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

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Abstract

We study how institutional constraints on the executive affect the governance of firms. In our model, each firm can be privately or state owned, and can elicit effort from a manager and an upstream agent through a mix of formal and relational contracts. We show that in contrast to the conventional wisdom, private ownership and high-powered incentives are not always an optimal governance bundle. Under weak constraints on the executive, state-owned firms can sustain stronger incentives and higher output than private ones. As institutions begin to strengthen, firms are optimally privatized and yet are trapped into weaker incentives and lower output than the state-owned firms they replaced. Only under strong enough institutions we see "Toyotas," highly productive firms governed by private ownership and high-powered incentives, optimally emerge in equilibrium. Our model can explain the mixed success of privatizations, and the slow diffusion of best management practices, in developing countries, suggesting that (radical) institutional reforms may be a pre-condition for managerial innovations.

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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 democratic institutions 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 of private asset ownership (Hart, Shleifer and Vishny, 1997; Megginson and Netter, 2001), incentives and governance (Williamson, 1979; Holmstrom and Milgrom, 1991; Bloom, Sadun and Van Reenen, 2012), and political checks and balances (Acemoglu, Johnson and Robinson, 2001; North, Wallis and Weingast, 2009). While existing studies examine firm governance (ownership and incentives) and political institutions in isolation, however, the empirical evidence suggests these two forces may importantly interact and constrain each other. On the one hand, private firms in developing and transition countries have been unable to replicate the high-powered incentives and strong governance of their counterparts in advanced liberal democracies (Blanchard and Kremer, 1997; Bloom, Schweiger and Van Reenen, 2012; Knyazeva, Knyazeva and Stiglitz, 2013). Figure 1 below illustrates this point: zooming in on delegation of authority – one of the managerial best practices identified by the World Management Survey - it shows that delegation is less frequently adopted by private firms in countries with weak political protection of property rights. On the other hand, many state-owned firms in countries with autocratic political institutions did successfully replicate the high-powered incentives and governance of private firms in liberal democracies (Groves, Hong, McMillan, and Naughton, 1994; Xu, 2000; Pucik, Xin and Everatt, 2003; Barg, 2020). These facts beg the question of whether the bundle of private ownership and strong governance that fostered the development and success of firms in the US, Japan or Europe can and should be replicated in countries with different political institutions.

In this paper we develop a tractable model that reconciles the empirical patterns described above, while generating broader theoretical insights on how political institutions constrain the governance of firms. In our baseline model, a firm consists of two players, a "seller" (equivalently, a supplier or an employee) and a "buyer" (a manager), whose efforts

[1]Note: The decentralization index (z-scored) by country is measured as the average plant manager's degree of autonomy over hiring, investment, products, and prices. The source is the LSE-CEP organizational survey (see Bloom et al., 2012). The index of security of property rights is by Ouattara and Standaert (2020). Regression analyses, available upon request, show that the positive correlation between delegation and institutional quality is robust to controlling for generalized and bilateral trust, both of which Bloom et al. (2012) found to be positively associated with delegation.

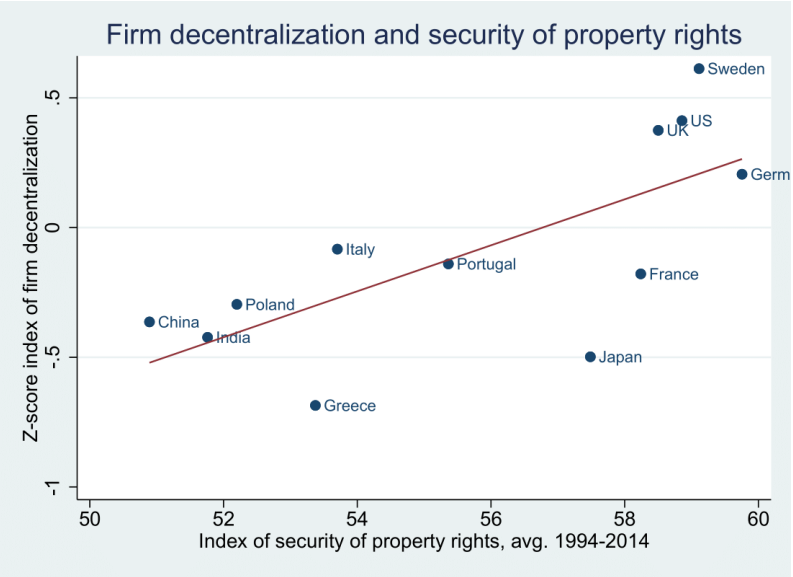

Figure 1: Firm decentralization and security of property rights[1]

jointly contribute to generate output. While output is always contractible, efforts are only contractible in the "enforcement state," which occurs with some probability. Thus, in the complementary "non-enforcement state," an output sharing incentive mechanism is necessary to induce the two agents to exert effort (modeling other mechanisms, such as piece rate contracts, would generate similar results).

Implementing output sharing is not straightforward in our setting because unlike in standard agency models, the buyer and the seller operate in the shadow of a third player, the ruler, who has an opportunity to appropriate the whole output. Preventing full appropriation may require assigning a share of the output to the ruler, thereby reducing the efforts that can be elicited from the productive agents. However, the ruler's power to appropriate output is not unconstrained: if she attempts to do so, she is removed from office with some probability, which we interpret as the strength of political institutions. Importantly, the consequences of removal depend on who collects the output. If the ruler collects it - which we interpret as state firm ownership - appropriation consists of withholding the buyer's and the seller's due shares, at the risk of being removed after consuming the output. If instead one of the productive agents (say, the buyer) collects output - which we interpret as private ownership - appropriation means that the ruler moves to take the output away from its owner, facing a risk to be removed before being able to consume it. Thus, the ruler faces a harsher expected punishment if she appropriates output under private ownership than under state ownership. This feature of our model mirrors real-world institutions: parliaments and supreme courts can intervene ex ante to block an arbitrary tax but can only intervene

ex post if the government withholds payments due to state employees or suppliers.

We use this model of "agency with a ruler" to characterize the allocation of output ownership and the incentive contract that jointly maximize total surplus, given the strength of political institutions. We first show that under low probability of removal (weak political institutions), it is efficient for the ruler to collect output and transfer small shares of it to the buyer and the seller, such that the two agents exert high effort in the enforcement state, and low effort in the non-enforcement state. Intuitively, it is not possible to induce an unconstrained ruler to leave large output shares to the buyer and the seller, who will therefore exert low efforts in the non-enforcement state. However, if the ruler owns the output, she has an incentive to pay the two agents an upfront salary in exchange for high efforts in the enforcement state, which guarantees a minimum level of surplus under state ownership. This arrangement cannot be replicated under private ownership because if the buyer owns the output, the unconstrained ruler has an incentive to appropriate it even in the enforcement state, thereby destroying the agents' incentives to participate in the game.

Next, we show that under high enough removal probability (strong political institutions), it is efficient for the buyer to collect output and transfer half of it to the seller, and for the ruler to collect a small share of the two agents' profits, which decreases in the probability of removal. Under this arrangement, the buyer and the seller exert first best efforts in the enforcement state, as before, and they also exert relatively high efforts in the non-enforcement state, although less than in the first best because output sharing cannot fully prevent free-riding (Holmstrom, 1982). The superiority of private ownership under strong political institutions follows from the fact that while the threat of removal always discourages appropriation by the ruler, it does so more effectively when the ruler does not collect output and hence faces the threat of removal ex ante, before she can consume it.

Altogether, our first two results highlight a simple but fundamental mechanism through which political institutions affect the choice between state and private ownership of firms. This mechanism can reconcile the superior performance of observed private firms relative to observed state-owned firms (Megginson and Netter, 2001) with the high incidence of state ownership in developing and transition countries. At the same time, our baseline model is restrictive because it assumes that incentives within a firm can only be created through output sharing. In the second part of our paper, we therefore study a more general and realistic model in which firms can use both formal output sharing contracts and relational contracts (Baker, Gibbons and Murphy, 1994) to elicit effort from the agents. Following Levin (2002), we model relational contracts as bonuses that are paid to the buyer and the seller on top of their output shares if they exert effort in the non-enforcement state. As usual, the downside of relational contracts is that if efforts cannot be enforced by a court, the promise to pay bonuses contingent on such efforts must be self-enforcing - that is, the

discounted future surplus from cooperation, minus the fallback surplus from reverting to purely formal contracting in the event of defection, must be higher than the parties' present gains from defection.

While the basic tradeoff between state and private ownership continues to exist in this extended model with relational contracts, additional results on the interaction between political institutions and firms' incentive systems emerge. Our key finding here is that incentive power and firm surplus have a U-shaped relationship with the strength of political institutions. When the probability of ruler removal is low enough, state ownership is optimal (as discussed above), the two agents exert first best efforts in the enforcement state, and relational contracts call for the ruler to pay them bonuses in the non-enforcement state. Under this arrangement, high expected surplus in the enforcement state can be used to sustain relational bonuses in the non-enforcement state, generating relatively high efforts and surplus. If the ruler reneges on the bonuses, mutual trust is broken and the parties revert to optimal formal governance - that is, state or private ownership under pure output sharing (Baker, Gibbons and Murphy, 2002). As the probability of removal increases, this fallback option improves, reducing the relational bonuses and efforts that can be sustained. The negative fallback effect of strong political institutions on incentives is partly compensated by a transfer of output shares from the ruler to the productive agents, which allows firms to sustain given efforts with lower relational bonuses, relaxing the self-enforcement constraint. However, as discussed above, political institutions increase the buyer's and seller's output shares faster under private ownership, which therefore becomes optimal at higher levels of removal probability. Moreover, it is only at high enough levels of such probability that the output transfer effect dominates the fallback option effect, such that bonuses and efforts increase in the strength of political institutions until eventually, private firms under a constrained ruler catch up with and surpass state-owned firms under autocracy.

Our findings are consistent with the observed gap in management quality between private firms in developed vs. developing countries, and with the relative success of state-owned firms in autocratic regimes like China. More broadly, our model implies that the governance of firms depends not only on firm and market characteristics, as emphasized by organizational economics, but also on political institutions. While the most productive firms are privately owned and can implement "Toyota-like," relational management practices, that might be driven by the fact that those firms are located in countries with strong political institutions. For a firm that operates under weak institutions, following a consultant's recommendation to adopt relational governance may backfire and completely break down cooperation. Moreover, transferring advanced management practices to firms located in autocratic regimes might have greater chances of success if those firms are state-owned, while privatizing a state-owned firm under weak political institutions may backfire and reduce

the firm's productivity.

Our model also has implications for institutional design and development. First, it suggests that in development policies, institutions should come first, and governance should follow. Rather than attempting to import strong governance into a weak institutional environment, hoping that institutional improvements will follow economic growth, reformers should prioritize the creation of checks and balances on the government as that is a pre-condition for strong governance to be transferable. Second, and related, our non-monotonicity result suggests that while radical institutional improvements, if feasible, improve firm governance, half-hearted reforms may backfire. Weak political institutions can support decent (though not excellent) governance in SOEs but mediocre institutions can only support poor governance that will lead to a reduction in firm value. This result may explain why the transition from communism to democracy and capitalism in the former Soviet countries, back in the 1990s, reduced economic output (Blanchard and Kremer, 1997). While the transition process introduced some constraints on governmental power, such as formal property rights and democratic elections, checks and balances remained weak after the collapse of communism, and the government often engaged in arbitrary taxation, especially against foreign firms (Spar and Jarosz, 1996; Lowes et al., 2023). The option to "squeeze" mediocre privatized firms through taxes may have caused post-soviet rulers to breach the relational contracts that state-owned firms had developed with employees and suppliers, imprisoning the newly privatized firms into a trap of weak governance and low productivity.

