CONTINGENT DELEGATION AND AMBIGUOUS PROPERTY RIGHTS

The Case of China's Reform

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We reconsider the theory of ambiguous property rights in China. In a static game context, this ownership allocation is good because a local entrepreneur can probably get services provided by local bureaucrats at lower costs than a private owner; but bad because once knowing the firm's unobservable income, local bureaucrats are likely to encroach the firm. In an ongoing relationship, such a predatory behaviour may be limited if local bureaucrats care enough about future returns. Ironically, they often discount future too much. An additional device to supplement the shadow of future is needed. In China, this is the contingent delegation from the central. Under this policy, local bureaucrats must compete to gain more autonomy on the basis of local economy's performance. If the expected gain from the competition is sufficiently large, it may become incentive compatible for capable local bureaucrats to enhance local firms, despite incapable ones shirks. For those shirkers, the central still keeps regulating their activities as if they were under the central planing regime. One then sees that the pace of reform is slow and uneven across regions or sectors. It may be seen as a step back compared with a rapid and large-scale reform such as the one in the Former Soviet Union. However, this policy has served reasonably well to solve some incentive problems in reform, including the central contradiction: the local agencies blame the central for lack of autonomy; and the central blames them for lack of accountability.

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1. Introduction

The theory of ambiguous property rights (David, Li, 1996) focuses on a static game of ownership allocation when ownership rights are unsecured and the owner of an asset has to fight for actual controls ex post. The story is as follows: There are two agents: E (for an entrepreneur) and G (for a local government). The game has two periods: In the first period, E has to make the decision in investment. In the next period, the profitability of the project is revealed (but only for the owners of the firm). In the *white state*, the owners of the firm enjoy the payoff from investment. In the *black state* (when some legal disputes arise), G's effort is needed or otherwise the firm's situation will be jeopardized. Thus, G may explore its bargaining power to extract some of the income generated by E. The paper discusses the allocation of ownership that E may choose to mitigate such a

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problem. E can either have G to share the ownership and then fight for actual control rights ex post; or can solely own the firm, in which case, she can reap all the profit. The downside is that if the black state actually arises, ex post negotiations to get G's services may be more costly than those where E and G share the ownership. The paper argues that under certain business environment *ambiguous property rights* are more efficient than un-ambiguously defined private ownership rights. In particular, if the black state is likely to arise so that securing G's service is important, the more *productive* the agent G is, the more likely the owner of a firm wants to invite G to share ambiguous property rights. A side product 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 in tax purposes.

It is quite common that, in transition economies, local firms are subject to encroachment by local agencies (McMillan, 2000). But other than China, there are countries where ambiguous property rights do not arise to response such a predation. Instead, we often observe many large firms are either still owned by the government or controlled by Mafia, while many small, private firms are hiding themselves 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 then may ask why Chinese local governments are more productive in enhancing local firms than their counterparts in other transition economies? And why Chinese local governments have strong incentives to promote local-economic development?

A possible explanation of 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 central. The central 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 central can induce the local bureaucrat to exert effort to achieve cooperative outcome; which, when feasible, will increase income of all parties: 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. Reputation mechanism in this setting works in two distinctive, but interrelated ways. In one way, reputation concerns may open the door to achieve cooperation between the local firm and the local agency. If the one-shot gain from deviation is outweighed by the future loss, holdup behaviour should not arise. The situations that local agencies are involved in rescuing local firms in distressed states are exactly what we would expect repeated transactions should predominate and reputation effects should matter. As already mentioned, reputation concerns may work in the other way as well. If the performance of local economy today influences the central government's perceptions about the local bureaucrat's ability, we should expect the local bureaucrat would exert effort to be productive.

A caveat for the above propositions is that in order for reputation mechanism to work, the parties must care enough about future returns. Ironically, due to the poor condition of financial markets, agents often have a short-term horizon. In this perspective, the simple reputation mechanism may not work as forceful as predicted by game theory. This suggests that the incentive structure in the game played by the three parties here may be more complex. In what follows is our story. In some extent, it reveals what allocation of ownership may be more efficient in facilitating cooperation.

For simplicity's sake, let us split the game played by the three parties into two games, one is linked with another. One is the *delegation* game between the central 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 needed with the price equal to the 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, in which phase, the parties will reverse to the Nash equilibrium of the static game (described by Li). Obviously, if the parties are *very* patient, cooperation can be achieved under any allocation of ownership. We are interested in situations where parties are so impatient so 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, Nash reversion strategy has 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 income subjected to tax. 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 share rule in favour of him; for instance, by taxing the firm's income more heavily. Anticipating that, E rationally plays Nash reversion strategy: be the sole owner and hide the firm's activity underground. G then must rely on monopoly power to extract agent E's wealth whenever she needs his services. Such a transaction too, is also supposed to be hidden underground among the insiders. Subsequently, the local economy no longer provides information to the central about the ability of the local government. This makes contingent delegation unfeasible.

