Relationships in the Wild: How Institutions Affect the Governance of Firms

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Abstract

In our model, firms employ agents in the shadow of a ruler who can expropriate them. We show that firms should be private under democracy and state-owned under autocracy. The ruler does not pay taxes and hence has stronger incentives than a private owner to employ the agents on contractible tasks. At the same time, the ruler can easily expropriate a firm she owns, and thus can less credibly promise output shares to incentivize effort. Under autocracy, output-sharing is not credible and thus the SOE's advantage dominates, whereas by constraining expropriation, democracy facilitates output sharing and strategically complements private ownership. We also show that firm performance has a U-shaped relationship with political checks and balances. These institutions prevent SOEs from using informal incentives because they improve the ruler's fallback option from reneging on them. As a result, we observe well-managed SOEs under autocracy (informal incentives, no taxes), poor private firms under weak democracy (formal incentives, high taxes), and well-managed private firms under strong democracy (formal and informal incentives, low taxes).

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1 Introduction

What makes firms like Toyota or Netflix successful? Being asked this question, a Martian visitor may notice three things. First, these firms flourished in countries with rule of law and checks and balances on the government. Second, they are privately owned. Third, they embraced and sometimes pioneered pay-for-performance and other advanced management practices, such as delegation of authority and relational supply chain governance.

Consistent with the observations of our Martian visitor, separate streams of economic literature have emphasized the efficiency-enhancing effects of private asset ownership (Hart, Shleifer and Vishny, 1997), incentives and governance (Williamson, 1979; Holmstrom, 1982), and political checks and balances (Acemoglu, Johnson and Robinson, 2001; North, Wallis and Weingast, 2009). A natural conclusion from these literatures is that one can increase firms' performance and economic development both by improving governance (i.e., privatizing firms and/or implementing high-powered incentives) under fixed political institutions and by improving political institutions under fixed governance.

The empirical evidence, however, suggests that the economic effects of political institutions and governance on firms do not simply add to each other but rather, they interact and constrain each other in subtle ways. On the one hand, private firms in developing and transition countries have been unable to replicate the incentive systems and management practices of their counterparts in advanced liberal democracies (Blanchard and Kremer, 1997; Bloom, Schweiger and Van Reenen, 2012). Figure 1 below illustrates this fact by showing that private firms in countries with weak constraints on governmental expropriation adopt on average poorer management practices (including pay-for-performance, delegation, and others) than their peers in countries with secure property rights.[1]

On the other hand, state-owned firms are still dominant in countries ruled by autocratic regimes (La Porta et al., 2002; Lin et al., 2020). Figure 2 below illustrates this fact by showing that banks are more likely to be state-owned in countries with weak constraints on expropriation than in those with secure property rights. Even more surprisingly, many SOEs in autocratic countries like China have been successful

[1]Regression analyses, available upon request, show that the positive correlation between management scores and property rights protection continues to hold at the firm level after controlling for size.

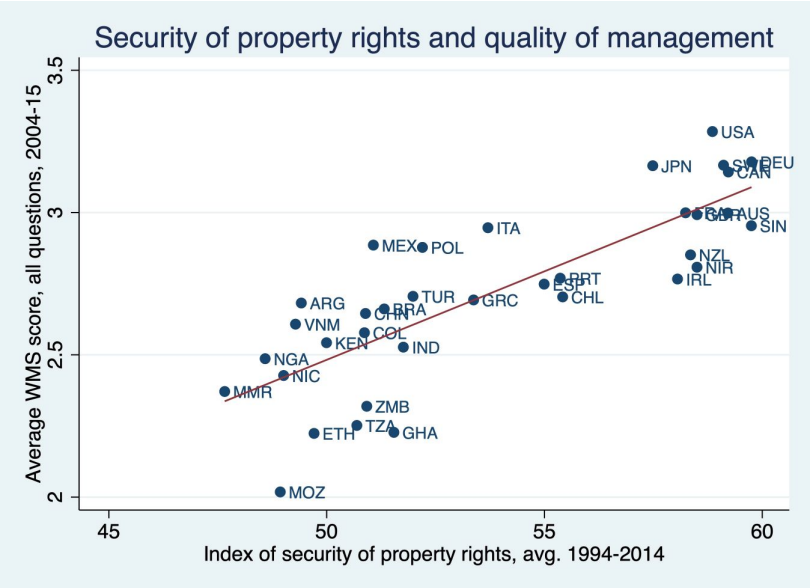

Figure 1: Firm management practices and security of property rights.

Note: Average WMS score is the average score of firms on 18 key management practices in the 2004-15 period, aggregated at the country level. The source is the Worlagement Survey of LSE-CEP (see Bloom et al., 2014). The index of security of property rights is the average of the country-level index constructed by Ouattara and Standaert (2020) for the 1994-2014 period.

at adopting "Toyota-style" incentive systems and management practices (Groves, Hong, McMillan, and Naughton, 1994; Xu, 2000), sometimes more so than their private counterparts (Cheng, Li and Li, 2021). Haier, with its celebrated subjective performance evaluation and incentive system (Pucik and Xin, 2004), is a case in point.

If these patterns are equilibrium outcomes to be explained (and not simply accidents or managerial and policy mistakes to be corrected), then we need economists to begin studying political institutions and the governance of firms in conjunction, rather than in isolation. The purpose of this paper is to develop a tractable model that tackles this challenge.

In our model, a firm consists of two productive agents, a "seller" (equivalently, a supplier or an employee) and a "buyer" (a manager), whose efforts jointly contribute to generate output. We assume that while output is always contractible, the agents' efforts may or may not be contractible, depending on the type of task required by the firm's production needs. When efforts are non-contractible, incentives are needed

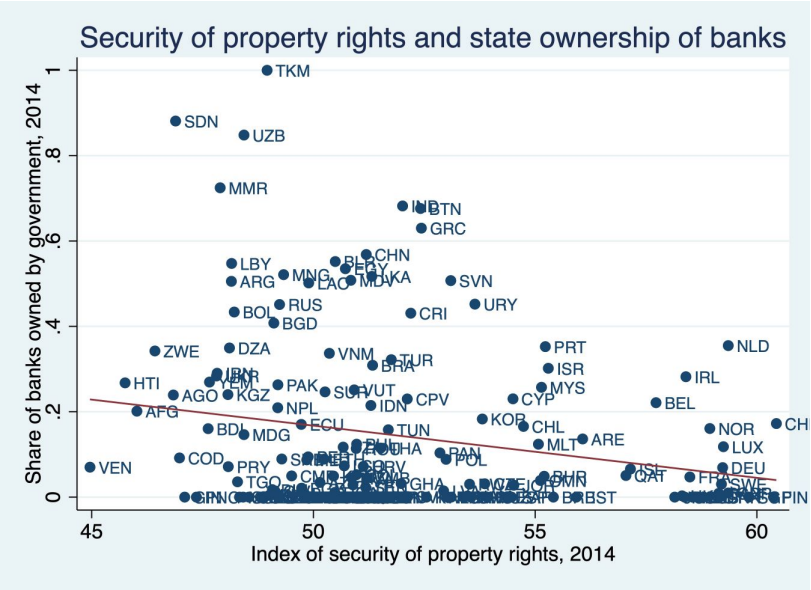

Figure 2: State ownership of banks and security of property rights

Note: The country-level share of state-owned banks in 2014 is constructed by Panizza (2023), following the methodology by LaPorta et al. (2002). The index of security of property rights for 2014 comes from Ouattara and Standaert (2020).

to induce the agents to work, which may take the form of a formal output sharing agreement or an informal subjective bonus. The central feature of our model is that unlike in standard agency settings, firms operate in the shadow of a third party, the ruler, who has an opportunity to expropriate the whole output, at the risk of being removed. Preventing expropriation therefore requires the ruler to receive a share of the output, which limits the contracts a firm can enter with the agents. The lower the probability of removal following expropriation (which we interpret as weak political institutions), the larger the constraint that the presence of the ruler imposes on firms' contracting possibilities.

In the first part of the paper, we study a "spot economy" in which firms solely rely on courts to enforce contracts with the agents, and on political institutions (i.e., the exogenous threat of removal) to deter expropriation by the ruler. We compare equilibrium incentive provision and output under two alternative modes of firm ownership. In the first mode, private ownership, one of the agents (say, the buyer) owns the firm and contracts with the other agent; courts enforce these productive contracts between agents, while a "political contract" requires the ruler not to expropriate the

firms' output, in exchange for taxes (and under the penalty of potential removal). In the second structure, state ownership, the ruler owns the firm and contracts with the buyer and the seller. Here, unlike the buyer under private ownership, the ruler has an option to ignore a court's order to pay the agreed upon output shares, and the political contract requires her not to do so (again, under the penalty of potential removal).

We find that under a low enough probability of ruler removal (weak political institutions), firms are optimally owned by the ruler and governed by simple contracts where the agents commit to exert effort on contractible tasks, in exchange for a fixed wage. In contrast, under strong enough political institutions, firms are optimally owned by the buyer and governed by more complex contracts that include output sharing among the agents to incentivize efforts on the non-contractible tasks. Intuitively, by moving output control and contracting rights from the agents to the ruler, state ownership has both a positive and a negative effect on firms. On the positive side, unlike a private firm's owner, the ruler does not pay taxes to outsiders, and hence can negotiate over the entire output when contracting with the agents. This "full-pie effect" induces the ruler to employ the agents efficiently on contractible tasks. On the negative side, if the ruler controls output, she can more easily expropriate it. This makes it harder for the ruler, relative to a private owner, to offer the agents output-sharing agreements that incentivize them to exert effort on non-contractible tasks. Consistent with the empirical evidence, but in contrast to the conventional wisdom in economics, our model therefore shows that production in autocracies is (optimally) organized through state-owned firms, even though these SOEs are less productive than the private firms one observes in advanced liberal democracies.

In the second part of our paper, we move from the spot economy described above to a "relational economy" where firms can complement court-enforced output sharing agreements with self-enforcing informal bonuses (Baker, Gibbons and Murphy, 1994), and expropriation by the ruler triggers not only institutional sanctions but also the termination of informal relationships (Olson, 1993; Greif et al., 1994). While the basic tradeoff between state and private ownership continues to exist in this relational economy, the interaction between subjective incentives and the ruler's threat of expropriation generates additional insights on the structure of firms' incentive systems, which can explain many observed patterns of firm governance in developing countries.

Our key finding in this second part of the paper is that the effectiveness of in-

centives, and the surplus generated by firms, have a U-shaped relationship with the strength of political institutions. When the probability of ruler removal is low, state ownership and low output sharing continue to be optimal (due to the overwhelming taxes under private ownership); unlike in the baseline model, however, the ruler can now replace formal output sharing with informal bonuses as a tool to incentivize the agents. If the ruler reneges on these bonuses, mutual trust is broken and the parties revert to the spot economy equilibrium (Baker et al., 2002). Under weak political institutions, this fallback option is unattractive for the ruler, and thus state-owned firms can credibly sustain relatively high bonuses and efforts. At intermediate levels of removal probability, however, the ruler's post-deviation fallback improves, the bonuses she can credibly promise become smaller, and efforts and output decrease. After a point, subjective bonuses under state ownership become so weak that private ownership becomes optimal, and the economy enters a "privatization trap": while private firms are now sufficiently productive to crowd out state ownership, they are quite heavily taxed (to deter full expropriation by the ruler), and can sustain neither high bonuses nor high efforts. In other words, private firms under mediocre political institutions are more poorly managed and less productive than the state-owned firms that existed under more autocratic institutions. It is only after the quality of political institutions increases further (and the ruler becomes highly constrained) that incentives in private firms become sufficiently effective for these firms to catch up with and finally outperform state-owned firms under autocracy. In our model, autocracies with state-owned firms therefore constitute a "local optimum".

These results can simultaneously explain the relative success of state-owned firms in autocratic regimes like contemporary China (Groves et al., 1994; Xu, 2000), and the failure of private firms in transition countries (Bloom, Schweiger and Van Reenen, 2012), at implementing "Toyota-like" incentive systems. The privatization trap can also explain why the chaotic transition to democracy in Russia, back in the 1990s, reduced firms' output (Blanchard and Kremer, 1997; Brown, Earle and Telegdy, 2006) until political institutions somewhat stabilized and property rights became more secure in the early Putin years (Brown, Earle and Gehlbach, 2013). Similarly, our trap results can explain why in South Korea, state-owned and semi-private firms performed well under non-democratic institutions, then declined when the country established free elections but lacked the checks and balances of advanced liberal democracies, and then flourished again as the country completed its democratization process (Amsden,

2001; Millhaupt and Pistor, 2008).