The rest of this paper is organized as follows. Section 2 discusses how our model relates to the economic literature. Section 3 presents the model. Section 4 outlines the general incentive provision problem and the basic constraints that the solution under either state or private ownership needs to satisfy. Section 5 analyzes how institutions affect the optimal mix of incentives and firm ownership (governance) when only formal contracts are feasible. Section 6 studies how institutions affect governance when relational contracts are also feasible. Section 7 discusses some applications of the model and section 8 discusses extensions. Section 9 concludes.

2 Relation to the literature

Our paper relates to both the literature on contracts and organizations and the literature on economic institutions. On the one hand, classic models of incentives (reviewed by Gibbons and Roberts, 2013, and Malcomson, 2013) and asset ownership (reviewed by Segal and Whinston, 2013) focus on imperfections in contractual enforcement, assuming strong political institutions and hence no risk of expropriation. On the other hand, models of institutions study how repeated interaction with traders overcomes the commitment prob-

lem of rulers (e.g., Olson, 1993; Greif, Milgrom and Weingast, 1994; Dixit, 2004; North, Wallis and Weingast, 2009) but abstract from contracting among the traders themselves. By exploring how institutional constraints on rulers shape the incentive systems and ownership structure of firms, our paper builds a bridge between these two literatures, which we hope will stimulate further theoretical and empirical research on the linkages between institutions, management and development.

Our paper also contributes to a (small) theoretical literature in economics, which uses an incomplete contracting approach to study the choice between state and private firm ownership. Contributions to this literature include Sappington and Stiglitz (1987), Laffont and Tirole (1993, ch. 17), and the more recent papers by Schmidt (1996), Hart et al. (1997), and Williamson (1999). Roland (2008) provides a concise review. While these papers adopt different modeling approaches and highlight different tradeoffs between state and private ownership, they have two common features that sharply differentiate them from our model. First, they do not study how the optimal design of incentives and contracts differs across state-owned and privately owned firms. Second, these papers do not model how institutions affect the choice between private and state ownership.[2]

3 Model

We consider an economy consisting of four (groups) of players: a ruler (she), two unit masses of identical productive agents (he) and a court system ("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. The players (and the economy) are infinitely lived, and discount the future at a common factor $\delta \in [0, 1)$.

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

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

[2]A partial exception is Che and Qian (1998), which focuses on the Chinese case to show that in an autocracy, private firms distort the production technology to hide revenue from the government. Unlike us, Che and Qian (1998) do not allow for variation in institutions and hence do not study how institutional differences affect firm ownership.

where a_B, a_S are the productive actions of the buyer and the seller, respectively. For concreteness, we will refer to these actions as "efforts," although other interpretations are possible. The cost of effort is borne privately by the respective 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 the efforts as generating a probability of successful output, we assume that $y \leq 1/2$.

The output generated by each firm will be owned either by the buyer (*private ownership*) or by the ruler (*state ownership*), and the owner of the output will need to contract with the remaining productive agents for their services. In other words, if the ruler owns a particular firm's output, she will need to contract with both the buyer and the seller, while if the output is owned by the buyer, he will need to contract with the seller. Since our main purpose is to study firm governance under different ownership structures, we assume for simplicity that firms in the economy are either all privately owned or state-owned. We briefly consider the possibility of a mixed economy with both private and state-owned firm in section 8. The contracting environment faced by firms is described in detail below.

Ruler: The actions available to the ruler depend on the allocation of ownership. When firms are state-owned, the ruler contracts with the buyer and the seller for the provision of their services. When firms are privately owned, the ruler enters a "political contract" with the buyers and sellers, which specify taxes to be paid by the latter. In addition to collecting taxes, the ruler has in each period an opportunity to expropriate the entire output of private firms.[4] The details of both production contracts and political contracts and taxation are described in the sections below.

Courts and formal contracts: The courts perform two functions in the model. First, they enforce formal contracts written with the productive agents in each firm. A formal contract for agent i consists of three components: (i) a fixed payment β_i (which could be negative), (ii) a share b_i of the realized output Y and (iii) specified effort levels to be taken. Firm output and monetary transfers (upfront payments and shares) can always be verified (and hence enforced) by courts. In contrast, effort levels, while observed by a firm's owner and productive agents, are only imperfectly verifiable by courts, implying that it may be necessary to used output-contingent contracts (rather than effort-for-salary contracts) to

[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.

[4]For state-owned firms, such temptation does not exist since the ruler already owns and collects the output.

incentivize the agents. We model imperfect verifiability as follows. There is a state of the world, $\theta_j \in \{E, N\}$, specific to the firm, that determines whether the contracted effort is verifiable and court-enforceable, where the probability of enforcement is $\Pr(\theta_j = E) = q_j$. This state is realized and observed by the contracting parties after the contract is signed but before the effort is chosen. If the state is E, courts will enforce specific performance, and the provider is compelled to deliver the contracted effort. If the state is N, the productive agent can exert zero effort and still collect the contracted payments. [5] We assume that the likelihood of enforceability is the same across productive agents so that $q_j = q_{j'} = q$.[6]

In addition to enforcing contracts, the courts provide constraints on the executive, whereby if the ruler deviates from any formal commitments she has made, she will be deposed with probability $\tau \in [0, 1]$ and a new ruler will be installed, the current ruler receiving a payoff of zero going forward. With probability $(1 - \tau)$, the deviation is successful and the ruler remains in power. [7] The immediate consequences of these institutional constraints for the ruler depend on firm ownership. In the case of private ownership, the ruler breaches her formal commitments when she attempts to expropriate the firms' output, over and above the agreed upon tax payments. Thus, a successful court intervention will prevent the ruler from expropriating not only in the future but also in the current period. In contrast, in the case of state ownership, the ruler breaches her formal commitments when she fails to make formally contracted payments to the productive agents after collecting the output. Thus, while a successful court intervention will punish the ruler in the future by removing her from power, it cannot prevent her from consuming the withheld payments in the current period. This difference across firm ownership structures in the nature of the ruler's breach, and hence of institutional sanctions, plays an important role in generating a trade-off between state and private ownership, as shown below. [8]

Relational contracts: Given the imperfections of formal contracts, as described above, greater efforts may be elicited from the productive agents by supplementing formal contracts

[5] Our setting is therefore richer than standard agency models, which assume efforts are never court-enforceable. Indeed, partial contractibility is the reason why unlike in standard models, formal contracts do not only specify incentives and payments but also effort levels in the "good" state.

[6] An institutional interpretation of the probability of non-enforcement, $1 - q$, is as failures and limitations of the courts (Djankov et al., 2003). For instance, inefficient courts may be more often clogged with cases and when that happens, the agents may be able to breach their contract without fearing punishment in the foreseeable future.

[7] For parsimony, we use the "courts" label to identify institutions in charge of sanctioning the ruler, regardless whether her violation is expropriation or non-payment. In practice, institutions other than courts, such as parliaments, may police expropriation (although supreme or constitutional courts may also be involved in such task).

[8] The model's results would be qualitatively unaffected if the ruler's failure to make due payments could be punished in the present with some probability. What matters is that the ruler can more easily escape immediate enforcement of payment obligations compared to the buyer and the seller and compared to her own obligation not to expropriate.

with relational contracts. As we will see, formal contracts suffice to ensure efficient actions in state $\theta_j = E$, so relational contracts are needed only in state $\theta_j = N$, when actions are not directly enforceable.[9] A relational contract rewards agent $i \in \{B, S\}$ with a bonus payment $B_{i,N}$ for the delivery of effort $a_{i,N}$. Such relational contracts can exist between the buyer and the seller under private ownership and between the ruler and both the buyer and the seller under state ownership.

Taxation: Given that output and monetary transfers can be verified, we assume that taxes specified by the political contracts are based on the agents' measurable profits. Thus, the total tax liability of a typical buyer and seller are given, respectively, by $T_B = \kappa_B (y(1 - b_S) - B_{S,N} - \beta_S) + t_B$, 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 lump-sum taxes. [10] Lump sum taxes allocate rents to the ruler, thereby facilitating self-enforcement of the political contracts (Olson, 1993; Greif et al., 1994; Acemoglu, 2003). Additionally, by distorting the agents' incentives, marginal taxes enable the ruler to choose firms' production levels in a way that further facilitates self-enforcement of the political contract. Our model therefore allows for a general and powerful class of political contracts. As we will see, the model shows that even with such effective political contracts, the quality of institutions (measured by q and τ) constrains the optimal governance of firms.

Other assumptions: Outside of the structural framework outlined above, we make three additional assumptions. First, all the players have deep pockets, so that the players are able to make the payments necessitated by the formal contracts even if no output is realized, and are able to buy a stake in a firm if warranted. Second, we assume that the output of the firm cannot be leveraged contractually, so that $\sum b_i \leq 1$. This is effectively a "no-sabotage" constraint, requiring that no player in the game has a payoff that is negatively related to the output of a firm. Third, we assume that the ruler cannot pledge wealth at the beginning of the game as a hostage to ensure compliance with her promised behavior. As the analysis below will show, the first assumption is largely irrelevant in the case of private ownership, and only matters under state ownership when the ruler offers stakes in the firm to the buyer and the seller in exchange for a payment. In that case limited liability would

[9] As formally shown below, relational contracts are valuable because in the presence of team production, output sharing (b_i) cannot elicit first best efforts from both agents when the actions are not directly enforceable (Holmstrom, 1982).

[10] 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 considering a positive baseline output level but which would generate no new qualitative insights while adding notational complexity. Alternatively, we could consider a situation where the ruler taxes output directly, which would lead to different equilibrium tax rates but again no qualitative differences in the logic of the model.

lower firm performance but results would be qualitatively similar to the current model. The third assumption is largely redundant in the sense that pledged wealth would simply make deviations less attractive under any arrangement and thus qualitatively similar to a higher patience level by the ruler. The key assumption is the "no-sabotage" constraint, which ensures that formal output sharing alone cannot elicit first-best efforts, and thus the analysis is non-trivial.

Equilibrium: The goal of the analysis is to solve for the surplus-maximizing subgame-perfect Nash equilibrium of the infinitely repeated game described above under different combinations of firm ownership (private vs. state) and institutions (different values of q and τ). An optimal equilibrium specifies the productive agents' efforts, as well as the incentive contracts (formal and relational) used to elicit such efforts. Given the features of our environment (absence of liquidity constraints and observability of efforts), Levin (2003) applies, and we can focus without loss on stationary equilibria in which on-path actions are the same in every period, and off-path deviations are sustained by the threat of future punishments. Because optimal punishments depend on the deviating player and on firm ownership, we describe them below, when we formally state the contracting problem.

