Endogenous Institutional Selection, Building Trust, and Economic Growth

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Abstract

Private-order market institutions founded on trust-based relational contracts suffer adverse selection and moral hazard problems, while public-order market institutions have a limited capacity to enforce contracts. We model agent selection between contract enforcement institutions and demonstrate that the state's contract enforcement capacity is complementary to private-order contract enforcement institutions. This suggests that improvements to public-order institutions cause the accumulation of trust and result in economic growth in both institutions. We discuss the robustness of our findings to different political institutions. Our predictions are illustrated by regressing generalized trust against proxies for public-order contract enforcement capacity.

1 Introduction

Economic relationships between agents can be governed either by formal contracts enforced by sovereign states or relational contracts that provide incentives through the value participants place on future interactions with the counter-party.[1] When agents commence a relational contract with an unknown partner, each party faces an adverse selection problem if potential partners vary in their ability to sustain an agreement.[2] An agent is *trustworthy*

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[1]In this paper we do not discuss the role that non-state organizations might play in enforcing contracts (e.g. trade groups or criminal organizations).

[2]A firm has a relative advantage at maintaining a relational contract if (for example) the firm has stable management committed to long run profits, can commit to maintaining a presence in a market, and does not suffer from shocks to cost or demand that make moral hazard tempting.

if she is capable of resisting the temptation of moral hazard, and we define the level of *generalized trust* in an economy as the probability that an unknown partner withstands such a temptation and fulfills a relational contract in equilibrium.[3] Trustworthiness is a property of preferences innate to the agent, while generalized trust is an endogenous belief about the behavior of others generated by the equilibrium interaction of individual preferences and the institutional structure of the economy.

A *public-order institution* is a third party enforcement mechanism[4] comprised of politicians who establish the laws defining the class of enforceable public-order agreements, auditors who monitor for verifiable evidence of breach of contract, and legal professionals that file claims against agents who have broken a formal contract. A contractual relationship may exceed the state's enforcement capacity because features of the contract are not verifiable by the court (e.g., bonus payments based on nonverifiable events), the court does not have sufficient expertise to determine when a breach of contract has occurred and who executed the breach,[5] or the contract requires terms that are forbidden by the legal system (e.g., forced labor contracts). Public-order contract institutions can be improved through legislative action, changes in the interpretation of existing law by the judicial system, alterations to the regulatory structure of the economy, and the elimination of corrupt elements of the public-order regime.[6]

Private-order institutions refer to monitoring technologies, punishment and reward mechanisms, and beliefs and social norms that allow for self-enforcing relational contracts between agents to take costly actions incentivized by the shadow of the future. For example, two firms could agree to engage in profitable joint production without a formal contract if violating the contract would cause reputational damage that forecloses future profitable interactions with the counterparty. We assume that any contract can be written in the private-order institution, but these informal agreements must be equilibria of a contracting

[3]Treating survey respondents' answers to questions measuring generalized trust as expressions of beliefs about the typical behavior of others is supported by the experimental results of Sapienza et al. [34]. Trust defined in this sense is one of the avenues through which social capital encourages economic growth (Knack and Keefer [23]).

[4]A third party enforcement mechanism is one in which contractual completion is incentivized (potentially through the threat of force) by an agent not party to the agreement.

[5]The United States Court of Appeals for the Federal Circuit (CAFC) was established to build patent enforcement expertise within U.S. legal institutions. Prior to the establishment of the CAFC in 1982, patents were rarely enforceable in court and sharing of intellectual property could only be accomplished through private-order institutions. The reform of the US patent law system represents an improvement to the set of public-order contracts available to intellectual property holders.

[6]Some of these examples are discussed informally in North [32].

game.

The critical feature of our model is that agents can choose the institution used to enforce their contracts. Examples include:

- A principal can write a simple, inefficient contract with an agent that is enforceable by the court. Alternatively, the principal can employ an efficient relational contract that cannot be enforced by the public-order institution.[7]

- Firms can engage in intranational trade and rely on public-order legal infrastructure for contract enforcement. Firms could also engage in international trade and use private-order relationships to compensate for weak or biased enforcement of international contracts (Woodruff [41]).

- Firms in transitional and developing economies could enforce trade agreements with corrupt or ineffective public-order regimes. However, informal institutions provide an alternative means of enforcement (McMillan [30]).

- In medieval times international trade was conducted with simple debt contracts (Williamson [40]). More complex, profitable principal-agent relationships were enforced via relational contracts (Greif [18], [19]).

Agents who break a relational contract are forced to conduct future business either with different partners or through formal contracts enforced by a state. If the state becomes capable of enforcing more profitable contracts, then the outside option for agents in a relational contract is improved and the incentives to maintain a relational contract weaken. This suggests that the contract enforcement institutions are substitutes for one another and that marginal improvements to public-order institutions may reduce the effectiveness of private-order institutions and potentially cause a welfare loss. This logic suggests that building or reforming public order institutions is best executed with a risky, one-time "Big Push" rather than a series of incremental steps.

The goal of this paper is to highlight selection of agents into contract enforcement institutions as a channel through which parallel institutions may serve as complements for one another. As the public-order institution becomes more efficient, agents that are

[7]Bernheim and Whinston [5], Baker et al. [3], Levin [28], and Fuchs [15] analyze cases where relational contracts may act as a complement to incomplete public-order contracts. The conclusions of these models are orthogonal to the institutional selection issues addressed herein.

incapable of fulfilling a self-enforcing contract in the private-order institution select into the public-order. The selection of untrustworthy agents out of the private-order institution ameliorates the adverse selection problem facing trustworthy agents in that institution and increases generalized trust. However, public-order institutions are an outside option for agents that break private-order contracts, and as this outside option improves the moral hazard problem in the private-order institution worsens and cooperative behavior may decrease. We use our model to explore the relative force of the moral hazard and adverse selection effects of institutional selection and demonstrate that the reduction of the adverse selection problem is more powerful than the increasing temptation of moral hazard, which implies that private- and public-order contract enforcement institutions are complements.

For the level of generalized trust in an economy to increase, either the average agent in the economy must become more trustworthy or the institutions of the economy must discourage agents that are not trustworthy from participating in relational contracts. In prior work, Tabellini [37] and Francois and Zabojnik [13] model the intergenerational transmission of norms for cooperation, which exemplifies the first channel for increasing trust in an economy. Our work suggests that improvements to public-order institutions can encourage the growth of trust through the second channel, which implies that trust can be increased and economic outcomes improved on much shorter time scales.[8] Furthermore (and unlike in Tabellini [37]), all agents have an incentive to support the strengthening of the public order institution, which makes our predictions robust to a wide array of assumptions regarding the political economy of institutional change.

The social capital literature argues that measures of generalized trust are a determinant of economic growth (Knack and Keefer [23]). Our model suggests that when the interaction between private and public-order institutions is endogenized the causality may be reversed: increases in public-order efficiency cause social capital (i.e., generalized trust) to accumulate and act as a multiplier of the effect of improvements to the public-order institutions. We illustrate this prediction by regressing generalized trust as measured by the 2005 World Values Survey against a number of proxies for the efficiency of public-order institutions.

Of course much is left out of our model. We provide a model of the public sector institution that omits issues such as the potential for a corrupt or otherwise poorly incentivized public-order institution. Moreover, we abstain from addressing the difference between contract enforcement and property rights. While we believe that all of these factors are

[8] Neither of these works addresses the effects of these complementarities on economic growth.

important, they largely pertain to the question of what makes public-order institutions effective. The primary point of our model is that improvements to public-order institutions need not harm private-order institutions.

Section 2 discusses our work in relation to the existing literature, and section 3 describes the model. Section 4 analyzes the effect of institutional selection on the contract enforcement institutions and discusses the political economy of changing the state's enforcement capacity. We illustrate our model in section 5 using data on generalized trust and public-order efficiency, and section 6 concludes. Appendices A and B analyze alternative formulations of the model.

2 Related Literature

The focus of this project is on the endogenous selection between public- and private-order enforcement institutions on the level of trust within an economy. Most prior works either do not assume heterogeneity amongst the agents (and so selection is a moot point), do not allow for selection at all, or assume that the assignment of agents to each institution is exogenous.

Kranton [24] provides a model wherein agents can conduct exchange in either a formal market institution with fiat money or in an informal institution based on reciprocal exchange. Kranton finds that the institutions exert negative externalities on each other - in other words, the institutions are substitutes. Moreover, Kranton emphasizes that selection can cause path-dependence in the economy that results in inefficient market institutions. From the stand-point of development economics, this implies a "Big Push" development policy that builds up the efficient institution and undermines the inefficient alternative. In other words, the parallel institutions cannot grow together, which is one of the important implications of our model.

