+1})dF(l), \\ \pi_{IP}(q_{t+1}) &= \int_{l_{h,t+1}}^a (V_P - c_{IP})dF(l).\end{aligned}$$

⁶Allowing more forward-looking in the model does not seem to affect the main qualitative results, since the driving force remains the same. This will become clear in the analysis below.

⁷This assumption can be justified as follows. Suppose in each sub-period all players in the same cohort die with probability $1 - \delta$, and they get zero payoff in the dying sub-period; this will give us the same results derived above if the original discount factor is set to one. Before they die, decisions on social mobility and legal investment are made for the next generation.

The collective objective function of parents in generation t is

$$\max_{q_{t+1}} \pi_{FG}(q_{t+1}) + \pi_{FP}(q_{t+1}) + \pi_{IP}(q_{t+1}) - C(q_{t+1}, q_t)k_t^{-1}.$$

The optimal solution is described in the following proposition.

Proposition 2 *The optimal legal quality q_{t+1}^* in a mobile society is uniquely determined by*

$$\frac{1 - \delta\rho}{1 - \delta} \frac{-\partial c_{G,t+1}}{\partial q_{t+1}} F(l_{G,t+1}) + \int_{l_{G,t+1}}^{l_{h,t+1}} \frac{-\partial c_{P,t+1}}{\partial q_{t+1}} dF(l) - C_1(q_{t+1}, q_t)k_t^{-1} \leq 0, = 0 \text{ if } q_{t+1}^* > q_*.$$

The legal development starts later and the legal quality q_{t+1}^ is lower when l_* is smaller and when the cultural preference α is stronger.*

So the legal development process starts only when the net gain of establishing legal contract enforcement becomes larger than exclusively using relational contracts. The development is slower in a society where initially more players engage in persistent relationships (i.e., l_* is smaller); such a situation tends to arise when the market and technological changes are little so that productivity shocks are milder. Similarly, since the marginal gain of improving legal system also decreases in the cultural preference α (due to $\frac{-\partial^2 c_P}{\partial q \partial \alpha} < 0$), the overall legal development is slowed down by α ; the aggregate welfare, however, is not necessarily lower because the values of persistent relationships π_{FP} and π_{IP} strictly increase in α while π_{FG} does not change.

3.2 Late Legal Development in a Rigid Society

When there is no mobility, the conflicts over legal development are between three groups: The IP group prefers zero investment in legal quality since $\frac{\partial c_{IP}}{\partial q} = 0$, and the FP group prefers less investment than the FG group since $\frac{\partial(-c_G)}{\partial q} > \frac{\partial(-c_P)}{\partial q} > 0$. Given that a rigid society policy has been chosen, the joint economic power of the IP and FP group must dominate that of FG (see Proposition 4). Since players in the dominant group have less gains from legal development, a rigid society tends to have inferior legal quality compared with the social optimal level that prevails in a mobile society. In specific, suppose the legal quality q_{t+1} is chosen in every generation t to maximize the welfare of the dominant group's immediate children.⁸ The collective objective function is thus

$$\max_{q_{t+1}} \pi_{FP}(q_{t+1}) + \pi_{IP}(q_{t+1}) - C(q_{t+1}, q_t)k_t^{-1}.$$

Since the interests of FG group, who benefits most from a higher legal quality, are ignored in the legal investment decision, the legal development of a rigid society is severely delayed.

⁸The within-group conflicts among IP and FP players would not affect the qualitative results.

Proposition 3 *The rigid society starts to invest in legal system at a later period, and in every period its legal quality q_{t+1}^E is also lower, compared with the social optimal solution in the mobile society.*

3.3 Endogenous Social Mobility Policy

As the above analysis shows, why some societies have embarked on an optimal legal development path while others failed may depend crucially upon how the social mobility policy is chosen, which is subject to huge conflict of interests among players.

In a mobile society, all players in generation $t + 1$ earns the same expected payoff

$$E(V_{t+1}) = \begin{cases} V_{0G}F(l_*) + \int_{l_*}^a V_{0P}dF(l) & \text{if } q_{t+1}^* \leq q_*, \\ \pi_{FG}(q_{t+1}^*) + \pi_{FP}(q_{t+1}^*) + \pi_{IP}(q_{t+1}^*) & \text{if } q_{t+1}^* > q_*. \end{cases}$$

In a rigid society, a player's payoff $V(l, q_{t+1}^E)$ is determined by his parent's project l and the legal quality q_{t+1}^E . Players in generation t who own superior projects with $V(l, q_{t+1}^E) \geq E(V_{t+1})$ naturally prefer the rigid society policy in order to preserve their privileges for their children, while others prefer the mobile society policy. These are the two relevant interest groups concerning social mobility policy. For convenience, the high income group is labeled the *elites*. If the elites have enough economic power to secure dominant political power, the society is said under *elite-ruling* where the elites' favorite mobility policy, the rigid one, will be chosen. If not, we are back to the benchmark case of a mobile society.⁹

Let $l_{e,t}$ denote the lowest productivity of projects owned by elites in generation t . It is uniquely determined by

$$V(l_{e,t}, q_{t+1}^E) = E(V_{t+1}). \quad (12)$$

When $q_{t+1}^E \leq q_*$, $l_{e,t} > l_*$ must be true because projects with $l \leq l_*$ earn an identical payoff \bar{l}_* that is the lowest among all projects; similarly, $l_{e,t} > l_{G,t}$ holds when $q_{t+1}^E > q_*$. So $l_{e,t} > \max\{l_*, l_{G,t}\}$ is always true and the endogenously formed elites engage only in persistent relationships.