4 The General Contracting Problem

Having outlined the environment, we can now proceed to solve the model. We will do this in three steps. In this section, we will detail the general contracting problem under both private and state ownership and derive the key constraints that need to be satisfied. In the next section, we will study the equilibrium when only formal contracts are used to elicit efforts from the agents. Such equilibrium is important for two reasons: first, as further discussed below, it affects the equilibrium under relational contracting as it provides the fallback option in the event of a deviation; second, it is empirically relevant in environments where relational contracts are unlikely to develop (for instance, due to low trust or heavy discounting of the future). Finally, in the last section of the model we will study optimal equilibria when both formal and relational contracts are used to incentivize production.

4.1 Private Ownership

The timeline of the stage game under private ownership is illustrated in Figure 2. The game begins with the political contract, whereby the parties agree on equilibrium taxation, $(\kappa_B, \kappa_S, t_B, t_S)$. Once taxes have been set, the buyer and the seller in each firm negotiate both the formal incentive contract, $(\beta_S, b_S, a_{B,E}, a_{S,E})$, and the relational contract,

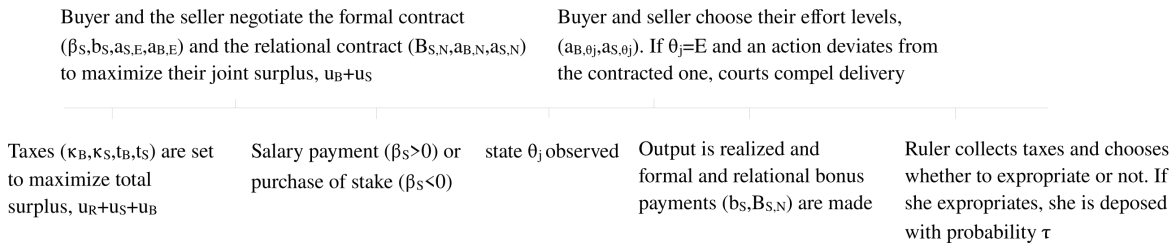

Figure 2: Timeline under private ownership

$(B_{S,N}, a_{B,N}, a_{S,N})$. The formal contract specifies efforts in the verification state, upfront payments, and the output sharing rule; the relational contract additionally specifies efforts, and a discretionary bonus payment for the seller, for the state in which efforts are not court-verifiable. Given deep pockets, the contract(s) will maximize the buyer's and the seller's joint surplus, and we assume without loss of generality that the buyer making a take-it-or-leave-it offer to the seller. Once the contract(s) are agreed-upon, the parties make any fixed payments associated with the contract(s).

After making the fixed payments, the agents observe whether the formal contract is enforceable (the state $\theta_j \in \{E, N\}$), and choose their efforts. If the contracted efforts are enforceable, courts compel their execution. If the efforts are not enforceable, output sharing and relational bonuses must ensure that they are incentive-compatible. Once the efforts are sunk, outputs are realized and the formal and relational bonus payments are made, after which the ruler collects taxes and chooses whether to expropriate the firms' outputs. If the ruler tries to expropriate, she is deposed with probability τ and receives a zero payoff from the current period and thereafter. If instead expropriation is successful, the ruler consumes aggregate output in the current period and remains in power, but all relational contracts are broken and the ruler reverts back to her preferred spot governance structure.

Given that the buyers and sellers are identical, we can perform our analysis by using a representative pair. An equilibrium must satisfy participation constraints for the buyer and the seller, such that both agents expect a positive payoff from contracting with each other. Additionally, an equilibrium must ensure that the buyer and the seller prefer honoring their side of the relational contract over reneging - that is, the equilibrium must satisfy self-enforcement constraints for both agents.

The buyer's participation constraint and self-enforcement constraint are given, respectively, by

$$u_B = (1-\kappa_B)\left((1-b_S)\, y\left(q\left(a_{B,E}+a_{S,E}\right)+(1-q)\left(a_{B,N}+a_{S,N}\right)\right)-\beta_S-(1-q)B_{S,N}\right)$$
$$-t_B-\tfrac{1}{2}qa_{B,E}^2-\tfrac{1}{2}(1-q)a_{B,N}^2\geq 0 \tag{2}$$

$$\begin{aligned}&-(1-\kappa_B)\, B_{S,N}+(1-\kappa_B)(1-b_S)\, y\left(a_{B,N}+a_{S,N}\right)-\tfrac{1}{2}a_{B,N}^2+\tfrac{\delta}{1-\delta}u_B\\&\geq \max_{a_B}(1-\kappa_B)(1-b_S)\, y\left(a_B+a_{S,N}\right)-\tfrac{1}{2}a_B^2+\tfrac{\delta}{1-\delta}u_B^{dev}\end{aligned} \tag{3}$$

The right hand side of the self-enforcement constraint follows from the fact that if the buyer chooses to renege, his optimal deviation entails both not paying the bonus promised to the seller and choosing an effort level that maximizes his current period's payoff (instead of the promised action). The label u_B^{dev} denotes the buyer's continuation payoff following a deviation, to be precisely defined in section 6.

Similarly, the seller's participation and self-enforcement constraints are given, respectively, by

$$u_S = (1-\kappa_S)\left(b_S y\left(q\left(a_{B,E}+a_{S,E}\right)+(1-q)\left(a_{B,N}+a_{S,N}\right)\right)+\beta_S+(1-q)B_{S,N}\right)$$
$$-t_S-\tfrac{1}{2}qa_{S,E}^2-\tfrac{1}{2}(1-q)\, a_{S,N}^2\geq 0 \tag{4}$$

$$\begin{aligned}&(1-\kappa_S)\left(b_S y\left(a_{B,N}+a_{S,N}\right)+B_{S,N}\right)-\tfrac{1}{2}a_{S,N}^2+\tfrac{\delta}{1-\delta}u_S\\&\geq \max_{a_S}(1-\kappa_S)\, b_S y\left(a_{B,N}+a_S\right)-\tfrac{1}{2}a_S^2+\tfrac{\delta}{1-\delta}u_S^{dev}.\end{aligned} \tag{5}$$

In words, the seller can either exert the promised effort level, receive the formal and relational incentive payments, and continue the relationship, or exert the statically optimal effort, collect the corresponding formal incentive payment, and receive the punishment payoff u_S^{dev} (to be precisely defined below) forever after.

In addition to ensuring individual rationality and incentive compatibility of the contracted efforts and payments, an equilibrium must also ensure incentive compatibility of the political contract - that is, the ruler must be better off collecting the agreed upon taxes than expropriating the economy's output and running the risk of being deposed. Formally, the ruler's per period payoff from honoring the political contract is

$$u_R = \kappa_B\left((1-b_S)\, y\left(q\left(a_{B,E}+a_{S,E}\right)+(1-q)\left(a_{B,N}+a_{S,N}\right)\right)-\beta_S-(1-q)B_{S,N}\right)$$
$$+\kappa_S\left(b_S y\left(q\left(a_{B,E}+a_{S,E}\right)+(1-q)\left(a_{B,N}+a_{S,N}\right)\right)+\beta_S+(1-q)B_{S,N}\right)+t_S+t_B, \tag{6}$$

so that her equilibrium present discounted payoff stream is $\frac{u_R}{1-\delta}$. In contrast, the ruler's discounted payoff stream from expropriation is

$$(1-\tau)\left(y\left(q\left(a_{B,E}+a_{S,E}\right)+(1-q)\left(a_{B,N}+a_{S,N}\right)\right)+\frac{\delta}{1-\delta}u_R^{dev}\right), \tag{7}$$

In words, if expropriation is successful (which occurs with probability $(1-\tau)$), the ruler receives the current expected output plus the post-deviation continuation payoff u_R^{dev} (to be precisely defined below). If expropriation is unsuccessful (which occurs with probability τ), the ruler is deposed and, as a result, does not receive any output in the current period and receives a payoff of zero forever after.[11] Thus, the political contract is incentive compatible, and hence credible for the buyers and sellers, if and only if

$$\frac{u_R}{1-\delta} \geq (1-\tau)\left(y\left(q\left(a_{B,E}+a_{S,E}\right)+(1-q)\left(a_{B,N}+a_{S,N}\right)\right)+\frac{\delta}{1-\delta}u_R^{dev}\right). \tag{8}$$

Given these basic constrains, the problem faced by the players is then to choose the political contract to maximize total surplus $\pi = u_R + u_B + u_S$, and to choose each firm's formal and relational contracts to maximize the buyer's and seller's joint surplus $u_B + u_S$, subject to constraints 2-5 and 8.

4.2 State Ownership

Under state ownership, the ruler is the residual claimant of firms' output and contracts with the two productive agents for effort provision. The timing of the actions is illustrated in Figure 3. First, the parties negotiate the formal $(\beta_i, b_i, a_{i,E})$ and relational $(B_i, a_{i,N})$ contracts to maximize their joint surplus. After that, the state of contract enforceability is realized and observed by the relevant parties; the productive agents make their effort choices; output is realized; and the ruler makes both formal and relational payments.

An equilibrium under state ownership must ensure that all agents expect a positive payoff from contracting with each other (participation constraints). Additionally, an equilibrium

[11] In all deviations to be considered, there is some ambiguity as to the most natural timing, which has no qualitative impact on the analysis but can have a quantitative impact on the exact levels. Here, the assumption is that the ruler needs to make the decision to expropriate at the same time as collecting the taxes. It is not possible to collect the taxes, then consume the taxes, and then attempt to expropriate the rest. Either the private sector consumes their value after the tax collection but before the ruler could try to grab the rest, or the ruler does not have time to consume her taxes if the expropriation effort fails.

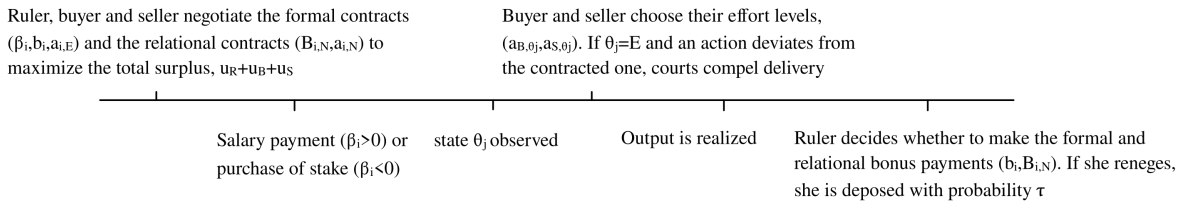

Figure 3: Timeline under state ownership

must ensure that the buyer and the seller are willing to exert the agreed upon efforts, and that the ruler is willing to make the agreed upon payments (self-enforcement constraints).