Kvaloy and Olsen [22] study a model of relational contracts that exist within the shadow of enforcement by the public-order. Unlike other works, Kvaloy and Olsen [22] model a situation where the agents can make a contract more complete by exerting effort, and the public-order institution finds it easier to enforce more complete contracts. The article points out that the effect on economic efficiency of changes to the public-order can be ambiguous and depends on the technology defining how contracts are completed.

The closest works to our study are Tabellini [37] and Francois and Zabojnik [13]. Both of these papers emphasize the positive externalities generated by trustworthy agents, study the role of socialization in encouraging agents to internalize norms for cooperative behavior, and operate on an intergenerational time scale. Neither paper allows for reputational effects, so what we refer to as a private-order institution cannot exist within their framework.[9] Our study emphasizes the power of effective institutional reform to enhance the efficiency of private-order institutions over short periods of time, whereas the intergenerational time frame of these earlier works cautions against attempts at rapid institutional change.

Dixit [9] analyzes a model of public- and private-order enforcement systems working in parallel wherein the public-order enforcement system is capable of perfectly enforcing any contractual agreement once the fixed cost of implementing the public-order is paid.[10] Prior to the establishment of a public-order institution, contracts can only be enforced through the private-order institution. Because of the nature of the public-order institution studied, Dixit cannot analyze the equilibrium effect of gradual improvements in the contract enforcement capacity of the public-order institution.

Sobel [36] provides a model of the interaction of reputational mechanisms with a costly legal system. The focus of the analysis is on the impact of changes in the cost effectiveness of the legal system on the form of long-run relationships in the economy. Adverse selection and the evolution of the form of the relational contract as the public-order institution changes, the focus of our analysis, are not included in Sobel's model.

Baker et al. [4] provides a model of relational and formal contracting between firms. The focus of this work is how the choice to integrate can influence the relative effectiveness of these contractual forms, whereas our work focuses on how changes in one institution influences outcomes in the other.

A number of papers have provided case studies of private-order institutions. Examples include judges at the medieval Champagne fairs (Milgrom et al. [31]), criminal organizations (Dixit [8] and [10], Leeson [27]), reputation building over time (Ghosh and Ray [16], Kranton [24], Watson [39]), trade associations in modern countries (Woodruff [41]), the community responsibility system (Greif [19]), firms in eastern Europe and former Soviet

[9] The notion of trust modeled by Tabellini [37] and Francois and Zabojnik [13] is similar to the trust-as-altruism results found in an experimental setting by Ashraf et al. [2]. It remains an open question whether such behavioral preferences could support agreements of significant size or impersonal agreements between firms.

[10] The system analyzed by Dixit bears a resemblance to Li [29], which characterizes relational contracts as low fixed cost, high marginal cost enforcement institutions and public-order contracts as high fixed cost, low marginal cost institutions.

states (Johnson et al. [21]), the New York Diamond Dealer's Club (Bernstein [6]), and the Maghribi traders' coalition (Greif [18]).

3 Model

We model the economy as a repeated game with periods indexed $t \in \{1, 2, ...\}$. There are two types of agents in the economy: untrustworthy, myopic agents ($\delta = 0$) and trustworthy, farsighted agents ($\delta \in (0, 1)$). An agent's type is private information and not observable by other agents. We assume that a measure one continuum of trustworthy agents participates in the economy along with a much larger set of untrustworthy agents.[11] If an agent's utility in period t is denoted u_t, the agent discounts future utility using intertemporal utility function

$$(1 - \delta) \sum_{\tau=0}^{\infty} \delta^{t+\tau} u_{t+\tau}$$

Although we model the untrustworthy agents as completely myopic, we only require that the untrustworthy agents be less willing or less capable of fulfilling relational contracts than the trustworthy agents. Other modeling choices that would yield qualitatively similar predictions include heterogeneity with regard to the time discount factor (but not total myopia) or to have the untrustworthy agents periodically suffer exogenous shocks to their payoffs that make fulfilling their relational contracts no longer incentive compatible. While these alternative assumptions yield qualitatively similar results, the analysis of the model would become significantly more complex.

Agents are either *matched* or *unmatched* at the beginning of each period. Unmatched agents have the choice at the beginning of the period as to whether to enter either the public- or private-order institution. How the remainder of the period unfolds for an unmatched agent depends on which institution is chosen. Matched players in the private-order institution know the complete history of their interaction with their current partner and play the prisoner's dilemma game described below using the value of a chosen at the beginning of the match.

Agents who choose to enter the private-order institution are randomly and uniformly pairwise matched in subperiod 1 with other unmatched agents who entered this institution.

[11] The ratio of trustworthy to untrustworthy agents in the private-order institution is endogenous. Our choice to have an unbounded set of untrustworthy agents is a technical device that relieves us of needing to consider corner solutions in our model of selection between the institutions.

We assume that agents are never matched with a previous partner. The fraction of trustworthy agents in the pool of unmatched agents is denoted γ and is determined endogenously in equilibrium by the free entry of agents into the private-order institution. We interpret γ as a measure of generalized trust that describes the probability that counterparties fulfill their agreements.

In subperiod 2, newly matched players (with a generic matched pair denoted i and j) announce contract sizes a_i and a_j. The contract size used throughout agents i and j's interaction is $a = \min\{a_i, a_j\}$. We interpret the action a as a relationship specific investment that is fixed for the duration of the partnership. In subperiod 3, the agents play the prisoner's dilemma game described below by independently and simultaneously choosing to cooperate, $c_j^t = 1$, or defect, $c_j^t = 0$.

	$c_j^t = 1$	$c_j^t = 0$
$c_i^t = 1$	$v(a), v(a)$	$l(a), d(a)$
$c_i^t = 0$	$d(a), l(a)$	$0, 0$

Untrustworthy, myopic agents take actions to maximize present period utility and in equilibrium defect from all relational contracts.

Finally, in subperiod 4 agents i and j choose whether to remain matched next period or re-enter the pool of unmatched agents. The choice to remain matched must be unanimous or both agents enter the pool of unmatched agents. We assume that with probability $1 - \rho \in (0, 1)$ the relationship of two matched agents fails and both agents are forced into the pool of unmatched agents regardless of their intention to stay matched.

The prisoner's dilemma game concisely captures the moral hazard problem facing the agents. We assume that $v(\cdot), l(\cdot)$, and $d(\cdot)$ are differentiable functions. Let $v'(a) > 0$ and $v''(a) \leq 0$. To capture the salient features of the prisoner's dilemma stage game, we let defection from the agreement yield $d(a) > v(a)$ for the defector and $l(a) < 0$ for the partner. For mathematical regularity we require $d'(a) > 0$, $l'(a) < 0$, $l''(a) < 0$ and that $d'(0)$ and $l'(0)$ be bounded. We also assume that $d'(a) > v'(a)$, which implies that the returns to defection (relative to cooperation) are increasing in the size of the contract. We let $a = 0$ denote a state of no economic activity wherein $v(0) = d(0) = l(0) = 0$.

Agents who choose to enter the public-order institution are randomly and uniformly pairwise matched in subperiod 1 with other agents who entered this institution. As in the private-order institution, each agent in the public order institution chooses a contract size in period 2 and plays the prisoner's dilemma game with their assigned partner in period 3. However, if either agent chooses to defect in subperiod 3 (i.e., chooses $c_i^t = 0$), either agent in the pair can submit verifiable evidence of the defection to the sovereign state in subperiod 4. In this event, the sovereign state can enforce a transfer of up to $P > 0$ utils from the agent who chose $c_i^t = 0$ to the other party.[12] The punishment, P, indexes the contract enforcement capacity of the public-order institution. All pairs in the public-order institution are broken at the end of the period.

The focus of our analysis is how increases in P affect the welfare of participants in both the public- and private-order institution. Increasing values of P correspond to improvements in the legal institutions of the economy with examples including:

- Establishment and enforcement of concepts such as *fiduciary duty* and *duty of care* that define verifiable standards that prevent satisfying a contract in a perfunctory fashion.

- Actions taken by the agents or the state to enhance the ability of courts to verify each agent's action (Kvaloy and Olsen [22]).

- Common interpretations of contracts that prevent agents from taking advantage of contractual incompleteness.

- Removal of corrupt officials that might allow a party to a contract to escape his or her legal obligations.

- Consistent legal norms and practices that prevent forum shopping, which adds uncertainty to the contract enforcement process.