Proposition 4 *At any generation t , agents with projects $l \geq l_{e,t}$ prefer the rigid society policy while others prefer the mobile society policy, where $l_{e,t} > \max\{l_*, l_{G,t}\}$. The rigid policy is more likely to be adopted when $\int_{l_{e,t}}^a l dF(l)$ is larger, when α is higher, and when q_t is lower under broad conditions.*

This proposition shows a society is more likely to have low mobility and elite ruling when its distribution of projects is highly unequal, when its cultural preference for persistent

⁹A more general model would allow a larger range of social mobility policies. But as long as elites prefer less mobility than the mass, similar qualitative results will follow.

relationship is strong, and when the legal system is less developed. So there is a two-way reinforcing relationship between elite ruling and slow legal development: Elite ruling directly leads to inferior legal quality (proposition 3), which reinforces the elite ruling by increasing the relative economic power of those favoring the rigid society policy. Similarly, a society with highly unequal initial endowment tends to have elite ruling, which in turn helps preserve the inequality through low social mobility and ineffective legal systems. All of these inefficient institutions can be further reinforced by a personalistic culture.

Though cultures are slow moving institutions, they may still, at least to some extent, respond to incentives. Since players in persistent relationships IP and FP get higher payoffs when α is higher, they may also find it beneficial to cultivate the cultural preference α , especially when improving the legal quality is too costly. Since the elites are composed exclusively by agents using IP and FP who prefer a stronger cultural preference than the average player in a mobile society, the endogenous culture α_{t+1}^E under elite ruling tends to be stronger than the social optimal level α_{t+1}^* , both of which are likely to be higher when more players engage in persistent relations and when the legal quality is lower because $\partial(-\frac{\partial c_P}{\partial \alpha})/\partial q < 0$. That is, a less developed legal system induces agents to invest more in α to enhance contract enforcement. So there exists a mutual reinforcing relationship between a stronger personalistic culture and elite ruling/low social mobility as well as lower legal quality.

In summary, there is a high correlation between low legal quality, strong cultural preference for personalistic relationships, and low social mobility plus elite ruling. Since these conditions are reinforcing each other, the high inequality in the initial endowment distribution may act as the ultimate driving force for these cultural, political, and legal institutions, which then in turn preserve the inequality (see figure 5). This implies that small differences in the initial conditions may perpetuate into vastly different clusters of institutions, which set societies into diverging development paths.

4 Discussions and Relevant Evidence

The paper shows that relational contracts are more widespread when the legal system is of low quality and high cost, when the cultural preference for personalistic relations is high, when there are elite ruling and low social mobility, and when the income inequality is high. The most salient example seems to be Latin America where all these elements are observed simultaneously. The high cost of using the legal system in Peru forced governing exchange by informal means, where 48% of the economically active population operates in the informal sector (De Soto 1989, p. 131), and business people invest time, effort, and

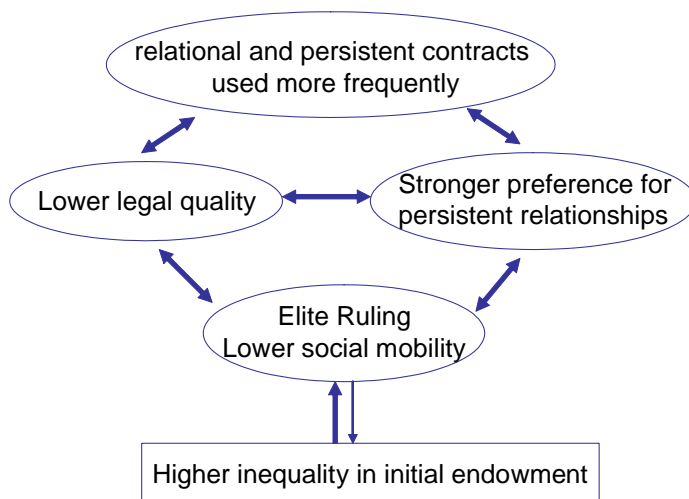


Figure 5: The mutual-reinforcement among political, cultural, and legal conditions

money in cultivating long-term friendships. Informal employment in urban populations in various Latin American countries averaged about 30% in 1989 (Portes 1994, p. 438).

The cultural and political roots of such a situation go back to the colonial era under the Spanish empire, which are best summarized by North et al. (2000):

“The Spanish and British carried their governance systems for political and economic systems across the Atlantic. In both systems, rights in land in the new world began with grants from the crown. Yet there the similarities ended. The Spanish empire lodged these rights in a system of privilege based on personal and corporate connection to the crown. In contrast, the British system lodged rights in a what became system of transferable titles enforced by the judiciary. The foundation of the Spanish system was political exchange, whereby elites gained rights and privileges by virtue of sustained loyalty and support for the crown. Given the powers and constraints on the absolutist crown, the political exchange of rights for political support helped ensure the crown’s long term survival.”

A deeper root of the sharp contrast between the above institutions may be the different levels of inequality in the initial endowment, where the greater disparity in resources is more likely to result in elite ruling. Indeed, the large plantation agriculture and slavery in mining in Latin America induce huge disparities in wealth. Even in today’s Brazil, for example, “the richest 1 percent of the population controls 13 percent of the nation’s wealth, while the poorest 50 percent controls only 13 percent” (Santiso 2006, p. 134).

In contrast, commodities were grown on family farms in North America where it exhibits relative equality in land endowment. Consequently, these societies allocate political power differently:

“... the United States and Canada were the clear leaders in doing away with restrictions based on wealth and literacy and introducing the secret ballot, and much higher fractions of the populations voted in these countries than anywhere else in the Americas. These societies were distinguished for their relative equality, population homogeneity, and scarcity of labor, and it is notable that others of British heritage, such as Barbados, generally retained stringent restrictions on the franchise well into the 20th century. Moreover, it is striking that the leaders in extending the suffrage in South and Central America, such as Uruguay, Argentina, and Costa Rica, are generally regarded as having been historically the most egalitarian of Latin American societies, and having initial factor endowments most closely resembling those of the United States and Canada.” (Engerman and Sokoloff 2001)