For any firm, the ruler's participation constraint under contract(s) $(\beta_i, b_i, a_{i,E})$ and $(B_{i,N}, a_{i,N})$ is given by

$$u_R = (1 - b_S - b_B)\, y\,(q\,(a_{B,E} + a_{S,E}) + (1-q)\,(a_{B,N} + a_{S,N})) - (1-q)\,(B_{B,N} + B_{S,N}) - \beta_B - \beta_S \geq 0, \tag{9}$$

Likewise, the participation constraint of productive agent i is given by

$$u_i = b_i y\,(q\,(a_{B,E} + a_{S,E}) + (1-q)\,(a_{B,N} + a_{S,N})) + (1-q)B_{i,N} + \beta_i - q\frac{1}{2}a_{i,E}^2 - (1-q)\,\frac{1}{2}a_{i,N}^2 \geq 0. \tag{10}$$

Since firms face the same contracting friction q and productive agents have the same productivity, we can focus on a representative firm with $b_S = b_B$, $\beta_B = \beta_S$, $B_{B,N} = B_{S,N}$ and so $a_{B,k} = a_{S,k}$.[12] As a result, we can simplify the participation constraints to

$$u_R = 2\,((1-2b)\,y\,(qa_E + (1-q)a_N) - (1-q)B_N - \beta) \geq 0, \tag{11}$$

$$u_i = 2by\,(qa_E + (1-q)a_N) + (1-q)B_N + \beta - q\frac{1}{2}a_E^2 - (1-q)\,\frac{1}{2}a_N^2 \geq 0. \tag{12}$$

Notice also that because of the continuum of (identical) firms, the ruler's realized payoff

[12] Convexity of the effort costs and the lack of effort interactions means balanced efforts will be optimal to maximize surplus, while balanced efforts are achieved optimally with symmetric contracts.

for the whole economy is equal to the expected payoff from a representative firm, so with slight abuse of notation, we will use u_R to denote both payoffs.

We are now ready to state the incentive constraints. For the ruler, we need to specify how failure to pay a buyer or seller in any given firm will affect the future behavior of other buyers and sellers, and hence the ruler's continuation payoff. Because the ruler is a common counterpart to all buyers and sellers, we assume maximal multilateral punishment of the ruler's deviations (Levin, 2002): if the ruler deviates in a particular firm, buyers and sellers in other firms will stop trusting the ruler forever after after. It is important to notice that unlike in a standard model (and unlike in private firms), the owner/ruler has the opportunity to renege not only on relational payments but also on formally contracted ones. Deviations on formal payments are punished multilaterally like those on relational payments. Additionally, if the ruler reneges on a formal payment, the courts intervene and the ruler will be deposed with probability $(1-\tau)$, earning a payoff of zero in all subsequent periods.

Given these assumptions, the ruler thus has two alternative deviation opportunities, which must be reflected in her incentive constraints. First, she may choose to renege on the relational bonuses, while honoring the formal payments. Given mass one of both buyers and sellers, of which fraction $1-q$ is in the non-enforceable state for which a relational bonus is needed, the ruler can save $-2B_N(1-q)$ by reneging on all relational bonuses at once. Thus, the self-enforcement constraint that deters this deviation is given by

$$\frac{\delta}{1-\delta}\left(u_R - u_R^{dev}\right) \geq 2(1-q)B_N, \tag{13}$$

where u_R^{dev} continues to denote the continuation payoff of the ruler following a deviation that does not lead to her being deposed, to be precisely defined below.

Alternatively, the ruler may choose to simultaneously default on both the formal and relational payments. By doing so, the ruler gains more in the present from a deviation but risks being deposed if the courts successfully intervene to sanction her abuse of power. The ruler's discounted payoff from honoring the promised payments promised is

$$-2B_N(1-q) + 2\left(1-2b\right)y\left(qa_E + (1-q)a_N\right) + \frac{\delta}{1-\delta}u_R, \tag{14}$$

while the ruler's payoff from simultaneously reneging on the formal and relational payments is

$$2y\left(qa_E + (1-q)a_N\right) + (1-\tau)\frac{\delta}{1-\delta}u_R^{dev}. \tag{15}$$

Thus, the joint deviation is not profitable as long as (14) is greater than (15), that is:

$$\frac{\delta}{1-\delta}\left(u_R - u_R^{dev}\right) + \tau\frac{\delta}{1-\delta}u_R^{dev} \geq 2(1-q)B_N + 4by\left(qa_E + (1-q)a_N\right). \tag{16}$$

The incentive constraints of the buyer and seller are straightforward and similar to those in the private firm:

$$B_N - \frac{1}{2}a_N^2 + 2bya_N + \frac{\delta}{1-\delta}u_i \geq \max_{a_i} by\left(a_i + a_N\right) - \frac{1}{2}a_i^2 + \frac{\delta}{1-\delta}u_i^{dev}, \tag{17}$$

where (B_N, a_N) is the relational contract offered by the ruler to both agents. The left-hand side denotes the payoff of agent i from exerting effort a_N in exchange for bonus B_N, as specified by the relational contract. The right-hand side denotes the agent's payoff from an optimal deviation: the agent earns the present gains from choosing the effort that maximizes her static payoff (given the profit-share b and the expectation that the other agent honors the relational contract), while receiving the post-deviation payoff in subsequent periods.

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 13,16,17 and $u_i \geq 0$

Having stated the general contracting problem under both private and state ownership, we now proceed to analyze firm governance - the optimal combination of ownership and incentive contracts - under different kinds of institutions. We begin with the benchmark case in which relational contracts are not feasible and formal contracts are the only tool available to elicit efforts from the agents. We then study the more general and interesting case in which both formal and relational contracts are available.

5 Governance and institutions under formal contracting

5.1 Private ownership

Suppose for the moment that buyers and sellers solely rely only on formal contracts (salary-for-work and output sharing) to manage their relationship. The optimal formal contract

governing the buyer-seller relationship, and the optimal political contract governing taxation, are given by the following proposition

Proposition 1 ***Equilibrium under formal contracts only:***
(i) the optimal marginal tax rate is equal across the productive agents, $\kappa_B = \kappa_S = \kappa^{ps}$*, and is given 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 efficient formal contract sets effort levels $a^{ps}_{B,E} = a^{ps}_{S,E} = (1-\kappa^{ps})\, y$ *and a profit-sharing rule* $b^{ps}_S = \frac{1}{2}$ *that induces effort levels* $a^{ps}_{B,N} = a^{ps}_{S,N} = \frac{1}{2}(1-\kappa^{ps})\, y$ *in the non-enforceable state.*

Proof. See Appendix A.1. ■

In the state where formal contracts are court-enforceable, the parties simply agree on the surplus-maximizing effort levels. In the state where formal contracts are unenforceable, efforts are elicited via output-sharing. Importantly, buyers and sellers choose the output sharing rule to optimally elude taxes: anticipating that the agent with lower tax liability has an incentive to work harder, they allocate a higher output share to that party.

Regarding the political contract, tax uniformity follows from the aforementioned fact that the agents reallocate their efforts to minimize tax liability. As a result, equalizing the marginal tax rates reduces the gap between total tax revenue and total output, thereby lowering the ruler's temptation to breach the political contract and expropriate.

Regarding taxation levels, one would expect the optimal marginal rate to be zero since its only effect is to scale back efforts and output. However, at zero marginal taxes, output may be too high relative to the stream of surplus the ruler can collect through lump sum taxes, and as a result, the ruler may be tempted to expropriate. To restore credibility of the political contract, the ruler selects a positive marginal tax rate that lowers output just enough to deter expropriation. The comparative statics of taxation are intuitive. The stronger the institutional constraints on the executive (the higher τ)or the more patient the ruler, the lower the marginal tax rate that is needed to keep the political contract credible. Interestingly, the quality of contract enforcement (measured by q) has the opposite effect. By raising private firms' output, better contract enforcement increases the ruler's gains from expropriation and thus requires reducing output through a higher marginal tax rate in order to restore the political contract's credibility.

Given these results, we can write total output in the economy as

$$\Pi^{ps} = y^2 (1-\kappa^{ps})(1+q), \tag{18}$$

Similarly, we can write total surplus as

$$\pi^{ps} = y^2 \left(\frac{(1+q)}{2} \left(1 - (\kappa^{ps})^2 \right) + \frac{(1-q)\left(1-\kappa^{ps}\right)^2}{4} \right). \tag{19}$$

5.2 State ownership

When purely formal contracts govern firms under state ownership, incentive constraints 13 and 17 can be ignored, and constraint 16 can be simplified after taking into account that relational bonuses are zero. Derivation of the optimal contract is then straightforward and is characterized by the following proposition:

Proposition 2 ***Formal contracts under state ownership:***
The surplus-maximizing formal contract under state ownership consists of (i) $a_E^{ss} = y$*, (ii)* $a_N^{ss} = by$ *and (iii)* $b^{ss} = \min\left\{ \frac{1}{2}, \frac{\sqrt{q^2+4\phi^2(1-q)}-(q-2(1-q)\phi)}{2(1-q)(1+\phi)} \right\}$*, where* $\phi = \frac{\tau\delta}{4(1-\delta)}$.

Proof. See Appendix A.2 ■

As in the case of private ownership, the ruler relies on salary-for-input contracts to elicit efforts in the state where formal contracts are enforceable, while relying on output sharing to elicit efforts in the other state. There are, however, two important differences with respect to private ownership. First, the threat of output expropriation, and the consequent need to set positive marginal tax rates, constrains effort in all states under private ownership. In contrast, under state ownership the ruler can set surplus-maximizing efforts in the state where formal contracts are enforceable. The reason why salary-for-effort contracts work so well under state ownership is that while the ruler can potentially claw back the agents' salaries, she has no incentive to do so before the efforts are chosen as the lack of payment would liberate the agents from the obligation to work. Thus, the agents can consume their upfront salaries before production, leaving the ruler with no expropriation opportunities.

The second important difference is that the optimal sharing rule under state ownership is generally lower than under private ownership ($b^{sp} \leq \frac{1}{2}$), implying that agents exert lower efforts when formal contracts are unenforceable. This result is driven by the ruler's special status, which enables her to renege on formal contracts. If institutions were strong enough

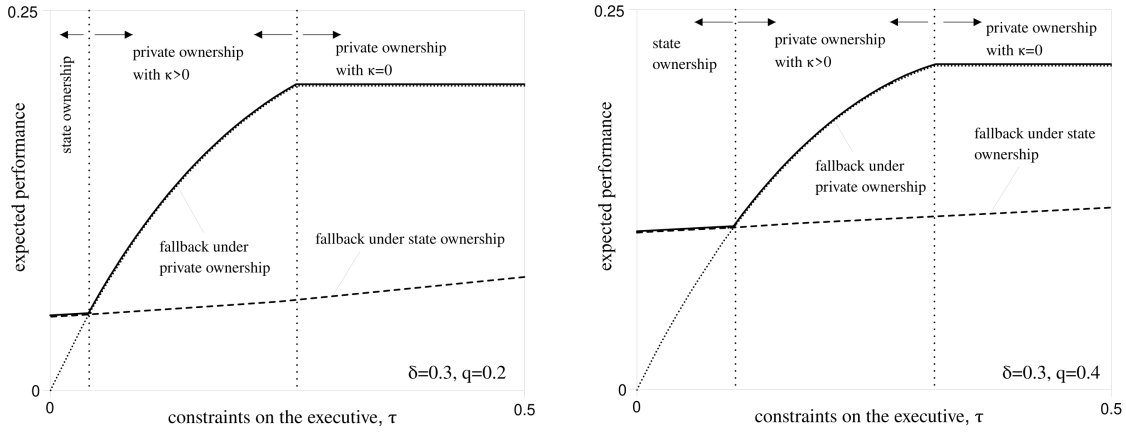

Figure 4: Examples of the equilibrium under no formal contracts

to commit the ruler to honor formal payments ($\tau = 1$), the optimal contract would indeed share output 50/50 among the buyer and the seller, as in the case of private ownership. As constrains on the ruler weaken, however, she becomes less afraid of being deposed, down to the point where she has no incentive to pay the whole output to the agents. In that case, the output shares must be set below 1/2 to restore credibility of the ruler's promises, and the lower τ (and the parties' patience δ), the farther the optimal sharing rule is from the 50-50 benchmark.

