Contingent delegation and ambiguous property rights:

The case of China's Reform

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ABSTRACT. – Ambiguous property rights may allow a local entrepreneur to get the services provided by local bureaucrats at lower costs compared with strong property rights. However, once local bureaucrats learn the firm's unobservable income, they likely encroach upon the firm. In an ongoing relationship, such predatory behaviour may be limited if local bureaucrats care enough about future returns. If, however, they are not sufficiently forward-looking, contingent delegation from the central government can prove as a useful mechanism. Under this policy, local bureaucrats must compete to gain more autonomy on the local economy's performance. If the expected gain from competition is sufficiently large, it may be incentive compatible for the capable local bureaucrats to enhance local firms, despite the fact that incapable ones may shirk. For these shirkers, the centre continues to regulate their activities as if they were under the central planning regime. This leads to a slow and uneven pace of reform across regions. Compared with a rapid and large-scale reform such as the one implemented in the former Soviet Union this policy may seem backward, yet has served reasonably well to solve some incentive problems in the reform, including the central dilemma: the local agencies blame the centre for lack of autonomy; and the centre blames them for lack of accountability.

Délégation contingente et droits de propriété discutables. Le cas des réformes en Chine

RÉSUMÉ. – Des droits de propriété ambigus peuvent permettre à un entrepreneur local d'obtenir des prestations de la part des bureaucrates locaux à des coûts plus faibles que dans le cas où les droits de propriété sont clairement définis. Cependant, une fois que les bureaucrates locaux observent les revenus de la firme, ils sont en mesure de capter les rentes. Dans le cas d'une relation durable, un tel comportement prédateur peut être limité si les bureaucrates locaux se préoccupent suffisamment de leurs rendements futurs. S'ils sont « myopes », une délégation contingente de la part du gourvernement central peut se montrer un mécanisme utile. Dans ce cas, les bureaucrates locaux doivent chercher à obtenir plus d'autonomie. Si les gains attendus de la concurrence sont suffisamment grands, les bureaucrates compétents sont en mesure de rendre les firmes plus efficaces, alors que les bureaucrates incompétents resquillent. Pour ces derniers, le centre régule leur activité directement. Cela conduit à des réformes lentes et différentes selon les régions. Comparé au processus de réforme brutal pratiqué dans l'ex-Union Soviétique, cette politique apparaît comme timorée, mais elle permet de résoudre convenablement certains problèmes d'incitations.

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1 Introduction

The theory of ambiguous property rights focuses on situations when ownership rights are unsecured and the owner of an asset has to fight for actual control ex post (LI, DAVID [1996]). The logic is as follows: there are two agents: *E* (she, for an entrepreneur) and *G* (he, for a local government). In the first period, *E* has to make an investment decision. In the next period, the profitability of the project is revealed only to the owners of the firm. In the *white state*, the owners of the firm enjoy the payoff from their investment. In the *black state* (when some legal disputes arise), *G*'s effort is needed; otherwise the firm's payoff will be jeopardized. Thus, *G* can choose to exploit its bargaining power to extract the income generated by *E*. The paper discusses the allocation of ownership whereby *E* may choose to mitigate such a problem. *E* can either have *G* to share the ownership and fight for actual control rights ex post; or solely own the firm, in which case, she can reap all the profit. The downside is that if the black state arises, ex post negotiations to get *G*'s services may be more costly than when *E* and *G* share the ownership. The paper argues that under certain business environments *ambiguous property rights* are more efficient than unambiguously defined private ownership rights. In particular, if the black state is likely to arise then securing *G*'s service is important, as the more *productive* the agent *G* is, the more likely the owner of a firm is to invite *G* to share ambiguous property rights. A side effect is that under ambiguous property rights, information about the firm's taxable income is shared between local firms and local agencies. This allocation of ownership then has some advantage for tax purposes.

In transition economies, it is quite common that local firms are subject to encroachment by local agencies. But other than China, there are countries where ambiguous property rights do not arise in response to such predation. Instead, we often observe that many large firms are either owned by the government, while many small, private firms are hiding underground. An obvious answer one can draw from the theory of ambiguous property rights is that, in these countries, local bureaucrats are not productive. One may then ask why Chinese local governments are more helpful in enhancing local firms than their counterparts in other transition economies? And why in China, *some* local governments have stronger incentives than others to promote local economic-development?

A possible explanation for the behaviour of Chinese local governments lies on the bargaining game between a local bureaucrat and the central government (MCMILLAN [1997]). The local bureaucrat has bargaining power from knowing more about the prospect of his local markets than the centre. The centre also has its rational counter. It can distinguish whether the local bureaucrat has low or high ability by offering stronger autonomy if he reveals himself to have high ability in promoting the local economy. In this way, the centre can induce the local bureaucrat to exert effort to achieve a cooperative outcome, if feasible, this will increase income of all parties; that is the local firms, the local bureaucrat, and the central government.

We then extend the static model into a repeated game between three players: a local entrepreneur, a local bureaucrat, and the central government. In this setting a reputation mechanism works in two distinctive but interrelated ways. In one way, reputation concerns may open door to achieve cooperation between the local entrepreneur and the local bureaucrat. If the one-shot gain from deviation is outweighed by the future loss, holdup behaviour should not arise. The situations in which local agencies are involved in rescuing local firms in distressed states are exactly what we would expect when repeated transactions predominate and reputation effects matter. As mentioned, reputation concerns may work in the other way. If the local economy's performance influences the central government's perceptions about the local bureaucrat's ability, we should expect the local bureaucrat to exert effort to be productive.