4 Analysis

We analyze strategies where all of the trustworthy agents select into the private order institution and only some of the untrustworthy agents enter the private order institution. Since we focus on stationary equilibria, the agents maintain their choice of institution in all periods. In the private order institution, we assume that once a relationship has been betrayed, both partners re-enter the pool of unmatched agents in the private order

[12] If both agents defect, the transfers net out to 0.

institution. Agents do not change their future behavior (either the contract sizes proposed or their choice of public or private order institution) as a result of past betrayals.

When the agents choose the contract size for their one-shot interaction, they must account for their partner's incentive to defect. The problem of the agents in the public-order institution when they choose their contract size is

$$G = \max_{a_G \in \mathbb{R}_+} v(a_G) \text{ such that } v(a_G) \geq d(a_G) - P \tag{4.1}$$

We focus our analysis on the payoff maximizing contract size, a_G^*, that satisfies the incentive compatibility constraint of equation 4.1.[13] Noting that $d(a_G) - v(a_G)$ is monotone increasing in a_G, in a payoff-maximizing equilibrium of this game

$$d(a_G^*) - v(a_G^*) = P$$

All agents find it incentive compatible to cooperate given contract size a_G^*. Furthermore, a_G^* is strictly increasing in P, which in turn implies that $G = v(a_G^*)$ is strictly increasing in P.

The efficiency of self-enforcing contracts used in the private-order institution is parameterized by $a \in \mathbb{R}_+$. The Pareto optimal self-enforcing contract offered by trustworthy agents in the private-order institution solves the **Full Institutional Selection Problem** (FISP) presented below. In any equilibrium, myopic agents in the private-order institution defect in every period. We consider equilibria wherein trustworthy agents cooperate with matched partners and choose to sever matches if their partner defects at any point in time.[14]

The solution to the FISP maximizes the payoffs of the unmatched trustworthy agents in equilibrium. Since the unmatched trustworthy agents are the actors who choose the contract size for successfully matched trustworthy pairs of agents, the preferences of these unmatched trustworthy agents is a natural point of reference for defining the objective function of our model. This is also the only equilibrium proof against pairwise deviations

[13]This is the only public-order contract immune to pairwise deviations by matched partners.

[14]The issue of equilibrium existence is trivial in our model. Consider the equilibrium where all agents select into the public-order institution on the equilibrium path. This is supported in equilibrium by all agents offering $a = 0$ if they select into the private-order institution and the off-path-belief that all agents in the private-order institution are untrustworthy. This describes a (weakly) inefficient equilibria for all G, and the unique equilibrium once moral hazard causes the private-order institution to collapse.

of the newly matched partners.[15] Denote the largest maximizer of FISP as a^*.

$$\max_{a\in\mathbb{R}_+} W(a;\gamma) = \max_{a\in\mathbb{R}_+} \gamma\left[(1-\delta)v(a) + \delta\left(\rho V(a;\gamma) + (1-\rho)W(a;\gamma)\right)\right] + \\ (1-\gamma)\left[(1-\delta)l(a) + \delta W(a;\gamma)\right] \tag{FISP}$$

such that

$$\begin{aligned} V(a;\gamma) &= (1-\delta)v(a) + \delta\left[\rho V(a;\gamma) + (1-\rho)W(a;\gamma)\right] \geq \qquad \text{(IC1)} \\ &\quad (1-\delta) * d(a) + \delta W(a;\gamma) \\ W(a;\gamma) &\geq (1-\delta)\gamma d(a) + \delta W(a;\gamma) \qquad \text{(IC2)} \\ W(a;\gamma) &\geq G \qquad \text{(LRIC)} \\ \gamma d(a) &\geq G \qquad \text{(SRIC)} \end{aligned}$$

The objective function, $W(a;\gamma)$, captures two possible outcomes of a matching. First, the trustworthy agent is matched with a trustworthy partner with probability γ, which earns the agent a current payoff of $(1-\delta)v(a)$ and a continuation payoff of

$$\delta\left(\rho V(a;\gamma) + (1-\rho)W(a;\gamma)\right)$$

where $W(a;\gamma)$ is the value function for unmatched trustworthy agents and $V(a;\gamma)$ is the value function for matched trustworthy agents. The second possible outcome is that the trustworthy agent is matched with an untrustworthy partner, which earns a current period payoff of $(1-\delta)l(a)$ and a continuation value of $\delta W(a;\gamma)$.

IC1 requires that matched trustworthy agents prefer to remain in a matched pair at contract level a^* to defecting and re-entering the pool of unmatched agents. IC2 requires that unmatched trustworthy agents prefer to try to match with another trustworthy agent to defecting and remaining in the pool of unmatched agents. The LRIC condition captures the selection problem facing the trustworthy agents.[16] If the trustworthy players cannot make more profits through cooperation in the private-order institution than by entering the public-order system, then the private-order institution will collapse as all agents opt to use the public-order contract enforcement institution.

[15] Appendix A analyzes the more complex problem wherein the objective function is the payoff of the matched trustworthy agents.

[16] "LR" refers to "Long Run," whereas "SR" refers to "Short Run."

The SRIC can be thought of as a market clearing condition that determines the endogenous level of generalized trust, $\gamma^*(G)$. The SRIC condition captures the incentive constraint of the untrustworthy agents and mediates selection between the institutions. The untrustworthy agents choose to enter the private-order institution if and only if the expected payoff from defecting against an unmatched trustworthy agent is greater than the payoff from a public-order contract.

The interpretation of SRIC as a market clearing condition makes transparent that our analysis of selection between the institutions does not rely on the details of the game played in either institution. Selection is determined by the endogenous equalization of the payoffs for the untrustworthy agents, however these payoffs are generated, of participating in each contract enforcement institution. For example, if we allowed agents within the private-order institution to build-trust over time as in (for example) Ghosh and Ray [16] or Watson [39], then the payoffs of the myopic agents in the private-order institution would be more complex, but a market clearing condition would still determine selection between the institutions. Moreover, the basic results we find below regarding the positive externality the public-order institution provides the private-order institution would continue to hold. We assume throughout that SRIC binds, which is equivalent to assuming the existence of untrustworthy potential entrants to the private-order institution for all G.[17]

The endogenous variables G, $\gamma^*(G)$ and $a^*(G)$ define the equilibrium outcomes of our model. $\gamma^*(G)$ is our metric of generalized trust in the economy. To see this, note that high values of $\gamma^*(G)$ signify that a larger fraction of the contracts in the private-order institution yield cooperative outcomes.[18] The equilibrium contract size, $a^*(G)$, is our metric for the economic development of the private-order institution. As we will see in our comparative statics analysis, $a^*(G)$ increases with G, which implies that the development of the public- and private-order institutions is complementary.

Our first step of analysis is to simplify the constraints.

Lemma 1. *IC2 implies IC1.*

[17] We show in Proposition 2 that the measure of untrustworthy agents selecting into the private-order institution decreases with G. If we assumed a fixed measure of untrustworthy agents β, then there would exist $\underline{G}$ such that

$$\frac{\beta}{1+\beta} > \gamma^*(\underline{G})$$

For any $G \leq \underline{G}$ we would have $(a^*(G), \gamma^*(G)) = (a^*(\underline{G}), \gamma^*(\underline{G}))$.

[18] All of the contracts in the public-order institution yield cooperative outcomes in the sense that third-party enforcement incentivizes agents to adhere to their agreements.

Proof. To see that IC2 implies IC1, note that IC2 can be written

$$\gamma\left[V(a;\gamma)\right]+(1-\gamma)\left[(1-\delta)l(a)+\delta W(a;\gamma)\right]\geq(1-\delta)\gamma d(a)+\delta W(a;\gamma)$$

Simplifying yields

$$\gamma\left[V(a;\gamma)-(1-\delta)d(a)-\delta W(a;\gamma)\right]+(1-\gamma)(1-\delta)l(a)\geq 0$$

Note that IC1 implies

$$V(a;\gamma)-(1-\delta)d(a)-\delta W(a;\gamma)\geq 0$$

and by definition we have $l(a)\leq 0$. Therefore, a failure of IC1 implies a failure of IC2. By contraposition, IC2 implies IC1. □

Lemma 2. *IC2 and SRIC imply LRIC. If SRIC holds with equality, then SRIC and LRIC imply IC2.*

Proof. Consider IC2

$$W(a;\gamma)\geq\gamma(1-\delta)d(a)+\delta W(a;\gamma)$$

This can be simplified to

$$W(a;\gamma)\geq\gamma d(a)\geq G$$

where the last inequality follows from SRIC. Therefore IC2 and SRIC imply LRIC.