5.3 Optimal formal governance

We conclude our analysis of the formal contracting benchmark by characterizing the optimal governance of firms (that is, the optimal combination of formal contracts and ownership) under different kinds of institutions (different levels of court quality, q, and constraints on the executive, tau). Figure 4 below depicts the total surplus from purely formal contracting under private and state ownership at different levels of τ, holding q and the players' patience δ constant.

When constraints on the executive are weak (τ close to zero), the optimal formal governance entails state ownership and efficient fixed wage contracts in the enforcement state, with low output sharing and low effort in the non-enforcement state. At low τ, output sharing is not credible under state ownership (because the ruler is tempted not to pay), but high efforts can be contracted in the enforcement state through pay-for-input contracts. Under private ownership, on the other hand, the need to constrain the ruler from expropriating requires the use of high marginal tax rates, which implies low effort levels in all states (even if output-sharing is implemented).

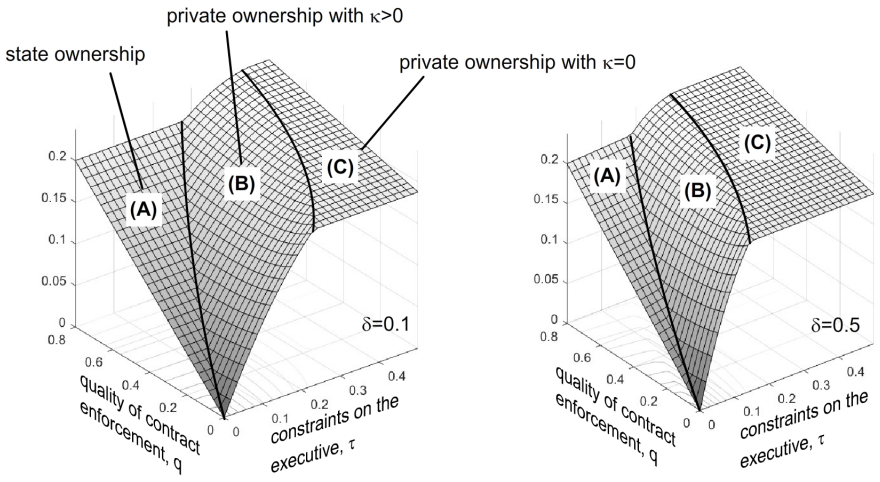

Figure 5: Fallback equilibria – maximal surplus attainable under no relational contracts

In contrast, when constraints on the executive are strong enough, the optimal formal governance entails private ownership (with zero marginal tax rate), efficient salary-for-effort contracts in the enforcement state, and fifty-fifty output sharing and positive efforts in the non-enforcement state. Intuitively, under sufficiently high τ, private ownership can more easily implement output sharing than state ownership because if the ruler unsuccessfully attempts to expropriate, she does not get to consume current output before being deposed. In contrast, if the ruler decides not to pay the agreed upon output shares under state ownership, she can consume output (which she owns and collects) before being deposed. Thus, when institutions are good enough to prevent prohibitive taxation, private ownership has an inherent advantage over state ownership in the use of formal incentive contracts. The intermediate area in-between low and high τ is covered by private ownership with positive marginal tax rate.

Figure 5 provides a more complete characterization of optimal formal governance by representing the surplus curves for different levels of both q and τ (again, holding δ constant). This figure shows that state ownership becomes more attractive under high q because state firms are relatively more dependent on salary-for-effort contracts. Additionally, the zero marginal tax region shrinks in q because strong contract enforcement increases the overall output in the economy, thus making expropriation more attractive. Relatedly, while surplus under both state ownership and private ownership with zero marginal tax rate increase in q, strong contract enforcement can actually reduce the private firms' surplus when the marginal tax rate is positive - again, due to the fact that high q increases the ruler's expropriation temptation and thus calls for higher marginal taxes.

Altogether, our analysis of formal governance illustrates the basic tradeoff between private and state ownership (expropriation and taxation vs. contract breach). The analysis above also 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 political institutions and weak constraints on the executive. At the same time, the formal governance model predicts relatively stable contract forms across institutional settings - namely, high-powered incentive contracts (via output sharing) under private ownership, and low-powered ones under state ownership. As such, the formal governance model cannot explain the observed variation in incentive power and best management practices across countries, and the successful implementation of such practices by state-owned firms in some developing economies. To explain these patterns, and to obtain a more relevant and complete characterization of governance under different kinds of institutions, we now analyze the full model, allowing firms to employ both formal and relational incentives to elicit productive efforts.

6 Governance and institutions under relational contracting

6.1 Private ownership

Recall that a relational contract consists of $(B_{S,N}, a_{B,N}, a_{S,N})$, that is, efforts to be exerted by the buyer and the seller in the non-enforcement state, and a discretionary bonus that the buyer should pay the seller upon delivery of the promised effort. For given taxes, the goal of relational contracting is to improve on the efforts elicited by output sharing and move towards the efficient effort level, $(1-\kappa)\,y$. To solve for the optimal relational contract, recall that the buyer's and seller's self-enforcement constraints are given by (3) and (5). The optimal deviations from a given promised effort $a_{i,N}$ are then $a_B^{dev} = (1-\kappa)\,(1-b_S)\,y$ and $a_S^{dev} = (1-\kappa)\,b_S y$, which allows us to rewrite the constraints as

$$\frac{\delta}{1-\delta}\left(u_B - u_B^{dev}\right) - \left[\frac{1}{2}\left((1-\kappa)\,(1-b_S)\,y\right)^2 - \left((1-\kappa)\,(1-b_S)\,y a_{B,N} - \frac{1}{2}a_{B,N}^2\right)\right] \geq (1-\kappa)\,B_{S,N} \tag{20}$$

$$(1-\kappa)\,B_{S,N} \geq \frac{1}{2}\left((1-\kappa)\,b_S y\right)^2 - \left((1-\kappa)\,b_S y a_{S,N} - \frac{1}{2}a_{S,N}^2\right) - \left(\frac{\delta}{1-\delta}u_S - \frac{\delta}{1-\delta}u_S^{dev}\right), \tag{21}$$

Combining the two constraints implies that the relationally contracted efforts $a_{B,N}, a_{S,N}$

are sustainable as long as

$$\begin{array}{l}\frac{\delta}{1-\delta}\left(\left(u_B+u_S\right)-\left(u_B^{dev}+u_S^{dev}\right)\right)\geq\frac{1}{2}\left(\left(1-\kappa\right)\left(1-b_S\right)y\right)^2+\frac{1}{2}\left(\left(1-\kappa\right)b_Sy\right)^2\\-\left[\left(\left(1-\kappa\right)\left(1-b_S\right)ya_{B,N}-\frac{1}{2}a_{B,N}^2\right)+\left(\left(1-\kappa\right)b_Sya_{S,N}-\frac{1}{2}a_{S,N}^2\right)\right].\end{array}\tag{22}$$

In words, as standard in repeated game models of relational contracting, the presented discounted surplus generated by the relationship between the buyer and the seller must exceed their joint present gains from reneging, that is, from choosing the effort levels that maximize their static individual payoffs. The solution to the contracting problem of privately owned firms is simplified by the following lemma, which characterizes the interaction between the formal and relational components of optimal contracts:

Lemma 3 ***Formal and relational contracts under private ownership:***

When both formal and relational contracts are feasible, the optimal formal output sharing rule under private ownership is $b=1/2$*, and the optimal relational efforts are symmetric:* $a_{B,N}=a_{S,N}=a_N$

Proof. See Appendix A.3. ■

The Lemma is intuitive: for a given total effort $a_{B,N}+a_{S,N}$, surplus is maximized (and thus the reneging temptation is minimized) by setting $a_{B,N}=a_{S,N}$ due to the convexity of effort costs. This goal can be achieved by splitting output evenly: $b=1/2$. This result allows us to simplify the aggregate self-enforcement constraint (22) to

$$\frac{\delta}{1-\delta}\left(\left(u_B+u_S\right)-\left(u_B^{dev}+u_S^{dev}\right)\right)\geq\frac{1}{4}\left(1-\kappa\right)^2y^2-\left(\left(1-\kappa\right)ya_N-a_N^2\right),\tag{23}$$

The optimal contract then consists of the buyer and the seller choosing a_N to maximize their joint surplus

$$u_B+u_S=\left(1-\kappa\right)^2y^2q+\left(1-q\right)\left(2\left(1-\kappa\right)ya_N-a_N^2\right)-\left(t_B+t_S\right),\tag{24}$$

subject to (23). We will discuss the determination of u_i^{dev} once we have considered the ruler's incentives to honor the political contract. The total output generated by the economy is given by

$$\Pi^{ps} = 2y\left(q\left(1-\kappa\right)y + (1-q)a_N\right), \tag{25}$$

which allows us to write the tax revenue collected by the ruler in equilibrium as

$$u_R = 2\kappa y\left(q\left(1-\kappa\right)y + (1-q)a_N\right) + t_B + t_S. \tag{26}$$

Incentive compatibility of the political contract is then given by

$$\frac{1}{1-\delta}u_R \geq (1-\tau)\left(\pi^{ps} + \frac{\delta}{1-\delta}u_R^{dev}\right), \tag{27}$$

After substituting, we can rewrite this constraint as

$$(t_B + t_S) \geq (1-\tau)\left(2\left(1-\delta\right)y\left(q\left(1-\kappa\right)y + (1-q)a_N\right) + \delta u_R^{dev}\right) - 2\kappa y\left(q\left(1-\kappa\right)y + (1-q)a_N\right). \tag{28}$$

The last step in our analysis is to combine incentive constraints (23) and (28) to characterize the joint sustainability of political and relational contracts (that is, of equilibrium taxes and non-enforceable efforts a_N). An important point here is that the equilibrium lump sum taxes are set at a level that push the post-deviation per period payoff of both the buyer and the seller to zero. This result is summarized by the following lemma.

Lemma 4 ***Interaction between equilibrium taxation and continuation payoffs following deviation:***

The lump-sum taxes $t_B + t_S$ are set in the equilibrium that maximizes total surplus at a level that makes continued production by the firm suboptimal and so $u_B^{dev} = u_S^{dev} = 0$. (The optimal response of the buyer and the seller following a deviation is to exit the market).

