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 endogenize public-order enforcement capacity and 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

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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* if she is capable of resisting the temptation of moral hazard,[3] 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.[4] 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.

The principal contribution of our work is providing a model of complementarities between improvements in public order enforcement capacity and the growth of generalized trust and economic productivity.[5] Our model emphasizes that improvements to the public-order institution change the distribution of agents selecting into the public- and private-order institutions. We show that the institutional selection mechanism implies that enhancement of public-order contract enforcement capacity alleviates the adverse selection and moral hazard problems of the private-order institution, increases generalized trust, and encourages economic growth in both the

[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.

[3] We identify trustworthiness with the time discount factor that determines an agent's valuation of future interactions and whether relational contracts are self-enforcing. Our formulation contrasts with Tabellini [37] and Francois and Zabojnik [13], both of which denote an agent as trustworthy if the agent has a preference (interpreted as an internalized norm for ethical behavior) for fulfilling relational contracts. Although moral norms play a role in determining the behavior of some economic agents, we are not confident that significant relationships between firms tempted by moral hazard can be supported by ethical sentiment alone.

[4] 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]).

[5] Typically the theoretical literature on institutions has considered private- and public-order enforcement systems as substitutes for one another (e.g. Kranton [24]).

public- and private-order institutions. In important prior work, Tabellini [37] and Francois and Zabojnik [13] argue that such complementarities can arise through the intergenerational transmission of norms for cooperation, whereas our model suggests that improvements to public order institutions can encourage the growth of trust and improved economic outcomes on much shorter time scales.[6] 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.

A *public-order institution* is a third party enforcement mechanism[7] whose participants include 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 nonverifiable 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,[8] 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.[9]

Private-order institutions refer to monitoring technologies, punishment and reward mechanisms, and beliefs and social norms that allow for self-enforcing contracts between agents to take costly actions incentivized by the shadow of the future. For

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

[7]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.

[8]The United States Court of Appeals for the Federal Circuit (CAFC) was established to build patent enforcement expertise within the 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.

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

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 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 contract that cannot be enforced by the public-order institution.[10]

- Firms can engage in intranational trade and rely on public-order legal infrastructure for contract enforcement. Agents 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]).

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. As the public-order institution becomes more efficient, untrustworthy agents that are incapable of fulfilling a self-enforcing contract in the private-order

[10]Bernheim and Whinston [4], 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.

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.

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 to accumulate and the effect of improvements to the public-order institutions are magnified. 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.

Section 2 discusses our work in relation to the existing literature, and section 3 describes the basic model. Section 4 analyzes the effect of institutional selection on the private-order contract enforcement institution, and section 5 endogenizes the public-order contract enforcement capacity and discusses the political economy of choosing the state's enforcement capacity. We illustrate our model in section 6 using data on generalized trust and public-order efficiency, and section 7 concludes. Appendices A and B, available on the author's webpage[11] in the original working paper, analyze alternative formulations of the model.

[11] http://www.arts.cornell.edu/econ/ab882/

2 Relations to the Literature

Beyond highlighting the effect of selection between public- and private-order enforcement institutions on the level of trust within an economy, one of the significant contributions of our work is to emphasize the resulting effect on economic development. 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.[12] Both of these works lack a structure to study the effect of changing norms of behavior on economic growth except in the sense that more cooperative behavior is observed as norms for ethical behavior become more prevalent. Furthermore, our study emphasizes the power of *effective* institutional reform[13] over short periods of time to enhance the efficiency of private-order institutions, 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.[14] Prior to the establishment of a public-order institution, contracts can only be enforced through the private-order institution. Because of the dichotomous nature of the public-order institution, 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

[12]The notion of trust modeled by Tabellini and Francois and Zabojnik 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.

[13]We highlight effective institutional reform since we require the development of the public-order institution to have an observable effect on the economic outcomes of agents operating within that institution.

[14]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 formal contracts as high fixed cost, low marginal cost institutions.