A caveat to the above propositions is that in order for reputation mechanisms to work, the parties must care enough about future returns. Ironically, due to poor conditions of financial markets, agents are often short sighted. In this perspective, the simple reputation mechanism may not work forcefully as predicted by game theory. This seems to suggest that the incentive structure in the game played by the three parties here may be more complex. In what follows is our argument. To some extent, it reveals which type of ownership allocation may be more efficient in facilitating cooperation.

For the sake of simplicity, let us split the game played by the three parties into two inter-linked games. One is the *delegation* game between the central government and the local government. The other is the *market enhancing* game between the local government (G) and the local entrepreneur (E). Let us focus on the latter for the moment. In this game, the two parties, E and G implicitly agree to take the efficient actions that maximize their joint profits: E will implement the first best investment; and have access to G's service whenever required with the price of the service equal to marginal cost. In return, G will gain some share of the income generated by E's investment in terms of (local) tax. Deviation from the agreement will trigger retaliation, which results in the parties reverting to the NASH equilibrium of the static game (as described by LI). Obviously, if the parties are very patient, cooperation may be achieved under any allocation of ownership. We are interested in situations where parties are so impatient such that cooperation is not incentive compatible under any ownership structure. Nevertheless, there are some differences between private ownership and ambiguous ownership with regard to information constraints.

Under private ownership rights, the NASH reversion strategy results in E being the sole owner of the firm. She is the only party who has information about the intrinsic value of investment, and hence, the firm's taxable income. In the cooperative paths, this information is revealed to G in exchange for having access to G's service at a low cost. However, once this information is revealed, G may breach the agreement by altering the sharing rule in favour of himself; for instance, by raising the tax on the firm's income. Anticipating that, E rationally plays the NASH reversion strategy. She chooses to be the sole owner and hide the firm's activity underground. G then must use his monopoly power to extract agent E's wealth whenever she requires his services. Such a transaction too, is also supposed to be hidden underground among the insiders. Subsequently, the local economy no longer provides

accurate information to the centre about the ability of the local government. This makes contingent delegation no longer feasible.

Next, let us consider the ambiguous property rights. With high discount rates, *E* anticipates that *G* will deviate from cooperation. Therefore, the NASH equilibrium will emerge if this were the *only* game to be played. A difference with the previous case is that, as a joint owner, *G* now has information about the taxable income of the firm. This condition may allow the cooperative outcome to emerge in a broader context, when the central government's actions and payoffs are taken into account.

As suggested, the central government may offer the local bureaucrat rewards contingent on the performance of the local economy. The incentive is clear: as better performance of the local economy yields a larger tax base. For such a reason, local firms' taxable incomes can act as information about the local bureaucrat's future performance. Contingent on this information, future rewards are provided for agent *G*. If such expected returns are large enough, it may become incentive compatible for the local bureaucrat to cooperate with the local firm, agent *E*. In other words, since defection in the local game will risk retaliation in *all* games, the local bureaucrat will hesitate to hold up the local firm (BERNHEIM *et al* [1990]).

One caveat should be added to this proposition. Often, the central government delegates its power to local bureaucrats more on political criteria than on their abilities. A labour market for local bureaucrats should be created; otherwise the incentive mechanism may not work (LAFFONT, TIROLE [1987]). Competition can reveal which prospective candidate is the most capable. Thus, introducing a market-based selection mechanism improves local agencies' quality (MCMILLAN [1997]).

One can then see that by employing a repeated game framework, we can examine local bureaucrats' ability and attitude in helping local firms endogenously rather than exogenously as in the static context. More specifically, this paper tries to address several questions: Does ownership structure matter in an on going relationship? Can the incapability of local bureaucrats and their predatory behaviour be mitigated by any ownership structure? What additional institution may be needed to facilitate cooperation and reduce local bureaucrats' incompetency? What are the long-term impacts of such institutional arrangements on economic reform?

Our paper complements CHE and QIAN [1998]. Their paper examines the efficient allocation of ownership in a multi-task context. Instead, our paper explores the scope of achieving cooperation when the players interact without the shadow of the law and only partly in the shadow of the future. In this setting, our research topic is related to the literature that focuses on the long-term development of market-supporting institutions. This includes papers by ARROW [1997], MCMILLAN and WOODRUFF [2002], QIAN [1994, 2000] and QIAN and ROLAND [1998].

The rest of the paper is organized as follows. Sections 2 and 3 review the theory of ambiguous property rights. Sections 4 to 6 present the theory of contingent delegation. Section 7 concludes the paper.

This paper benefits from the literature on incentives and organizations, which includes AGHION and TIROLE [1997], BAKER *et al* [1999], GROSSMAN and HART [1986], HALONEN [2002], HOLMSTROM [1999] and TADELIS [2002].

2 The Stage Game

Our stage game is a simplified version of LI, DAVID [1996]. We consider a business relationship between agents E and G, which last for two periods. In the first period, *ex ante* E must make an investment, k, which is specific to the assets of the firm. In the second period, the (net) return from investment, $?k$, is revealed, but only for the insiders. At that stage, due to the absence of an adequate legal system to enforce contracts, either a *white* state or a *black* state will arise. In the white state, the owner(s) of the firm obtain all the gains from the investment, $?k$. In the black state, however, the firm is trapped in a legal dispute. In order for the firm's owner to reobtain the profits, θk, a "rescuing" service from G is needed or otherwise the firm's owner will gain nothing. LI assumes that the efforts that E or G put into the business are too complex to have explicit contracts that specify who will get control rights contingent on what will happen at time 2. At time 1, *ex ante* contracts can only be written on the allocation of ownership. The only relevant choice is whether E is the sole owner of the firm, or E and G share the ownership, in which case, they both must fight for actual control ex post when time 2 comes.

ASSUMPTION 1: *the cost of investment, k, is* $C(k)$ *such that:*
$C(0) = 0$ *;* $C'(k) > 0$ *; and* $C''(k) > 0$.