To see the second part of our proposition, note that if SRIC holds with equality we have from LRIC

$$W(a;\gamma)\geq G=\gamma d(a)$$

Reversing the simplification above transforms this into IC2. □

We can write the simplified **Institutional Selection Problem** (ISP) as

$$\begin{aligned}\max_{a\in\mathbb{R}_+} W(a;\gamma) & \qquad \text{such that} & \\ W(a;\gamma) \;\;&\geq\;\; G & \text{(LRIC)}\\ \gamma * d(a) \;\;&=\;\; G & \text{(SRIC)}\end{aligned}$$

For sufficiently large G, the only values of $(a^*(G),\gamma^*(G))$ that satisfy SRIC cause a moral hazard problem for the trustworthy agents that destroys the possibility for cooperation even amongst the trustworthy agents in the private-order institution. At this point unmatched trustworthy agents will select into the public-order institution. Agents will continue to participate in the private-order institution only so long as a preexisting match continues and, asymptotically, all of the agents will select into the public-order institution. This is summarized in the following proposition.

Proposition 1. *Suppose* $\lim_{a\to\infty} -\frac{l(a)}{d(a)} < \infty$. *Then there exists* $\overline{G} < \infty$ *such that for all* $G > \overline{G}$ *all unmatched agents select into the public-order institution.*

Proof. We will prove that equilibrium values of $W(a;\gamma)$ are bounded, and it follows that there exists $\max_{(a,\gamma)} W(a;\gamma) \leq \overline{G}$ and LRIC cannot be satisfied for $G > \overline{G}$. Note that

$$W(a;\gamma) \leq \gamma \frac{v(a)}{1-\delta\rho} + (1-\gamma)l(a)$$

From the SRIC condition we have in equilibrium

$$W(a;\gamma) \leq \frac{G}{1-\delta\rho}\frac{v(a)}{d(a)} + l(a) - G\frac{l(a)}{d(a)}$$

Noting that $l(a) < 0$, $\lim_{a\to\infty} -\frac{l(a)}{d(a)} \leq c$, $\lim_{a\to\infty} \frac{v(a)}{d(a)} < \infty$ since $v(a) \leq d(a)$, and that $v(a)$, $l(a)$, and $d(a)$ are continuous, we have that $W(a;\gamma)$ is bounded in equilibrium. □

It is obvious that for $\delta, \rho > 0$ sufficiently large and $G > 0$ sufficiently small that we have participation in the private-order institution. We now provide a comparative static result on contract efficiency within this regime, but we require that matched pairs of agents are not exogenously separated with high probability relative to the discount factor.[19] Since relational contracts are usually thought of as durable arrangements, we consider the high ρ case to be of interest. We find that $a^*(G)$ is increasing in G, so we conclude that the public- and private-order institutions are complementary - improvements to the public-order institution yield an additional welfare enhancement by increasing the efficiency of contracts in the private-order institution indirectly through the institutional selection channel.[20]

[19]The result may continue to hold for small values of ρ, but in these cases the result will turn on the relative magnitudes of $v'(a)$ and $l'(a)$.

[20]This is similar to Proposition 4 of Ghosh and Ray [16], which implies that an exogenous increase in the fraction of trustworthy agents results in an increase in the payoffs of newly matched agents.

Proposition 2. *For $G < \overline{G}$ and $1 - 2\delta + \delta^2\rho \geq 0$, $(a^*(G), \gamma^*(G))$ are increasing in G*

Proof. First note that

$$\begin{aligned}
W(a;\gamma) &= \left(\frac{1-\delta}{1-\delta\rho} - \delta(1-\gamma)\right)^{-1} (1-\delta)\left(\gamma\frac{v(a)}{1-\delta\rho} + (1-\gamma)l(a)\right) \\
V(a;\gamma) &= \frac{1-\delta}{1-\delta\rho}v(a) + \frac{\delta(1-\rho)}{1-\delta\rho}W(a;\gamma)
\end{aligned}$$

It is straightforward to show that

$$\begin{aligned}
\frac{\partial^2}{\partial\gamma\partial a}W(a;\gamma) &= C^{-2}(1-\delta)\left[\frac{C-\gamma\delta}{1-\delta\rho}v'(a) - (C+\delta(1-\gamma))l'(a)\right] \\
\frac{\partial^2}{\partial a^2}W(a;\gamma) &= C^{-1}(1-\delta)\left(\gamma\frac{v''(a)}{1-\delta\rho} + (1-\gamma)l''(a)\right)
\end{aligned}$$

where

$$C = \frac{1-\delta}{1-\delta\rho} - \delta(1-\gamma)$$

Given $1 - 2\delta + \delta^2\rho \geq 0$, these formulas imply that $\frac{\partial^2}{\partial a^2}W(a;\gamma) < 0$ and $\frac{\partial^2}{\partial\gamma\partial a}W(a;\gamma) > 0$ for sufficiently large ρ and $G \in [0, \overline{G}]$.

Suppose that $\gamma^*(G)$ is increasing in G. From $\frac{\partial^2}{\partial a^2}W(a;\gamma) < 0$ and $\frac{\partial^2}{\partial\gamma\partial a}W(a;\gamma) > 0$, we have that $a^*(G)$ is also increasing in G. Consider the opposite case, wherein $\gamma^*(G)$ is decreasing in G. Then $\frac{\partial^2}{\partial a^2}W(a;\gamma) < 0$ and $\frac{\partial^2}{\partial\gamma\partial a}W(a;\gamma) > 0$ implies $a^*(G)$ is decreasing in G. But this is incompatible with the SRIC, which requires

$$\gamma(G)d(a(G)) = G$$

which is violated if both $(a^*(G), \gamma^*(G))$ are decreasing in G. □

In figure 1 we plot the values of $(a^*(G), \gamma^*(G))$ from a parameterized example.[21] The first panel describes the fraction of the unmatched agents in the private-order institution that are trustworthy, $\gamma^*(G)$, and the second panel draws the equilibrium private-order contract size, $a^*(G)$. The third panel displays the payoffs to the trustworthy agents in the private-order institution who are matched, $V(a^*(G), \gamma^*(G))$, and those trustworthy agents that are unmatched, $W(a^*(G), \gamma^*(G))$. Prior to the collapse of the private-order

[21] We assumed that $v(a) = a$, $d(a) = a + a^2$, and $l(a) = -\frac{1}{2}a^2$.

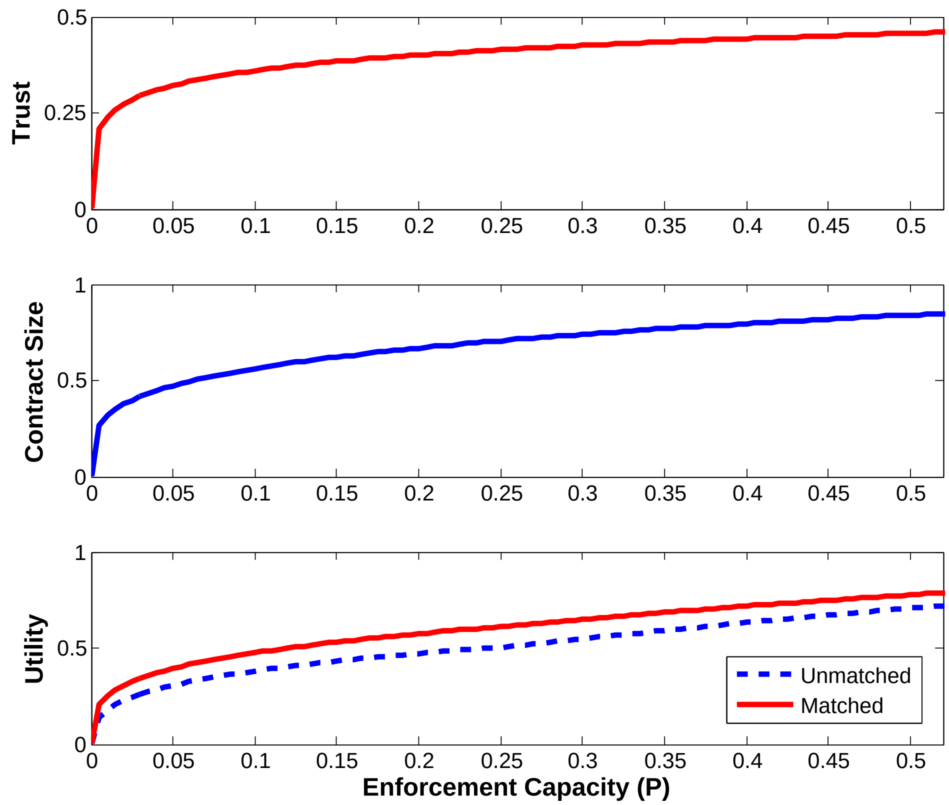

Figure 1: Equilibrium Outcomes

institution ($G \leq \overline{G} = 0.52$) all agents benefit from increasing G. After the private-order institution collapses ($G > \overline{G}$), all unmatched agents enter the public-order institution. Matched agents will remain matched since[22]

$$V(a^*(\overline{G}), \gamma^*(\overline{G})) > W(a^*(\overline{G}), \gamma^*(\overline{G})) = \overline{G}$$

However, once the matches are exogenously ended, the newly unmatched agents immediately select into the public-order institution. The economic implication is that marginal improvements to the public-order institution at high levels of development may put a halt to the formation of new private-order contracts. The trustworthy agents then leave the private-order institution at a rate of $1 - \rho$ per period. Also note that the private-order

[22]Obviously if G is much larger than $\overline{G}$, the following relation will not hold.

institution collapses for $\gamma^*(\overline{G}) < 1$, which implies that positive measures of untrustworthy agents participate in both institutions until the private-order institution collapses.