The rest of this paper is organized as follows. Section 2 discusses how our study relates to the economic literature. Section 3 presents the model. Section 4 analyzes how political institutions affect firms' governance in a spot economy. Section 5 performs this analysis in a relational economy. Section 6 discusses empirical applications of the model and section 7 presents some extensions. Section 8 concludes.

2 Relation to the literature

Our paper relates to both the vast economic literature on contracts and organizations (see Gibbons and Roberts, 2013, for a comprehensive review) and the literature on political institutions. On the one hand, classic models of incentives (e.g., Holmstrom, 1982, and thereafter) and asset ownership (e.g., Grossman and Hart, 1986, and thereafter) focus on imperfections in contractual enforcement, assuming strong political institutions and hence no risk of expropriation. On the other hand, models of political institutions study how repeated interactions can provide incentives to rulers and governmental agents (e.g., Olson, 1993; Greif, Milgrom and Weingast, 1994; Dixit, 2003; North, Wallis and Weingast, 2009; Myerson, 2015), abstracting from contracting and incentive provision among private traders. By exploring how institutional constraints on rulers shape contracting and ownership in firms, our paper builds a bridge between these two literatures, which we hope will stimulate further inquiry into the interplay of political institutions and organization.

Our paper also contributes to a (smaller) literature that uses an incomplete contracting approach to compare state and private ownership. Contributions to this literature include Schleifer and Vishny (1994), Schmidt (1996), Hart et al. (1997), Che and Qian (1998), and Williamson (1999). Among these models, the only ones that study ownership under weak political institutions are Shleifer and Vishny (1994) and Che and Qian (1998). Shleifer and Vishny (1994) show that an autocratic ruler may prefer state ownership as it more easily allows her to recruit and reward clients. Our model shows that weak political institutions favor state ownership even if the ruler's preferences for nepotism are similar across political regimes. Che and Qian (1998) develop a model of Chinese autocracy in which private firms distort the production technology to hide revenue from the government. Neither these two models nor the other papers in this literature study how governance differs across state-owned

and private firms under different political regimes.

3 Model

We study an economy consisting of four groups of players: a ruler (she), two unit masses of identical productive agents (he), and the courts. We will call the two masses of productive agents "buyers" and "sellers" for brevity. One can think of the buyers as downstream firms and the sellers as their upstream suppliers. Alternatively, one can think of the buyers as managers of the downstream firms and the sellers as their employees. Production of output requires the matching of a buyer and a seller and their joint efforts, and these activities are overseen by the courts and the ruler, as discussed below. All players are risk-neutral, infinitely lived, and discount the future at a common factor $\delta \in [0, 1)$. The model's ingredients and timeline are described in detail below.

Production: Once a buyer and a seller are matched, they jointly produce output $Y \in \{0, y\}$. The probability that high output $y > 0$ is produced is

$$\Pr(Y = y) = a_B + a_S, \tag{1}$$

where a_B, a_S are the productive efforts of the buyer and the seller, respectively.[2] The cost of effort is borne privately by each agent and given by $c(a_i) = \frac{1}{2}a_i^2$, with $i \in \{B, S\}$. Given the unit mass of buyers and sellers and their pairwise effort choices, the total output in the economy is then given by $\Pi = y \int_j \sum_i (a_{i,j})\, dj$ while the social surplus is given by $\pi = \int_j \sum_i (y a_{i,j} - c(a_{i,j}))\, dj$, where $j \in [0, 1]$ indexes the particular pair formed.[3] To satisfy the interpretation of efforts as generating a probability of successful output, we assume that $y \leq 1/2$.

Ownership: Output at each firm will be owned either by one of the productive agents, say, the buyer (*private ownership*) or by the ruler (*state ownership*). Under state ownership, the ruler collects and controls the firm's output, and contracts with

[2]Because we focus on stationary equilibria throughout the model (as discussed below), we omit time subscripts for all variables.

[3]Note that while the output of any given pair is stochastic, the aggregate output in the economy will be a deterministic function of the effort choices.

both agents for their efforts. Under private ownership, the buyer collects output and contract with the seller. Thus, as in standard economic models (Grossman and Hart, 1986), the players' productive roles (i.e., who exerts effort) do not depend on ownership. What does depend on ownership is the allocation of control and contracting rights at each firm, that is: (1) who collects output and (2) who contracts with the productive agents. Since our main purpose is to study contract design and ownership at a typical firm, we assume for simplicity that firms in the economy are either all privately owned or all state-owned. We consider the possibility of a mixed economy with both private and state-owned firm in section 7.

Contracts: Contracts ensure that the buyer and the seller at each firm exert effort, and can include both formal (i.e., court-enforceable) provisions and informal (i.e., self-enforcing) ones. We assume that while output and payments are verifiable by courts, efforts may or may not be verifiable, depending on the agents' task. Formally, a stochastic state $\theta_j \in \{E, N\}$, specific to each firm, is realized and observed by the agents and the owner after the contract is signed but before efforts are chosen. In the "enforcement" E, the agents' task is such that efforts are verifiable (e.g., producing an input with standard specifications). In contrast, in the "non-enforcement state" state N, efforts are unverifiable (e.g., producing a non-standard, customized input), implying that the agents can shirk while collecting any contracted fixed wages.[4] Given this environment, a contract specifies, for each agent i and firm: (i) a formal fixed payment β_i (which could be negative), (ii) a formal share $b_i \in [0, 1]$ of the realized output Y, (iii) a formal effort level to be exerted in state E, $a_{i,E}$, (iv) an informal effort level to be exerted in state N, $a_{i,N}$, and (v) an informal bonus, $B_{i,N}$, to be paid if the agent exerts the promised effort $a_{i,N}$. While fixed wage contracts (β_i in exchange for $a_{i,E}$ suffice to elicit effort in state E, incentive provisions (either formal, b_i, or informal, $B_{i,N}$) are necessary in state N. We denote the enforcement state's probability as $\Pr(\theta_j = E) = q_j$, and we assume for simplicity that it is the same across productive agents: $q_j = q_{j'} = q$. We interpret q as a combination of (1) complexity in the firm's production process and (2) quality of the court system.

Ruler: The ruler has an opportunity to expropriate each firm's output - by moving to steal it from the buyer under private ownership, or by refusing to pay the two

[4]Similar results would obtain if we included both contractible and non-contractible efforts in a multitasking model.

agents their promised shares under state ownership. To prevent full expropriation, which would destroy the agents' incentive to participate in production, the ruler offers a "political contract" to the buyers and sellers, which specifies a promise to obey the courts' order to pay (under state ownership) or a promise not to steal output (under private ownership). To make compliance attractive, under private ownership the political contract also specifies taxes that the ruler can collect from the buyer and the seller at each firm. Given that output and monetary transfers can be verified, we allow these taxes to include both lump sum transfers and shares of the agents' profits. Thus, the total tax liability of a typical buyer and seller are given, respectively, by $T_B = \kappa_B (y(1 - b_S) - \beta_S - B_{S,N}) + t_B$, and $T_S = \kappa_S (yb_S + \beta_S + B_{S,N}) + t_S$, where κ_B and κ_S are marginal tax rates, and t_B and t_S are the lump-sum taxes.[5] Under state ownership, the ruler contracts directly with the agents and can use fixed transfers in the contract to extract surplus so there is no need for her to collect taxes.

Political institutions: If the ruler expropriates output, courts enforce the political contract with probability $\tau \in [0, 1]$, in which case the ruler is removed from office and receives a payoff of zero going forward (while a new ruler is installed). With probability $1 - \tau$, courts fail to enforce the political contract and the ruler remains in power. We interpret τ as the quality of political institutions, in the sense of rule of law and formal constrains on the ruler's power.[6] A key assumption we make here is that removal of the ruler is faster under private ownership: if the ruler attempts to expropriate output in period t, her period-t expected payoff is $(1 - \tau)\Pi$ under private ownership, and Π under state ownership. This assumption captures the fact that ownership transfers residual rights of control over a firm (Grossman and Hart, 1986). Under state ownership, if the ruler decides to expropriate the agents, she can consume the whole output right away, and after that face the risk of removal. In contrast, under private ownership, expropriation requires the ruler to steal output she does not control, implying that courts have a chance to remove the ruler before she can consume it.[7] Private ownership and political institutions (τ) are therefore

[5] This formulation seems to be most representative of practical taxation. Given the normalization of low output to zero, the literal interpretation does mean that some firms will get subsidies when the output fails and the buyer still owes payments to the seller. We could avoid this by assuming a positive low output or that the ruler taxes rather than income. Doing so would complicate the analysis without generate any additional insights.

[6] In practice, institutions other than courts, such as parliaments, may be in charge of enforcing the political contract (although supreme or constitutional courts may also be involved in such task).

[7] Technology and institutions may prevent the ruler from consuming some share γ of the output

strategic complements in deterring expropriation, an important feature of the model that will become clearer below.

Other assumptions: We make three additional assumptions. First, all players have deep pockets, so that they can make payments even if no output is realized. Second, output cannot be leveraged contractually, so that $\sum b_i \leq 1$. This is effectively a "no-sabotage" constraint, requiring that no player's payoff decreases ina firm's output. Third, the ruler cannot pledge wealth at the beginning of the game as a hostage to ensure compliance with her promises. Assumptions 1 and 3 could be easily relaxed without qualitatively affecting the results. Assumption 2 ensures that output sharing alone cannot elicit first-best efforts, and thus the analysis is non-trivial.

Timeline of the stage game: The timeline in each period depends on firm ownership. Under private ownership, the ruler chooses at the outset the marginal and lump sum taxes, $(\kappa_B, \kappa_S, t_B, t_S)$. Next, the buyer at each firm makes a TIOLI offer to the seller (given deep pockets, assuming a TIOLI offer is without loss), which specifies a contract $(\beta_S, b_S, a_{B,E}, a_{S,E}, a_{B,N}, a_{S,N}, B_{S,N})$. If the seller accepts, the agreed upon fixed payments are made, after which the agents observe the effort enforceability state $\theta_j \in \{E, N\}$, and choose their efforts accordingly. Once the efforts are sunk, output at each firm is realized and the contracted shares are paid out, after which the ruler chooses whether to collect the announced taxes or move to expropriate the entire output. If the ruler moves to expropriate, she is immediately deposed with probability τ whereas with probability $(1-\tau)$, she consumes the output and remains in power. Under state ownership, the timeline is similar except that now, the ruler owns the output and contracts with the agents for their efforts. At the outset, the ruler makes a TIOLI offer specifying a contract, $(\beta_i, b_i, a_{i,E}, a_{i,N}, B_{i,N})$, for each agent. After that, the state is realized, the agents choose their efforts, output is realized, and the ruler chooses whether to pay out the formally contracted output shares and the informally agreed bonuses. If the ruler defaults on the formal output shares (by consuming the full output), thus violating the political contrac, she is deposed with probability τ whereas she remains in power with probability $(1-\tau)$.

(under state ownership), or enable her to consume some share λ (under private ownership), before expropriation is observed and punished. Our analysis would continue to hold in this more general model so long as the control rights attached to ownership create an asymmetry between the two shares: $\gamma < \lambda$.

4 Benchmark analysis: governance and political institutions in a spot economy

We begin our analysis by studying a "spot economy" where parties solely rely on courts to enforce contracts and on political institutions to prevent expropriation. Formally, within each ownership structure, we analyze subgame perfect equilibria of the repeated game described above in which players ignore history (i.e., the sequence of actions in previous periods) when choosing their actions in any given period t. In such a model, bonuses contingent on non-contractible efforts are never honored and hence are not included in a firm's contract. Consequently, contracts in the spot economy only consist of formal provisions (fixed payments, output shares, and contractible effort levels). In section 5, we analyze the more general case of a "relational economy" where actions can be conditioned on the history of play and informal contractual provisions can be self-enforcing.

After characterizing the equilibrium within each ownership structure for different strengths of political institutions, we compute the spot economy's overall equilibrium by selecting the ownership structure that generates the highest total expected In section 5, we analyze the more general case of a "relational economy" where actions can be conditioned on the history of play and informal contractual provisions can be self-enforcing. We discuss equilibrium selection in this more general model below. surplus. This is the equilibrium the ruler would like to select (having all the bargaining power, she appropriates the whole surplus under each ownership structure). Given deep pockets, this is also the equilibrium that the players would negotiate under different allocations of bargaining power.