In terms of the model, Latin America countries have both personalistic culture and high inequality of endowment, which mutually reinforce each other in a vicious circle. Actually the endowment inequality plus elite ruling is the real malicious element, which not only blocks the social optimal legal development but also lowers the social welfare. In contrast, the personalistic culture may slow down the legal development but not necessarily reduce the overall welfare. This result is consistent with experiences of East Asian countries, which have impersonal resource allocation policies to increase social mobility and hence break the trap of underdevelopment. For example, in Japan,

“social status and income earning potential are allocated through the educational system, and entry into the top public schools is determined solely by impersonal examinations. Neither political pull nor financial contributions have any direct influence on this most important of resources ... Equally important, entry into elite levels of the bureaucracy can only be accomplished through impersonal examinations. Thus, one pillar of power and influence over policymaking is allocated independently of personal networks.” (Reed 2001)

So a society can still achieve economic development while maintaining its culture preference for loyalty in personal relationship, but it has to get rid of elite ruling and the associated rigid resource allocation rules that protect the privileges of elites. In other words, bad political institutions are more powerful in blocking efficient contract enforcement institutions. On the other hand, since the cultural preference for stable personalistic relations tends to

decrease over time as the legal quality improves (Greif 1997), rigidly imposing traditional cultural values may also hinder economic and legal development.

The following graph shows some preliminary empirical evidence consistent with the main results of the model, where the data are from Botero et al. (2004). The legal quality is indicated by “Log number of days to start a business,” which is the natural logarithm of the number of days required to obtain legal status to operate a firm in 1999. Its level is the highest, and hence the legal quality is lowest in Latin America. The second highest level is in East Asia, followed closely by western countries, where those with the common law tradition, which arguably has the most individualistic culture, require the shortest time to start a business. As expected, the same ranking applies to the “Size of the unofficial economy” as a percentage of GDP, which is about 41.4% in Latin America, more than two times as large as the others. This order is completely reversed for the degree of institutionalized democracy during 1950-1995 and the average schooling level, which may reflect the extent of elite ruling and social mobility. The per capita GNP is the lowest in the Latin America, while those of others are much higher and similar to each other. The average Gini index (not shown) is around 32-36 for both West and East Asian groups, while it is 51.4 in Latin America, which has almost the highest income inequality among all countries (United Nations 2005).

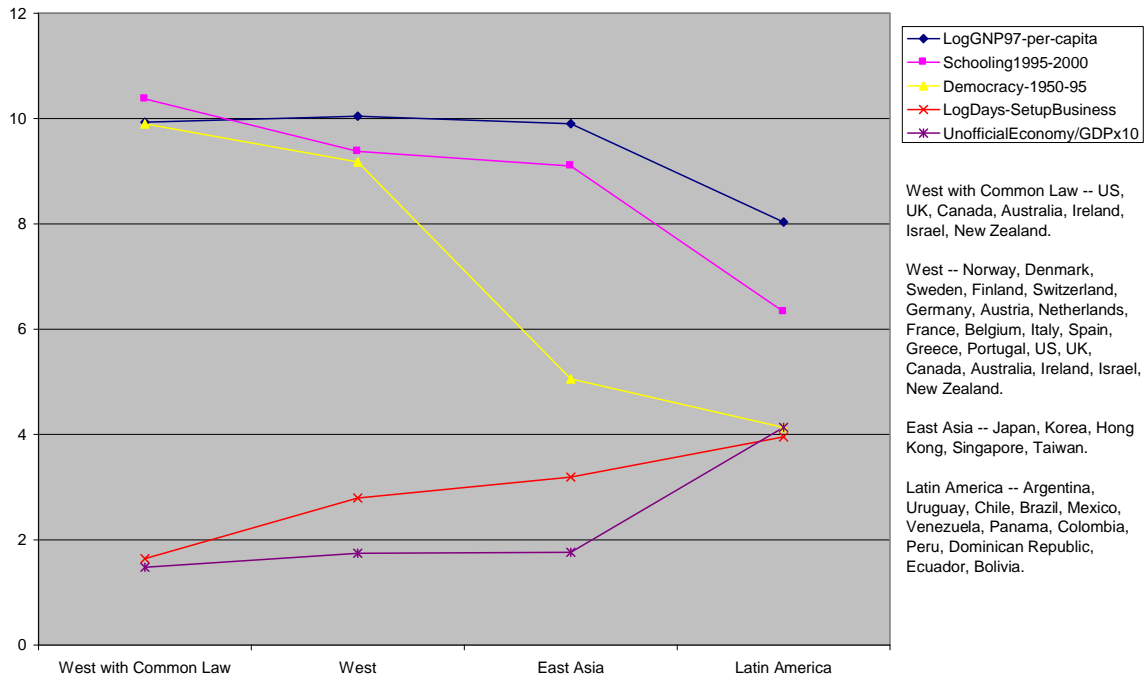


Figure 6: Legal quality, unofficial economy, democracy, schooling, and GNP

5 Conclusions

This paper analyzes the interactions between relational and impersonal contract enforcement institutions and their dynamic evolution. The personalistic relationship and a cultural taste for it can be compatible to economic development, though their prevalence is reduced when the legal quality improves. The elite ruling and low social mobility, however, present a large barrier for legal development and efficient contract enforcement. An even deeper root is the allocation of factor endowment, where more equal distribution may be the ultimate cure for most illness in a stagnant society. Though casual evidence offers some initial support, the empirical validity of these results needs to be tested more extensively in future research.

The paper can be extended in various ways. For example, it is interesting to model investment decisions that improve the quality of relationships, increasing either its productivity or the likelihood that established relationships remain productive; it seems plausible that a higher legal quality shifts resources from maintaining old matches to improving the productivity of new ones, which may speed up technological changes. The roles of multilateral networks and information transmission and punishment mechanisms may be explored to shed light on different features of relational contracts than those discussed in the paper. The coercive constraint institutions as suggested by Greif (2005) may present another barrier in legal development and in the transition of contract enforcement institutions.