Proof. Suppose, for simplicity and realism, that if a buyer or a seller deviates from the pairwise relational contract, this deviation is not observed by anyone else. Then, while trust between the two agents is broken after the deviation, and their relationship reverts to purely formal contracting, their tax liabilities remain the same as in the equilibrium. Then, if the two agents continue to participate in a post-deviation subgame, $(u_B + u_S) - \left(u_B^{dev} + u_S^{dev}\right)$ is independent of $(t_B + t_S)$. That subgame cannot be part of an optimal

equilibrium, however, because then the ruler's non-expropriation constraint could be relaxed by increasing $(t_B + t_S)$ up to the point where following a deviation, the buyer and the seller are better off exiting the productive sector and realizing $\left(u_B^{dev} + u_S^{dev}\right) = 0$. In other words, the equilibrium taxation provides endogenously a maximal punishment, as if there were contagion among punishments and deviations were punished multilaterally by the ruler and all other buyers and sellers ■

Given the above Lemma, we can combine the agents' and ruler's incentive constraints and write the joint constraint as

$$\begin{array}{l} qy^2\left(1-\kappa^2\right)+(1-q)\left(2ya_N-a_N^2\right)\geq \\ (1-\tau)\left(2\left(1-\delta\right)y\left(q\left(1-\kappa\right)y+(1-q)a_N\right)+\delta u_R^{dev}\right) \\ +\frac{(1-\delta)}{\delta}\left(\frac{1}{4}\left(1-\kappa\right)^2y^2-\left(\left(1-\kappa\right)ya_N-a_N^2\right)\right), \end{array} \tag{29}$$

where the first line is the total surplus generated by the relationship between the buyer and the seller, the second line captures the (normalized) deviation payoff for the ruler from expropriating output in the economy, and the third line captures the buyer's and seller's joint payoff from deviating from their relational contract. The surplus generated then needs to be sufficient to deter both of these potential deviations. We can then write the final relational contracting problem under private ownership as

$$\begin{array}{ll} \max\limits_{\kappa} & qy^2\left(1-\kappa^2\right)+(1-q)\left(2ya_N^{pr}-\left(a_N^{pr}\right)^2\right) \\ \text{s.t.} & a_N^{pr}=\max\limits_{a_N}\left(1-\kappa\right)\left(2ya_N\right)-a_N^2 \text{ and constraint (29) under } a_N=a_N^{pr}. \end{array}$$

In words, the marginal tax rate is chosen to maximize surplus, subject to the constraints that (1) non-enforceable efforts maximize the productive agents' surplus shares and (2) both the marginal tax rate and the non-enforceable efforts satisfy the joint incentive constraint.

6.2 State ownership

Given the general problem stated in section 4, the optimal combination of formal and relational contract terms under state ownership is summarized in the following lemma:

Lemma 5 ***Formal and relational contracts under state ownership:***
The surplus-maximizing contract $(b^{sr}, \beta^{sr}, B_N^{sr}, a_E^{sr}, a_N^{sr})$ *has the following properties: (i)* $a_E^{sr} = y = a^{FB}$*, (ii)* $u_i = u_i^{dev} = 0$*, (iii) both equations (13) and (16) will be binding as long as* $a_N^{sr} < a^{FB}$ *and (iv)* $a_N^{sr} = b^{sr}y + \sqrt{2B_N^{sr}}$

Proof. See Appendix A.4 ■

While fully characterizing the optimal equilibrium in explicit form is cumbersome, its basic features are relatively straightforward. First, the ruler extracts all the surplus from the stage game. Surplus is better at motivating the ruler than the productive agents because of her ability to potentially break her formal commitments and also because she faces the relational deviation temptation only with respect to a fraction $1-q$ of the firms. Second, as in section 5, the optimal formal contract sets enforceable efforts at the first-best level. Third, the mix of formal and relational 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, $b < 1/2$ and so the formal incentives will be weaker under state ownership. Given that the fixed wages only reallocate surplus, we will ignore them from now on, and so long as the incentive constraint is binding, we can simplify the ruler's problem to:

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

$$\text{s.t.} \qquad a_N = by + \sqrt{2B_N}$$
$$\frac{\delta}{1-\delta}\left(u_R - u_R^{dev}\right) = 2\left(1-q\right)B_N$$
$$\frac{\delta}{1-\delta}\tau u_R^{dev} = 4by\left(qy + (1-q)a_N\right)$$

Having characterized optimal relational contracts under state and private ownership, we now conclude our model by analyzing the optimal relational governance (that is, the surplus-maximizing combination of formal contracts, relational contracts and firm ownership) under different kinds of institutions.

6.3 Optimal relational governance

Figure 6 illustrates the optimal relational governance under different levels of τ, the strength of constraints on the executive. We know from our previous analysis that at low τ, private ownership requires high marginal taxes that destroy the agents' incentives to exert effort. By limiting the surplus available to sustain relational contracts, high taxes hamper a fortiori the use of relational incentives in private firms, and as a result, relational contracts are either weak or non-existent at low τ. In contrast, state ownership does not require distortionary taxes, and can therefore create sufficient rents to sustain relational incentives in the state where efforts are non-verifiable. State ownership, in combination with weak formal incentives and strong relational incentives, is therefore the optimal equilibrium arrangement at low τ. This result is consistent with the observed adoption of advanced management practices and incentive systems by state-owned firms in certain developing countries.

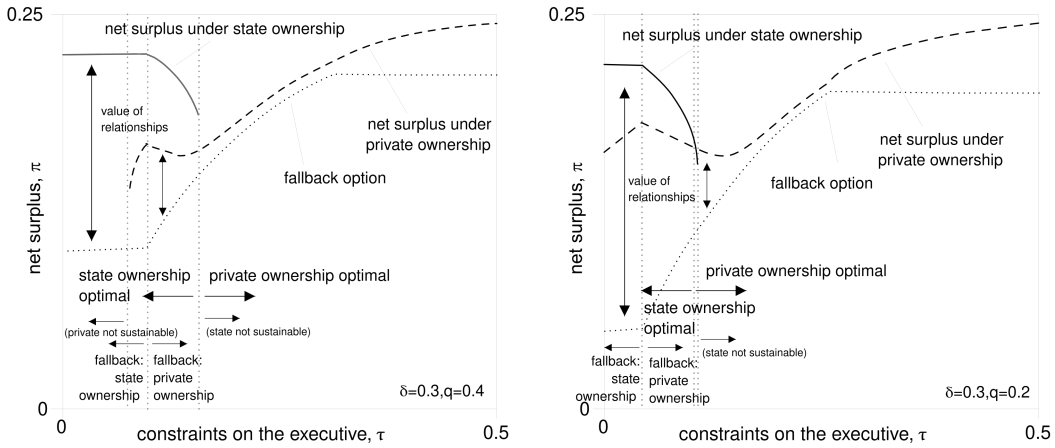

Figure 6: Examples of the surplus-maximizing equilibria

As τ grows, surplus under formal private ownership increases until eventually, formal private ownership becomes the ruler's fallback option from breaching her relational contract with the agents. Because of this improvement in the fallback option, the sustainability of relational contracts under state ownership is eroded, and equilibrium efforts and surplus decrease. Eventually, relational incentives under state ownership either become completely unsustainable or are dominated by private ownership, even though private ownership itself supports limited relational incentives and surplus. In this intermediate range of constraints on the executive we then see firms that are nominally private yet are heavily taxed and relatively poorly managed (in the sense that they are governed by weak incentives).

As τ increases further, taxes continue to decrease and the relational 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 institutional constraints on the ruler more than compensate the negative effect that plagued relational contracting under state ownership, namely, the improvement in the ruler's fallback option.

Altogether, the positive association between constraints on the ruler and relational governance 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 the maximal attainable surplus in τ defines a "privatization trap," whereby firms that are (optimally) privatized in weakly institutionalized transition countries have worse management and performance than the state-owned firms they replaced. This privatization trap is further illustrated in Figure 7, which plots the maximum equilibrium surplus for various levels of the players' patience. We will return on the empirical significance of the trap in the next section.

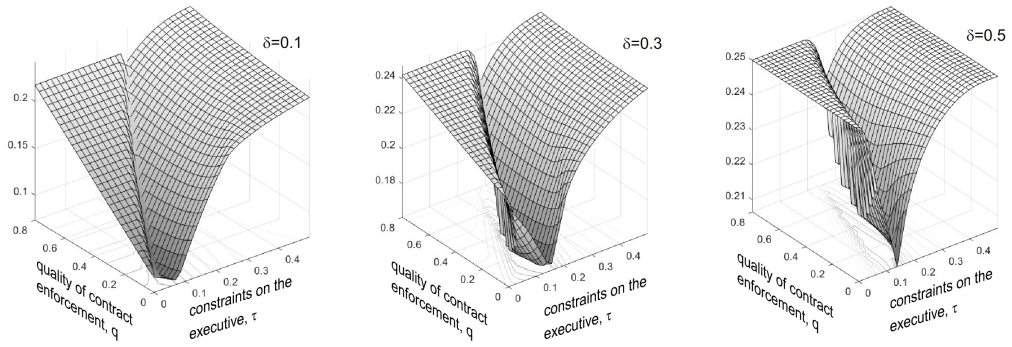

Figure 7: Examples of equilibrium surplus generated

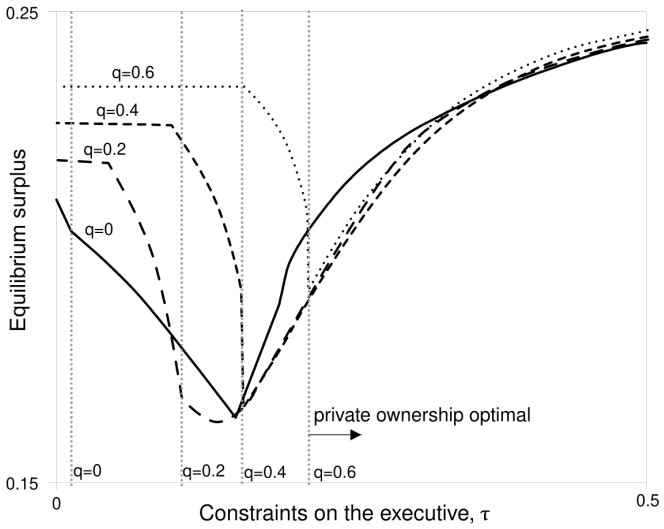

Figure 8: Example of the effect of quality of contrct enforcement on surplus generated

All of the patterns discussed above, including the privatization trap, are present for various levels of contract enforcement quality. In fact, while better contract enforcement improves incentives and performance at low or high levels of constraints on the executive, it can amplify the trap at intermediate levels of τ, as illustrated in Figure 8.