The spot economy model is a useful starting point, for two reasons. First, it provides key insights on the choice between state and private ownership that carry over to the relational economy analyzed in section 5. Second, as we shall see, optimal governance in a spot economy is the outcome the parties fall back on when their informal contracts break down. Thus, the results in this section importantly affect our analysis of the relational economy below.

4.1 Private ownership

To characterize the spot equilibrium under private ownership, we proceed by backward induction: we begin by solving for the buyer's optimal contract at each firm, conditional on taxes, and then we solve for the taxes that maximize the ruler's payoff given such contract. Under given contracts and taxes, the buyer's payoff is

$$u_B = (1-\kappa_B)\left((1-b_S)\,\Pi - \beta_S\right) - t_B - \tfrac{1}{2}qa_{B,E}^2 - \tfrac{1}{2}(1-q)a_{B,N}^2,$$

and the seller's participation constraint is

$$u_S = (1-\kappa_S)\left(b_S\Pi + \beta_S\right) - t_S - \tfrac{1}{2}qa_{S,E}^2 - \tfrac{1}{2}\left(1-q\right)a_{S,N}^2 \geq 0. \tag{2}$$

where $y\left(q\left(a_{B,E}+a_{S,E}\right)+\left(1-q\right)\left(a_{B,N}+a_{S,N}\right)\right) = \Pi$ denotes a typical firm's expected output. In words, each player expects to receive his share of the output and to incur the effort cost (both of which depend on whether the realized state of the world supports contractible efforts ($a_{i,E}$) or not ($a_{i,N}$)), makes (or receives) the prescribed fixed transfer β_i, and is taxed by the ruler at the prescribed marginal rate κ_i and lump-sum level t_i.

As noted above, when efforts are contractible, courts can compel the buyer and the seller to supply them in the promised amount. However, when efforts are not contractible, the agents choose them to maximize their individual payoffs, given the output shares and marginal taxes. That is, non-contractible efforts satisfy the incentive constraints

$$a_{B,N}^{ps} = (1-\kappa_B)\left(1-b_S\right)y \text{ and } a_{S,N}^{ps} = (1-\kappa_S)\,b_S y. \tag{3}$$

Anticipating this, the buyer chooses the contract terms that maximize u_B, subject to the seller's participation and incentive constraints:

$$\max_{\beta_S, b_S, a_{B,E}, a_{S,E}} u_B$$

s.t. constraints 2 and 3.

Lastly, anticipating the efforts that buyers and sellers at each firm will exert under given taxes, the ruler chooses the tax levels to maximize her payoff. If the ruler could

commit to the announced taxes, it would be optimal for her to maximize efforts and output by selecting zero marginal tax rates ($\kappa_B = \kappa_S = 0$) while using the lump-sum transfers to extract the economy's surplus. Since the ruler cannot commit, however, the political contract with the agents must be incentive compatible: the ruler's stream of tax revenues, which she risks losing upon being deposed, must offset her present gains from expropriation, or else the agents will not participate in production. A key point here is that in the absence of marginal taxes, high efforts and output might make expropriation too tempting for the ruler. Thus, positive marginal taxes may be necessary for the ruler to select low-enough output levels to make the non-expropriation promise incentive compatible. Formally, if the ruler honors the political contract, her payoff is

$$u_R = \kappa_B \left((1 - b_S) \Pi - \beta_S \right) + \kappa_S \left(b_S \Pi + \beta_S \right) + t_S + t_B,$$

where Π denotes both a typical firm's expected output (as above) and the economy-wide realized output level.[8] For the ruler not to breach the political contract, earning this payoff in each period must be more attractive than expropriating the economy's output (the ruler's optimal deviation), that is, the following incentive constraint must be satisfied:

$$\frac{u_R}{1-\delta} \geq (1 - \tau) \left(\Pi + \frac{\delta}{1-\delta} u_R \right), \tag{4}$$

The right hand side follows from the ruler's difficulty to expropriate agents when she does not own the firms' output: with probability τ, expropriation fails and the ruler is removed by the courts, in which case she receives a payoff of zero both in the future and in the current period.

The equilibrium taxes then maximize u_R, subject to the ruler's incentive constraint 4 and the agents' efforts as determined by the buyer's program from above. The resulting private ownership equilibrium is summarized in the following proposition:

Proposition 1 ***Equilibrium in a spot economy under private ownership:*** *In a spot ecponomy, the equilibrium under private ownership is as follows: (i) the marginal tax rate is equal across the productive agents, $\kappa_B = \kappa_S = \kappa^{ps}$, and is given*

[8] Given the mass of firms, fraction q of the firms is always in the enforceable state while a fraction $1 - q$ is the non-enforceable state.

by $\max(0, \kappa^*)$*, where* $\kappa^* = 1 - \frac{4\tau(1+q)}{(1+3q)(1-(1-\tau)\delta)}$*, with* $\frac{d\kappa^*}{d\delta} < 0$, $\frac{d\kappa^*}{dq} > 0$ *and* $\frac{d\kappa^*}{d\tau} < 0$.
(ii) the contract sets contractible effort levels $a^{ps}_{B,E} = a^{ps}_{S,E} = (1 - \kappa^{ps})\, y$*, and an output-sharing rule* $b^{ps}_S = \frac{1}{2}$ *that induces non-contractible effort levels* $a^{ps}_{B,N} = a^{ps}_{S,N} = \frac{1}{2}(1 - \kappa^{ps})\, y$.

Proof. See Appendix A.1. ■

Intuitively, given deep pockets, the buyer selects contractible effort levels that maximize the buyer's and seller's joint output share given taxes, minus the effort costs. Output-sharing is used to incentivize the agents to exert non-contractible efforts, and given convexity of the effort costs, the buyer optimally selects a 50/50 output-sharing rule. Lastly, the ruler sets equal marginal tax rates across agents, due again to effort cost convexity and the efficiency of a balanced allocation of effort. Most importantly, as discussed above, the ruler may need positive marginal taxes to induce an output level low enough to deter expropriation. Because these taxes reduce the expected surplus available to the buyer and the seller when negotiating their contract, they constrain both contractible efforts (directly) and non-contractible efforts (by lowering the agents' effective output shares). The equilibrium marginal tax rate and the ensuing effort distortion decrease in both the quality of political institutions, τ, and the ruler's patience, δ.

Interestingly, the effect of effort contractibility (measured by q) on taxes and effort is opposite to the effect of political institutions. By raising output under given taxes, contractibility increases the ruler's gains from expropriation and thus requires a higher marginal tax to reduce output and restore the political contract's credibility. This result is consistent with cross-country evidence showing that improvements in contract enforcement institutions are less beneficial than improvements in political institutions (Acemoglu and Johnson, 2005), and may even reduce GDP when political institutions are too weak (Aldashev and Zanarone, 2017).

4.2 State ownership

In the state ownership equilibrium, the ruler selects contract terms that maximize her per period payoff, given the effort levels those contract terms will elicit from the buyer and the seller at each firm. Given identical agents and linear output, such optimal contract must be symmetric so we can write the ruler's per period payoff as

$u_R = (1-2b)\,\Pi - 2\beta$. Similarly, we can write the agents' payoffs and participation constraints as

$$u_i = b\Pi + \beta - q\frac{1}{2}a_E^2 - (1-q)\,\frac{1}{2}a_N^2 \geq 0. \tag{5}$$

where $\Pi = y\,(qa_E + (1-q)\,a_N)$ denotes the firm's expected output and the economy's aggregate output, as before. When the required efforts are non-contractible, the agents will select them to maximize their payoffs so these efforts are given by the incentive constraint

$$a_N = by. \tag{6}$$

Additionally, the contracted payments must be incentive compatible for the ruler, who unlike the buyer under private ownership, has an opportunity to withhold them. This condition is easily satisfied for the fixed wage β: if the ruler does not pay it upfront, the agents can hold their contractible efforts as a hostage because courts will not compel the agents to exert such efforts unless the wage has been paid. This mechanism does not apply to the output share b, however, which must be paid after the efforts are sunk. Thus, for b to be incentive compatible, the threat to be removed must be strong enough to deter expropriation by the ruler, that is:

$$\frac{\delta}{1-\delta}u_R \geq 2b\Pi + (1-\tau)\,\frac{\delta}{1-\delta}u_R \tag{7}$$

The optimal contract under state ownership then maximizes u_R subject to equations 5, 6, and 7, and it is given by the following proposition:

Proposition 2 ***Equilibrium in a spot economy under state ownership:*** *In a spot economy, the equilibrium under state ownership is as follows: (i) the agents' contractible effort is $a_E^{ss} = y$, (ii) non-contractible effort is $a_N^{ss} = by$, and (iii) the output sharing rule is* $b^{ss} = \min\left\{\frac{1}{2}, \frac{\sqrt{q^2+4\phi^2(1-q)}-(q-2(1-q)\phi)}{2(1-q)(1+\phi)}\right\}$, *where* $\phi = \frac{\tau\delta}{4(1-\delta)}$.

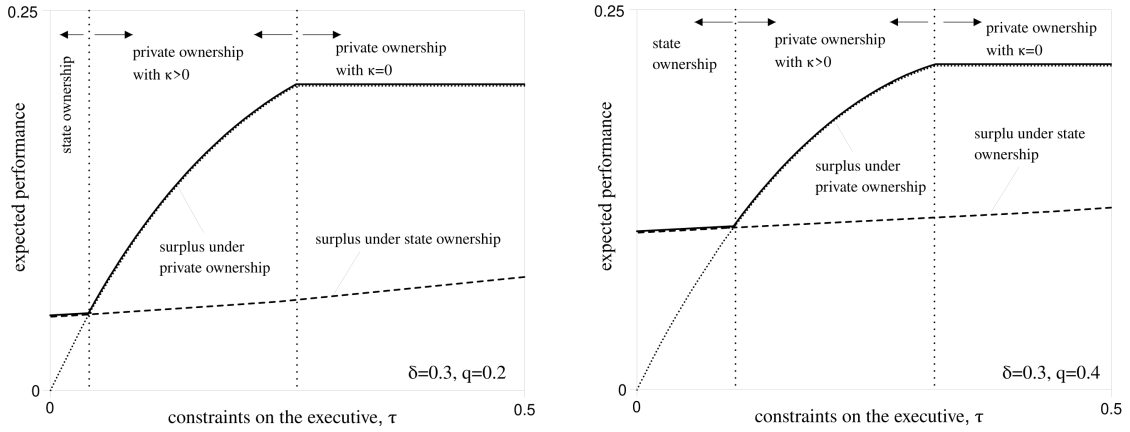

Figure 3: Optimal governance in a spot economy under different political institutions

Proof. See Appendix A.2 ■

Unlike under private ownership, the ruler now selects efficient amounts of contractible effort. That occurs because the ruler does not owe taxes to outsiders, and thus she negotiates with the agents effort levels that maximize the firm's full output minus the effort costs. At the same time, the equilibrium sharing rule under state ownership is generally lower than under private ownership ($b^{ss} \leq \frac{1}{2}$) due to the ruler's commitment problem. The ruler would like to give half output to each agent to maximize production, while using fixed payments to extract the surplus. However, if political institutions are too weak (low τ) or the ruler is too impatient (low δ), the ruler cannot credibly promise to do so. In that case, the agents' output shares must be set below 1/2 to restore credibility, and the lower τ and δ, the farther the output sharing rule is from the 50-50 efficient benchmark.

4.3 Optimal spot governance

Figure 3 depicts the total expected surplus generated under private ownership (solid curve) and state ownership (dashed curve) in a spot economy at different strengths of political institutions, τ, holding contract enforceability, q, and the players' patience, δ, constant. The optimal governance for firms is the ownership-contract bundle that generates higher surplus.

This Figure provides theoretical foundations for one of the stylized facts described in the introduction - namely, the high incidence of state ownership in developing countries characterized by weak constraints on the executive. When political institutions are weak (τ close to zero), the ruler's incentive constraint is too tight to sustain output sharing, and thus non-contractible efforts are low under both ownership structures. However, while state-owned firms are at least able to select efficient amounts of contractible effort (due to the full-pie effect), high taxes prevent private firms from doing so, implying that state ownership, combined with fixed wages and low output sharing, is the optimal governance at low levels of τ. In contrast, when political institutions are strong enough (high τ), and hence some output sharing is feasible, private ownership is the optimal governance. This occurs because under private ownership, expropriation is more difficult than under state ownership, as it requires the ruler to steal output she does not control, and thus the ruler's incentive constraint is less stringent.