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Appendix

1. Proof for Lemma 1.

Recall that in any informal relational contract the matched partners do not start to cooperate until after the N th period. When the match is still fresh in any period $n \geq N + 1$, the value of such an established persistent relationship IP at period n is V_P . In any period $n < N$, the value of continuing the relationship when the match is still fresh is $V_n = \delta[\rho V_{n+1} + (1 - \rho)\bar{l}]$. Then the value at the initial period of a relationship is

$$V_{0,N} = \frac{(\delta\rho)^N a + \delta(1 - \rho)\bar{l}}{1 - \delta\rho}. \quad (13)$$

In any period $n \geq N + 1$ when the match is still fresh, agents will not cheat if the payoff of cheating $b + \delta V_{0,N}$ is smaller than V_P , the payoff of cooperation. The condition $b + \delta V_{0,N} \leq V_P$ determines the minimum number of periods, \underline{N} , that players have to stick to each other before cooperation starts:

$$(\delta\rho)^{\underline{N}} = \frac{a + \delta(1 - \rho)l - b(1 - \delta\rho)}{a\delta}. \quad (14)$$

Suppose without loss of generality all persistent relationships go through exactly \underline{N} periods before cooperating. Plugging (14) into (13) we get

$$V_{0P} = \frac{a - b(1 - \delta\rho) + \delta(1 - \rho)\bar{l}}{\delta(1 - \delta\rho)}, \quad (15)$$

which is the value of a new match adopting IP.¹⁰

A persistent relationship will continue even when the match goes stale. Doing so is rational when it yields a higher payoff than starting a new relationship. That is, $\bar{l} \geq V_{0P}$ must hold, which is equivalent to $l \geq \frac{a - b(1 - \delta\rho)}{\delta\rho} \equiv l_*$. Then V_{0P} can be rewritten as $V_{0P} = \frac{\rho l_* + (1 - \rho)\bar{l}}{1 - \delta\rho}$, where $\min\{V_{0P} : l \geq l_*\} = \bar{l}_*$. The gap between V_P and V_{0P} is

$$c_{IP} \equiv V_P - V_{0P} = \frac{a - \rho l_* - (1 - \rho)l}{1 - \delta\rho},$$

which represents the relationship-building cost. Its highest level is $c_{IP}(l = l_*) = \frac{b - a}{\delta\rho}$.

¹⁰The integer problem on the minimum number of noncooperative periods is assumed away; otherwise some minor quantitative adjustment is needed, which will not change the qualitative results.

Following similar arguments as above we get the following conditions for IG.

$$\begin{aligned}
V_{IG} &= a + \delta(\rho V_{IG} + (1 - \rho)V_{0G}) \Rightarrow V_{IG} = \frac{a + \delta(1 - \rho)V_{0G}}{1 - \delta\rho}. \\
V_{nG} &= \delta[\rho V_{n+1,G} + (1 - \rho)V_{0G}] \Rightarrow V_{0G} = \frac{(\delta\rho)^N a + \delta(1 - \rho)V_{0G}}{1 - \delta\rho} \Rightarrow V_{0G} = \frac{(\delta\rho)^N a}{1 - \delta}. \\
b &\leq V_{IG} - \delta V_{0G} = \frac{(1 - \delta(\delta\rho)^N)a + \delta(1 - \rho)(\delta\rho)^N a}{1 - \delta\rho} \Rightarrow a(\delta\rho)^N = \frac{a - b(1 - \delta\rho)}{\delta\rho} = l_* \\
&\Rightarrow V_{0G} = \frac{a - b(1 - \delta\rho)}{(1 - \delta)\delta\rho} = \bar{l}_* \\
&\Rightarrow V_{IG} = \frac{a + \delta(1 - \rho)\bar{l}_*}{1 - \delta\rho}. \\
c_{IG} &\equiv V_{IG} - V_{0G} = \frac{a - l_*}{1 - \delta\rho} = \frac{b - a}{\delta\rho}.
\end{aligned}$$

Since conditions (3) and (5) imply $V_{0P} \geq V_{0G}$ when $l \geq l_*$, we get the result.

2. Proof for Lemma 2.

(1) FG. We first study the legal contract FG leading to a good-weather relationship. Suppose an unmatched player obtains a value W_G while a matched player in is V_G . On the equilibrium path of a good-weather relationship where players cooperate immediately when they meet, $V_G - c = W_G$. That is, once they spend cost c to write an effective contract to forbid cheating, each player can obtain a value of V_G . When players cooperate, they get a immediately, followed by a continuation value V_G with probability ρ and W_G with probability $1 - \rho$. That is $V_G = a + \delta(\rho V_G + (1 - \rho)W_G)$, which with $W_G = V_G - c$ gives

$$\begin{aligned}
V_G &= \frac{a - \delta(1 - \rho)c}{1 - \delta}, \\
W_G &= \frac{a - (1 - \delta\rho)c}{1 - \delta}.
\end{aligned}$$

Let's check the possible one-shot deviation. In a new match, if a player cheats he gets payoff $b(1 - Q(c, q)) + \delta W_G - c$, where the first term is his expected current payoff, and in the next period he will start as an unmatched player with payoff δW_G since his partner will break up the partnership. If he cooperates, the match will continue where he gets $V_G - c$. Cheating will not happen when

$$b(1 - Q(c, q)) \leq V_G - \delta W_G,$$

which becomes $bQ(c, q) + \delta\rho c \geq b - a$ after plugging in V_G and W_G . Define c_G to make the equality hold and we get condition (7): $bQ(c_G, q) + \delta\rho c_G = b - a$. Since players will not cheat when $c \geq c_G$, c_G is the minimum cost to use FG.

Another condition is that it must be desirable to break up a match when it becomes stale. That is $\bar{l} \leq W_G$ should hold, which is $l \leq a - (1 - \delta\rho)c$. When the equality holds, we get $c_S = \frac{a-l}{1-\delta\rho}$ as the threshold legal cost, above which players will not break up a stale match. So good-weather relationships are feasible when $c \in [c_G, c_S]$. Note that c_G is independent of l while c_S decreases in l . This implies when players adopt a good-weather relationship, $c_G \leq c_S$ must be true, or equivalently

$$l \leq a - (1 - \delta\rho)c_G \equiv l_G$$

holds, where $c_G = c_S$ when $l = l_G$. So in a given legal system, only projects with low $l \leq l_G$ will adopt good-weather relationship.