Below are the assumptions that facilitate computation:

ASSUMPTION 2: θ *follows a uniform distribution* $\theta \sim U[0,1]$*, and this is common knowledge.*

ASSUMPTION 3: *At time 2, the black state has probability* $(1-p)$*. Furthermore, this distribution of states is independent of the distribution of* θ.

Let us briefly examine the optimal allocation of ownership in the static game.

Under private ownership, in the white state, no service, g, from G is needed. The payoffs for the agents are:

$$P_E^W = \theta k - C(k)$$

$$P_G^W = 0$$

Where, P denotes the payoff, the superscript indicates the state of nature, the subscript denotes the agent.

In the black state, without G's service, E will gain nothing. Therefore, G can charge the highest rate r for his service, g, so long as E still can afford it; that is $\theta k - rg \geqslant 0$. This implies: $\theta \geqslant rg/k$. Subsequently, G's expected payoff is:

$$P_G^B = E(rg - r_0 g \,|\theta \geqslant rg/k) = (r - r_0)g(1 - rg/k)$$

where, r_0 is the unit cost of G's service.

Optimally, G should charge E at the rate $r = \dfrac{k + r_0 g}{2g}$. Consequently, E's expected return becomes:

$$P_E^B = E(\theta k - r_g \,|\theta r g/k) - C(k) = \left(1 - \frac{k + r_0 g}{2k}\right)\left(\frac{k - r_0 g}{4}\right) - C(k)$$

Overall, E's expected return under private ownership is:

$$(1) \qquad P_E^P = p\theta k + (1 - p)\left(1 - \frac{k + r_0 g}{2k}\right)\left(\frac{k - r_0 g}{4}\right) - C(k)$$

Consequently, the investment, k^p, should be chosen by E to maximize this sum.

Under ambiguous property rights, in the white state, agent E's effort is relatively more important and agent G's effort is relatively unimportant. In the black state, this power relation is reversed. Optimally, E should have full control rights in the white state and so should G in the black state. We then assume that, in the white state, E acts as if she had full control over the firm's assets. If G fully cooperates, the firm's profitability is θk. If their negotiation breaks down, G will gain nothing, but agent E can still generate $\lambda\theta k$ without G, where $0 \leqslant \lambda \leqslant 1$. Under NASH-bargaining with perfect information about θ, each party then can expect to get half of the joint surplus:

$$P_E^W = \frac{1}{2}\lambda\theta k + \frac{1}{2}\theta k - C(k)$$

$$P_G^W = \frac{1}{2}(1 - \lambda)\theta k$$

On the contrary, in the black state, G acts as if he had full control rights $(\lambda = 0)$. E should give up her control rights, in which case, the joint surplus shrinks to $\theta k - r_0 g$, reflecting some cost born by the coalition due to legal disputes with outsiders. If their negotiation breaks down, they both end up with nothing. This is because E has no real control in the black state and G is not productive without E (G's effort is not synergistic with the firm's assets). Each party then expects to get half of the joint surplus, so long as $\theta \geqslant r_0 g/k$.

From the first-period perspective, E's expected payoff under ambiguous property rights is:

$$P_E^B = E\left\{\frac{1}{2}(\theta k - r_0 g)\,|\theta \geqslant r_0 g/k) - C(k)\right.$$
$$\left. = \frac{1}{2}\left(1 - \frac{r_0 g}{k}\right)\left(\frac{k - r_0 g}{2}\right) - C(k)\right\}$$

Overall, E's expected return is:

$$(2) \qquad P_E^a = \frac{1}{2}[p(\lambda+1)\theta k + (1-p)\left(1-\frac{r_0 g}{k}\right)\left(\frac{k-r_0 g}{2}\right) - C(k)$$

Agent E then should choose k^a to maximize this value.

3 Ownership Decision in the Static Game

In order to know which ownership arrangement E should choose, it is useful to compare both cases above with the first-best situation when E obtains unambiguous control rights all the time and has access to g at the price of r_0, when needed.

Specifically, the social welfare in the white state is $\theta k - C(k)$. In the black state this value becomes:

$$E(\theta k - r_0 g)\,|\theta \geqslant r_0 g/k) - C(k) = \frac{1}{2}\left(1-\frac{r_0 g}{k}\right)(k - r_0 g) - C(k).$$

Thus, total expected social welfare is:

$$(3) \qquad P^* = p\,\theta k + \frac{1}{2}(1-p)\left(1-\frac{r_0 g}{k}\right)(k - r_0 g) - C(k)$$

PROPOSITION 1 (LI [1996]): *So long as $p < 1$, both private and ambiguous property rights arrangements are inefficient. Furthermore, the lower the probability, p, the lower the $r_0 g$, and the higher the λ, the more likely it is that the private ownership is strictly dominated.*

PROOF: The first order conditions of problems 1, 2, and 3 are written as follows, respectively:

$$(4) \qquad \frac{p}{2} + \frac{(1-p)}{8}\left[1 - \frac{r_0^2 g^2}{(k^p)^2}\right] = C'(k^p)$$

$$(5) \qquad \frac{p(1+\lambda)}{4} + \frac{(1-p)}{4}\left[1 - \frac{r_0^2 g^2}{(k^a)^2}\right] = C'(k^a)$$

$$(6) \qquad \frac{p}{2} + \frac{(1-p)}{2}\left[1 - \frac{r_0^2 g^2}{(k^*)^2}\right] = C'(k^*)$$

By comparison, we see that $k^* \geqslant \max\{k^p, k^a\}$ so long as $p < 1$. *Ceteris paribus*, $k^a \geqslant k^p$ if λ and $(1-p)$ are large, and $r_0 g$ is sufficiently small. Intuitively, because λ reflects the bargaining power of E, when λ is too low, ambiguous property rights will less likely to be efficient. Likewise, the inverse of $r_0 g$ can be interpreted as productivity of G for the firm in a distressed state. Thus, when G is productive, involving G as an ambiguous owner is efficient.