We conclude by commenting on how the players' patience (δ) affects relational governance. The comparative statics on δ are illustrated in Figure 9. While higher patience (for instance, due to a more stable and prosperous economic outlook) improves relational governance under all firm ownership structures, our numerical analysis reveals that patience is relatively more valuable under state ownership. Formally, state ownership becomes optimal under a wider range of parameters as the players become more patient. This result stands in contrast to the case of purely formal governance from section 5, where the region of

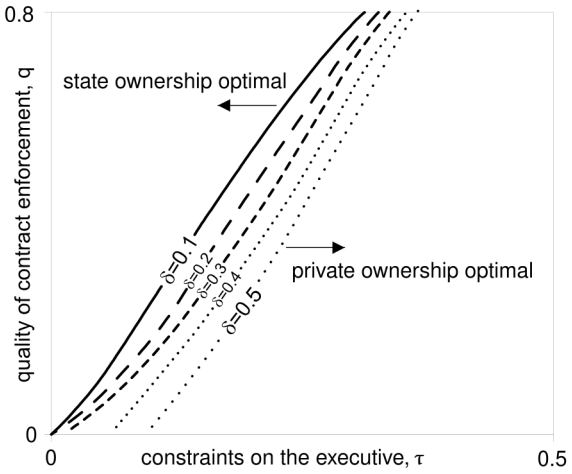

Figure 9: The effect of patience levels on the choice between state and private ownership.

optimal state ownership shrank as the players became more patient. The intuition behind this result is that because formal incentive contracts are less effective under state ownership, relational contracts are relatively more valuable in such a setting. In turn, this implies that increased patience, which helps to sustain relational contracts, benefits state ownership relatively more than private ownership. This finding is consistent with Williamson (1999), who argues that relative to private sector managers, public sector ones tend to have low-powered incentive contracts and are primarily rewarded through the threat of losing their high fixed salary in the event of egregious misconduct and termination.

7 Applications and empirical relevance

We conclude our paper by discussing empirical patterns consistent with our model and opportunities for future empirical research. We begin by reviewing historical evidence on the relative performance of and transition from state to private firm ownership in the former Soviet bloc and South Korea. We then discuss how one could move beyond these encouraging historical correlations and develop a thorough test of our model, which jointly examines our theoretical prediction on how institutions affect firm ownership and management practices.

7.1 Privatizations

An extensive empirical literature, reviewed by Megginson and Netter (2001), finds that privatization in the OECD countries has been generally successful in increasing the productivity and profitability of firms. Some developing and transition economies, most notably

Chile and the Czech Republic, also undertook successful privatizations (Biais and Perotti, 1999). Contrarily, in several developing countries, particularly in the former Soviet area, privatizations have been shown to reduce the productivity of former state firms (e.g., studies in Roland, 2008; Knyazeva et al., 2003; Brown et al., 2006; Guriev and Megginson, 2007). In Russia, Karas et al. (2010) find that private banks perform worse than state-owned banks, even in the late 2000s, and that this difference cannot be explained by the choice of production process, the bank's environment, management's risk preferences, the bank's activity mix, or bank size. Anderson et al. (2000) study the early-1990s privatization in Mongolia and find that after privatization, firms with residual state ownership appear to be more efficient than fully private firms. More generally, Nellis (1999) argues that "the farther east one travels, the less likely is one to see rapid or dramatic returns to privatization" (p. 6).

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 government budgetary constraints). In all of those countries, the government's taxation power was constrained by an independent elected parliament, though there were differences across them in the strength of broader checks and balances on the government's discretion. 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, the ex-Soviet countries in the 1990s continued to have imperfect protection of property rights and an unpredictable and punitive tax system (Black et al., 2000). Consistent with these patterns, our model predicts that under 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 even the modest relational contracts with employees and suppliers that were sustainable under state ownership during autocratic rule. As a result, privatized firms experience a decline in productivity, and are caught in a low-productivity trap until political institutions move closer to the advanced democracy benchmark. Indeed, the historical evidence suggests that privatizations did succeed in countries that transitioned more rapidly to advanced democratic institutions, such as Chile (1986-91) and the Czech Republic (1991-94).

7.2 Industrial development in South Korea

Prior to 1987 (the Sixth Republic), South Korea was essentially governed by military rule (although in 1963-1987 the political regime was nominally democratic). In 1987, anti-

government protests induced a regime change and led to the first direct presidential election in 16 years. Although the first president in this new regime (Roh Tae-woo) came from the military, his government promoted democratization (by increasing freedom of the press, liberalizing international travelling, and giving autonomy to the 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 democratic regime.

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 sectors declared as militarily strategic by the state in 1973 (e.g., the heavy chemicals industry) grew 80 per cent more than comparable manufacturing firms not targeted by the state. Milhaupt and Pistor (2008) investigate in greater depth the role of the chaebols. They 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 but provided in exchange capital 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 primarily relied on the diffusion of foreign technology (Amsden, 2001). However, once the country reached the technological frontier, the Korean model of economic 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. Reforms between 1997 and 2000 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 and different growth model, based on private economic initiative, which led to a rapid increase in South Korea' R&D intensity (Santacreu and Zhu 2018) 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 process, its economic system transitioned to full private

ownership and firm productivity increased.

7.3 Testability

Testing our model requires firm-level data on ownership structure and management practices, and exogenous variations in political institutions and firm ownership. While gathering such data is ambitious, recent advances in empirical research in both organizational economics and development suggest it is feasible. The World Management Survey research program has collected (and continues to collect) firm-level data on management practices, including the use of pay-for-performance and delegation, 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 that could be leveraged in future cross-country studies. There are well established approaches to instrument for political checks and balances and the protection of private property rights across countries (Acemoglu, Johnson and Robinson, 2001; Acemoglu and Johnson, 2005), which could be combined with the aforementioned data to study the effect of institutions on firm governance and management practices. Lastly, field experiments on organizational design and management practices have been increasingly 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 plausible strategy to test our model would be to develop a field experiment in which relational management practices are introduced in random samples of state-owned and private firms within country, or across randomly chosen suppliers of a multinational firm operating in multiple countries with varying political institutions. The former experiment could be conducted in collaboration with a governmental or international agency whereas the latter experiment could be conducted in collaboration with a multinational. In the latter experiment, buyer-supplier relationships in which a supplier of the multinational works for a local state-owned firm could serve as a control group. Empirical studies along these lines would provide important insight for research on organizations and development as well as for policy, and we hope they will be pursued in the near future.

8 Extensions

In this section, we will briefly outline two potential extensions to the model. First, the analysis above focused on the whole economy being under either private or state ownership. However, even if the productive activities are similar, it is possible that the optimal

equilibrium may exhibit mixed ownership, with a fraction of the firms state-owned and the remaining being private, and we will consider that first. Second, the analysis assumed that both "buyers" and "sellers" are needed to complete the productive task. In other words, the analysis assumed that the parties had specialized in their roles. Alternatively, each productive agent might be able to undertake the whole productive task himself, thus avoiding the need for formal or relational contracting altogether, but at the loss of specialization. Allowing for such an extra choice illustrates how the ruler's expropriation temptation and the resulting limited ability to build relationships may hinder the level of specialization that rises in the economy under private ownership.

8.1 Economy with mixed ownership

The main analysis focused on comparing the outcomes between fully private and fully state ownership. While this provides a logical benchmark since all the firms are equivalent, the existence of a continuum of productive agents allows for the ruler to own only a fraction of the productive sector. In this section, we will briefly consider the implications of fractional ownership, both for the fallback and the equilibrium outcome. First, consider the determination of the fallback option. Given the analysis from above, the fallback option in the case of mixed ownership, with λ fraction of the economy under private ownership, is simply a weighted average of the two constraints from earlier. In particular, the pooled constraint becomes

$$\frac{\delta\tau}{1-\delta}\left(\lambda\pi^{priv}+(1-\lambda)\,\pi^{state}\right)\geq\left(2\,(1-\lambda)\,b\Pi^{state}+\lambda\left((1-\tau)\,\Pi^{priv}-T\right)\right). \tag{30}$$

In short, if the ruler deviates, she loses her future surplus with probability τ and this loss must outweigh the potential gains, which are now composed of saving the output shares promised in the state sector, plus the probability of successful expropriation over and above the set taxes. The ability to pool the two constraints creates the possibility of transferring slack 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 the state sector, where pay-for-input contracts are useful for providing performance, which creates slack in the incentives and allows the ruler to lower the marginal tax rate in the private sector. The resulting equilibrium then has a high-productivity private sector co-existing with a low-productivity public sector, but it is exactly the low productivity of

the public sector which still generates rents to the ruler that is helping to discipline her not to expropriate the private sector.

The logic behind the best equilibrium, which allows for relational contracts, follows similarly, with the exception of adding the relational contract (B_N, a_N) as an additional choice variable for both sectors. From the analysis above, we have immediately that the condition for honoring the relational contract under state ownership continues to be given by

$$\frac{\delta}{1-\delta}\left(u_R - \widetilde{u}_R^{dev}\right) \geq 2\left(1-\lambda\right)\left(1-q\right)B_N, \tag{31}$$

while we can construct the joint constraint on honoring relationships and formal contracts by pooling the constraints across the two sectors and we get

$$\begin{array}{l} \frac{\delta}{1-\delta}\left(u_R - \left(1-\tau\right)u_R^{dev}\right) \geq 2\left(1-\lambda\right)b\pi^{state} + 2\left(1-\lambda\right)B(1-q) \\ +\lambda\left(\left(1-\tau\right)\Pi^{priv} - \pi^{priv}\right) + \lambda\frac{1-\delta}{\delta}\left(\frac{1}{4}\left(1-\kappa\right)^2 y^2 - \left(\left(1-\kappa\right)ya_N^{priv} - \left(a_N^{priv}\right)^2\right)\right) \end{array}, \tag{32}$$

while the private parties continue to set their relational contract to maximize their surplus $2\left(1-\kappa\right)ya_N^{priv} - \left(a_N^{priv}\right)^2$, but now with respect to the above constraint.

The only complication that remains is considering how the various potential deviations impact the continuation play of the game. When the ruler deviates from either of the formal obligations (profit-sharing and taxation), we can continue to assume that if the ruler is not deposed, she will then pick the most-favorable fallback option for her with no further relational contracts possible. Similarly, the taxation remains such that the private parties, in the absence of a relational contract, prefer to exit the productive sector. The only challenge is to determine how the ruler is impacted if she deviates on her relational contract with the state sector. For simplicity, we will assume here that if the ruler breaks her relational commitments in the state-owned sector, the news spreads and the trust in the ruler is lost even in the private sector (and so the bilateral buyer-seller relationships are terminated due to the collapse of overall trust), and so the ruler reverts to her preferred fallback equilibrium. Under this stark assumption, numeric simulations suggest the opposite result from above. Now, the ruler can use the private sector surplus as a hostage to pay high relational bonuses in the state sector, and we can observe equilibria with mixed ownership where the state sector performs strictly better than the private sector. The equilibrium results are, however, sensitive to the assumptions regarding the consequences of a relational deviation by the ruler, and arise only in the vicinity of parameters where the performance of

fully private or state-owned economies are sufficiently similar so that the ability to transfer slack across the constraints on the margin dominates the inherent performance differences identified in the main analysis. Therefore, more detailed considerations of the implications of mixed ownership are left for future analysis.