(2) FP. The value of an established match in FP is V_P , while an unmatched player gets $W_P = V_P - c$. A player will not cheat if $b(1 - Q(c, q)) \leq V_P - \delta W_P$. It is simplified to

$$bQ(c, q) + \delta c \geq b - \frac{(1 - \delta)a + \delta(1 - \rho)l}{1 - \delta\rho},$$

where the equality holds when $c = c_P$, which is the minimum cost to use FP. Note that the right hand side is exactly δc_{IP} , which can also be connected to δc_S :

$$bQ(c_P, q) + \delta c_P = \delta c_{IP} = b - a + (1 - \rho)\delta c_S.$$

The condition $W_P \leq \bar{l}$ is equivalent to $c \geq c_S$. So players prefer FP when $c \geq \max\{c_P, c_S\}$.

(3) The cost conditions can be related in the following way:

$$bQ(c_P, q) + \delta(c_P - c_S) + \delta\rho c_S = b - a = bQ(c_G, q) + \delta\rho c_G.$$

When $c_P = c_S$, condition (8) is exactly the same as (7), which means $c_P = c_G$. But then $c_P = c_G = c_S$ must hold, which happens only when $l = l_G$ since $c_G = c_S$ holds at $l = l_G$. The above condition can be rewritten as

$$b(Q(c_G, q) - Q(c_P, q)) + \delta\rho(c_G - c_P) = \delta(1 - \rho)(c_P - c_S).$$

When $c_P > c_S$, we must simultaneously have $c_G > c_P > c_S$, where $c_G > c_S$ happens only when $l > l_G$. Similarly, if $c_P < c_S$, we must simultaneously have $c_G < c_P < c_S$ and $l < l_G$.

$\frac{\partial c_G}{\partial q} < 0$ and $\frac{\partial c_P}{\partial q} < 0$ since

$$\begin{aligned} \frac{\partial c_G}{\partial q} &= -\frac{bQ_q(c_G, q)}{bQ_c(c_G, q) + \delta\rho} < 0, \\ \frac{\partial c_P}{\partial q} &= -\frac{bQ_q(c_P, q)}{bQ_c(c_P, q) + \delta} < 0. \end{aligned}$$

When $l \geq l_G$ we know $c_G > c_P$ from the analysis above. But this, together with $Q_{qc} \geq 0$, $Q_{cc} \leq 0$, and $\rho < 1$, implies $\frac{-\partial c_G}{\partial q} > \frac{-\partial c_P}{\partial q}$.

$$\begin{aligned}\frac{\partial^2 c_G}{\partial q^2} &= -\frac{bQ_{qq}(bQ_c + \delta\rho) - b^2Q_q(Q_{cq} + Q_{cc}\partial c_G/\partial q)}{(bQ_c + \delta\rho)^2} > 0, \\ \frac{\partial^2 c_P}{\partial q^2} &= -\frac{bQ_{qq}(c_P, q)(bQ_c + \delta) - b^2Q_q(c_P, q)(Q_{cq} + Q_{cc}\partial c_P/\partial q)}{(bQ_c + \delta)^2} > 0.\end{aligned}$$

l_G is increasing and concave in q since

$$\begin{aligned}\frac{\partial l_G}{\partial q} &= (1 - \delta\rho)\frac{-\partial c_G}{\partial q} > 0, \\ \frac{\partial^2 l_G}{\partial q^2} &= -(1 - \delta\rho)\frac{\partial^2 c_G}{\partial q^2} < 0.\end{aligned}\tag{16}$$

Then this implies q is increasing and convex in l_G .

When $l > l_G$, only FP is an equilibrium since $c_G > c_S$. When $l < l_G$, both FP and FG are feasible since $c_G < c_P < c_S$. Players either incur a cost c_G to engage in FG, getting a net value \bar{l}_G in (10), or incur a cost c_S to have FP and get $V_P - c_S = \bar{l}$. It is easy to see that when $l < l_G$, FG has a higher value than FP, and when $l = l_G$ players are indifferent.

3. Proof for Proposition 1.

1) $q < q_*$. When $q < q_*$ and hence $c_G > \frac{b-a}{\delta}$, the corresponding threshold $l_G(q)$ is denoted by $l_G^l < l_*$. Players with $l \leq l_G^l < l_*$ strictly prefer IG to FG since $V_{0G} = \frac{l_*}{1-\delta} > \frac{l_G^l}{1-\delta} = V_G - c_G$. Those in the middle with $l \in (l_G^l, l_*)$ have to compare V_{0G} under IG with $V_P - c_P$ under FP, where $V_{0G} = \frac{l_*}{1-\delta} = (V_P - c_P)|_{(l=l_*, q=q_*)} > (V_P - c_P)|_{(l < l_*, q < q_*)}$ holds since $V_P - c_P$ increases in both l and q . So agents prefer IG to FP. When $l > l_* > l_G^l$, we have $c_P > c_S > c_{IP}$ so that IP is strictly preferred to FP. So when $q < q_*$, IG is chosen when $l < l_*$ and IP when $l > l_*$. Similar arguments apply to the case with $q = q_*$ where players are indifferent between IG and FG when $l < l_*$ and still choose IP when $l > l_*$.