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 contractual form as development advances, the focus of our analysis, are not included in Sobel's model.

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 states (Johnson et al. [21]), the New York Diamond Dealer's Club (Bernstein [5]), 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 the 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 to other agents. We assume that a measure one continuum of trustworthy agents participates in the economy.[15] If an agent's utility in period t is denoted u_t, the agent discounts future utility using intertemporal utility function

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

Agents are either *matched* or *unmatched* at the beginning of each period. Matched players 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 advent of the match. Those agents who are unmatched at the beginning of period t choose whether to select into the public-order or the private-order institution. Those

[15]The ratio of trustworthy to untrustworthy agents in the private-order institution is endogenous. Our choice to normalize the population of trustworthy agents is without loss of generality.

agents who choose to enter the public-order institution receive a payoff of G and the period ends. In section 5 we provide a model of the public-order institution that endogenizes G in terms of the underlying characteristics of that institution.

Agents who choose to enter the private-order institution are randomly and uniformly pairwise matched in subperiod 1. If there is a positive measure of agents in the private-order institution, 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. 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 agent i and j's interaction is then $a = \min\{a_i, a_j\}$.[16] 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 defect in all relational contracts in equilibrium.

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 is employed as it concisely captures both the increasing returns possible under cooperation as well as the temptation to defect. We assume that $v(\circ), l(\circ)$, and $d(\circ)$ are differentiable functions. Let $v'(a) > 0$ and $v''(a) < 0$. To capture the salient features of the prisoner's dilemma stage game, we

[16] We think of a as a fixed relationship specific investment.

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 let $a = 0$ denote a state of no economic activity wherein $v(0) = d(0) = l(0) = 0$.

4 Analysis - Private Order Institution

The efficiency of self-enforcing contracts used in the private-order institution is parameterized by $a \in \mathbb{R}_+$ and, in the absence of defection by either party, the total production for each agent is $v(a)$. We study the Pareto efficient equilibrium contract size, a, that is possible in the private-order institution as a function of the efficiency of the public-order institution G.

The Pareto optimal self-enforcing contract offered by trustworthy agents in the private-order institution solves the **Full Institutional Selection Problem** (FISP). In any equilibrium, untrustworthy agents defect in every match. We consider equilibria wherein trustworthy agents cooperate with matched partners and choose to sever matches if their partner defects at any point in time.[17] 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

[17]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.

function of our model.[18,19]

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

such that

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

The objective function, $W(a;\gamma)$, captures two 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 $\delta W(a;\gamma)$.

[18]Suppose that an agent proposes a larger contract size at the beginning of a matching (e.g. the a optimal for matched agents). Since the equilibrium we find is optimal for unmatched trustworthy agents, applying the D1 criterion (Cho and Kreps [6]) would induce the partner to believe that the deviator is surely an untrustworthy agent and refuse to agree to the deviation.

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

Manipulation reveals that

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

Denote the largest maximizer of FISP as a^*. 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.[20] If the trustworthy players cannot make more profits by cooperation in the private-order institution than by entering the public-order system, then the private-order institution will collapse as all agents will opt to use the public-order contract enforcement institution.

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 clear 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. 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.[21]

The endogenous variables $\gamma^*(G)$ and $a^*(G)$ define the equilibrium outcomes of

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

[21]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

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.[22] The equilibrium contract size, $a^*(G)$, is our metric for the economic development of the private-order institution. As we shall 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.*

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 strictly, then SRIC and LRIC imply IC2.*

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there would exist $\underline{G}$ such that

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

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

[22] 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. 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 is strict 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

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

For sufficiently large G, the only values of $(a^*(G), \gamma^*(G))$ that satisfy the SRIC cause a moral hazard problem for the trustworthy agents that destroys the possibility for cooperation even amongst the trustworthy agents. 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 the 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 on contract efficiency within this regime, but we require that matched pairs of agents are not exogenously separated with high probability.[23] 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.