5 Full analysis: governance and political institutions in a relational economy

The spot economy analyzed above is inherently inefficient: even under no expropriation risk ($\tau = 0$) and fifty-fifty output sharing, non-contractible efforts are below the first best level $a^{FB} = y$, due to the freeriding-in-teams problem (Holmstrom, 1982). In this section, we analyze a "relational economy" where parties condition current actions to the history of play, and thus can potentially self-enforce informal contracts where the agents promise to exert higher efforts in exchange for a bonus (Baker et al., 1994; Levin, 2003). We interpret such informal incentive contracts as the relational management practices pioneered by advanced capitalist firms like Toyota or Lincoln Electric.

Formally, we study subgame perfect equilibria of the infinitely repeated game between the ruler and the buyer and the seller at each firm, with the following features.

Private ownership: (1) taxes and contract terms (upfront payments, output shares, efforts and bonuses) are the same in every period. (2) Contract terms maximize the buyer's per period payoff given taxes chosen by the ruler, while taxes maximize the ruler's payoff given the contract terms they will induce. (3) If in any given period

the buyer or the seller at a firm reneges on the promised non-contractible effort or informal bonus, equilibrium taxes continue to apply in subsequent periods, and the firm perpetually reverts to the optimal spot governance structure conditional on such taxes. (4) If in any given period the ruler expropriates a firm's output and is not removed from office, all firms perpetually revert to the optimal spot governance structure - that is, the structure that maximizes the ruler's payoff (and surplus) in the spot economy.

State ownership: (1) Contract terms are the same in every period.(2) Contract terms maximize the ruler's payoff. (3) If the ruler defaults on a contractual payment (formal or informal) and is not removed, all firms in the economy perpetually revert to the optimal spot governance structure.

Discussion: Given the features of our environment (absence of liquidity constraints and observability of efforts), Levin (2003) applies, and thus focusing on stationary equilibria is without loss (see also MacLeod and Malcomson, 1989). Reversion to optimal spot governance following a deviation is a standard punishment strategy in the literature on relational contracts (Baker et al., 2002). Multilateral punishment of the ruler's deviations by all firms is optimal by standard arguments (Levin, 2002). Assuming such punishment follows deviations on both informal bonuses and formal payments is also optimal because it minimizes the ruler's post-deviation payoff. Lastly, Lemma 4 below shows that the assumed bilateral punishment of buyers' and sellers' deviations on informal contracts is optimal: R can select equilibrium taxes such that she extract all the surplus while pushing the agents' post-deviation payoffs down to zero.

As in section 4, after characterizing the equilibrium within each ownership structure for different strengths of political institutions, we define the economy's overall equilibrium by selecting the ownership structure whose equilibrium generates the highest total expected surplus.

5.1 Private ownership

The analysis of private ownership is similar to the previous section, except that contracts now also include informal terms, that is, non-contractible efforts $a_{B,N}, a_{S,N}$,

and a discretionary bonus $B_{S,N}$ that the buyer should pay the seller upon delivery of the promised effort. The goal of adding bonuses to formal output sharing is to move the equilibrium levels of non-contractible effort closer to the tax-conditional efficient level, $(1-\kappa)\,y$. The buyer's payoff is now given by

$$u_B = (1-\kappa)\left((1-b_S)\,\Pi - \beta_S - (1-q)B_{S,N}\right) - t_B - \tfrac{1}{2}qa_{B,E}^2 - \tfrac{1}{2}(1-q)a_{B,N}^2,$$

and the seller's participation constraints at each firm is

$$u_S = (1-\kappa)\left(b_S\Pi + \beta_S + (1-q)B_{S,N}\right) - t_S - \tfrac{1}{2}qa_{S,E}^2 - \tfrac{1}{2}\,(1-q)\,a_{S,N}^2 \geq 0 \qquad (8)$$

Additionally, the two agents' promise to exert non-contractible effort when prescribed, and the buyer's promise to pay an effort-contingent bonus to the seller, must satisfy the incentive constraints:

$$\begin{aligned} &-(1-\kappa)\,B_{S,N} + (1-\kappa)\,(1-b_S)\,y\,(a_{B,N}+a_{S,N}) - \tfrac{1}{2}a_{B,N}^2 + \tfrac{\delta}{1-\delta}u_B \\ &\geq \max_{a_B}\left((1-\kappa)\,(1-b_S)\,y\,(a_B+a_{S,N}) - \tfrac{1}{2}a_B^2\right) + \tfrac{\delta}{1-\delta}u_B^{dev} \end{aligned} \qquad (9)$$

$$\begin{aligned} &(1-\kappa)\left(b_S y\,(a_{B,N}+a_{S,N}) + B_{S,N}\right) - \tfrac{1}{2}a_{S,N}^2 + \tfrac{\delta}{1-\delta}u_S \\ &\geq \max_{a_S}\left((1-\kappa)\,b_S y\,(a_{B,N}+a_S) - \tfrac{1}{2}a_S^2\right) + \tfrac{\delta}{1-\delta}u_S^{dev}. \end{aligned} \qquad (10)$$

In words, each agent must prefer to pay (or accept) the promised bonus, exert the promised effort, consume his output share, and continue on the equilibrium path rather than renege on the bonus, choose the effort opportunistically, and enter the punishment phase. The terms u_B^{dev} and u_S^{dev} denote the buyer's and the seller's per period payoffs in the punishment phase, to be precisely characterized by Lemma 4 below. The optimal deviations from a given promised effort are $a_B^{dev} = (1-\kappa)\,(1-b_S)\,y$ for the buyer and $a_S^{dev} = (1-\kappa)\,b_S y$ for the seller. The solution to the private firm's contract design problem is simplified by the following lemma, which follows from the same intuitive arguments underlying Proposition 1 above.

Lemma 3 *In a relational economy, the equilibrium contract under private ownership prescribes output-sharing rule* $b^{pr} = \frac{1}{2}$ *and symmetric efforts* ($a_{B,E} = a_{S,E} = a_E$, *and*

$a_{B,N} = a_{S,N} = a_N$*). Moreover, for a given marginal tax rate, non-contractible efforts are given by* $a_E^{pr} = (1-\kappa)\, y$

Proof. See Appendix A.3. ■

After substituting the buyer's and seller's optimal deviations, and taking into account Lemma 3, we can sum up the two agents' incentive constraints to obtain a unique condition for the private firm's contract to be self-enforcing:

$$\frac{\delta}{1-\delta}\left((u_B + u_S) - \left(u_B^{dev} + u_S^{dev}\right)\right) \geq \frac{1}{4}(1-\kappa)^2 y^2 - \left((1-\kappa)\, y a_N - a_N^2\right), \qquad (11)$$

In words, the present discounted surplus generated by the relationship between the buyer and the seller must exceed their joint present gains from reneging. The optimal contract then consists of the buyer and the seller choosing a_N to maximize their joint surplus $u_B + u_S$, subject to (11).

To complete the analysis, we must now consider the ruler's choice of taxes, and how this interacts with firms' incentive systems. As usual, the ruler's incentive constraint prescribes that his payoff from collecting taxes must exceed the payoff from expropriating the whole economy's output, that is:

$$\frac{1}{1-\delta} u_R \geq (1-\tau)\left(\Pi + \frac{\delta}{1-\delta} u_R^{dev}\right), \qquad (12)$$

where $u_R = \kappa \Pi^{pr} + t_B + t_S$ is the ruler's per period equilibrium payoff, and u_R^{dev} is the ruler's per period payoff if she expropriates but is not removed by courts (i.e., surplus under the optimal spot governance structure).

The last step in our analysis is to combine incentive constraints (11) and (12) to fully characterize the equilibrium under private ownership. To do so, the next Lemma specifies the buyer's and the seller's payoffs after a deviation on the informally contracted efforts and bonuses, u_B^{dev} and u_S^{dev}, under our assumed punishment strategy.

Lemma 4 *The equilibrium lump-sum taxes* t_B *and* t_S *make the two agents indifferent between participating in production and exiting following a deviation:* $u_B^{dev} = u_S^{dev} = 0$.

Proof. See Appendix A.4. ■

Given the above results, we can sum the agents' and the ruler's incentive constraints to obtain a unique self-enforcement condition for private ownership.

$$\begin{aligned} &qy^2\left(1-\kappa^2\right)+(1-q)\left(2ya_N-a_N^2\right)\geq \\ &(1-\tau)\left(2\left(1-\delta\right)y\left(q\left(1-\kappa\right)y+(1-q)a_N\right)+\delta u_R^{dev}\right) \\ &+\tfrac{(1-\delta)}{\delta}\left(\tfrac{1}{4}\left(1-\kappa\right)^2y^2-\left(\left(1-\kappa\right)ya_N-a_N^2\right)\right), \end{aligned} \tag{13}$$

The first line in the self-enforcement constraint is total surplus in the economy, the second line is the (normalized) deviation payoff the ruler obtains from expropriating output, and the third line is the buyer's and seller's joint payoff from deviating on the informal contract terms. Surplus then needs to be sufficient to deter both of these potential deviations. We can thus write the ruler's tax choice problem under private ownership as

$$\begin{aligned} &\max_{\kappa} qy^2\left(1-\kappa^2\right)+(1-q)\left(2ya_N^{pr}-\left(a_N^{pr}\right)^2\right) \\ &\text{s.t.} \qquad a_N^{pr}=\max_{a_N}\left(\left(1-\kappa\right)\left(2ya_N\right)-a_N^2\right), \text{ and constraint (13) under } a_N=a_N^{pr}. \end{aligned}$$

In words, the marginal tax rate is chosen to maximize total surplus, subject to the constraints that (1) non-contractible efforts maximize the buyer' and the seller's joint surplus given marginal taxes, and (2) both the marginal tax rate and the effort levels satisfy the self-enforcement constraint.

5.2 State ownership

Under state ownership, the ruler enters both formal contracts (as in section 4) and informal contracts $(B_{i,N}, a_{i,N})$ with the two agents at each firm, and collects the output they produce. Since all firms face the same contracting friction q, agents are identical, and effort costs are convex, we can focus on a representative firm with equal contract terms across agents. As a result, the ruler's payoff can be written as $u_R = 2\left(\left(1-2b\right)y\left(qa_E+(1-q)a_N\right)-(1-q)B_N-\beta\right)$, and productive agents' participation constraints can be written as

$$u_i = 2by\left(qa_E + (1-q)a_N\right) + (1-q)B_N + \beta - q\frac{1}{2}a_E^2 - (1-q)\frac{1}{2}a_N^2 \geq 0. \qquad (14)$$

The incentive constraints of the buyer and seller are similar to those under private ownership, except that now incomes are not subject to taxes:

$$B_N - \frac{1}{2}a_N^2 + 2bya_N + \frac{\delta}{1-\delta}u_i \geq \max_{a_i}\left(by\left(a_i + a_N\right) - \frac{1}{2}a_i^2\right) + \frac{\delta}{1-\delta}u_i^{dev}, \qquad (15)$$

The ruler has two alternative deviation opportunities, and thus two separate incentive constraints. First, she may choose to renege on the subjective bonuses, while honoring the formally contracted output shares. Given mass one of both buyers and sellers, of which fraction $1-q$ is in the non-enforcement state for which a subjective bonus is needed, the ruler can save $-2B_N(1-q)$ by reneging on all bonuses at once. Thus, the incentive constraint that deters this deviation is given by

$$\frac{\delta}{1-\delta}\left(u_R - u_R^{dev}\right) \geq 2(1-q)B_N, \qquad (16)$$

where u_R^{dev} is total surplus under the optimal spot governance, as discussed above.

Alternatively, the ruler may choose to simultaneously default on both the bonuses and the output shares. By doing so, the ruler gains more in the present from a deviation but risks being removed if the courts successfully intervene to sanction her abuse of power. The incentive constraint that deters this joint deviation is:

$$\frac{\delta}{1-\delta}\left(u_R - (1-\tau)\,u_R^{dev}\right) \geq 2(1-q)B_N + 4by\left(qa_E + (1-q)a_N\right). \qquad (17)$$

where the left hand side denotes the ruler's net continuation payoff following a joint deviation, while the right hand side denotes the present gains from such deviation - that is, the bonuses and output shares saved by the ruler.