2) $q > q_*$. When $q > q_*$ and hence $c_G < \frac{b-a}{\delta\rho}$, the corresponding threshold $l_G(q)$ is denoted by $l_G^h > l_*$. Players with $l \leq l_* < l_G^h$ strictly prefer FG to IG since $V_{0G} = \frac{l_*}{1-\delta} < \frac{l_G^h}{1-\delta} = V_G - c_G$. Players with $l \in [l_*, l_G^h]$ prefer FG to IP since $V_{0P} < V_G - c_G$:

$$\begin{aligned}V_{0P} &< \frac{a - b(1 - \delta\rho) + \delta(1 - \rho)\bar{l}_G^h}{\delta(1 - \delta\rho)} < \bar{l}_G^h = V_G - c_G \\ &\Leftrightarrow a - b(1 - \delta\rho) + \delta(1 - \rho)\bar{l}_G^h < \delta(1 - \delta\rho)\bar{l}_G^h \\ &\Leftrightarrow l_G^h > \frac{a - (1 - \delta\rho)b}{\delta\rho} = l_*.\end{aligned}$$

So FG is chosen for any project $l \leq l_G^h$. Since $c_P(l, q) > c_{IP}(l)$ holds for $l > l_h$ while the opposite is true when $l < l_h$, FP is chosen for $l \in [l_G, l_h]$ while IP for $l \in [l_h, a]$.

For any $q > q_*$, l_h is an increasing and concave function of q since by (11)

$$\begin{aligned}\frac{\partial l_h}{\partial q} &= \frac{1 - \delta\rho - \partial c_P(l_h, q)}{1 - \rho} > 0, \\ \frac{\partial^2 l_h}{\partial q^2} &= -\frac{1 - \delta\rho}{1 - \rho} \frac{\partial^2 c_P(l_h, q)}{\partial q^2} < 0.\end{aligned}$$

When $q = q_*$, $c_P = \frac{b-a}{\delta\rho} = c_{IP}$ at l_* , so we get $l_h = l_* = l_G$. For any $q > q_*$, $l_h > l_G$ is equivalent to

$$\begin{aligned}-\delta(1 - \delta\rho)c_P + b(1 - \delta\rho) - (1 - \delta)a &> a\delta(1 - \rho) - \delta(1 - \rho)(1 - \delta\rho)c_G \\ \Leftrightarrow \delta(c_G - c_P) + b - a - \delta\rho c_G &> 0,\end{aligned}$$

where the last inequality comes from $c_P(l, q) < c_G < \frac{b-a}{\delta\rho}$ for $q > q_*$ and $l > l_G^h$. When $l = a$, $c_{IP} = \frac{\rho(a-l_*)}{1-\delta\rho} > 0$; so when $l_h = a$, $c_P(l_h, \bar{q}) = c_{IP}(l_h) > 0$. In contrast, when $l_G = a$, we have $c_G = c_P = c_S = 0$ and the legal quality must have reached the highest possible level.

4. Proof for Corollary 1.

Repeating the calculation in the basic model, we get

$$\begin{aligned}V_P(\alpha) &= \frac{a + \delta(1 - \rho)(l + \alpha)/(1 - \delta)}{(1 - \delta\rho)}, \\ \delta c_{IP}(\alpha) &= b - \frac{a(1 - \delta) + \delta(1 - \rho)(l + \alpha)}{(1 - \delta\rho)} = bQ(c_P, q) + \delta c_P, \\ c_S(\alpha) &= \frac{a - (l + \alpha)}{1 - \delta\rho}, \\ l_*(\alpha) &= \frac{a - b(1 - \delta\rho)}{\delta\rho} - \alpha, \\ l_G(q, \alpha) &= a - (1 - \delta\rho)c_G - \alpha, \\ l_h(q, \alpha) &= l_h(q, 0) - \alpha. \\ \frac{-\partial^2 c_P(q, l, \alpha)}{\partial q \partial \alpha} &= \frac{\delta(1 - \rho)}{1 - \delta\rho} \partial \left(\frac{-1}{bQ_c(c_P, q) + \delta} \right) / \partial q = \frac{\delta(1 - \rho)}{1 - \delta\rho} \frac{Q_{cc}(c_P, q)}{bQ_c(c_P, q) + \delta} < 0.\end{aligned}$$

The payoffs and costs for good-weather matches remain the same as before.

5. Proof for Proposition 2.

The FOC illustrates the trade-off between reduced costs in using legal contracts and the marginal cost of improving legal quality:

$$\frac{(1 - \delta\rho)}{(1 - \delta)} F(l_{G,t+1}) \frac{-\partial c_{G,t+1}}{\partial q_{t+1}} + \int_{l_{G,t+1}}^{l_{h,t+1}} \frac{-\partial c_{P,t+1}}{\partial q_{t+1}} dF(l) - C_1(q_{t+1}, q_t) k_t^{-1} \leq 0, \quad = 0 \text{ if } q_{t+1} > q_*. \quad (17)$$

Since $C_2(q_{t+1}, q_t) < 0$ and k_t increases over time, it is less costly to invest in legal system at later times when both q_t and k_t are higher. Suppose the first time the equality holds is T_0 , and the associated optimal legal quality is $q_{T_0}^* > q^*$. Then for any $t < T_0$, we have $q_t = 0$. Thus T_0 is uniquely determined by

$$k_{T_0-1} = \left[\frac{(1-\delta\rho)F(l_{G,T_0}) - \partial c_{G,T_0}}{(1-\delta)} \frac{\partial c_{G,T_0}}{\partial q_{T_0}} + \int_{l_{G,T_0}}^{l_{h,T_0}} \frac{-\partial c_{P,T_0}}{\partial q_{T_0}} dF(l) \right]^{-1} C_1(q_{T_0}^*, 0). \quad (18)$$

Since $\frac{-\partial c_G}{\partial q} > \frac{-\partial c_P}{\partial q}$ holds by Lemma 2, the marginal gain of improving legal quality increases in $F(l_{G,t+1})$. From (9) and (2) we get

$$l_{G,t+1} = \delta\rho l_* + (1-\delta\rho)(b - c_{G,t+1}).$$

So the LHS in (17) increases in l_* , the proportion of projects using IG when $q_t \leq q_*$. It implies the optimal q_{t+1}^* is higher and T_0 is lower when l_* is larger.