In short, the relative efficiency of ambiguous property rights over the private one depends on the triple $(p, \lambda, r_0 g)$. Notice that these parameters vary from one sector of production to another. The proposition 1 then suggests multiple equilibria. In the sector of small business owned by an individual or a family, we should expect that λ is low. Thus, in this sector, private ownership rights are more likely to be chosen by entrepreneurs. On the contrary, in industrial sectors, one may expect ambiguous property rights to arise *if* agent G is productive.

As inherited from the central planning, the industrial sectors are characterized by a complex set of highly specific relations between firms. In the absence of the shadow of the law, deregulation opens the room for imperfect competition and bargaining (Li, Wei, [1999]; and Blanchard and Kremer, [1997]). If many parties are linked in a complex set of specific relations, contractual disputes may be severe. As a result, the probability of black state, $1-p$, is expected to be high for each individual firm in those sectors. Securing government agencies' service becomes important. If the government agencies are productive, or equivalently, if $r_0 g$ is low, an otherwise private firm would choose to have ambiguous property rights.

4 Repeated Transactions

Now let us suppose the game is played repeatedly. Further, the parties agree implicitly to act according to the first best: At time 1, E implements the socially optimal level of investment, k^*. At time 2, E still keeps all control right and has access to G's service at the price of r_0 if the black state actually arises. The two parties then share the surplus according to the *efficient rule* (P_E^*, P_G^*). (The sharing rule will be defined later).[1] Deviation from cooperative action will trigger punishment phase. We should see that the agent E's promise to implement is assumed credible, since in reality G can observe E's move and can determine *ex post* allocation of gains. The problem then is a type of One-Side Prisoner's Dilemma.

It is well known that, under an ongoing relationship, the efficient investments could be supported using the trigger strategy and reversion to the Nash equilibrium of the static game as punishment (Halonen [2002]). Obviously, if the parties are very patient (the discount rates are not too high), cooperation can emerge under any ownership structure. One obstacle to relational

1. For a detail discussion about the efficient sharing rule in repeated game context, see Halonen [2002].

contracting in transition economies is that discount rates are high (McMillan -Woodruff [1999]). Most private firms are excluded from formal financial markets. The under development of financial institutions also indicates that, in general, high interest rates, whether actual or implicit, limit any forward-looking cooperation. We are interested in situations when the agents are so impatient that incentive constraints are *incompatible* and therefore, no ownership structure alone can guarantee the first best in repeated transactions. Our aim is to investigate whether there exists additional institutions that can make it incentive compatible for parties to cooperate. Toward this end, let us first consider the incentive constraint.

It is easy to see that E will agree to cooperate if and only if her share of surplus in the first best situation is not lower than her payoff in the punishment path in which both parties implement Nash-reversion strategies of static game. Specifically,

$$P_E^* = (1-\tau)P^* \geqslant P_E^N \tag{7}$$

where, τ is the (local) tax rate on E's profits, P^*, under cooperation; P_E^N is E's payoff in the punishment path.

Likewise, in order for G not to deviate from the sharing rule *after* E has already implemented k^*, his share of the surplus in the first best case must be sufficiently high. Specifically,

$$\frac{P_G^*}{1-\delta} = \frac{\tau P^*}{(1-\delta)} \geqslant P_G^d + \frac{\delta}{1-\delta} P_G^N \tag{8}$$

where, P_G^d is G's one-shot deviation payoff and , P_G^N is G's payoff in punishment path in which both parties implement Nash-reversion strategies.

Thus, the tax rate, τ, must not be too high in order for E to implement the efficient level of investment, k^*. But that tax rate also must not be too low in order for G not to deviate from the sharing rule. These two requirements may be inconsistent, causing the reputation mechanism to break down. Below, we will discuss this issue in greater detail.

We first notice that from (7), E will cooperate, if and only if:

$$\tau \leqslant \frac{P^* - P_E^N}{P^*} \tag{9}$$

On the other hand, from (8), G will act in according to the efficient sharing rule if and only if:

$$\tau \geqslant (1-\delta)\frac{P_G^d}{P^*} + \frac{P_G^N}{P^*} \tag{10}$$

To guarantee the best incentives for cooperation, we must have:

$$\frac{P^* - P_E^N}{P^*} \geqslant (1-\delta)\frac{P_G^d}{P^*} + \delta\frac{P_G^N}{P^*} \tag{11}$$

or equivalently,

$$\delta \geqslant \underline{\delta} = \frac{P_E^N + P_G^d - P^*}{P_G^d - P_G^N} \tag{12}$$

ASSUMPTION 4: *Agent E prefers receiving the payoff in* NASH *reversion strategies,* P_E^N*, over being cheated or gaining only* $P^* - P_G^d$*, that is,* $P_E^N > P^* - P_G^d$.

Condition (12) means that the more the agent E dislikes to be cheated and the less severe is the punishment against agent G's deviation, or equivalently, the smaller is the difference between the one-shot gain from deviation and the payoff in the punishment phase for G, the higher the forward-looking behaviour agents must have in order to illicit the parties to implement first best.[2]

PROPOSITION 2: *Under repeated transactions, the lowest discount factor that guarantees the first best is* $\underline{\delta}(P_E^N + P_G^d - P^*, P_G^d - P_G^N)$*. Furthermore, the factor* $\underline{\delta}$ *is monotonically increasing in the first term and decreasing in the second term in the brackets.*

To investigate the range of parameters that allows the incentive constraint (12) to hold, we first examine the gain and the loss from deviation for agent G.