The political economics of changes in P are particularly simple in our model. Agents in the public-order institution are in favor of increasing P since this directly improves their ability to contract and results in higher payoffs from their one period contracts. Participants in the private-order institution favor increases in P as this relieves the adverse selection problem they face. Therefore as long as the individual, party or coalition that controls the choice of public-order institution is motivated by economic self-interest, the incentives in the economy point towards more developed and effective public-order contracting institutions.[23]

Our model suggests that the improvement of public-order institutions is, in some sense, inevitable, which raises the question of why some countries retain institutional structures that suppress economic growth and generalized trust. One possibility is that improving institutions is a costly and delicate process that must occur gradually - adoption of new institutions may be no easier or rapid than the adoption of new technologies. The notion of *civic capital* captures a static notion of the difficulty of implementing novel institutions in underdeveloped economies (Djankov et al. [12]).

A second explanation is that parties that remain unmodeled in our study could impede institutional progress. For example, political actors might be able to profit through extra-legal means by accepting bribes from firms or skimming from government revenues. If the ability of these agents to reap these profits is impeded by the development of the public-order institutions and these same agents can interfere with efforts at improving institutions, then the progression of public- and private-order institutional development, economic growth, and generalized trust could be stunted. Even though the incentives of the vast majority of the polity point towards improved public-order institutions, it is conceivable (and perhaps even likely) that the costly and difficult task of improving institutions or the efforts of a small number of agents reaping extra-legal benefits could stymie the development process.

[23] As noted by Guiso et al. [20], the focus of Tabellini [37] on democratic political institutions is not ideal since democratic institutions are relatively recent compared to the intergenerational transmission mechanism he proposes. Our predictions also apply to the political incentives of agents in undemocratic political institutions, although those with the real authority to alter institutions may not be motivated by economic incentives alone.

4.1 Extension: Gradual Changes to the Public-Order Institution

One of the goals of our paper is to justify the use of gradual improvements to the public-order institution. Implicitly we assume that a "Big Push" development policy that makes sudden large changes to public order institutions is associated with more risk than a series of smaller institutional changes. If this implicit assumption is true, then the sequence of small changes may be more desirable than a single radical institutional change.[24] However the comparative statics above study different stationary equilibria. What can our model say about situations in which a sequence of future improvements to the public-order institution are anticipated?

Most of our modeling structure remains unchanged with one major exception. Since we have assumed that the choice of a is fixed for the duration of the relationship, trustworthy agents in long-run relationships may eventually desire to break an old relationship in order to recontract in the shadow of an improved public-order. For the purposed of our model, we assume that agents need to find a new partner to form a new contract. This structure loosely captures the idea that different kinds of partners may be required for different levels of a.

We now model the equilibrium given a sequence of public-order enforcement capacities, $(P_1, P_2, ...)$, and let $P_{i+1} > P_i$ so that the public-order institution is improving over time. We assume that the agents understand how the public order-institution will change over time and take this into account when writing their contracts in both institutions. An equilibrium of this dynamic game is defined by sequences of contract sizes for the public- and private-order institutions as well as the degree of generalized trust in the private-order institution in each period. Since we continue to focus on the Pareto optimal equilibria, the contract size within the public-order institution in period t is simply

$$G_t = \max_{a_G \in \mathbb{R}_+} v(a_G) \text{ such that } v(a_G) \geq d(a_G) - P_t$$

Let the sequence of contract sizes adopted in the private-order institution be denoted $(a_1, a_2, ...)$ with associated levels of generalized trust $(\gamma_1, \gamma_2, ...)$. The problem solved by the participants in the private-order institution that have just been matched in period t is

[24] One might fairly argue that time discounting might make a single, fast change at high risk superior to a slow series of low risk changes.

$$W_t(a_t, \gamma_t) = \max_{a \in \mathbb{R}_+} \gamma_t \left[(1-\delta)v(a_t) + \delta\left(\rho V_t^1(a_t;\gamma_t) + (1-\rho)W_{t+1}(a_{t+1};\gamma_{t+1})\right)\right] +$$
$$(1-\gamma)\left[(1-\delta)l(a) + \delta W_{t+1}(a_{t+1};\gamma_{t+1})\right]$$

subject to the following constraints.

$$\begin{aligned} V_t^\tau(a_t;\gamma_t) &= (1-\delta)v(a_t) + \delta\rho\max\{V_t^{\tau+1}(a_t;\gamma_t), W_{t+\tau}(a_{t+\tau};\gamma_{t+\tau})\}+ \\ &\qquad \delta(1-\rho)W_{t+\tau}(a_{t+1};\gamma_{t+1}) \\ W_{t+\tau}(a;\gamma) &\geq G_{t+\tau} \\ \gamma d(a) &= G_t \end{aligned} \tag{4.2}$$

The novel aspect of the model is that the payoff from continuing a relationship is nonstationary, which is reflected in the recursive definition of equation 4.2. Since P is gradually growing over time, there is a shrinking benefit to continuing a match of age τ that started in period t, captured by $V_t^{\tau+1}(a_t;\gamma_t)$, relative to the benefit of breaking a match and finding a new partner in period $t+\tau$, denoted $W_{t+\tau}(a_{t+\tau};\gamma_{t+\tau})$. Matched pairs will eventually find it optimal to sever their current relationship to reap the benefits of readjusting the contract size.

The equilibria of our model with foresight regarding future changes to P are qualitatively the same as our earlier model. In particular, raising P increases the contract size in both institutions[25] and increases general trust. The novel feature of our model with foresight is that relationships within the private-order institution can be severed endogenously in order to re-optimize the contract size. We have numerically solved the model with foresight under the same parameters as the simulations above with the resulting equilibrium relationship lengths plotted as a function of P in figure 2. Since P increases over time, we could have equivalently drawn the plot as a function of time.

Our numerical results reveal that (under the parameterization chosen) that the maximal relationship length is increasing with the level of public-order contract enforcement capacity. We chose to increase P linearly, so the increase in maximum length of a relationship in the private-order institution is due to the diminishing marginal effect of improvements

[25]Recall that G increases with P and, so long as $G < \overline{G}$, this in turn raises the values of a and γ in the private order institution.

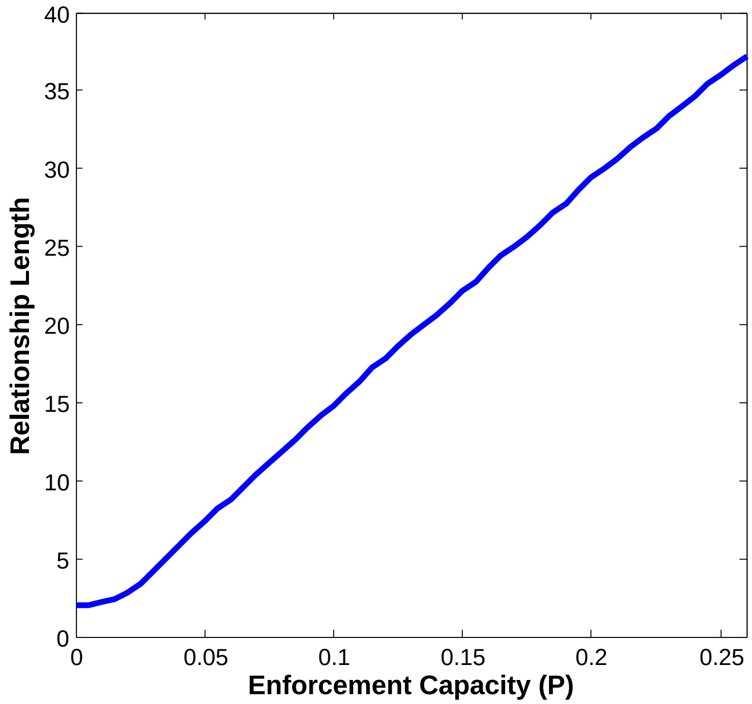

Figure 2: Equilibrium Outcomes

in the public-order institution on the efficiency of private-order contracts. In other words, when the public-order institution has only a weak contract-enforcement capacity, small improvements yield large effects on the private-order institution. Therefore, agents will want to re-optimize their contracts regularly. At higher stages of development, the same improvement to the public-order institution yields smaller improvements to the contracts used in the private-order institution. As a result, agents face weaker incentives to re-optimize their contract size at later stages of development.