The LHS in the FOC (17) decreases in α since

$$\begin{aligned} \frac{\partial LHS}{\partial \alpha} &= \frac{(1-\delta\rho)f(l_{G,t+1})}{(1-\delta)} \frac{\partial c_{G,t+1}}{\partial q_{t+1}} - \frac{\partial c_{P,t+1}}{\partial q_{t+1}} \Big|_{l_{G,t+1}} f(l_{G,t+1}) \\ &\quad - \int_{l_{G,t+1}}^{l_{h,t+1}} \frac{\partial^2 c_{P,t+1}}{\partial q_{t+1} \partial \alpha} dF(l) + \frac{\partial c_{P,t+1}}{\partial q_{t+1}} \Big|_{l_{h,t+1}} f(l_{h,t+1}) \\ &\leq \frac{\delta(1-\rho)f(l_{G,t+1})}{(1-\delta)} \frac{\partial c_{G,t+1}}{\partial q_{t+1}} \Big|_{l_{G,t+1}} - \int_{l_{G,t+1}}^{l_{h,t+1}} \frac{\partial^2 c_{P,t+1}}{\partial q_{t+1} \partial \alpha} dF(l) + \frac{\partial c_{P,t+1}}{\partial q_{t+1}} \Big|_{l_{h,t+1}} f(l_{h,t+1}) < 0, \end{aligned}$$

where the first inequality is got by $\frac{\partial c_{G,t+1}}{\partial q_{t+1}} \leq \frac{\partial c_{P,t+1}}{\partial q_{t+1}} \Big|_{l_{G,t+1}} < 0$, and the second inequality also by $\frac{\partial^2 c_{P,t+1}}{\partial q_{t+1} \partial \alpha} > 0$. So we have

$$\frac{\partial q_{t+1}^*}{\partial \alpha} = -\frac{\partial LHS}{\partial \alpha} / SOC < 0,$$

that is, the optimal legal quality is lower when α is higher. Similarly, since the marginal gain of improving legal system decreases in α , the investment in legal system starts later. Furthermore, in each period the legal quality is also lower not only because α is higher, but also because the previous legal quality is also lower.

6. Proof for Proposition 3.

The FOC is $\pi'_{FP}(q_{t+1}^E) + \pi'_{IP}(q_{t+1}^E) - C_1(q_{t+1}, q_t)k_t^{-1} \leq 0$. Since the marginal gain is smaller than that in the mobile society, the optimal choice q_{t+1}^E is lower than q_{t+1}^* at any period $t \geq T_{0E}$. The first period the equality holds is T_{0E} , which is uniquely determined by

$$k_{T_{0E}-1} = [\pi'_{FP}(q_{T_{0E}}^E) + \pi'_{IP}(q_{T_{0E}}^E)]^{-1} C_1(q_{T_{0E}}, 0).$$

It is easy to check $T_{0E} > T_0$. If $q_{T_{0E}}^E < q_{T_0}^*$, then $T_{0E} > T_0$ is true since

$$\begin{aligned} k_{T_{0E}-1} &> [\pi'_{FP}(q_{T_0}^*) + \pi'_{IP}(q_{T_0}^*)]^{-1} C_1(q_{T_0}^*, 0) \\ &> [\pi'_{FG}(q_{T_0}^*) + \pi'_{FP}(q_{T_0}^*) + \pi'_{IP}(q_{T_0}^*)]^{-1} C_1(q_{T_0}^*, 0) = k_{T_0-1}. \end{aligned}$$

If $q_{T_{0E}}^E \geq q_{T_0}^*$, then $q_{T_{0E}}^E$ must be achieved at some later time T'_0 than T_0 in the mobile society, where $T'_0 < T_{0E}$ holds since

$$\begin{aligned} k_{T'_0-1} &= [\pi'_{FG}(q_{T_{0E}}^E) + \pi'_{FP}(q_{T_{0E}}^E) + \pi'_{IP}(q_{T_{0E}}^E)]^{-1} C_1(q_{T_{0E}}^E, 0) \\ &< [\pi'_{FP}(q_{T_{0E}}^E) + \pi'_{IP}(q_{T_{0E}}^E)]^{-1} C_1(q_{T_{0E}}^E, 0) = k_{T_{0E}-1}. \end{aligned}$$

So $T_{0E} > T'_0 > T_0$ is true. Again $T_{0E} > T_0$ holds.

7. Proof for Proposition 4.

(1) When $q_{t+1} \leq q_*$, the elites use IP while others IG so that $V(l_{e,t}) = V_{0P}(l_{e,t})$ and

$$\begin{aligned} E(V_{t+1}) &= V \equiv \int_{l_*}^a V_{0P} dF(l) + V_{0G} F(l_*) \\ &= \frac{\rho l_* (1 - F(l_*))}{(1 - \delta \rho)} + \frac{(1 - \rho)}{(1 - \delta \rho)(1 - \delta)} \int_{l_e}^a l dF(l) + \frac{l_* F(l_*)}{1 - \delta}. \end{aligned}$$

Then (12) becomes $V_{0P}(l_{e,t}) = V$, which boils down to

$$l_{e,t} = l_e \equiv l_* F(l_*) + \int_{l_*}^a l dF(l).$$

Based on this equation we get

$$\frac{\partial l_e}{\partial \alpha} = -F(l_*) - l_* f(l_*) + l_* f(l_*) = -F(l_*) < 0.$$