Given the participation and incentive constraints described above, we can write the ruler's problem as

$$\max_{b,\beta,B_N,a_E,a_N} u_R$$

s.t. constraints 16,17,15 and $u_i \geq 0$

The equilibrium under state ownership is summarized in the following lemma:

Lemma 5 *In a relational economy, the equilibrium under state ownership,* $(b^{sr}, \beta^{sr}, B_N^{sr}, a_E^{sr}, a_N^{sr})$*, has the following properties: (i) contractible efforts are set at the first best level:* $a_E^{sr} = a^{FB} = y$*; (ii) all surplus goes to the ruler:* $u_i = u_i^{dev} = 0$*; (iii) both of the ruler's incentive constraints, (16) and (17), are binding as long as* $a_N^{sr} < a^{FB}$*; and (iv) non-contractible efforts are given by* $a_N^{sr} = b^{sr}y + \sqrt{2B_N^{sr}}$

Proof. See Appendix A.5 ■

Two observations are in order. First, Surplus is more effectively used to motivate the ruler than the productive agents because (a) the ruler can default on formally contracted payments and (b) she faces the temptation to deviate on the informal bonuses only with respect to a fraction $1-q$ of the firms. As a result, it is optimal for the ruler to extract all the surplus. Second, the optimal mix of formal and informal incentives (b, B_N) is such that the ruler's incentive constraint is binding. The implication of this observation is that as long as the first-best is not attained, there will be less output sharing under state ownership than under private ownership, as in the spot economy model: $b < 1/2$. Given that the fixed wages only reallocate surplus, we will ignore them from now on, and so long as the incentive constraints are binding, we can simplify the ruler's problem to:

$$\max_{b,B_N} u_R = \left(qy^2 + (1-q)\left(2ya_N - a_N^2\right)\right)$$

s.t. $a_N = by + \sqrt{2B_N}$

$\frac{\delta}{1-\delta}\left(u_R - u_R^{dev}\right) = 2(1-q)B_N$

$\frac{\delta}{1-\delta}\tau u_R^{dev} = 4by\left(qy + (1-q)a_N\right)$

We now conclude our model by analyzing the optimal governance of firms (that is, the surplus-maximizing equilibrium) under different kinds of political institutions.

5.3 Optimal relational governance

Figure 4 illustrates the optimal governance of firms under different levels of τ. The solid and dashed curves represent surplus under state and private ownership, respectively, when both output sharing and subjective incentives are available. The dotted curve represents surplus under the optimal ownership structure in a spot economy - that is, the ruler's fallback option after a deviation.

We know from our spot economy model that at low τ, deterring expropriation of output under private ownership requires high marginal taxes; these taxes, in turn, limit the effort levels that private firms are willing to contract. By capping the surplus available to sustain informal bonuses, high taxes hamper a fortiori the use of these subjective incentives, which are are therefore either weak or non-existent in private firms at low τ. We also know from the spot economy model that even under low τ, state ownership can implement efficient levels of contractible efforts. Unlike in the spot economy, however, state-owned firms can now also use informal bonuses to elicit non-contractible efforts. Because output sharing is not feasible at low τ, the ruler's fallback option following a deviation on the informal bonuses is low, and thus the ruler/owner can credibly promise relatively high bonuses and elicit relatively high efforts. State ownership, in combination with low output sharing but strong informal incentives, is therefore the optimal governance at low τ, which is consistent with the observed adoption of advanced incentive systems and management practices by state-owned firms in China and other autocratic regimes.

As τ grows, the ruler's reneging temptation decreases while her fallback option improves but because of low output sharing, both of these opposite effects are small and tend to offset each other. As τ continues to grow, however, spot private ownership becomes the ruler's fallback option, and because its attractiveness grows rapidly in τ, the sustainability of informal incentives under state ownership is eroded by a mechanism similar to Baker et al. (1994, 2002). As a result, informal bonuses, equilibrium efforts and surplus in state-owned firms start decreasing. Eventually, bonuses under state ownership either become completely unsustainable or are dominated by private ownership, even though private ownership itself still supports limited bonuses and surplus. In this intermediate range of political institutions, we then see firms that are nominally private yet are heavily taxed and relatively poorly managed, in the sense that they are governed by less effective incentive systems than the state-

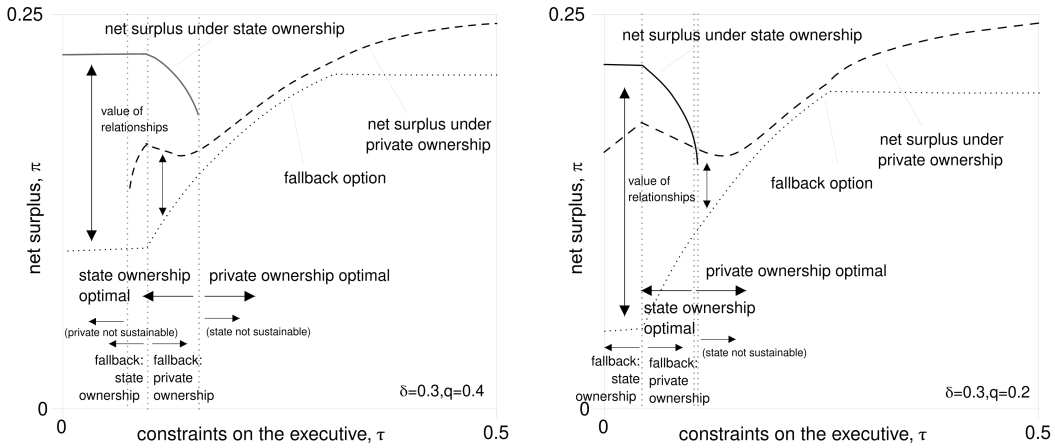

Figure 4: Firm governance in a relational economy under different political institutions

owned firms they replaced. As τ increases further, taxes continue to decrease and the informal incentives, effort and surplus that can be sustained under private ownership increase until eventually, private firms catch up with and even surpass state-owned firms at their best (that is, under low τ). Notice that under private ownership, this surplus-enhancing effect of political institutions on taxes and incentives more than compensates the increase in the ruler's fallback option.

Altogether, the fact that stronger political institutions increase effort and the effectiveness of private firms' incentive systems provides theoretical foundations for the empirical observation that private firms are more likely to adopt best management practices in developed countries than in developing ones. Additionally, non-monotonicity of firm surplus in τ describes a "privatization trap," whereby firms that are (optimally) privatized under mediocre political institutions have worse incentive systems and performance than the state-owned firms they replaced. This result is consistent with the empirical evidence on privatizations in transition countries and on South Korea's industrial development, to which we return below. Lastly, the U-shaped form of surplus under the optimal governance suggests that autocracies (low τ) may be economic local optima: thanks to their ability to implement informal incentives in state-owned firms, they perform much better than mediocre democracies (intermediate τ). It is only after radical improvements in political institutions (high τ) that democracies can support Toyota-like, well managed private firms, thus outperforming autocracies.

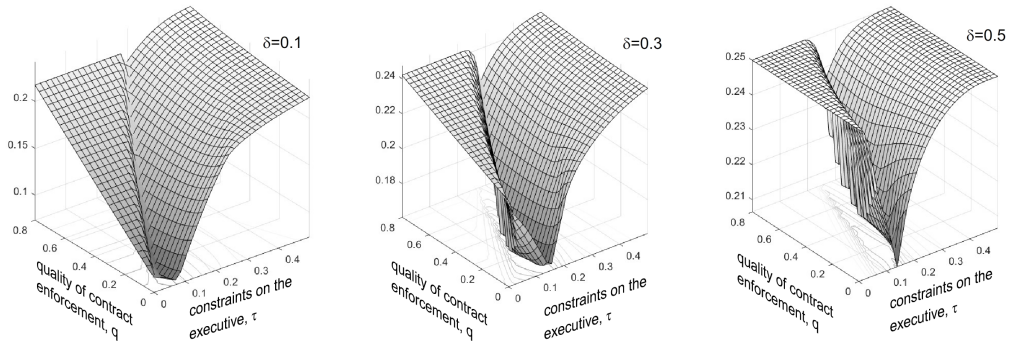

Figure 5: Optimal governance under different political institutions and contractibility levels

The U-shaped relationship between political institution and surplus is further illustrated in Figure 5, which plots surplus for various levels of players' patience and effort contractibility. All of the patterns discussed above, including the privatization trap, are present for various contractibility levels. In fact, while contractibility improves incentives and performance under very weak (low τ) or very strong (high τ) political institutions, it can amplify the trap at intermediate levels of τ.

6 Applications and empirical relevance

We conclude our paper by discussing empirical patterns consistent with our model and opportunities for future empirical research.

6.1 Privatizations

An extensive empirical literature, reviewed by Megginson and Netter (2001), finds that privatization in the OECD countries has been successful in increasing the productivity and profitability of firms. Contrarily, in Russia and the former Soviet area, aggregate output has declined following privatizations (Blanchard and Kremer, 1997), and there is evidence that individual firms' productivity has also declined after their privatization (e.g., Brown et al., 2006). For instance, Karas et al. (2010) find that private banks in Russia performed worse than state-owned banks even in the late

2000s, and that this difference cannot be explained by managers' risk preferences or by the bank's production process, environment, activity mix, and size.

Our model can explain these seemingly conflicting facts. The OECD countries had relatively developed political institutions as they started to privatize state firms in the 1990s (mostly to ease their budgetary constraints). In all of those countries, the government was constrained by an independent elected parliament, though there were differences across them in the strength of broader checks and balances. In contrast, many developing countries on which privatizations were imposed (often as a precondition for international loans) had weak political institutions. In particular, despite their formal transition to democracy and the creation of checks and balances that did not exist under communist rule, Russia and other ex-Soviet countries in the 1990s continued to suffer from weak property rights and an unpredictable and punitive tax system (Black et al., 2000). Consistent with the observed patterns, our model predicts that under such mediocre political institutions (i.e., neither autocracy nor advanced democracy), privatizing and then expropriating state-owned enterprises is too attractive for the government, preventing the development of relational contracts with employees and suppliers that were sustainable under state ownership during autocratic rule. As a result, privatized firms are caught in a low-productivity trap until political institutions move closer to the advanced democracy benchmark. Indeed, privatizations did succeed in countries that transitioned more rapidly to advanced democratic institutions, such as Chile in 1986-91 and the Czech Republic in 1991-94 (Biais and Perotti, 1999). Moreover, even in Russia, the performance of privatized firms appears to have increased and surpassed that of SOEs after political institutions and property rights somewhat stabilized in the early Putin years, prior to the autocratic post-2012 turn (Brown, Earle and Gehlbach, 2013).

6.2 Industrial development in South Korea

Prior to 1987, South Korea was essentially governed by military rule (although in 1963-1987 the regime was nominally democratic). In 1987, anti-government protests led to the first direct presidential election in 16 years. Although the first elected president (Roh Tae-woo) came from the military, his government promoted democratization by increasing freedom of the press, liberalizing travelling, and giving autonomy

to universities. As a result of these reforms, in 1992 South Koreans elected the first civilian president in 30 years (Kim Young-sam). Since then, South Korea has been effectively a democracy.

Amsden (1989) argues that the sustained economic growth of South Korea in a period characterized by weak political institutions (1960-1980) was enabled by the state's involvement in productive activities and by its tight links to business conglomerates (chaebols). Consistent with that, Lane (2019) shows that firms in militarily strategic sectors (e.g., the heavy chemicals industry) grew 80 per cent more than comparable manufacturing firms not targeted by the state. Milhaupt and Pistor (2008) further note that in the absence of investor protections and a legal framework for financial contracts, the chaebols engaged in a symbiotic relationship with the government, which could influence their business decisions while provided in exchange protection from competition, licenses, and favorable regulations. In other words, the chaebols could be seen as quasi-state actors.

The Korean chaebol system was fairly productive when Korean industry relied on the diffusion of foreign technology. However, once the country reached the technological frontier, the Korean model of development began showing weaknesses. In additional to the lack of modern legal institutions, the corrupt interlinkage between government and the chaebols was financially harmful for the state (Pirie 2007: 76). Moreover, the chaebols wanted to relax (at least partially) their alliance with the government to gain access to international credit markets (Hundt 2009: 94). As a result of these deficiencies, economic reformers gradually took control of the government's agenda and launched a new wave of institutional reforms in 1997, following the financial crisis. These reforms deregulated economic activity and established an independent financial regulator, an autonomous central bank, and other checks and balances and market-supporting institutions (Pirie 2007: 107-122). Altogether, these reforms sparked a new growth model based on private economic initiative, which led to a rapid increase in South Korea' R&D and innovation (Jamrisko et al. 2019).

Like the historical patterns of privatizations, those of Korean industrial development are consistent with our model. State-owned and semi-private firms performed relatively well under non-democratic institutions, then declined when the country established free elections but lacked the checks and balances of advanced liberal democracies. As the country completed its democratization, its economic system transitioned to full private ownership and firm productivity increased.