We have assumed that agents need to break their current match in order to find a partner with whom to re-optimize. While this is fitting with our interpretation of the contract size as a costly, irreversible investment, a natural alternative assumption is that partners can choose to re-optimize their investment within the current relational contract. Watson [39] provides an analysis of a game wherein agents gradually increase the stakes of their contract, and this serves as a tool to screen out agents that are more willing to betray their partner.[26]

[26] Watson [39] attributes differences in the willingness to betray a partner by assuming different per-period

In our current model, the ability to readjust the size of the contract after learning your partner is trustworthy would increase the value of remaining in the private order institution for the trustworthy agents and lead to the private order institution surviving for higher values of G. However, natural extensions of our model would greatly complicate this story. For example, if we assumed that $0 < \delta_{Untrustworthy} < \delta_{Trustworthy} < 1$, then we would have to worry that an untrustworthy agent might be willing to cooperate for a few periods to increase the contract size before finally betraying his or her partner. Complications of this nature in Watson [39] leads to equilibria where the agents slowly ratchet up the size of the contract while gradually screening out untrustworthy agents. We conjecture that dynamics of this form would arise if we allowed agents to reoptimize the size of their contract as time passes. We leave these interesting questions aside as these effects are only loosely related to our primary question about the interaction of public and private order institutions.

4.2 Extension: Externalities from the Private-Order Institution

Private-order institutions often provide other benefits to members, either in parallel markets to the one under consideration or in the form of private benefits and costs to institutional membership. For example the Maghribi traders' coalition was a community founded on a religious institution that provides value to its members apart from the economic interactions the social structure sustains (Greif [18]). We assume that leaving the private-order institution entails losing all associated positive externalities from the underlying social structures. To capture this effect, we extend our model to include a private benefit Δ for trustworthy players that select into the private-order institution. Our problem becomes

$$W(a;\gamma) = \max_{a\in\mathbb{R}_+} \gamma\left[(1-\delta)v(a) + \delta\left(\rho V(a;\gamma) + (1-\rho)W(a;\gamma)\right)\right] + \\ (1-\gamma)\left[(1-\delta)l(a) + \delta W(a;\gamma)\right]$$

such that

$$\begin{aligned} W(a;\gamma) + \Delta &\geq G && \text{(LRIC)} \\ \gamma * d(a) &= G && \text{(SRIC)} \end{aligned}$$

payoffs as opposed to our assumption of differing discount factors.

LRIC can be satisfied for a greater range of G as Δ increases, which expands the set of parameters for which private- and public-order institutions remain complements. Therefore, one would expect that resilient social structures that provide significant private benefits to members ($\Delta > 0$) are promising venues for locating private-order institutions and studying the institutions' efficiency.

One could also model the symmetric case wherein access to the private-order institution is an excludable club good for which an entry fee ($\Delta < 0$) must be paid. In this case the entry fees shrink the parameter set for which the public- and private-order institution remain complements, and $W(a;\gamma) - G$ is an upper bound on the fees. A model of this form would imply that a strengthened public-order has a non-monotonic effect on the maximum possible fee for joining such an institution.[27] Therefore one would expect fees such as social strictures and other costs of joining the private-order institution to increase as G rises, but to fade as economic development proceeds.

5 Social Capital, Trust, and Economic Development

Studies have argued that generalized trust, a proxy for social capital, drives economic growth by allowing agents to depend on relational contracts in lieu of less efficient public-order enforcement (Knack and Keefer [23]).[28] A common choice for an international metric of generalized trust is the following World Values Survey question: "Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?" The World Values Survey trust question tracks $\gamma^*(G)$ if respondents base their reply on the probability that other agents are trustworthy and fulfill their contracts in the private-order institution. Knack and Keefer [23]) provides regressions that show a 10 percentage point increase in the trust variable increases the per capita growth rate by 0.8 percentage points, which the authors interpret as social capital causing development and growth.[29]

Our analysis of the effect of the development of public-order institutions on the effective-

[27] Note that $W(a(G);\gamma(G)) - G$ is nonmonotone in G.

[28] This contrasts with models of social capital as participation in organizations or social networks (Putnam [33]) or as an individual investment in the accumulation of social skill and characteristics (Glaeser et al. [17]).

[29] Knack and Keefer [23] use economic performance measured subsequently to the assesment of trust. However, if generalized trust is a dynamic equilibrium phenomenon as in our model, it is not clear that reverse causality is absent.

ness of private-order contract enforcement suggests that the development of public-order contract enforcement capacity can cause the accumulation of social capital, which implies that social capital acts as a multiplier of the effectiveness of investments in public-order institutions. In effect, development makes the organizations and social capital underlying private-order enforcement more effective.[30] The efficiency of public-order institutions can be increased by reforming a country's legal structure, creating accounting and auditing agents, fighting public-order corruption, and empowering the ability of the state to enforce judgements. Since there is no clear consensus on how to directly reform social norms such as trustworthiness to encourage the accumulation of social capital, our interpretation is an optimistic finding for economic policy in developing and transitional economies as it suggests the accumulation of social capital is an indirect outcome of traditional institutional reform and development programs.

In order to provide an illustration of our prediction that generalized trust, $\gamma^*(G)$, is increasing in public-order contract enforcement capacity, P, we conduct regressions of the country average of the generalized trust measure from the 2005 World Values Survey against a variety of proxies for the strength of the public-order institutions in each nation.[31] Given that enforcing a contract through the public-order institution involves filing a grievance with the legal system (or bargaining in the shadow of such a filing), our proxies focus on the strength and efficiency of the judicial system. The prediction drawn from our model is that each of these proxies for a high public-order contract enforcement capacity will increase the country average trust variable.

We emphasize that our regressions of generalized trust on metrics of public-order enforcement capacity are meant to merely illustrate our predictions and not prove a causal relationship. Our theory implies that the correlations we find between public order institutions and generalized trust can be interpreted as the outcome of improved public-order institutions encouraging trust. These regressions omit a number of conflating factors that have been cited in the literature as influencing social capital such as the presence of hierarchical religions, infant mortality, and infrastructure quality (La Porta et al. [25]); the level of property rights protection (Acemoglu et al. [1]); and taxation and bureaucracy (Friedman et al. [14]). We acknowledge that all of these variables likely play a role in determining a society's level of generalized trust.[32]

Table 1 presents summary statistics for our variables. Our first two proxies for the

[30] To the authors' knowledge this possibility was first mentioned in Sobel [35].

[31] A stronger test would also regress a measure of relational contract size, a^*, against metrics for public-

Table 1: Summary Statistics

Variables	Mean	Std. Dev.	Min	Max	# Obs.
Enforcement	6.195	1.631	3.5	8.945	45
Law and Order	7.185	2.379	1.67	10	45
Public-Order Corruption	4.989	2.306	1.5	9.3	56
Enforcement Time	514.8	347.2	109	1459	55
% Organization Member	0.496	0.238	0.05	1	45
Civic Norms	30.90	2.407	24	35.5	45
Log GDP	8.171	1.663	4.827	10.53	55

efficiency of contract enforcement in the public-order institution are drawn from Djankov et al. [11].[33] The **Enforcement** variable indexes the enforceability of contracts, and **Law and Order** indexes the integrity of the legal system in 2000. These index variables are scaled from 0 to 10, and our theory predicts that higher values for these variables are associated with higher levels of generalized trust. Our proxy for corruption, **Public-Order Corruption**, is drawn from Transparency International's *Corruption Perceptions Index 2010* (Transparency International [38]). Public-order corruption measures perceptions of a nation's public-order corruption on a 10 point scale (10 being least corrupt) as reported in surveys of country experts and business leaders with experience operating in the nation, and this variable ought to positively influence generalized trust. **Enforcement Time,** measured in days, is drawn from the World Bank's *Doing Business 2007* survey (World Bank [42]). Higher values of this regressor indicate slower, less efficient judicial systems and ought to be associated with lower values of generalized trust.