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

Proof. It is straightforward to show that

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

[23]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 $l'(a)$.

where

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

From these formulas we can conclude 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. 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 institution ($G \leq \overline{G} = 0.72$) all agents benefit from increasing G. After the public-order institution collapses ($G > \overline{G}$), all unmatched agents enter the public-order institution. Matched agents will remain matched since

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

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 institution collapses for $\gamma^*(\overline{G}) < 1$, which implies that

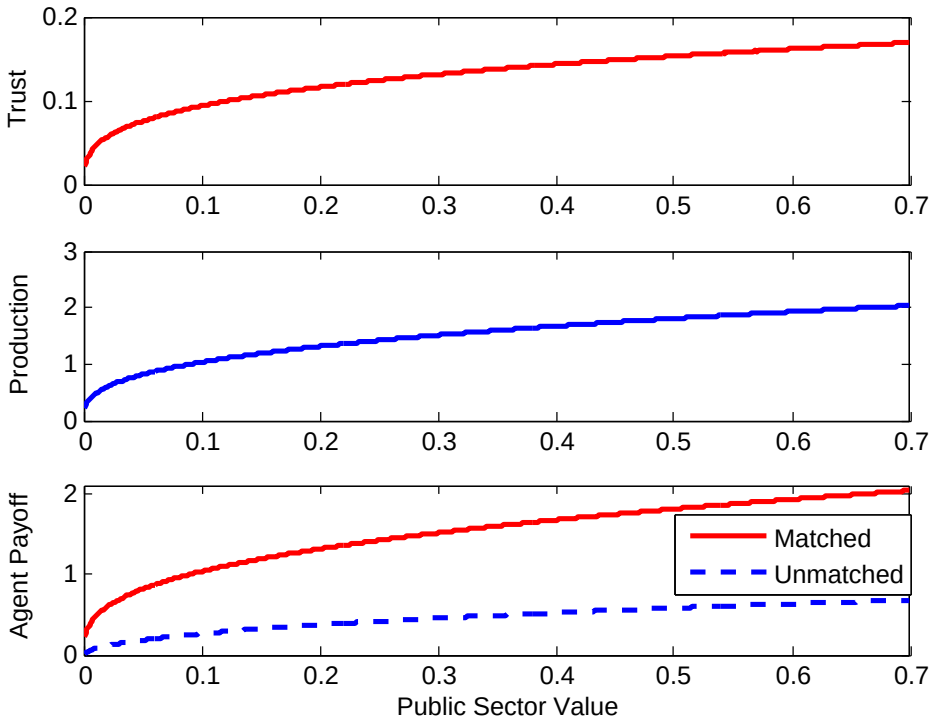

Figure 1: Equilibrium Outcomes

positive measures of untrustworthy agents participate in both institutions until the private-order institution collapses.

As G increases there are two effects. First, the efficiency of the contracts in the private-order institution increases. Second, untrustworthy agents leave the private-order institution and so participation in the private-order institution falls. Noting that all trustworthy agents participate in the private-order institution, the total utility generated by the private-order institution is

$$\frac{1-\rho}{1-\rho+\gamma}W(a;\gamma)+\frac{\gamma}{1-\rho+\gamma}V(a;\gamma)+\frac{1-\gamma}{\gamma}\frac{1-\rho}{1-\rho+\gamma}G$$

where we compute the steady state measure of trustworthy agents that are unmatched ($\frac{1-\rho}{1-\rho+\gamma}$) and matched ($\frac{\gamma}{1-\rho+\gamma}$) by demanding the flows into and out of these groups balance. The third term accounts for the welfare of the untrustworthy agents

in the private-order institution. Note that the participation in the private-order institution, $\gamma^*(G)^{-1}$, falls as G rises. As a result we cannot sign the effect of changes in G on the total welfare generated within the private-order institution without parameterizing the model further.[24] Therefore, our model may be consistent with data that suggests that the size of the informal sector and generalized trust are negatively correlated (e.g. D'Hernoncourt and Méon [7]).[25]

4.1 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 (Greif [18]) was a community founded on a religious institution that has value apart from the economic interactions the social structure sustains. 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

$$W(a;\gamma) \geq G - \Delta \quad \text{(LRIC)}$$

$$\gamma * d(a) = G \quad \text{(SRIC)}$$

[24] It is straightforward to describe per period productivity in the private-order institution, but we cannot sign the total output produced in the institution without parameterizing our model.