6.3 Testability

Testing our model requires firm-level data on ownership and incentives, and exogenous variation in political institutions and ownership. Gathering such data is ambitious, yet feasible. The World Management Survey has collected firm-level data on management practices, including pay-for-performance, across several countries. Recent studies (Macchiavello and Morjaria, 2020) have surveyed relational management practices in buyer-supplier relationships within a given developing country, providing a benchmark for future cross-country studies. There are well-established approaches to instrument for political checks and balances across countries (Acemoglu, Johnson and Robinson, 2001), which could be combined with the aforementioned data to study the effect of political institutions on firm ownership and management. Lastly, field experiments on organizational design and management have been conducted in large emerging economies such as China and India (e.g., Kala, 2022), where there is within-country variation in both institutional quality and firm ownership. One potential strategy to test our model would be to develop a field experiment in which high-powered incentives are introduced in random samples of state-owned and private firms across randomly chosen divisions of a multinational in countries with varying political institutions. In this experiment, buyer-supplier relationships in which a supplier of the multinational works for a local state-owned firm could serve as a control group.

7 Extension: mixed economy

Our main analysis compares fully private and fully state ownership. While this is natural given that all firms are identical, the existence of a continuum of productive agents allows for the ruler to own a fraction of firms. In this section, we briefly consider the implications of such fractional ownership. Let us begin with the spot economy. Under mixed ownership, with λ fraction of firms under private ownership, the ruler's pooled incentive constraint becomes

$$\frac{\delta\tau}{1-\delta}\left(\lambda\pi^{priv}+(1-\lambda)\,\pi^{state}\right)\geq\left(2\,(1-\lambda)\,b\Pi^{state}+\lambda\left((1-\tau)\,\Pi^{priv}-T\right)\right). \quad (18)$$

If the ruler deviates, she loses her future surplus with probability τ and this loss must outweigh the potential gains, which now consist of saving the promised output shares in state-owned firms, plus the probability of successful expropriation in privately owned firms. The advantage of pool the ruler's incentive constraints via kixed ownership is that slack can be transferred across the individual constraints. Numeric analysis reveals that mixed fallback option can indeed be optimal when the stand-alone productivity of the two sectors is not too different. The logic is that the ruler strategically lowers the formal incentive pay b in state firms, which have an advantage in the use of fixed wage contracts, and this creates slack that allows the ruler to lower the marginal taxes charged to private firms. The resulting equilibrium features a high-productivity private sector co-existing with a low-productivity state sector. Moreover, it is exactly the low productivity of the state sector that generates rents sufficient to induce the ruler not to expropriate the private sector.

In the relational economy the logic is similar, except that we must include the informal contract (B_N, a_N) as an additional choice variable for both sectors. It immediately follows from the analysis above that the ruler's incentive constraint for honoring the informal bonuses under state ownership continues to be given by

$$\frac{\delta}{1-\delta}\left(u_R - \widetilde{u}_R^{dev}\right) \geq 2\left(1-\lambda\right)\left(1-q\right)B_N, \tag{19}$$

while we can construct the ruler's joint constraint on honoring both informal and formal contracts by pooling the constraints across the two sectors:

$$\begin{array}{l} \frac{\delta}{1-\delta}\left(u_R - \left(1-\tau\right)u_R^{dev}\right) \geq 2\left(1-\lambda\right)b\pi^{state} + 2\left(1-\lambda\right)B(1-q) \\ +\lambda\left(\left(1-\tau\right)\Pi^{priv} - \pi^{priv}\right) + \lambda\frac{1-\delta}{\delta}\left(\frac{1}{4}\left(1-\kappa\right)^2 y^2 - \left(\left(1-\kappa\right)ya_N^{priv} - \left(a_N^{priv}\right)^2\right)\right). \end{array}, \tag{20}$$

In private firms, the agents continue to select informal bonuses in their contract to maximize their joint surplus net of taxes $2\left(1-\kappa\right)ya_N^{priv} - \left(a_N^{priv}\right)^2$.

It remains to be considered how the various potential deviations affect continuation play. When the ruler expropriates (under private ownership) or defaults on formal output shares (under state ownership), we continue to assume that if she is not removed, all firms will perpetually revert to the spot governance that maximizes

the ruler's payoff (and surplus). Similarly, equilibrium taxes under private ownership continue to ensure that the agents receive zero utility after deviating on their informal contract. The only challenge is to determine the ruler's fallback option after defaulting on the informal bonuses under state ownership. Here, we assume that news of the ruler's deviation spreads and thus trust in the ruler is permanently lost even in the private sector, such that private firms revert to the optimal spot governance. Under this stark assumption, numeric simulations suggest the opposite result from the spot economy analysis. Now, the ruler can use the private sector as a hostage to pay high informal bonuses in the state sector, and we can observe equilibria with mixed ownership where the state sector performs strictly better than the private sector. These results are, however, sensitive to the assumed consequences of the ruler's deviations, and arise only when the performance of fully private or state-owned economies are sufficiently similar, such that the ability to transfer slack across incentive constraints on the margin dominates the performance differences identified in the main analysis. A more comprehensive investigation of mixed ownership is left for future work.

8 Conclusion

In this paper, we have studied how political institutions affect incentive provision and ownership in firms. Our key insight is that the "capitalist paradigm," whereby firms should be privately owned and managed through high-powered incentive systems, does not hold for countries with weak constraints on the executive. We have shown that in such regimes, state-owned firms can sustain more effective incentive systems and higher output than private ones, and that governance has a U-shaped relationship with political institutions. Our model has broad implications for both development and management. First, it elucidates how political institutions constrain firms' governance. Thus, for a firm that operates under weak political institutions, following a consultant's recommendation to copy Toyota's governance may backfire and completely break down cooperation. Relatedly, transferring Toyota's incentive system to firms in autocratic regimes might have greater chances of success if those firms are state-owned, while privatizing a SOE under weak political institutions may backfire. Second, our model suggests that political institutions have a first order effect on development. Rather than attempting to import strong governance into a weak

institutional environment, reformers should prioritize the creation of checks and balances on the government (as difficult as it is) because that is a precondition for strong governance to be transferable. Third, the U-shaped relationship between surplus and political institutions uncovered by our model suggests that while advanced liberal democracies may be global optima, autocracies are local ones. If the institutional reforms needed to reach the global optimum (i.e., a fully constrained ruler) are too costly, and in the absence of exogenous accelerators like wars or revolutions, reverting from a mediocre democracy to autocracy may be economically too attractive, and as a result, gradual projects of political reform may fail.

By integrating a ruler into a model of contract design, our paper also provides a tractable framework that could be used to study how additional dimensions of governance, such as delegation and organizational structure, adapt to different institutional environments. Moreover, our model could be extended to study the role of non-governmental "rulers" in organizations. For instance, a corporate executive may be able to "expropriate" the output generated by a division, thereby affecting contracting between the division's management and employees or suppliers, and the resulting frictions may play out differently if employees and managers respond directly to the corporate headquarters (akin to our state ownership scenario). Exploring the implications of our modeling framework for non-political settings is beyond the scope of our paper but may constitute an important opportunity for future research.

References

[1] ACEMOGLU, D., and S. JOHNSON, (2005), "Unbundling Institutions," *Journal of Political Economy* 113: 949-995.

[2] ACEMOGLU, D., S. JOHNSON, and J. ROBINSON, (2001), "The Colonial Origins of Comparative Development: An Empirical Investigation," *American Economic Review* 91: 1369-1401.

[3] ALDASHEV, G., and G. ZANARONE, (2017), "Endogenous Enforcement Institutions," *Journal of Development Economics* 128: 49-64.

[4] AMSDEN, A., (1989), *Asia's Next Giant: Late Industrialization in South Korea*. Oxford, UK: Oxford University Press.

[5] BAKER, G., R. Gibbons, and K. J. MURPHY, (1994), "Subjective Perfor-

mance Measures in Optimal Incentive Contracts," *Quarterly Journal of Economics* 109: 1125-1156.

[6] BAKER, G., R. Gibbons, and K. J. MURPHY, (2002), "Relational Contracts and the Theory of the Firm," *Quarterly Journal of Economics* 117: 39-84.

[7] BIAIS, B., and E. PEROTTI, (2002), "Machiavellian Privatization," *American Economic Review* 92: 240-258.

[8] BLACK, B., R. KRAAKMAN, and A. TARASSOVA, (2000), "Russian Privatization and Corporate Governance: What Went Wrong," *Stanford Law Review* 52: 1731-1808.

[9] BLANCHARD, N., and M. KREMER, (1997), "Disorganization," *Quarterly Journal of Economics* 112: 1091-1126.

[10] BLOOM, N., H. SCHWEIGER, and J. VAN REENEN, (2012), "The Land that Lean Manufacturing Forgot? Management Practices inn Transition Countries," *NBER Working Paper* 17231.

[11] BLOOM, N., R. LEMOS, R. SADUN, D. SCUR, and J. VAN REENEN, (2014), "JEEA-FBBVA Lecture 2013: The new empirical economics of management," *Journal of the European Economic Association* 12: 835-876.

[12] BROWN, J., J. EARLE, and A. TELEGDY, (2006), "The Productivity Effects of Privatization: Longitudinal Estimates from Hungary, Romania, Russia, and Ukraine," *Journal of Political Economy* 114: 61-99.

[13] BROWN, J., J. EARLE, and S. GELBACH, (2013), "Privatization," in Alexeev, M., and S. Weber (eds.), *Oxford Handbook of the Russian Economy*, Oxford: Oxford University Press, pp. 161-188.

[14] CHE, J., and Y. QIAN, (1998), "Insecure Property Rights and Government Ownership of Firms," *Quarterly Journal of Economics* 113: 467-496.

[15] CHENG, H., H. LI, and T. LI, (2021), "The Performance of State-Owned Enterprises: New Evidence from the China Employer-Employee Survey," *Economic Development and Cultural Change* 69: 513-540.

[16] DIXIT, A., (2003), "On Modes of Economic Governance," *Econometrica* 71: 449-481.

[17] GIBBONS, R., and J. ROBERTS, (2013), *The Handbook of Organizational Economics* Princeton: Princeton University Press, 56-99.

[18] GREIF, A., P. MILGROM, and B. WEINGAST, (1994), "Coordination, Commitment, and Enforcement: The Case of the Merchant Guild," *Journal of Political Economy* 102: 745-776.

[19] GROVES, T., Y. HONG, J. McMILLAN, and B. NAUGHTON, (1994), "Autonomy and Incentives in Chinese State Enterprises," *Quarterly Journal of Economics* 109: 183-209.

[20] HART, O., A. SHLEIFER, and R. VISHNY, (1997), "The Proper Scope of Government: Theory and an Application to Prisons," *Quarterly Journal of Economics* 112: 1127-1161.

[21] HOLMSTROM, B., (1982), "Moral Hazard in Teams," *Bell Journal of Economics* 13: 324-340.

[22] HUNDT, D., (2009), *Korea's Developmental Alliance: State, Capital and the Politics of Rapid Development*. London, UK: Routledge.

[23] JAMRISKO, M., L. MILLER, and W. LU, (2019), "These Are the World's Most Innovative Countries," Bloomberg.com, January 22. https://www.bloomberg.com/news/articles/2019-01-22/germany-nearly-catches-korea-as-innovation-champ-u-s-rebounds

[24] KARAS, A., K. SCHOORS, and L. WEILL, (2010), "Are Private Banks More Efficient than Public Banks? Evidence from Russia," *Economics of Transition* 18: 209-244.

[25] LANE, N., (2019), "Manufacturing Revolutions: Industrial Policy and Industrialization in South Korea," Working paper, Monash University, Australia.

[26] LEVIN, J., (2002), "Multilateral Contracting and the Employment Relationship," *Quarterly Journal of Economics* 117: 1075-1103.

[27] LEVIN, J., (2003), "Relational Incentive Contracts," *American Economic Review* 93: 835-857.

[28] MACLEOD, B., and J. MALCOMSON, (1989), "Implicit contracts, incentive compatibility, and involuntary unemployment," *Econometrica* 57: 447-480.

[29] MYERSON, R., (2015), "Moral Hazard in High Office and the Dynamics of Aristocracy," *Econometrica* 83: 2083-2126.

[30] MEGGINSON, W., and J. NETTER, (2001), "From State to Market: A Survey of Empirical Studies on Privatization," *Journal of Economic Literature* 39: 321-389.