Next, let us consider the ambiguous property rights. Provided that discount rates are too high, E should end up with the same conclusion that G will deviate from cooperation. Therefore, Nash equilibrium will emerge if this is the *sole* game to be played. The only difference with the previous case is that, as a shared owner, G now has information about 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 already suggested, the central government may offer the local bureaucrat, agent G, with rewards contingent on performance of local economy. The incentive

is clear: better performance of local economy means larger tax base. For this purpose, the taxable income of local firms 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. Put differently, since defection in the local game will risk to be retaliated in *all* games, the local bureaucrat will hesitate to hold up the local firm (Bernheim *et al*, 1990).

Again, one caveat should be added to this proposition. Often, the central government delegates its power for local bureaucrats more on political criteria than for their ability. A labour market for local bureaucrats should be created or otherwise the incentive mechanism will not work (Laffont and Tirole, 1987). Competition can reveal who among the prospect candidates is the most able. Thus, introducing a market-based selection mechanism improves local agencies' quality (McMillan, 1997).

One then sees that by employing repeated game framework, we can examine local bureaucrats' ability and attitude in helping local firms endogenously rather than just given exogenously as in the static context. More specifically, this paper tries to address several questions: Does ownership structure matter in on going relationship? Can incapability of local bureaucrats and their predatory behaviour be mitigated in any ownership structure? What additional institution may be needed to facilitate cooperation and reduce local bureaucrats' incompetence? 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 multi-task context. As already mentioned, 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 future. In this perspective, our research topic is related to the literature that focuses on long-term development of market-supporting institutions. This includes the papers by Arrow (1997), McMillan and Woodruff (2002), Qian (1994, 2000), 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 7 present the theory of contingent delegation. Section 8 concludes the paper.

This paper benefits from the literature on incentives and organizations, which includes Aghion and Tirol (1997), Baker *et al* (1999), Grossman et al (1986), Halonen (2002), Holmstrom (1982) 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 asset of

the firm. In the second period, the profitability of the firm, qk, is revealed, but only for the insiders. At that stage, due to the absence of the shadow of the law, 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, qk. In the black state, however, the firm is trapped in a legal dispute. In order for the firm's owner to reobtain the profits, qk, the rescuing service from G is needed or otherwise the firm's owner will gain nothing. Li assumed that the efforts that E or G put into the business are too complex to have explicit contracts that specify who will get control right 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 either 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.

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

Below are assumptions that facilitate computation:

ASSUMPTION 2: q follows a uniform distribution$q \sim U[0,1]$, 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 q.

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:

$$P_E^W = qk - C(k)$$

$$P_G^W = 0$$

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 $qk - rg \geq 0$. This implies: $q \geq rg/k$. Subsequently, G's expected payoff is:

$$P_G^B = E(rg - r_0 g \mid q \geq rg/k) = (r - r_0) g(1 - rg/k)$$

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

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

$$P_E^B = E(qk - rg \mid q \geq rg/k) - C(k) = (1 - \frac{k + r_0 g}{2k})(\frac{k - r_0 g}{4}) - C(k)$$

Overall, E's expected return is:

$$P_E^p = pqk + (1-p)\,(1 - \frac{k + r_0 g}{2k})(\frac{k - r_0 g}{4}) - C(k) \qquad (1)$$

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 relation of power is reversed. Optimally, E should have full control right 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 asset. If G fully cooperates, the firm's profitability is qk. If their negotiation breaks down, G will gain nothing, but agent E can still generate λqk without G, where $0 \leq \lambda \leq 1$. Under Nash-bargaining with perfect information about q, each party then can expect to get half of the joint surplus:

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

$$P_G^W = \tfrac{1}{2}(1-\lambda)qk$$

On the contrary, in the black state, G acts as if he had full control right ($\lambda = 0$). E should give up her control right, in which case, the joint surplus shrinks to $qk - r_0 g$, reflecting some cost born by the coalition due to legal disputes with outsiders. If their negotiation breaks down, they both will 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 asset). Each party then expects to get half of the joint surplus, so long as $q \geq r_0 g / k$.