The elite has higher economic power than others when

$$\int_{l_e}^a V_{0P} dF(l) - \int_{l_*}^{l_e} V_{0P} dF(l) - V_{0G} F(l_*) \geq 0 \Leftrightarrow \int_{l_e}^a V_{0P} dF(l) - \frac{1}{2} V \geq 0$$

holds, where $\int_{l_e}^a V_{0P} dF(l) = \frac{\rho l_* (1 - F(l_e))}{(1 - \delta \rho)} + \frac{(1 - \rho)}{(1 - \delta \rho)(1 - \delta)} \int_{l_e}^a l dF(l)$. This condition implies that, for two societies with the same mean V , the one with a higher inequality in l distribution (where $\int_{l_e}^a l dF(l)$ is higher) has a higher probability of elite ruling. The LHS of the above inequality increases in α because

$$\begin{aligned} \frac{\partial LHS}{\partial \alpha} &= \int_{l_e}^a \frac{\partial V_{0P}}{\partial \alpha} dF(l) - \int_{l_*}^{l_e} \frac{\partial V_{0P}}{\partial \alpha} dF(l) + 2V_{0P}(l_e) f(l_e) \\ &= \frac{(1 - \rho)}{(1 - \delta \rho)(1 - \delta)} [1 - 2F(l_e) + F(l_*)] + 2V_{0P}(l_e) f(l_e) > 0, \end{aligned}$$

where the second equality holds due to $\frac{\partial V_{0P}}{\partial \alpha} = \frac{(1-\rho)}{(1-\delta\rho)(1-\delta)}$, and the inequality holds when $1 - 2F(l_e) + F(l_*) > 0$, which is true under broad conditions.

(2) When $q_{t+1} > q_*$, we assume w.l.o.g. $l_{e,t} \leq l_{h,t+1}$ so that the elites include players whose children use both IP and FP. Then $l_{e,t}$ is uniquely determined by

$$V_P(l_{e,t}) - c_P(l_{e,t}, q_{t+1}^E) = \pi_{FG}(q_{t+1}^*) + \pi_{FP}(q_{t+1}^*) + \pi_{IP}(q_{t+1}^*),$$

where the LHS strictly increases in $l_{e,t}$ while the RHS is independent of it. By the implicit function theorem

$$\frac{\partial l_{e,t}}{\partial \alpha} = -\frac{\partial(V_{P,t+1} - c_{P,t+1})/\partial \alpha - \partial E(V_{t+1})/\partial \alpha}{\partial[V_P(l_{e,t}) - c_{P,t+1}]/\partial l_{e,t}} < 0,$$

since

$$\begin{aligned} \frac{\partial E(V_{t+1})}{\partial \alpha} &= \int_{l_{G,t+1}}^a \frac{\partial(V_{P,t+1} - c_{IP,t+1})}{\partial \alpha} dF(l) + \int_{l_{G,t+1}}^{l_{h,t+1}} \frac{\partial c_{IP,t+1} - \partial c_{P,t+1}}{\partial \alpha} dF(l) \\ &< \frac{\partial(V_{P,t+1} - c_{IP,t+1})}{\partial \alpha} \end{aligned}$$

due to $1 - F(l_{G,t+1}) < 1$ and $\frac{\partial c_{IP,t+1} - \partial c_{P,t+1}}{\partial \alpha} = \frac{bQ_c}{\delta} \frac{\partial c_{P,t+1}}{\partial \alpha} + \frac{bQ_q}{\delta} \frac{\partial q_{t+1}}{\partial \alpha} < 0$.

The elites have dominant economic power when $\int_{l_{e,t}}^{l_{h,t+1}} (V_P - c_{P,t+1}) dF(l) + \int_{l_{h,t+1}}^a (V_P - c_{IP}) dF(l) \geq \frac{1}{2} E(V_{t+1})$, which is

$$\int_{l_{h,t+1}}^a (V_P - c_{IP}) dF(l) + \int_{l_{e,t}}^{l_{h,t+1}} (V_P - c_{P,t+1}) dF(l) - \int_{l_{G,t+1}}^{l_{e,t}} (V_P - c_{P,t+1}) dF(l) - F(l_{G,t+1})(V_G - c_{G,t+1}) \geq 0.$$

Again the LHS increases in α since

$$\begin{aligned} \frac{\partial LHS}{\partial \alpha} &= \int_{l_{h,t+1}}^a \frac{\partial(V_P - c_{IP,t+1})}{\partial \alpha} dF(l) + \int_{l_{e,t}}^{l_{h,t+1}} \frac{\partial(V_P - c_{P,t+1})}{\partial \alpha} dF(l) \\ &\quad - \int_{l_{G,t+1}}^{l_{e,t}} \frac{\partial(V_P - c_{P,t+1})}{\partial \alpha} dF(l) - 2f(l_{e,t})(V_P - c_{P,t+1}) \frac{\partial l_{e,t}}{\partial \alpha} \\ &\geq [1 - 2F(l_{e,t}) + F(l_{G,t+1})] \frac{\partial(V_P - c_{P,t+1})}{\partial \alpha} \Big|_{l_{e,t}} - 2f(l_{e,t})(V_P - c_{P,t+1}) \frac{\partial l_{e,t}}{\partial \alpha} > 0, \end{aligned}$$

given that $\frac{\partial V_{0P,t+1}}{\partial \alpha_{t+1}}$ is independent of l while $\frac{\partial(V_P - c_{P,t+1})}{\partial \alpha}$ decreases in l , $\frac{\partial l_{e,t}}{\partial \alpha} < 0$, and when $1 - 2F(l_{e,t}) + F(l_{G,t+1}) \geq 0$ is true, which holds under broad conditions.

The LHS decreases in q_t when

$$\int_{l_{e,t}}^{l_{h,t+1}} \frac{-\partial c_{P,t+1}}{\partial q_t} dF(l) < [F(l_{h,t+1}) - F(l_{e,t})] \frac{-\partial c_P(l_{e,t}, q_{t+1}^E)}{\partial q_t} < \frac{1}{2} \frac{\partial E(V_{t+1})}{\partial q_t}$$

holds, where the first inequality holds because $\frac{-\partial c_{P,t+1}}{\partial q_t}$ decreases in l . Since $F(l_{h,t+1}) < 1 < \frac{1}{2} + F(l_{e,t})$, a sufficient condition for the second inequality to hold is $\frac{-\partial c_P(l_{e,t}, q_{t+1}^E)}{\partial q_t} \leq \frac{\partial E(V_{t+1})}{\partial q_t}$ where the average gain from a higher legal quality is larger than that of the bottom elite player with $l_{e,t}$, which is true under broad conditions.