Notice that, from (9), the highest tax rate agent G can demand E to pay in the first best situation is $\tau^* = \dfrac{P^* - P_E^N}{P^*}$. Thus, G's share of the surplus in the first best is simply $P^* - P_E^N$. From assumption 4, E only implements the projects such that $P_G^d > P^* - P_E^N$. But then, given the optimal tax rate, G always has incentive to deviate from the efficient sharing rule, no matter what allocation of ownership is chosen. In particular,

Under private property rights, the expected payoff from deviation for G is

$$P_G^d = (1 - p)(r - r_0)g(1 - rg/k^*) \tag{13-p}$$

where, $r = \dfrac{k^* + r_0 g}{2g}$.

2. We measure the severity of punishment path by the amount $P_G^d - P_G^N = P_G^d - P^* + P^* - P_G^N$. This sum amounts to $1 + \dfrac{P^* - P_G^N}{P_G^d - P^*}$, which is largest when the gain from deviation is lowest relative to the loss from deviation. This implies that the punishment is most severe when the gap $P_G^d - P_G^N$ is largest.

Under ambiguous property rights, this one-shot gain becomes:

$$\text{(13-a)} \quad P_G^d = \frac{1}{2}\left[p(1-\lambda)\theta k^* + (1-p)\left(1-\frac{r_0 g}{k^*}\right)\left(\frac{k^*-r_0 g}{2}\right)\right]$$

As already mentioned, we measure the loss from deviation by using the difference between the one-shot gain from deviation and the payoff in the punishment path. The larger the difference, the more severe the punishment.

Under private property rights, this loss for G is:

$$\text{(14-p)} \qquad P_G^d - P_G^N = \frac{1}{4}(1-p)\left[\frac{(k^*-r_0 g)^2}{k^*} - \frac{(k^p-r_0 g)^2}{k^p}\right]$$

Under ambiguous property rights, that loss becomes:

$$P_G^d - P_G^N = \frac{1}{2}p(1-\lambda)\theta(k^*-k^a) + \frac{1}{4}(1-p)\left[\frac{(k^*-r_0 g)^2}{k^*} - \frac{(k^a r_0 g)^2}{k^a}\right]$$

Take the expected value of the right hand side, we have:

(14-a)

$$P_G^d - P_G^N = \frac{1}{4}\left[p(1-\lambda) - (k^*-k^a) + (1-p)\left\{\frac{(k^*-r_0 g)^2}{k^*} - \frac{(k^a-r_0 g)^2}{k^a}\right\}\right]$$

The following propositions come directly from (14-p), (14-a), and the first order conditions (4) – (6).

LEMMA 1: *Under any ownership structure, the less productive the agent G, or equivalently, the greater the cost $r_0 g$, the weaker it is the threat of punishment for agent G, or equivalently, the smaller it is the gap $P_G^d - P_G^N$.*

Next, let us consider agent E's preferences over the possibility of being cheated. This reflects by the first term in the brackets of Proposition 1.

Let $\Delta = E_\theta(P_E^N + P_G^d - P^*)$, we have:

LEMMA 2: *Under the private property right,*

$$\text{(15-p)} \qquad \begin{aligned} \Delta &= [C(k^*) - C(k^p)] \\ &\quad - \frac{1}{2}\left[p(k^*-k^p) + (1-p)\left\{\frac{(k^*-r_0 g)^2}{2k^*} - \frac{(k^p-r_0 g)^2}{4k^p}\right\}\right] \end{aligned}$$

Given $p < 1$, one can check that the second term in (15-p) is strictly positive. Nevertheless, by assumption 1, $C' > 0$ and $C'' > 0$, the term Δ is

strictly positive for a wide range of production technologies. Furthermore, the more inefficient the system is, that is the greater C'' and the greater $r_0 g$, the larger it is the term Δ.

From this perspective, assumption 4 can be restated as follows: If the system is very efficient so that $\Delta < 0$; the gain from cooperation becomes sufficiently large such that the holdup problem no longer matters. We are interested in the cases, in which the system is *inefficient*. Thus, agent G has incentives to defect.

The following Lemma is the ambiguous property right counterpart of lemma 2.

LEMMA 3: *Under ambiguous property rights,*

(15-a)

$$\Delta[C(k^*)C(k^a)] - \frac{1}{4}\left[p(1+\lambda)(k^* - k^a) + (1-p)\left\{\frac{(k^* - r_0 g)^2}{k^*} - \frac{k^a - r_0 g)^2}{k^a}\right\}\right]$$

Combined with Lemma 1 and Lemma 2, we propose that,

PROPOSITION 3: *Under any ownership structure, the more* inefficient *the system, that is the more rapidly the cost of production increases in k and the higher the cost of G's rescuing service, the greater is the lower bound for the discount factor,* $\underline{\delta}$. *Subsequently, the narrower the range of discount factors that support cooperation.*

Provided that the system of production and organizations in transition economies are inefficient, the minimum discount factor, $\underline{\delta}$, must be large. In other words, the parties cooperate only if they are *very* patient. Ironically, due to the weaknesses of financial institutions in those countries, contractual parties tend to care little about future returns. As a result, the reputation mechanism is not as forceful or predictable as in the simple repeated-game story and therefore not an effective mechanism. To ensure cooperation, additional devices are needed to supplement the shadow of the future. The main focus of this paper is on that issue. To this end, let us discuss the information constraint under each allocation of ownership.