[31] MILHAUPT, C., and K. PISTOR, (2008), *Law Capitalism: What Corporate Crises Reveal About Legal Systems and Economic Development Around the World*. Chicago, IL: University of Chicago Press.

[32] NORTH, D., J. WALLIS, and B. WEINGAST, (2009), *Violence and Social Orders: A Conceptual Framework for Interpreting Recorded Human History*, Cambridge: Cambridge University Press.

[33] OLSON, M., (1993), "Dictatorship, Democracy, and Development," *American Political Science Review* 87: 567-576.

[34] OUATTARA, B. and S. STANDAERT, (2020), "Property rights revisited," *European Journal of Political Economy* 64: 101895.

[35] PALTSEVA, E., G. TOEWS, and M. TROYA-MARTINEZ, (2021), "Exploiting Relational Dynamics to Improve Government's Commitment: The Case of Natural Resource Extraction," New Economic School Working Paper.

[36] PANIZZA, U., (2023), "State-owned commercial banks," *Journal of Economic Policy Reform* 26: 44-66.

[37] PIRIE, I., (2007), *The Korean Developmental State: From Dirigisme to Neo-Liberalism*. London, UK: Routledge.

[38] PUCIK, V., and K. XIN, (2004), "Managing Performance at Haier (A)," IMD Case 191.

[39] SCHMIDT, K., (1996), "The Costs and Benefits of Privatization: An Incomplete Contracts Approach," *Journal of Law, Economics and Organization* 12: 1-24.

[40] WILLIAMSON, O., (1979), "Transaction Cost Economics: The Governance of Contractual Relations," *Journal of Law and Economics* 22: 233-261.

[41] Xu, C., (2000), "Control, Incentives and Competition: The Impact of Reform on Chienese State-Owned Enterprises," *Economics of Transition* 8: 151-173.

A Proofs

A.1 Proof of proposition 1

When the required efforts are non-contractible (state $\theta = N$), the buyer chooses $a_{B,N}$ to maximize u_B while the seller chooses $a_{S,N}$ to maximize u_S. As a result, the effort levels under given output sharing and taxes are $a_{B,N} = (1-\kappa_B)(1-b_S)y$ and $a_{S,N} = (1-\kappa_S)b_S y$.[9] Deep pockets allow the buyer to push the seller to his participation constraint, which allows us to write the seller's total compensation as

$$b_S y\left(q\left(a_{B,E}+a_{S,E}\right)+(1-q)\left(a_{B,N}+a_{S,N}\right)\right)+\beta_S = \frac{t_S+\frac{1}{2}qa_{S,E}^2+\frac{1}{2}(1-q)a_{S,N}^2}{(1-\kappa_S)}.$$

Substituting this compensation into the buyer's utility, we can write the buyer's contract design problem as

$$\begin{aligned}\max_{a_{B,E},a_{S,E},b_S} u_B = (1-\kappa_B)&\left(y\left(q\left(a_{B,E}+a_{S,E}\right)+(1-q)\left(a_{B,N}+a_{S,N}\right)\right)-\frac{t_S+\frac{1}{2}qa_{S,E}^2+\frac{1}{2}(1-q)a_{S,N}^2}{(1-\kappa_S)}\right)\\ &-t_B-\tfrac{1}{2}qa_{B,E}^2-\tfrac{1}{2}(1-q)a_{B,N}^2\end{aligned}$$

$$\text{s.t.} \qquad a_{B,N} = (1-\kappa_B)(1-b_S)y \text{ and } a_{S,N} = (1-\kappa_S)b_S y.$$

It immediately follows from the above program that the buyer optimally selects contractible effort level $a_{S,E} = (1-\kappa_S)y$ and $a_{B,E} = (1-\kappa_B)y$. After ubstituting these efforts, we can rewrite the buyer's payoff in the contract design program as

$$\begin{aligned}u_B = (1-\kappa_B)&\left(q\left(2-\kappa_B-\kappa_S\right)+(1-q)\left((1-\kappa_B)\left(1-b_S^2\right)+(1-\kappa_S)b_S\left(2-b_S\right)\right)\right)\frac{y^2}{2}\\ &-\tfrac{(1-\kappa_B)}{(1-\kappa_S)}t_S-t_B,\end{aligned}$$

which the buyer then maximizes with respect to b_S. The solution is sharing rule $b_S = \frac{(1-\kappa_S)}{(1-\kappa_B)+(1-\kappa_S)}$.[10]

[9] Indeed, this is the reason why the buyer also wants to commit to an action in the formal contract. Without commitment, his action would be driven by the profit-share instead of efficiency, worsening net surplus. And momentarily, we will see that the optimal contract calls for $b_S > 0$ so that such commitment is strictly optimal.

[10] Notice that while this solution follows from the assumption of deep pockets, this assumption is actually not necessary since a strategic allocation of the lump-sum tax liability could be used to ensure $\beta_S \geq 0$.

Next, we prove that $\kappa_S = \kappa_B = \kappa$ is the ruler's optimal tax policy. Given deep pockets, the ruler appropriates the whole expected surplus conditional on the buyer's contract choice. Thus, we can rewrite the ruler's incentive constraint (7) as

$$\tfrac{1-(1-\tau)\delta}{1-\delta}\pi \geq (1-\tau)\,\Pi,$$

where $\pi = \Pi - E\left(\sum_i c\left(a_i\right)\right)$. Assume $\kappa_B > \kappa_S$ without loss of generality, and increase κ_S and decrease κ_B so that the overall output level, Π, is unchanged. Then, if the expected cost $E\left(\sum_i c\left(a_i\right)\right)$ decreases as a result of this, the constraint is relaxed and the optimal tax policy needs to satisfy $\kappa_B = \kappa_S$. Now, from above we have that $a_{B,N} = \frac{(1-\kappa_B)^2}{(1-\kappa_B)+(1-\kappa_S)}y$, $a_{S,N} = \frac{(1-\kappa_S)^2}{(1-\kappa_B)+(1-\kappa_S)}y$, $a_{S,E} = (1-\kappa_S)\,y$ and $a_{B,E} = (1-\kappa_B)\,y$, while the output level is simply

$$y\left(q\left(a_{B,E}+a_{S,E}\right)+(1-q)\left(a_{B,N}+a_{S,N}\right)\right).$$

Then, for the output to be unchanged, we need

$$\begin{array}{l} y\frac{d}{d(1-\kappa_B)}\left(q\left(a_{B,E}+a_{S,E}\right)+(1-q)\left(a_{B,N}+a_{S,N}\right)\right) \\ +\, y\frac{d}{d(1-\kappa_S)}\left(q\left(a_{B,E}+a_{S,E}\right)+(1-q)\left(a_{B,N}+a_{S,N}\right)\right)\frac{d(1-\kappa_S)}{d(1-\kappa_B)} = 0, \end{array}$$

which we can write as

$$-\frac{\left(((1-\kappa_B)+(1-\kappa_S))^2-2(1-q)(1-\kappa_S)^2\right)}{\left(((1-\kappa_B)+(1-\kappa_S))^2-2(1-q)(1-\kappa_B)^2\right)} = \frac{d(1-\kappa_S)}{d(1-\kappa_B)}.$$

The expected cost of effort, in turn, is given by

$$\begin{array}{l} q\left(\frac{1}{2}a_{B,E}^2+\frac{1}{2}a_{S,E}^2\right)+(1-q)\left(\frac{1}{2}a_{B,N}^2+\frac{1}{2}a_{S,N}^2\right) = \\ \frac{1}{2}y^2\left[q\left((1-\kappa_B)^2+(1-\kappa_S)^2\right)+(1-q)\left(\frac{(1-\kappa_B)^4+(1-\kappa_S)^4}{((1-\kappa_B)+(1-\kappa_S))^2}\right)\right], \end{array}$$

and differentiating with respect to the tax level we get

$$\begin{array}{l} 2q\left(1-\kappa_B\right)+(1-q)\frac{(1-\kappa_B)^4+2(1-\kappa_B)^3(1-\kappa_S)-(1-\kappa_S)^4}{((1-\kappa_B)+(1-\kappa_S))^3} \\ +\left(2q\left(1-\kappa_S\right)+(1-q)\frac{(1-\kappa_S)^4+2(1-\kappa_S)^3(1-\kappa_B)-(1-\kappa_B)^4}{((1-\kappa_B)+(1-\kappa_S))^3}\right)\frac{d(1-\kappa_S)}{d(1-\kappa_B)}. \end{array}$$

Rearranging these expressions, we obtain the following condition for costs to decrease as a result of the changes in marginal tax rates:[11]

$$\frac{2q(1-\kappa_B)((1-\kappa_B)+(1-\kappa_S))^3+(1-q)\left((1-\kappa_B)^4+2(1-\kappa_B)^3(1-\kappa_S)-(1-\kappa_S)^4\right)}{2q(1-\kappa_S)((1-\kappa_B)+(1-\kappa_S))^3+(1-q)\left((1-\kappa_S)^4+2(1-\kappa_S)^3(1-\kappa_B)-(1-\kappa_B)^4\right)} \leq \frac{\left(((1-\kappa_B)+(1-\kappa_S))^2-2(1-q)(1-\kappa_S)^2\right)}{\left(((1-\kappa_B)+(1-\kappa_S))^2-2(1-q)(1-\kappa_B)^2\right)},$$

The remainder is just some tedious simplification. To simplify the notation, let $x = (1-\kappa_B)$ and $y = (1-\kappa_S)$, with $x < y$ since $\kappa_B > \kappa_S$. Then, the expression becomes

$$\frac{2qx(x+y)^3+(1-q)\left(x^4+2x^3y-y^4\right)}{2qy(x+y)^3+(1-q)(y^4+2y^3x-x^4)} \leq \frac{\left((x+y)^2-2(1-q)y^2\right)}{\left((x+y)^2-2(1-q)x^2\right)}.$$

Cross-multiplying, expanding the expressions and grouping like-terms gives

$$\begin{aligned}
&q\left(x-y\right)\left[\left(x+y\right)^2-\left(1-q\right)\left(x^2+xy+y^2\right)\right]\left(x+y\right)^3-q\left(1-q\right)\left(x+y\right)^3\left(x^3-y^3\right)\\
&+(1-q)\left[x^4-y^4\right]\left(x+y\right)^2-2(1-q)^2xy\left(x^4-y^4\right)\\
&-(1-q)^2\left[x^6-y^6\right]+(1-q)xy\left[x^2-y^2\right]\left(x+y\right)^2-(1-q)^2x^2y^2\left[x^2-y^2\right]\leq 0,
\end{aligned}$$

which after some further simplification can be written as

$$\begin{aligned}
&q\left(x-y\right)\left(xy+q\left(x^2+xy+y^2\right)\right)\left(x+y\right)^3\\
&+2(1-q)^2x^2y^2\left(x^2-y^2\right)+\left(1-q\right)^2xy\left(x^4-y^4\right)\leq 0,
\end{aligned}$$

which is true since $x < y$ by assumption.