In addition to the proxies for public-order enforcement capacity, we include two additional metrics of social capital computed from the 2005 World Values Survey. **% Organization Member** is the fraction of the population that is a member of an organization or group. **Civic Norms** measures the extent to which respondents approve of antisocial activities and is scaled between 0 and 40. These two metrics of social capital capture the potential use of social networks and/or internalized social norms as tools to enforce relational contracts by monitoring and punishing defectors. By controlling for these other

order contract enforcement capacity, P. We are unaware of any metrics that capture this variable.

[32] To the extent that these factors proxy for the efficiency of the public-order institution, then the influence of these factors on trust (and hence GDP growth) could act through the channel our model describes.

[33] The reader should consult Djankov et al. [11] for complete definitions of these variables. **Enforcement** is the variable "Enforceability of contracts," and **Law and Order** is the variable "Law and order."

elements of social capital we hope to isolate the impact of improvements to the public-order institution on generalized trust.

Inclusion of **log GDP** in our regressions provides a control for other institutional innovations that might have increased the efficiency of private-order contracting (and hence increased trust). One example of such an institution is private-order information clearinghouses such as credit rating bureaus, bond rating agencies, and auditing firms. While the services of these agencies are regulated by public-order agencies and may play a role in legal enforcement actions, these clearinghouses play a crucial role in monitoring and disseminating the reputation of actors in the private-order institutions of the economy.

Table 2: Dependent Variable: Trust

Enforcement	0.100**				0.060
	(0.037)				(0.052)
Law and Order		0.034**			0.026
		(0.016)			(0.021)
Public-Order			0.052***		0.015
Corruption			(0.018)		(0.030)
Enforcement Time				-0.001**	-0.0001
				(0.0007)	(0.0001)
% Organization	-0.053	0.138	0.029	0.064	0.062
Member	(0.160)	(0.123)	(0.094)	(0.095)	(0.196)
Civic Norms	0.016	0.011	0.014	0.0144	0.005
	(0.015)	(0.013)	(0.009)	(0.009)	(0.015)
Log GDP	-0.065	0.006	-0.027	0.026*	-0.069
	(0.039)	(0.028)	(0.024)	(0.014)	(0.042)
Intercept	-0.217	-0.433	-0.209	-0.314	0.117
	(0.475)	(0.408)	(0.316)	(0.309)	(0.500)

We first provide regressions that focus on each of our measures independently. All of our variables have the expected sign and are significant at the 5% level. Since we do not wish to take a stand on the relative merits of our different metrics of public order enforcement capacity, we complete our analysis by conducting a regression including all of our measures. In addition, the final regression alleviates the omitted variable bias implicit in the regressions that focus on individual measures. Although none of the measures are individually significant in our final regression, an F-Test of the measures reveals that the set of metrics is significant at the 5% level.

One objection to our data analysis is that generalized trust as measured by the World

Values Survey is not an adequate proxy for $\gamma^*(G)$. An alternative causal story is that societies with efficient judiciaries encourage respondents to claim they trust strangers more readily because respondents are confident that the legal system will induce trustworthy behavior on the part of their counter-parties. Alternative causal stories of this nature point highlight the need for concrete, observable proxies for the forms of social capital that encourage efficient relational contracting and economic growth.

We have not found a data source to test our predictions regarding selection between institutions, particularly our suggestion that agents that utilize private-order enforcement are more trustworthy than agents that rely on public-order enforcement institutions. Empirically testing this prediction requires identifying farsighted and myopic agents and assessing when these agents utilize public-order enforcement. One could potentially proxy for firm farsightedness with a model that predicts which firms are likely to shutdown in the near future. Producing a metric of legal system usage is more difficult. For example, firms could make heavy de facto use of public-order institutions by bargaining in the shadow of public-order enforcement. Alternately, we could identify firms using contract enforcement mechanisms outside of the public-order institution, but this is also a daunting task. We leave the identification, collection, and analysis of these metrics as a promising subject for future work.

6 Conclusion

Agents within the economy have a choice as to which institutions they wish to employ, and the institutions chosen have effects on the kinds of agreements possible in equilibrium. In our model we assume that the payoff to participating in a public-order institution is limited by the state's capacity for enforcing contracts. Contracts within the private-order institution are trust-based and must be self-enforcing equilibria of a contracting game featuring two-sided moral hazard.

Interaction between the private- and public-order institutions is mediated by an adverse selection problem facing the trustworthy agents. When trustworthy agents are matched with a new partner in the private-order institution, there is a chance that the new partner is an untrustworthy agent that will defect from the agreement. Trustworthy agents limit their potential losses by restricting the payoffs of contracts offered to counterparties, which lowers the efficiency of transactions in the private-order institution.

A strong public-order helps draw agents that cannot or will not fulfill relational contracts out of the private-order institution, which alleviates the adverse selection problem in the private-order institution. However, an improved public-order (certeris paribus) may worsen the moral hazard problem facing agents in the private-order institution by providing an outlet for agents who cannot or will not fulfill a contract. Our analysis shows the benefit of reducing the adverse selection outweighs the harm caused by increased moral hazard.

Our model provides a theory of complementarities between these enforcement institutions, which implies that improvements to the public-order institution can cause growth in trust and economic production in both institutions. This suggests that the gradual reform of public-order institutions need not hurt the functioning of private-order institutions, which implies a massive, risky reform program is not necessary to improve economic outcomes. Our results also suggest that all agents, not just those employing the public-order institution, benefit from improved public-order enforcement, which implies that improvements to the public-order enforcement institution would find broad support within many different political institutions.

We use our model to reinterpret the macroeconomic literature on the effect of social capital on economic growth. This literature interprets measures of generalized trust as proxies for the robustness of private-order institutions and uses regression studies to determine the impact of social capital on economic productivity (Knack and Keefer [23]). Our model shows that when the interaction between private- and public-order institutions is endogenized, increases in public-order efficiency causes social capital to accumulate. Therefore efforts to reform a state's judiciary, improve monitoring technologies such as auditors, and create an effective capacity for the state to enforce its judgements will lead to the accumulation of social capital as private-order institutions are strengthened endogenously. Empirical studies of the impact of social capital on growth can be reinterpreted as demonstrating that social capital acts as a multiplier for the effectiveness of investments in public-order contract enforcement capacity.

We illustrate the prediction of complementarity between public- and private-order institutions by regressing a generalized trust measure derived from the 2005 World Value Survey against proxies for the strength of public-order institutions. Our findings support the predictions of our theory and can be interpreted as suggesting that the accumulation of social capital is caused by and acts as a multiplier of the efficiency gains resulting from improvements to public-order contract enforcement institutions.

While our paper makes an initial step in studying the endogenous interaction between public- and private-order enforcement systems, much work remains to be done. One promising direction for future research is to elaborate the model of public-order institutions to study what makes these incentive structures self enforcing and study the incentives of politicians and other actors competing to influence the structure of the public-order institution.

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A Appendix: Alternate Formulation - For Online Publication

We assumed in section 4 that the objective function of the institutional selection problem is the welfare of the unmatched trustworthy agents. An alternative formulation of the problem is an economy wherein norms for contract size are determined by the agents in ongoing matches. Our constraint simplification argument applies in this setting, so we can write our alternate institutional selection problem as

$$\begin{aligned} \max_{a \in \mathbb{R}_+} V(a;\gamma) = (1-\delta)v(a) \quad &+ \quad \delta\left[\rho V(a;\gamma) + (1-\rho)W(a;\gamma)\right] \text{ such that} \\ W(a;\gamma) \quad &\geq \quad G \qquad \text{(LRIC)} \\ \gamma d(a) \quad &\geq \quad G \qquad \text{(SRIC)} \end{aligned}$$

The first term of the objective function, $(1-\delta)v(a)$, captures the present period profits. The second term captures the expected continuation payoff if the match continues, $\rho V(a;\gamma)$, or is exogenously broken, $(1-\rho)W(a;\gamma)$. Denote the equilibria of this model as $(\gamma_A^*(G), a_A^*(G))$.

Comparative statics in this alternate structure are complicated by the two independent constraints on the objective. As in our prior formulation, for sufficiently large G the private-order institution will collapse as LRIC cannot be satisfied and all agents select into the public-order institution. So long as LRIC does not bind our analysis in section 4 holds, which implies that $(\gamma_A^*(G), a_A^*(G))$ is increasing in G for sufficiently small G and large ρ.