5 Information Constraint

We have shown that the optimal tax rate should be chosen such that (9) holds. That is, $\tau^* = \dfrac{P^* - P_E^N}{P^*}$. This implies that if G does not discount

future returns too much, or equivalently, if δ is greater than $\underline{\delta} = \dfrac{P_E^N + P_G^d - P^*}{P_G^d - P_G^N}$, this tax rate would allow the first best outcome to emerge. We are interested in situations, in which G does discount future returns heavily; that is $\delta < \underline{\delta} = \dfrac{P_E^N + P_G^d - P^*}{P_G^d - P_G^N}$. Obviously, the socially optimal outcome will not emerge under any allocation of ownership. In particular, E knows that if she implements the first best investment, G will deviate from the efficient sharing rule because his short-term gain from deviation is larger than his long-term loss. E then rationally chooses to play NASH-reversion strategy. Up to this point, there are some differences between private property rights and ambiguous property rights with regard to information constraint.

Under private property rights, the NASH reversion strategy has E being the only owner of the firm. To mitigate G's predatory behaviour, E optimally hides information about the firm's profit. On the contrary, under ambiguous property rights, the NASH reversion strategy has G as a shared owner of the firm. G now has information about the taxable income of the firm. This condition may allow cooperative outcome to emerge in a broader context when the central government, CG, comes to play an additional game with agent G.

Being modelled as the agent who wants to maximize the fiscal revenue, CG cares about the performance of local markets; but its disadvantage is that it lacks information about them. By contrast, agent G knows more about the prospect of his area, since he is a shared owner of local firms; but he may have insufficient incentives to promote the local economy. CG however has its rational counter to resolve this inconsistency. It can induce agent G to work hard by offering strong incentives if he reveals himself to have high ability.

Specifically, suppose agent G exerts effort to promote local markets. For instance, he properly resolves legal disputes and shares income with local firms according to the efficient rule, τ^*. The local market eventually develops. It attracts mobile capital pouring into the region and creates more opportunities for local firms. Since tax collection depends on how local bureaucrats manage to explore such advantages, the central government may find it reasonable to delegate more autonomy to agent G. Subsequently, G may expect to harvest some residual income from his effort. If this expected return is sufficiently large, it may become incentive compatible for agent G to enhance local firms.

We then see that in a repeated game framework, ambiguous property rights may be more efficient than private property rights. This is not because one type of ownership allocation is better than another in facilitating cooperation. This issue is redundant since, by assumption, the parties are very impatient. It is because the ambiguous property right releases information constraint, making contingent delegation feasible.

The local bureaucrat G now not only shares ambiguous ownership with local firms. But he also has his stake in the game played with agent CG regarding regional development. By delegating autonomy contingent on the local bureaucrat's ability, the central government may be able to alter the payoff structure of the game in favor of cooperation.

Formally, let V_G^a be agent G's present value of the lifetime expected return in the cooperative path played with agent E. That is:

$$V_G^a = \frac{\tau^* P^*}{1-\delta} = \frac{P^* - P_E^a}{1-\delta} \tag{16}$$

Similarly, let V_G^r be the present value of his expected return from gaining autonomy over his region. By contrast, if he defects when sharing ambiguous ownership rights, he gains a current payoff, P_G^d plus the future expected return in the punishment path:

$$v_G^a = \frac{1}{1-\delta} P_G^a \tag{17}$$

In region-wide, he obtains bribes, whose total value is φ, plus the future expected return from being the local bureaucrat of an economically undeveloped region, v_G^r. (These payoffs, φ and v_G^r, will be determined later).

The local bureaucrat then will not defect if and only if:

$$V_G^a + V_G^r > P_G^d + \varphi + \delta[v_G^a + v_G^r] \tag{18}$$

Provided that the parties are very impatient, that is $\delta < \underline{\delta}$, we have:

$$\frac{\tau^* P^*}{1-\delta} < P_G^d + \frac{\delta}{1-\delta} P_G^a,$$

or equivalently,

$$V_G^a < P_G^d + \delta v_G^a \tag{19}$$

The question whether the incentive constraint (18) is satisfied or not boils down to the following condition:

$$V_G^r > \varphi + \delta v_G^r \tag{20}$$

In other words, it may become incentive compatible for agent G to cooperate with local entrepreneur E if and only if his expected gain from delegation of power from the centre, V_G^r, is sufficiently large. By contrast, if the slack (20) is too small, say, because the central government delegates its power to local bureaucrats more on political criteria than for their ability, such an initial failure to provide the right incentives may trap the local economy into predatory state, in which, local bureaucrats hold up local firms. The success or failure of reforms therefore crucially depends on how the delegation of power from the centre to the local agencies is implemented. We then need to explicitly incorporate this game into our analysis.

6 Contingent Delegation of Power

Suppose the central government must decide whether to delegate autonomy to the local government or to retain its controls over local activities. If the central government, agent CG, *does* retain its power, the local bureaucrat, agent G, would suffer if he exerts high efforts (since most of the gain from his work would be taxed away). Anticipating that, agent G will choose to shirk and gain a net payoff φ_G^s by transgressing the wealth of local firms, but he needs to make a side payment α_{CG}^s to agent CG in order to stay in the position. As will be shown, when government bodies collude in such a way, their actions constitute a sub-game-perfect NASH-equilibrium. We shall call this outcome as *collusive* state.

The two parties (as well as the local firms, which are omitted here), however, can achieve a socially optimal outcome if the central government keeps its hands off while the local government makes efforts to promote the local economy. We shall call it as *cooperative* state. In payoffs, the latter gains residual incomes or perks $\phi(N,k^*)$, which increases in the number of the local firms, N, and the cooperative outcome in the sharing-ownership game, k^*, while the former receives a tax revenue $\tau(N)$, which also increases in N.[3] For simplicity's sake, we assume that the tax burdens, $\phi(N,k^*) + \tau(N)$, are born evenly by each local firm and are included in their cost function, $C(k)$. This reflects the part of total cost each firm pays for using public goods provided by the public sector, such as infrastructures, legal institutions to support contracts.[4]

Notice that deregulation of power from the central government is *necessary* for agent G to work efficiently. But the latter may be tempted to abuse this power to capture φ for personal gain. For example, local bureaucrats may collect bribes for providing permits and licences, or for erecting barriers to entry for competitors (SHLEIFER and VISHNY [1993]). In these cases, the centre gets the worst outcome γ. This leads to one-side prisoner dilemma, in which, the collusive state emerges as a sub-game NASH equilibrium, despite the fact that cooperative state is socially optimal: $\phi(N,k^*) + \tau(N) > \varphi_G^s + \alpha_{CG}^s$.