[25] The literature about the informal sector is not directly related to our work as agents enter the informal sector for reasons, such as tax and regulatory evasion, orthogonal to the issues we discuss.

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 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 not only increases the efficiency of the private-order institution but has a non-monotonic effect on the maximum possible fee for joining such an institution.[26] Therefore one would expect fees such as social strictures and other costs of joining the private-order institution to potentially increase as G rises, but to necessarily fade as economic development proceeds.

5 Endogenizing the Public Order Institution

The model above focuses on the role of public-order enforcement on equilibrium outcomes within the private-order institution and did not rely on a specific model of the public-order institution. In this section we develop a model of contracting within the public-order institution in order to study how changes in the enforcement regime applied within the public-order institution influence the value from participating in the public-order. In addition, we use our model of the public-order institution to discuss the political economy of institutional change.

We assume that one-period contracts within the public-order institution are formed between randomly matched firms in a spot market. Contracts have the form of an agreement for both agents to take action $a_P \geq 0$ for a total payoff to each agent of $\rho(a_P)$ in the event the contract is fulfilled. We assume that a_P is chosen by

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

simultaneous announcement as in the private-order institution. If the contract is not fulfilled, one party earns $\kappa(a_P) > \rho(a_P)$ and the other $\tau(a_P) < \rho(a_P)$. The payoffs from not fulfilling the contract can be the result of one party expropriating the effort of the other or finding a loophole in the contract that allows the party to fulfill the contract in a perfunctory, low cost manner. In the event that the contract is not fulfilled, each party receives $\kappa(a_P)$ or $\tau(a_P)$ with 50% probability, which captures the idea that parties cannot tell ex ante whether they will be able to benefit from the failure to fulfill a contract. We assume that the surplus yielded by fulfilling the contract, $2 * \rho(a_P) - [\kappa(a_P) + \tau(a_P)]$, is positive and increasing in a_P.

In addition to choosing the size of the contract, contracting agents i and j dedicate effort $e_i, e_j \geq 0$ to writing the contract at a cost $c(\cdot)$ where $c'(\cdot), c''(\cdot) > 0$. The probability that the contract is fulfilled given a total effort level $e = e_i + e_j$ invested in writing the contract is $q(e) \in [0, 1)$ where $q(0) = 0$ and $q'(e) > 0$. The total payoff of agent i is then

$$G(\phi) = \max_{a_P, e_i \geq 0} q(e_i + e_j) * \rho(a_P) + (1 - q(e_i + e_j)) * \left(\frac{1}{2}\kappa(a_P) + \frac{1}{2}\tau(a_P)\right) - \frac{1}{\phi}c(e_i)$$

where ϕ indicates the level of public order enforcement capacity. We denote the optimal levels of contract size and effort $a_P^*(\phi)$ and $e_i^*(\phi)$.

The parameter ϕ is meant to capture all of the factors that make it less costly for agents to write a contract that precludes either party from exploiting the terms of the contract to their own benefit. Features of a public order institution with high values of ϕ may include:

- Establishment and enforcement of concepts such as *fiduciary duty* and *duty of care* that prevent agents from either taking advantage of their counterparty or completing the contract in a perfunctory fashion.
- Enhancing 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.

It is straightforward to show that increases in ϕ, which reduces the cost of writing contracts, increases economic production ($a_P^*(\phi)$), causes the agents to exert more effort writing enforceable contracts ($e_i^*(\phi)$), and increases the value of entering the public order institution. If one interprets the rate at which contracts are enforced as a form of public order generalized trust or trust in the effectiveness of public order institutions, then increases in ϕ imply greater levels of both of these forms of trust.