Finally, having established symmetry of the marginal tax rate, the formal contract simplifies to $b_S = \frac{1}{2}$ and thus $a_{B,N} = a_{S,N} = \frac{(1-\kappa)}{2}y$ while $a_{B,E} = a_{S,E} = (1-\kappa)\,y$. From here, it then follows that the total output produced in the economy becomes

$$\Pi = y\left(q\left(a_{B,E}+a_{S,E}\right)+\left(1-q\right)\left(a_{B,N}+a_{S,N}\right)\right) = y^2\left(1-\kappa\right)\left(1+q\right),$$

while the total surplus becomes

$$\pi = y^2\left(\frac{(1+q)}{2}\left(1-\kappa^2\right)+\frac{(1-q)(1-\kappa)^2}{4}\right).$$

Then, given that the ruler extracts the economy's surplus in equilibrium, whereas she

[11] Noting that since $(1-\kappa_B) < (1-\kappa_S)$ is our starting assumption, both denominators are positive and so we can do the division involved in this step without reverting the sign of the inequality needed for cost reduction to occur.

grabs the economy's output after a deviation (if she is not removed by the courts), it needs to be that

$$\frac{1}{1-\delta}\pi \geq (1-\tau)\left(\Pi + \frac{\delta}{1-\delta}\pi\right) \Leftrightarrow \left(\frac{1-(1-\tau)\delta}{(1-\tau)}\right)\pi \geq (1-\delta)\,\Pi,$$

which then becomes

$$\left(\frac{1-(1-\tau)\delta}{(1-\tau)}\right)\left(\frac{(1+q)}{2}\left(1-\kappa^2\right) + \frac{(1-q)(1-\kappa)^2}{4}\right) \geq (1-\delta)\,(1-\kappa)\,(1+q)$$

or after some further simplification

$$\kappa \geq 1 - \frac{4\tau(1+q)}{(1+3q)(1-(1-\tau)\delta)}.$$

From here it follows immediately that

$$\frac{d\kappa}{d\delta} = -\frac{4\tau(1+q)(1-\tau)}{(1+3q)(1-(1-\tau)\delta)^2} < 0; \frac{d\kappa}{dq} = \frac{8\tau}{(1-(1-\tau)\delta)(1+3q)^2} > 0; \frac{d\kappa}{d\tau} = -\frac{4(1+q)(1-\delta)}{(1+3q)(1-(1-\tau)\delta)^2} < 0$$

A.2 Proof of proposition 2

After unpacking the output expression, we can rewrite the ruler's incentive constraint under state ownership, (11), as

$$(1-2b)\,2y\left(qa_E + (1-q)a_N\right) + \frac{\delta}{1-\delta}u_R \geq 2y\left(qa_E + (1-q)a_N\right) + (1-\tau)\left(\frac{\delta}{1-\delta}u_R\right),$$

which can be further simplified to

$$\tau\frac{\delta}{1-\delta}u_R \geq 4by\left(qa_E + (1-q)a_N\right).$$

Given that the ruler can appropriate the whole surplus due to the deep pockets assumption, we can write the ruler's contract design problem as

$$\max_{a_E,b} u_R = \left(2qya_E - a_N^2 + (1-q)\left(2ya_N - a_N^2\right)\right)$$

subject to the agents' non-contractible effort choice, $a_N = by$, the no-budget-breaker constraint, $b \leq 1/2$, and the incentive constraint above. It immediately follows from this program that the ruler's optimal contract selects contractible efforts $a_E = y$.

After substituting this and the agent's choice of non-contractible efforts, the ruler's problem becomes

$$\max_b u_R = y^2\left(q + (1-q)\left(2b - b^2\right)\right)$$

$$\text{s.t.} \qquad \tau \tfrac{\delta}{1-\delta} u_R \geq 4by^2\left(q + (1-q)b\right) \qquad \textit{and} \qquad b \leq 1/2.$$

Notice that u_R increases in b while the ruler's incentive constraint becomes more stringent as b grows. Thus, either the incentive constraint is binding or $b = 1/2$. From here it then follows that the maximal formal output sharing rule is given by

$$\tfrac{\tau\delta}{4(1-\delta)}\left(q + (1-q)\left(2b - b^2\right)\right) = b\left(q + (1-q)b\right).$$

Define $\phi = \frac{\tau\delta}{4(1-\delta)}$ and rearrange the expression to yield

$$0 = (1-q)(1+\phi)b^2 + b\left(q - 2(1-q)\phi\right) - q\phi.$$

Then, we can write the maximal credible formal incentive strength as

$$b = \tfrac{-(q-2(1-q)\phi) + \sqrt{q^2 + 4\phi^2(1-q)}}{2(1-q)(1+\phi)}.$$

A.3 Proof of Lemma 3

Combining the two agents' incentive constraints, (14) and (15), we obtain a joint constraint for the sustainability of the informally agreed non-contractible efforts, $(a_{B,N}, a_{S,N})$:

$$\begin{aligned}&\tfrac{\delta}{1-\delta}\left((u_B + u_S) - \left(u_B^{dev} + u_S^{dev}\right)\right) \geq \tfrac{1}{2}\left((1-\kappa)(1-b_S)y\right)^2 + \tfrac{1}{2}\left((1-\kappa)b_S y\right)^2 \\ &- \left[\left((1-\kappa)(1-b_S)ya_{B,N} - \tfrac{1}{2}a_{B,N}^2\right) + \left((1-\kappa)b_S y a_{S,N} - \tfrac{1}{2}a_{S,N}^2\right)\right].\end{aligned}$$

Consider minimizing the right-hand side for a given target effort level, $a_{B,N} + a_{S,N}$, where equal efforts would strictly maximize net surplus and thus the left-hand side of the expression. Given b_S, the optimal allocation of efforts would solve

$$(1-\kappa)(1-b_S)y - a_{B,N} - (1-\kappa)b_S y + a_{S,N} = 0,$$

which we can rearrange to $a_{S,N} = a_{B,N} + (1-\kappa)\, y\, (2b_S - 1)$, which allows us to write the total effort as

$$a_{S,N} + a_{B,N} = 2a_{B,N} + (1-\kappa)\, y\, (2b_S - 1)\,.$$

Later, we want to consider the optimal b_S, so to hold the total effort constant, it needs to be that

$$2\tfrac{da_{B,N}}{db_S} + 2\,(1-\kappa)\, y = 0 \rightarrow \tfrac{da_{B,N}}{db_S} = -\,(1-\kappa)\, y.$$

Next, using $a_{S,N} = a_{B,N} + (1-\kappa)\, y\, (2b_S - 1)$, we can expand the right-hand side of the agents' joint incentive constraint to

$$\tfrac{1}{2}\left((1-\kappa)\,(1-b_S)\, y\right)^2 + \tfrac{1}{2}\left((1-\kappa)\, b_S y\right)^2 - \left[2\,(1-\kappa)\, y\,(1-b_S)\, a_{B,N} - a_{B,N}^2 + \tfrac{(1-\kappa)^2 y^2 (2b_S-1)}{2}\right].$$

Differentiating this expression with respect to b_S, we obtain that the optimal profit share is

$$\begin{aligned} &-\left((1-\kappa)^2\,(1-b_S)\, y^2\right) + \left((1-\kappa)^2\, b_S y^2\right) \\ &-\left[-2\,(1-\kappa)\, y a_{B,N} + 2\,(1-\kappa)\, y\,(1-b_S)\,\tfrac{da_{B,N}}{db_S} - 2a_{B,N}\tfrac{da_{B,N}}{db_S} + (1-\kappa)^2\, y^2\right] = 0, \end{aligned}$$

which further simplifies to

$$(1-\kappa)^2\, y^2\,(2b_S - 1) = (1-\kappa)^2\, y^2\,(2b_S - 1)\,.$$

While $b_S = 1/2$ provides a solution, the effort interactions are such that the right-hand side is actually independent of the profit share. But the net surplus itself is maximized by setting $a_{S,N} = a_{B,N}$ (efficient allocation of costs given the target level of total effort), which then uniquely identifies $b_S = 1/2$ as the optimal profit share.

A.4 Proof of Lemma 4

Suppose a buyer or a seller deviates from the informal contract (by failing to exert the promised non-contractible effort or to pay the agreed upon bonus). Under our

assumed punishment strategy, the two agents permanently terminate the informal agreement and revert to spot governance after such a deviation, while the ruler continues to collect the same taxes as in equilibrium. Given such strategies, if the two agents participate with positive utility in a post-deviation subgame, the left hand side of self-enforcement constraint (16), $(u_B + u_S) - \left(u_B^{dev} + u_S^{dev}\right)$, is independent of the lump sum taxes, $(t_B + t_S)$. But then, a post-deviation subgame where the agents participate with positive utility cannot be part of an equilibrium that is optimal for the ruler because if it were, the ruler's non-expropriation constraint (18) could be relaxed, and her payoff increased, by raising $(t_B + t_S)$ up to the point where following a deviation, the buyer and the seller are indifferent between participating and exiting the economy, that is, up to the point where $\left(u_B^{dev} + u_S^{dev}\right) = 0$.

A.5 Proof of Lemma 5

To characterize the state ownership equilibrium in a relational economy, we need to combine the ruler's and the agents' incentive constraints. For the agent(s) to be willing to exert the promised non-contractible efforts, it needs to be that

$$B_N - \tfrac{1}{2}a_N^2 + 2bya_N + \tfrac{\delta}{1-\delta}u_i \geq \max_{a_i} by\left(a_i + a_N\right) - \tfrac{1}{2}a_i^2 + \tfrac{\delta}{1-\delta}u_i^{dev},$$

which given the agent's optimal deviation, $a_i = by$, simplifies to

$$B_N \geq \tfrac{(by)^2}{2} - \left(bya_N - \tfrac{1}{2}a_N^2\right) - \tfrac{\delta}{1-\delta}\left(u_i - u_i^{dev}\right).$$

Regarding the ruler, consider first the incentive constraint that deters a deviation on the informal bonuses alone:

$$\tfrac{\delta}{1-\delta}\left(u_R - u_R^{dev}\right) \geq 2(1-q)B_N.$$

Combining this with the agents' incentive constraints gives us

$$\tfrac{\delta}{1-\delta}\left(u_R - u_R^{dev}\right) \geq 2(1-q)\left(\tfrac{(by)^2}{2} - \left(bya_N - \tfrac{1}{2}a_N^2\right) - \tfrac{\delta}{1-\delta}\left(u_i - u_i^{dev}\right)\right).$$

Consider next the incentive constraint that prevents the ruler from deviating on both the informal bonuses and the formally contracted output shares:

$$\tfrac{\delta}{1-\delta}\left(u_R - u_R^{dev}\right) + \tau\tfrac{\delta}{1-\delta}u_R^{dev} \geq 2(1-q)B_N + 4by\left(qa_E + (1-q)a_N\right).$$

After combining it with the agents' incentive constraints, this condition becomes

$$\begin{array}{l}\tfrac{\delta}{1-\delta}\left(u_R - u_R^{dev}\right) + \tau\tfrac{\delta}{1-\delta}u_R^{dev} \geq \\ 2(1-q)\left(\tfrac{(by)^2}{2} - \left(bya_N - \tfrac{1}{2}a_N^2\right) - \tfrac{\delta}{1-\delta}\left(u_i - u_i^{dev}\right)\right) \\ +4by\left(qa_E + (1-q)a_N\right).\end{array}$$

From the two joint constraints it follows immediately that all surplus should be allocated to the ruler, so that $u_i = u_i^{dev} = 0$. Given this, we can write the agent's constraint as

$$B_N - \tfrac{1}{2}a_N^2 + bya_N \geq \tfrac{(by)^2}{2},$$

which allows us to write the maximal effort that the ruler is able to request from the agent as a function of both the formal and informal incentives as

$$a_N^{sr} = \sqrt{2B_N} + by.$$

Thus, we can now reduce the ruler's problem to

$$\max_{a_E, b, B_N} u_R = q\left(2ya_E - a_E^2\right) + (1-q)\left(2ya_N - a_N^2\right)$$

subject to $a_N = \sqrt{2B_N} + by$ and the two joint reneging constraints above. It immediately follows from this program that $a_E = y$. Let us now go back to the ruler's incentive constraints to show that both must be binding. These constraints are

$$\begin{array}{l}\tfrac{\delta}{1-\delta}\left(u_R - u_R^{dev}\right) \geq 2(1-q)B_N \\ \tfrac{\delta}{1-\delta}\left(u_R - u_R^{dev}\right) + \tau\tfrac{\delta}{1-\delta}u_R^{dev} \geq 2(1-q)B_N + 4by\left(qy + (1-q)a_N\right).\end{array}$$

Consider increasing B_N and decreasing b in a way that holds a_N and so u_R constant. The first constraint is clearly tightened while for the second constraint, the net effect is

$$2(1-q)+4\tfrac{db}{dB_N}y\left(qy+(1-q)a_N\right).$$

Moreover, the constant effort assumption requires that the change satisfies

$$\tfrac{1}{2}\sqrt{2}B_N^{-1/2}+\tfrac{db}{dB_N}y=0\rightarrow\tfrac{db}{dB_N}=-\tfrac{1}{2y}\sqrt{2}B_N^{-1/2},$$

so we have

$$\begin{array}{l}2(1-q)+4\tfrac{db}{dB_N}y\left(qy+(1-q)a_N\right)\\ 2(1-q)-4\tfrac{1}{2y}\sqrt{2}B_N^{-1/2}y\left(qy+(1-q)\left(\sqrt{2B_N}+by\right)\right)\\ -(1-q)-\sqrt{2}B_N^{-1/2}\left(qy+(1-q)by\right)<0.\end{array}$$

Thus, the proposed change in the bonus and output share always relaxes the second constraint, implying that both constraints must be binding. And then, given that the first constraint requires

$$\tfrac{\delta}{1-\delta}\left(u_R-u_R^{dev}\right)=2(1-q)B_N,$$

the second constraint simplifies to

$$\tau\tfrac{\delta}{1-\delta}u_R^{dev}=4by\left(qy+(1-q)a_N\right).$$