In reality, if the delegation of power is done according to the political criteria rather than for local bureaucrat's ability, agent G more likely abuses his power. The collusive state therefore often emerges when the central government fails to delegate its power on local bureaucrat's ability.

Next, let us assume that the centre will delegate autonomy to agent G only if the latter has proved his capability, ε, to promote the local economy. Obviously, ε is unknown from the beginning. But market learning will eventually eliminate the imperfection of information. For instance, mobile factors,

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3. Here we abuse the notation by using $\tau(N)$ to indicate (national) tax.

4. Subsequently, these taxes are conceptually different with $\tau^* P^*$, the share that the local government gains in cooperative path played with a local entrepreneur. One may expect that, when there is an increase in the use of formal institutions to coordinate activities between different firms, the formal tax system will become more important in tax revenue.

such as capital and labor, tend to pour into regions where the local government's capability, ε, is high (TIBOUT [1956]). In other words, a labour market for local bureaucrats is created. Thus, in (20), the value V_G^r can be interpreted as the expected gain for a diligent local government in competition with other jurisdictions to attract mobile capital *and* gain autonomy over the local business. We then can make the condition (20) more precise by assuming that:

ASSUMPTION 5: *the present value of agent G's expected return from gaining autonomy over his region, V_G^r is defined as follows:*

$$V_G^r = \phi(N,k^*) + \delta[\varepsilon V_G^r + (1-\varepsilon)v_G^r] \tag{21}$$

Equation (21) reflects that the local government may fail in the competition with the probability $(1-\varepsilon)$.

Notice the incentive constraint (20), it is clear that agent G will not shirk his duty, if $\phi(N,k^*) + \delta[\varepsilon\, V_G^r + (1-\varepsilon)v_G^r] > \varphi + \delta v_G^r$ or, equivalently, if

$$\varepsilon > \frac{1}{\delta}\frac{\varphi - \phi(N,k^*)}{V_G^r - v_G^r} \tag{22}$$

The inequality in (22) may shed light on some interesting features of China's deregulation that are summarized in the following proposition:

PROPOSITION 4: *Provided that local bureaucrats must compete to gain autonomy over local business, reflected by the rule (21). Then:*

(1). If bribes φ are negligible, even a local government who is not very capable still works hard to promote local businesses. Improvements in the accounting system, standardization of products, and better-defined property rights seem to be imperative in decentralization because they overall will reduce corruption.

(2). The higher the on-job consumption (perks), $\phi(N,k^*)$, the more the farsighted orientation, δ, and the larger net expected gain for a capable local government, $V_G^r - v_G^r$, the more likely it is local governments will work hard.

(3). When the values of these factors are relatively negligible while bribes are large, only the competent local-governments will work honestly for the prosperity of their community. But incapable ones are likely to shirk. However, the competition among different jurisdictions in order to gain more command over properties may put a check on incompetent local governments. Consequently, cooperation in the game of delegation of power is conventionalized.[5]

5. One may recognize that these three features are closely related. Gains from the devolution of power induce local agencies to compete, which in turn, increases the expected gains for a diligent local government. As the two forces work reciprocally, they boost the reform to advance (MCMILLAN [1997]).

(4). Ceteris paribus, the more innately capable is the agent G, or equivalently, the higher the value of ε, the perk, $\phi(N,k^*)$, and the larger the net expected gain for working hard, $V_G^r - v_G^r$, the greater it is the slack (20). When sufficiently large, it potentially relaxes the binding constraint (19), making the achievement of the first best in the market-enhancing game feasible.

Taking into account the inequality (19), Proposition 4 can be re-expressed as follows:

PROPOSITION 5: *Assume that $\delta/\underline{\delta} < 1$. The* effective ability*, the lowest level of ability, with which agent G finds it in his own interest to work diligently for local firms and expects to gain larger residual rights over his local business, is:*

$$\underline{\varepsilon} = \varepsilon(\delta/\underline{\delta}, N, k^*, \varphi, \varphi_G^S) \tag{23}$$

Furthermore, ε is monotonically decreasing in $\delta/\underline{\delta}$, N, and k^* ; and monotonically increasing in φ and φ_G^S.

Unlike in (22), $\underline{\delta}$ now appears in the incentive constraint. Intuitively, the lower the actual discount factor, δ, in comparison with the lower bound $\underline{\delta}$, the less incentive for agent G to cooperate with local firms when sharing ownership. Therefore, higher gains from the delegation of power from the centre are needed to induce agent G to play a market-enhancing role. This makes high ability local bureaucrats' actions and payoffs differed from low ability ones'.

For those whose innate abilities are high, their expected gains from having more autonomy over their region, V_G^r, are high. Thus, they are provided with strong incentives to work hard for their community. On the contrary, for those whose abilities are mediocre, they will shirk anyway since their expected return V_G^r is so low. Rationally, the centre, CG, retains its power, making those agents its direct subordinates. Thus it keeps regulating their activities as if they were under the central planing regime. One then sees the lower the value $\delta/\underline{\delta}$, the higher the effective ability is required.

An interesting implication is that, under contingent delegation, the paces of deregulation are slow and uneven across regions. Compared with a rapid, large-scale reform, such as the one implemented in the former Soviet Union this policy may seem backward, yet has served reasonably well to solve some incentive problems in the reform, including the central dilemma: local agencies blame the centre for their lack of authority while the centre blames the locals for their lack of accountability.