Proposition 3. *$a_P^*(\phi)$, $e_i^*(\phi)$ and $G(\phi)$ are increasing.*

Proof. That $a_P^*(\phi)$ and $e_i^*(\phi)$ are increasing follows from noting that

$$q(e_i + e_j) * \rho(a_P) + (1 - q(e_i + e_j)) * \left(\frac{1}{2}\kappa(a_P) + \frac{1}{2}\tau(a_P)\right) - \frac{1}{\phi}c(e_i)$$

is supermodular in (a_P, e_i, ϕ). We have from the Envelope Theorem that

$$G'(\phi) = \frac{1}{\phi^2}c(e_i^*(\phi)) > 0$$

□

The political economics of changes in ϕ are particularly simple in our model, which contrasts with the multiple equilibria of Tabellini [37]. The ability of agents to select between institutions ameliorates the conflict between trustworthy agents wishing to defend their investment in long-run relationships versus the untrustworthy agents who wish to escape punishment after defecting. Agents in the public-order institution are in favor of increasing ϕ 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 ϕ as this increases $G(\phi)$, which

helps relieve the adverse selection problem facing participants in the private-order institution. Therefore as long as the individuals, 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.[27]

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 radically different 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.

[27]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 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).

6 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?"[29] Knack and Keefer provide 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 suggesting that social capital causes development and growth.[30,31]

Our analysis of the effect of the development of public-order institutions on the probability of defection from private-order agreements suggests that the development of public-order contract enforcement capacity may cause the accumulation of social capital, which would imply 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.[32] 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.[33] Since there

[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]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.

[30]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.

[31] If growth is (partially) driven by the efficiency of the private-order institutions, our model predicts the finding that increasing trust, driven by improvements to public-order enforcement institutions, promotes economic growth (Knack and Keefer [23]).

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

[33]All of these elements of public-order institutions can also be used as means for the state to

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 development programs.

In order to provide an illustration of our prediction that generalized trust, $\gamma^*(G)$, is increasing in public-order efficiency, $G(\phi)$, 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.[34] Given that the first step of enforcing a contract through the public-order institution is 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. In effect, we are not attempting to argue for a novel source of civic capital that encourages the adoption of good institutions. 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.[35]

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extract rents from economic agents, so investing in state capacity is a double-edged sword.

[34] A stronger test would also regress our metrics for public-order efficiency against a measure of relational contract size, $a^*(G)$. We are unaware of any metrics that capture this variable.

[35] 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.

Table 1 presents summary statistics for these variables.

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

Our first two proxies for the efficiency of contract enforcement in the public-order institution are drawn from Djankov et al. [11].[36] 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. **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

[36]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."

approve of antisocial activities and is scaled between 0 and 40. These two metrics of social capital capture the potential use of social networks as tools to enforce relational contracts by monitoring and punishing defectors. By controlling for these other 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 Corruption			0.052***		0.015
			(0.018)		(0.030)
Enforcement Time				-0.001**	-0.0001
				(0.0007)	(0.0001)
% Organization Member	-0.053	0.138	0.029	0.064	0.062
	(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 jointly 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 $\gamma^*(G(\phi))$. 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 out the vague definition of trust used in the literature on social capital and emphasize the need for concrete, observable proxies for the forms of social capital that encourage efficient relational contracting and economic growth.[37]

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 (i.e. farsighted) than agents that rely on public-order enforcement institutions. Empirically testing this prediction requires identifying farsighted and myopic firms and assessing when these firms 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. Finally, we would need to identify firms using contract enforcement

[37]We are drawing a distinction between a direct observation of social capital, however defined, and survey measures of equilibrium beliefs about the strategies of other agents as provided by the World Values Survey. One could also imagine a functional proxy for social capital if data on the efficiency of relational contracts were collected directly, although we are unaware of attempts to gather such a data set.

mechanisms outside of the public-order institution, which is also a daunting task. We leave the collection, study and analysis of these metrics as a promising subject for future work.