We can visualize equilibria for a fixed value G when both constraints bind by considering SRIC and LRIC as curves in (a,γ) space as illustrated in figure 2. Equilibria are represented by the intersection of these lines.

When both LRIC and SRIC bind, we require the implicit function theorem to derive comparative statics. Since SRIC binds it cannot be the case that both $\gamma_A^*(G)$ and $a_A^*(G)$ decrease with G. In addition, since LRIC binds it cannot be the case that $\gamma_A^*(G)$ falls and $a_A^*(G)$ rises with G as $W(a;\gamma)$ would decrease.[34] However, if $d(a)$ has little response to small changes in a at $a_A^*(G)$, it is possible that increasing G is associated with a large decrease in $a_A^*(G)$ and a small increase in $\gamma_A^*(G)$ to satisfy LRIC. Similarly, if $d(a)$ is very responsive to a small change in a at $a_A^*(G)$, a small increase in G could result in a small

[34] When LRIC weakly binds, the solution is in a regime where $\frac{\partial}{\partial a}W(\gamma_A(G),a)$ evaluated at $a_A(G)$ is negative.

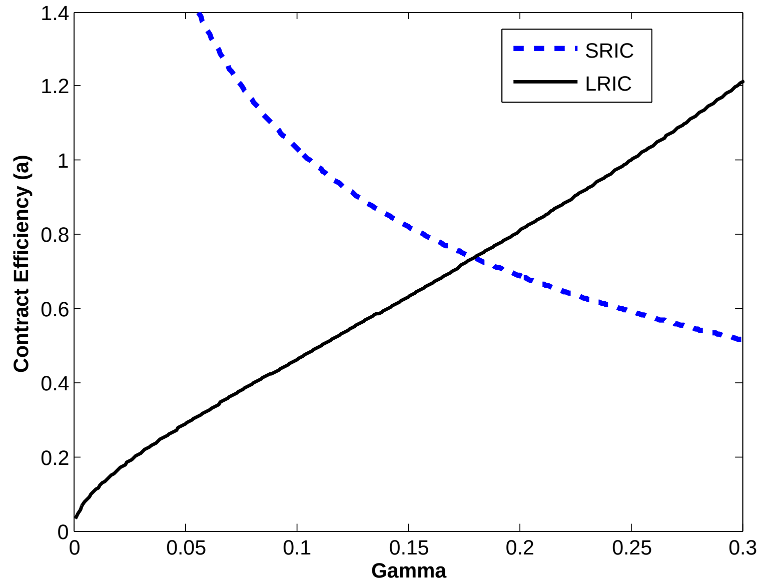

Figure 3: Equilibrium Conditions

decrease in $a_A^*(G)$ and a large increase in $\gamma_A^*(G)$. The third (and most intuitive) possibility is that an increase in G causes an increase in both $a_A^*(G)$ and $\gamma_A^*(G)$.

We use the following notational convention for derivatives

$$\frac{\partial}{\partial a}W(a;\gamma) \triangleq W_a(a;\gamma) = \frac{(1-\delta)}{C}\left[\gamma\frac{v'(a)}{1-\delta\rho} + (1-\gamma)l'(a)\right]$$
$$\frac{\partial}{\partial \gamma}W(a;\gamma) \triangleq W_\gamma(a;\gamma) = \frac{(1-\delta)}{C^2}\left[\frac{C-\gamma\delta}{1-\delta\rho}v(a) - (C+\delta(1-\gamma))l(a)\right]$$

where

$$C = \frac{1-\delta}{1-\delta\rho} - \delta(1-\gamma)$$

The implicit function theorem them yields[35]

$$\frac{\partial a_A}{\partial G} = \frac{d(a) - W_\gamma(a;\gamma)}{d(a) * W_a(a;\gamma) - \gamma d'(a) * W_\gamma(a;\gamma)}$$
$$\frac{\partial \gamma_A}{\partial G} = \frac{W_a(a;\gamma) - \gamma d'(a)}{d(a) * W_a(a;\gamma) - \gamma d'(a) * W_\gamma(a;\gamma)}$$

[35] We ignore the requisite rank condition of the implicit function theorem.

with all terms evaluated at $(\gamma_A^*(G), a_A^*(G))$.

To provide structure for our analysis, we examine the case of relationships of infinite duration, $\rho = 1$, and study the limit where the trustworthy players become arbitrarily patient, $\delta \to 1$.[36,37] In this case we can write

$$\begin{aligned} W_\gamma(a;\gamma) &= \frac{(1-\delta)}{C^2}\left[v(a) - l(a)\right] \\ W_a(a;\gamma) &= \frac{(1-\delta)}{C}\left[\frac{\gamma}{1-\delta}v'(a) + (1-\gamma)l'(a)\right] \end{aligned}$$

Taking limits we see that

$$\begin{aligned} \underset{\delta\to 1}{Lim}\ W_\gamma(a;\gamma) &= 0 \\ \underset{\delta\to 1}{Lim}\ W_a(a;\gamma) &= v'(a) \end{aligned}$$

The limit value of $W_\gamma(a;\gamma)$ reflects the fact that adverse selection, a short run phenomenon, does not significantly influence the incentives of sufficiently patient agents. The second term reflects the direct effect of increasing a on the welfare of trustworthy agents once they are matched with another trustworthy agent.

Our comparative statics in the limit as $\delta \to 1$ can be simplified to

$$\begin{aligned} \underset{\delta\to 1}{Lim}\frac{\partial a_A}{\partial G} &= \frac{1}{v'(a)} > 0 \\ \underset{\delta\to 1}{Lim}\frac{\partial \gamma_A}{\partial G} &= \frac{v'(a) - \gamma d'(a)}{d(a) * v'(a)} \end{aligned}$$

We can generate unambiguous comparative statics for $a_A^*(G)$, but our conclusions regarding $\gamma_A^*(G)$ remain ambiguous without specifying our model fully since this term depends on the parameterized indifference condition of the myopic agents.

[36]Since we have set $\rho = 1$, farsighted players in the unmatched pool will eventually be permanently matched. In the long run the pool of unmatched players will need to be refreshed with entering farsighted agents.

[37]If we reverse the order of limits, then we describe a model wherein the agents maximize the average utility ($\delta = 1$) derived from relational contracts with longer and longer expected durations ($\rho \to 1$). But then $W = V$ and our analysis from Section 3 applies.

B Appendix: Endogenous Flow of Agent Types - For Online Publication

The formulation in the body of the paper assumed that all trustworthy agents, a set of finite measure, participate in the private-order institution and a pool of untrustworthy agents divide themselves between the private- and public-order institutions. Without exogenous breakups or entry of new agents, the pool of unmatched agents would empty as pairs of trustworthy agents match. The exogenous break-up of matches between trustworthy agents provides a mechanism for activity to persist in the pool of unmatched agents in the private-order institution in the long run.

An alternative method for insuring participation in both institutions is to assume that matches last forever ($\rho = 1$), but interpret the discount factor as the probability of an agent remaining in the economy next period. With probability δ an agent in the economy stays in the economy the next period, and with probability $1-\delta$ the agent exits the economy and receives utility 0 in all future periods. In this setting a measure λ_{LR} of trustworthy agents enter the economy and a measure $(1-\delta)n_{LR}$ of trustworthy agents leave each period, where n_{LR} denotes the measure of trustworthy agents in the economy in steady state.[38] Note that

$$n_{LR} = \frac{\lambda_{LR}}{1-\delta}$$

Let the measure of trustworthy agents matched with other trustworthy agents equal n_M and the measure of trustworthy agents in the pool of unmatched agents be n_U. Equalizing steady state flows of trustworthy agents between the matched and unmatched sets yields

$$n_U = \delta n_U + \lambda_{LR} - 2\delta\gamma n_U + 2\delta(1-\delta)n_M \qquad (n_U)$$

The first and second terms capture the measures of surviving trustworthy agents in and new trustworthy entrants to the pool of unmatched agents. The third term is the measure of surviving trustworthy agents matched in the present period. The fourth term captures entrants to the pool of unmatched agents resulting when exactly one member of a matched pair of trustworthy agents leaves the economy.

$$n_M = \delta^2 n_M + 2\delta\gamma n_U - 2(1-\delta^2)n_M \qquad (n_M)$$

[38]The myopic agents can be represented by a large pool of short lived agents who participate in the economy for one period and then exit.

The first term reflects matched pairs where both agents survive, while the second term captures the measure of newly matched trustworthy agents. The third term is the measure of agents in matched pairs where at least one agent leaves the economy. Equation (n_M) and (n_U) can be solved to determine the steady-state measures of matched and unmatched long run agents.