8.2 Economy with a choice to specialize

Consider the possibility that the agents are able to perform the productive task all by themselves but at a lower efficiency. In particular, suppose that if an agent undertakes both tasks by himself, the probability of successful outcome is $\overline{a}$, and the cost of effort is given by $\frac{c}{2}\overline{a}^2$. Alternatively, the agents can specialize in each of the two tasks, and the production takes place as above. Finally, assume that $c > 1$, so that in the absence of contracting frictions, it is efficient for the agents to specialize in their respective tasks. Then, under state ownership, the agents will continue to specialize since the ruler is unable to avoid the contracting friction whether interacting with one or two agents. Under private ownership, however, an agent is able to avoid the frictions by engaging in production himself. Further, if agents choose not to specialize under private ownership, there is clearly no need for building relationships and the best equilibrium is determined by the ruler's expropriation constraint. Solving the agent's effort problem under marginal tax rate κ allows us to write the total surplus and the output generated by the economy as $\pi = \frac{\left(1-\kappa^2\right)y^2}{c}$ and $\Pi = \frac{2(1-\kappa)y^2}{c}$, respectively. The ruler's expropriation constraint then becomes

$$\frac{1}{1-\delta}\frac{\left(1-\kappa^2\right)y^2}{c} \geq (1-\tau)\left(\frac{2\left(1-\kappa\right)y^2}{c} + \frac{\delta}{1-\delta}\frac{\left(1-\kappa^2\right)y^2}{c}\right), \tag{33}$$

which we can then rearrange to solve

$$\kappa \geq \kappa^* = 1 - \frac{2\tau}{1-(1-\tau)\delta}. \tag{34}$$

This option not to specialize provides a potentially better fallback option than either private markets with specialization or state ownership. On one hand, this option can be valuable if the parties are unable to sustain relationships in the first place and thus benefit from the extra security that individual production provides. On the other hand, exactly because it provides a more attractive fallback option, it can limit the parties ability to sustain relationships under specialization.

Two illustrations of the resulting equilibrium are provided in Figure 10, where the black (solid and dashed) lines illustrate the equilibrium surplus and the fallback surplus under the

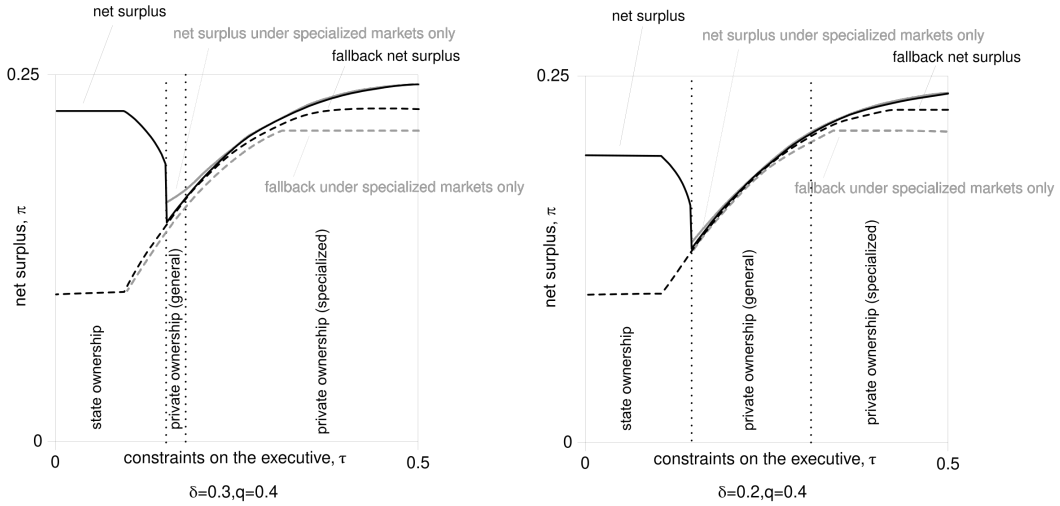

Figure 10: Examples (and comparison) of the equilibria under the choice to specialize (c=1.1)

option to specialize, while the gray lines illustrate the same under the assumption of specialized production only (main analysis). In both cases, the optimal fallback option for private ownership is to engage in general production, shifting the fallback value up. This result, in turn, amplifies the initial dip in performance, making sustaining any relational contracts impossible due to the more attractive fallback option. Thus, not only does performance drop as we transition from state to private ownership, but firms also switch to generalist production. It is only once the constraints on the executive become strong-enough that we transition to high-performing private ownership under specialization.

9 Conclusion

In this paper, we have studied theoretically how political institutions affect the management and ownership of firms. The key insight from our model is that the "capitalist paradigm," whereby firms should be privately owned and managed through high-powered incentive contracts, does not hold for countries with weak constraints on the executive. We have shown that under such weak institutions, state-owned firms can sustain higher-powered incentives and higher output than private ones. We have also shown that as institutions become marginally stronger, it becomes too attractive for the state to privatize and tax state-owned firms, which destroys the credibility of incentives under state ownership. As a result, state-owned firms are replaced by private firms that employ weaker incentive systems, and produce lower output, than the state-owned firms they replaced. Only after radical

institutional improvements the capitalist paradigm, characterized by privately owned firms managed through high-powered incentive systems, emerges as the optimal equilibrium.

By integrating the government into a model of private contracting, our paper provides a tractable framework that could be used in the future to study how various dimensions of governance, such as delegation and organizational design, optimally adapt to different political and institutional environment. Additionally, our paper has several implications for management and development. On the management side, our model suggests that for firms that operate under weak institutions, following a consultant's recommendation to adopt best management practices (i.e., the practices observed in the most productive firms) may backfire. Moreover, transferring such best practices to firms in weak institutional environments might have greater chances of success if those firms are state-owned than if they are private. On the development side, our model suggests that reforms of political institutions and reforms of contracting and governance should be unbundled (Acemoglu and Johnson, 2005), and that institutional reforms should come first and be radical. While weak political institutions can support decent (though not excellent) governance in SOEs, mediocre institutions can only support poor governance that will lead to a reduction in productivity and output.

We hope that empirical researchers will take our model to the data, and that applied theorists will continue to investigate the interplay between political institutions and organizational design.

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A Proofs

A.1 Proof of proposition 1

First, when the state is non-enforceable, the buyer and the seller are free to choose their effort levels, and thus the buyer chooses $a_{B,N}$ to maximize (2) while the seller chooses $a_{S,N}$ to maximize (4), which give $a_{B,N} = (1-\kappa_B)(1-b_S)y$ and $a_{S,N} = (1-\kappa_S)b_S y$.[13] Second, deep pockets allows the buyer to push the seller to his participation constraint, which allows us to write the minimum compensation to ensure participation as

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

which then allows us to write the buyer's problem as

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

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

From here it then follows immediately that the formal contract sets $a_{S,E} = (1-\kappa_S)y$ and $a_{B,E} = (1-\kappa_B)y$ as the surplus-maximizing enforceable actions that can be specified in the contract. Performing the substitutions allows us to write the buyer's payoff as

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

which the buyer then maximizes with respect to b_S, which then gives $b_S = \frac{(1-\kappa_S)}{(1-\kappa_B)+(1-\kappa_S)}$. As a side note, note that while this solution follows from the assumption of deep pockets, it is actually not necessary since a strategic allocation of the lump-sum tax liability could be used to ensure $\beta_S \geq 0$.

Next, to establish $\kappa_S = \kappa_B = \kappa$ for the optimal tax policy, recall that the ruler's expropriation constraint was given by

[13] 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.

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

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

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

and differentiating with respect to the tax level we get

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

which we can rearrange to[14]

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

as the condition for costs to decrease as the result of the change. The remainder is just

[14]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.

some arduous 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

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

which we can simplify to

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

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

and finally we get

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

$$q\left(x-y\right)\left(xy+q\left(x^2+xy+y^2\right)\right)\left(x+y\right)^3$$

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

which is true since $x<y$.

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

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

while the total surplus becomes

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

Then, given that the ruler continues to be able to extract the full surplus under taxation while grabbing the whole output under deviation, it needs to be that (recall that under formal contracts only, no further punishment can be imposed on the ruler if expropriation succeeds)

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

which then becomes

$$
\begin{aligned}
&\left(\tfrac{1-(1-\tau)\delta}{(1-\tau)}\right)\left(\tfrac{(1+q)}{2}\left(1-\kappa^2\right)+\tfrac{(1-q)(1-\kappa)^2}{4}\right)\geq(1-\delta)\left(1-\kappa\right)\left(1+q\right)\\
&\left(1-\left(1-\tau\right)\delta\right)\left(2\left(1+q\right)\left(1+\kappa\right)+\left(1-q\right)\left(1-\kappa\right)\right)\geq4\left(1-\tau\right)\left(1-\delta\right)\left(1+q\right)\\
&\kappa\left(1+3q\right)\geq\tfrac{4(1-\tau)(1-\delta)(1+q)}{(1-(1-\tau)\delta)}-(3+q)\\
&\kappa\left(1+3q\right)\geq\tfrac{(1-\delta)(1+3q)-\tau(4(1+q)-\delta(1+3q))}{(1-(1-\tau)\delta)}\\
&\kappa\geq1-\tfrac{4\tau(1+q)}{(1+3q)(1-(1-\tau)\delta)}.
\end{aligned}
$$

From here it follows immediately that

$$
\begin{aligned}
&\tfrac{d\kappa}{d\delta}=-\tfrac{4\tau(1+q)(1-\tau)}{(1+3q)(1-(1-\tau)\delta)^2}<0\\
&\tfrac{d\kappa}{dq}=\tfrac{8\tau}{(1-(1-\tau)\delta)(1+3q)^2}>0\\
&\tfrac{d\kappa}{d\tau}=-\tfrac{4(1+q)(1-\delta)}{(1+3q)(1-(1-\tau)\delta)^2}<0
\end{aligned}
$$

A.2 Proof of proposition 2

If the ruler does not utilize relational contracts, we only need to ensure that the promised formal incentives are credible. We can write this solution constraint as

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

which simplifies to

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

while the agent's action choice in the non-contractible state is $a_N = by$ and the absence of a budget breaker requires that $b \leq 1/2$. The ruler's problem is then

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

subject to the above, where u_R follows from the deep pockets assumption so that the ruler is able to extract all the surplus from the relationships. From here, it follows immediately that $a_E = y$ while substituting the agent's action choice in the expressions we get

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

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

Now, u_R is increasing while the constraint is tightening in b, so either the constraint is binding or $b = 1/2$. From here it then follows that the maximal formal incentives are 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

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

which then allows us to write the maximal credible formal incentive strength to be given by

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

A.3 Proof of Lemma 4

Recall that we can write the constraint for the sustainability of $(a_{B,N}, a_{S,N})$ as

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

Now, let us 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

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

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

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

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

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

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

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

and then differentiating the expression with respect to b_S we have that the optimal profit share is given by

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

which then simplifies to

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

so that 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 5

For the solution, we need to simply combine the ruler's and the agents' reneging temptations. Consider first the sustainability of the relational contracts alone. We have that for the ruler to adhere to the agreement, it needs to be that

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

while for the agent(s) to adhere to the agreement, it needs to be that

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

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

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

Combining the constraints gives us

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

Relatedly, we can write the ruler's constraint for not deviating on both her relational and formal contracts as

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

which becomes, once substituting in the agent's constraint

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

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. Finally, note that it immediately follows that $a_E = y$. And then, going back to the ruler's reneging constraints, which were

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

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 we have the net effect as

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

while 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

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

Thus, the change always relaxes the second constraint. Thus, both constraints must always be binding. And then, given that the first constraint gives

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

the second constraint simplifies to

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

Now, using these it is technically possible to solve b and B_N even in closed-form but the expressions are cumbersome and contain no particular additional economic intuition.