7 Conclusion

The focus of our paper is the interaction of selection between public- and private-order contract enforcement institutions, generalized trust and economic growth. 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. Our theory does not rely on the intergenerational reformation of ethical norms of cooperation, which allows us to explain instances where trust and economic production grow rapidly and where ethical norms alone may not suffice to enforce cooperation (e.g. impersonal relationships between firms). Our model of the public order institution suggests that improved public order enforcement is broadly beneficial, which implies that improvements to the public order enforcement institution would find broad support within many different political institutions.

Agents within the economy have a choice as to which institution they wish to employ, and the institution chosen has effects on the kinds of agreements that are possible. 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 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. However, a strong public-order institution is an outside option

for untrustworthy agents and will, in equilibrium, attract some of the untrustworthy agents. As the adverse selection problem is ameliorated by a strengthened public-order institution, contracts within the private-order institution become more efficient. This process continues until the point where the state capacity for enforcement makes the public-order institution attractive even to trustworthy agents and moral hazard causes the private-order institution to collapse.

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 may cause 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 an 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 may be driven, at least in part, by improvements in the efficiency of public-order contract enforcement institutions.

While our paper makes an initial step in studying the 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. In addition, models of other modes of interaction between public- and

private-order institutions (or a hybrid of the two forms) may reveal other causal factors that warrant study.

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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

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

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 fails 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 $(\gamma_A^*(G), a_A^*(G))$ are 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 the 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. Note that 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

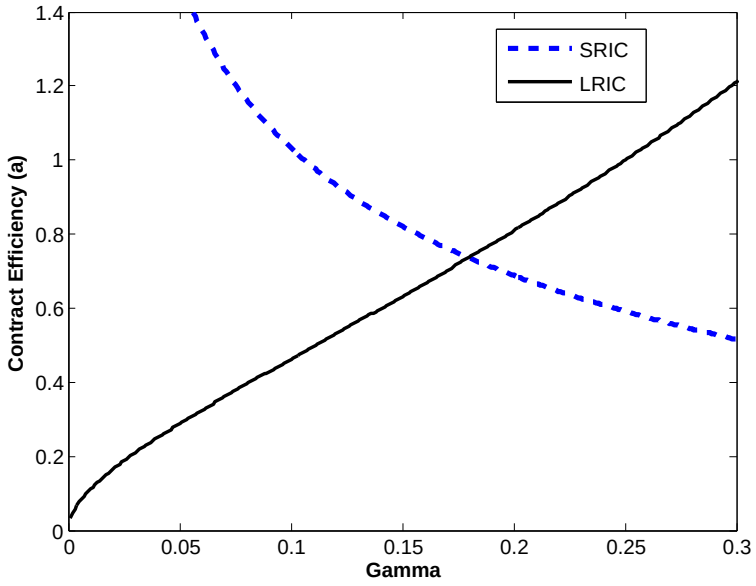

Figure 2: Equilibrium Conditions

be the case that $\gamma_A^*(G)$ falls and $a_A^*(G)$ rises with G as $W(a;\gamma)$ would decrease.[38] 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 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 $\gamma_A^*(G)$.

[38]Since $V(\gamma, a)$ exhibits greater complementarities between (γ, a) than $W(\gamma, a)$, we have

$$\arg\max_{a\geq 0} V(\gamma, a) \geq \arg\max_{a\geq 0} W(\gamma, a)$$

where $\geq$ refers to the strong set order. When the 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.

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[39]

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

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, $\delta \to 1$.[40,41] In this case we can write

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

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

[40]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.

[41]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.

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 patient 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 untrustworthy agents.

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. 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, where n_{LR} denotes the measure of trustworthy agents in the economy in steady state.[42] 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.

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

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. The per-capita welfare in the economy

[42] 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.

across both the public- and private-order institutions is

$$n_U W(a, \gamma) + n_M V(a, \gamma) + \lambda_{SR} * G$$