7 Conclusions

This paper is concerned with whether different types of ownership structures can encourage cooperative behaviours during economic reform. If the value of the discount factor is high, then the cooperative outcome can emerge under any ownership structure. An obstacle for contractual relations in transition economies is that the value of the discount factor is often low. Ironically, the lower bounds can be too high. This is because the production system is inefficient. As a result, the reputation mechanism is not as forceful or predictable as in the simple repeated-game story and therefore not an effective mechanism under any ownership allocation. To ensure cooperation, additional devices are needed to supplement the shadow of the future. In China's reform, such an additional device is contingent delegation. It serves to pool incentive constraints, making cooperation incentive compatible.

Contingent delegation, however, can only be implemented under some specific allocation of ownership. As demonstrated in section 6, ambiguous property rights can be *more efficient* than private ones in terms of information. This is because ambiguous property rights reveal information about a firm's income subjected to tax. The information can then be used by the central government to assess future performance of local bureaucrats and subsequently determine their future rewards. Such a contingent policy can potentially alter the payoff structure in favour of cooperation and induce a large number of firms enter the market. One then expects a new phase of reform is underway; in which, there is an increase in the use of formal institutions to coordinate activities between different organizations (not modelled in this paper). The ambiguous property rights regime gradually becomes insignificant. This conjecture fits with the fact that a large number of state and township-village enterprises have been privatized recently in China. ▼

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APPENDIX

Proof of Lemma 1:

From the first order conditions (4) – (6), we can see that, if $C''(h)$ is sufficiently large, the investment level chosen by agent E is decreasing in $r_0 g$. Furthermore, k^* is decreasing in $r_0 g$ more greatly than both k^p and k^a. We also see that, when the choice of investment k is decreasing in $r_0 g$, so is the fraction $(k - r_0 g)^2/k$. Together, these imply $P_G^d - P_G^N$ becomes smaller when $r_0 g$ becomes larger.

Proof of Lemma 2:

By definition, we have $\Delta = E_\theta(P_E^N + P_G^d - P^*)$. Let us first calculate this expected value for the case of private ownership rights:

$$P_E^N + P_G^d - P^* =$$

$$\text{(A1)} \qquad p\theta k^p + (1-p)\left(1 - \frac{k^p + r_0 g}{2k^p}\right)\left(\frac{k^p - r_0 g}{4}\right) - C(k^p)$$

$$\text{(A2)} \qquad +(1-p)(r - r_0)g(1 - rg/k^*)\,,\; r = \frac{k^* + r_0 g}{2g}$$

$$\text{(A3)} \qquad -\left[p\theta k^* + \frac{1}{2}(1-p)\left(1 - \frac{r_0 g}{k^*}\right)(k^* - r_0 g) - C(k^*)\right]$$

Let us simplify these formulas:

$$\text{(A1)} = p\theta k^p + (1-p)\frac{(k^p - r_0 g)^2}{8k^p} - C(k^p)$$

$$\text{(A2)} = (1-p)\frac{(k^* + r_0 g)^2}{4k^*}$$

$$\text{(A3)} = -\left[p\theta k^* + \frac{1}{2}(1-p)\frac{(k^* - r_0 g)^2}{k^*} - C(k^*)\right]$$

Together, we have:

$$\Delta = E_\theta(P_E^N + P_G^d - P^*) = [C(k^*) - C(k^P)] - \frac{1}{2}\left\{p\theta(k^* - k^p) + \frac{1-p}{2}\left[\frac{(k^* - r_0 g)^2}{k^*} - \frac{(k^p - r_0 g)^2}{2k^p}\right]\right\}$$

Proof of Lemma 3 is similar so it is omitted.

Proof of Proposition 5

Recall that equation (21) is:

$$V_G^r = \phi(N,k^*) + \delta[\varepsilon V_G^r + (1-\varepsilon)v_G^r]$$

We can rewrite it as follows:

$$(1-\delta\varepsilon)V_G^r = \phi(N,k^*) + \delta(1-\varepsilon)v_G^r$$

Therefore, we have:

$$(1-\delta\varepsilon)(V_G^r - v_G^r) = \phi(N,k^*) + (\delta-1)v_G^r$$

But $v_G^r = \varphi_G^s/(1-\delta)$. This implies:

$$(V_G^r - v_G^r) = \frac{1}{1-\delta\varepsilon}(\phi(N,k^*) - \varphi_G^s)$$

Using the inequality (22), we then have:

$$\varepsilon > \frac{(1-\delta\varepsilon)}{\delta}\frac{[\varphi - \phi(N,k^*)]}{[\phi(N,k^*) - \varphi_G^s]}$$

Subsequently,

$$\varepsilon > \frac{1}{\delta}\left[1 - \frac{\phi(N,k^*) - \varphi_G^s}{\varphi - \phi(N,k^*)}\right]$$

Normalize δ by $\underline{\delta}$ and take notice of (19) and (20), we then have:

(A4) $$\underline{\varepsilon} = \Gamma(\underline{\delta}/\delta)\left[1 - \frac{\phi(N,k^*) - \varphi_G^s}{\varphi - \phi(N,k^*)}\right]$$

Where, the function $\Gamma(.)$ is a strictly increasing in its argument.

As we can see from (A4), if either N or k^* increases, so does $\phi(N,k^*)$. Subsequently, the fraction $\dfrac{\phi(N,k^*) - \varphi_G^s}{\varphi - \phi(N,k^*)}$ increases, or equivalently, φ decreases. We also can see that is decreasing in $\delta/\underline{\delta}$, and monotonically increasing in φ and φ_G^s.