From the first-period perspective, E's expected payoff becomes:

$$P_E^B = E\{\tfrac{1}{2}(qk - r_0 g) \mid q \geq r_0 g/k) - C(k) = \tfrac{1}{2}(1 - \frac{r_0 g}{k})(\frac{k - r_0 g}{2}) - C(k)$$

Overall, E's expected return is:

$$P_E^a = \tfrac{1}{2}[\,p(\lambda + 1)qk + (1-p)\,(1 - \frac{r_0 g}{k})(\frac{k - r_0 g}{2})] - C(k) \qquad (2)$$

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 $qk - C(k)$. In the black state this value becomes: $E(qk - r_0 g) \mid q \geq r_0 g / k) - C(k) = \frac{1}{2}(1 - \frac{r_0 g}{k})(k - r_0 g) - C(k)$. Thus, total expected social welfare is:

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

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 l, 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:

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

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

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

By comparison, we see that $k^* \geq \max\{k^p, k^a\}$ so long as $p < 1$. Ceteris paribus, $k^a \geq k^p$ if l and $(1-p)$ are large, and $r_0 g$ is sufficiently small. Intuitively, because l reflects the bargaining power of E, when l 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 $(p, l, r_0 g)$. 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 l 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 bargaining (Blanchard and Kremer, 1997; and Li, Wei, 1999). If many parties are linked in a complex set of specific relations, contractual disputes may be severe. Furthermore, systematic shocks, such as fiscal and banking crisis, can cause an economic-wide fluctuation of production with considerable uncertainty (McKinnon, 1993). 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). Deviation from cooperative action will trigger punishment phase. We should see that the agent E's promise to implement k^* 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 game.

It is well known that, under ongoing relationship, the efficient investments could be supported using the trigger strategy and reversion to Nash equilibrium of 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 contracting in transition economies is that discount rates are high (McMillan – Woodruff, 1999). Most private firms are excluded from formal financial markets. The un-development of financial institutions also indicates that, in general, the high interest rates, 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 relax incentive constraint and make it to become 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 first best situation is not lower than her payoff in punishment path in which both parties implement Nash-reversion strategies of static game. Specifically,

$$P_E^* = (1-t)P^* \geq P_E^N \qquad (7)$$

Where, t is the (local) tax rate on E's profits, P^*, under cooperation; P_E^N is E's payoff in 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 first best case must be sufficiently high. Specifically,

$$\frac{P_G^*}{1-d} = \frac{tP^*}{(1-d)} \geq P_G^d + \frac{d}{1-d} P_G^N \tag{8}$$

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, t , 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 reputation mechanism to break down. Below, we will discuss this issue in a greater detail.

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

$$t \leq \frac{P^* - P_E^N}{P^*} \tag{9}$$

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

$$t \geq (1-d)\frac{P_G^d}{P^*} + d\,\frac{P_G^N}{P^*} \tag{10}$$

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

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

or equivalently,

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

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 it is the punishment against agent G's deviation, or equivalently, the smaller it is the difference between one-shot gain from deviation and the payoff in the punishment phase for G, the higher the forward-looking behaviour the agents must have in order to illicit the parties to implement first best[1].

PROPOSITION 2: Under repeated transactions, the lowest discount factor that guarantees the first best is $\underline{d}(P_E^N + P_G^d - P^*, P_G^d - P_G^N)$. Furthermore, the factor $\underline{d}$ 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 first best situation is $t^* = \frac{P^* - P_E^N}{P^*}$. Thus, G's share of the surplus in first best simply is $P^* - P_E^N$. 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

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

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

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

$$P_G^d = \tfrac{1}{2}[p(1-l)qk^* + (1-p)(1 - \frac{r_0 g}{k^*})(\frac{k^* - r_0 g}{2})] \qquad \text{(13-a)}$$

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

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[1] 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 $1 + \frac{P^* - P_G^N}{P_G^d - P^*}$, 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 private property rights, this loss for G is:

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

Under ambiguous property rights, that loss becomes:

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

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

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

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

LEMMA 2: Under the private property right,

$$\Delta = [C(k^*) - C(k^p)] - \tfrac{1}{2}[p(k^* - k^p) + (1-p)\{\frac{(k^* - r_0 g)^2}{2k^*} - \frac{(k^p - r_0 g)^2}{4k^p}\}] \qquad (15\text{-p})$$

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. In 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 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 ambiguous property right counterpart of lemma 2.

LEMMA 3: Under the ambiguous property right,

$$\Delta = [C(k^*) - C(k^a)] - \tfrac{1}{4}[\,p(1+l)(k^* - k^a) + (1-p)\{\frac{(k^* - r_0 g)^2}{k^*} - \frac{(k^a - r_0 g)^2}{k^a}\}\,] \quad \text{(15-a)}$$

Combined with Lemma1 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 it is the lower bound for the discount factor, $\underline{d}$. 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, $\underline{d}$, 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 care little about future returns. As a result, 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, $t^* = \dfrac{P^* - P_E^N}{P^*}$. This implies that if G did not discount future returns too much, or equivalently, if d were greater than $\underline{d} = \dfrac{P_E^N + P_G^d - P^*}{P_G^d - P_G^N}$, 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 $d < \underline{d} = \dfrac{P_E^N + P_G^d - P^*}{P_G^d - P_G^N}$. Obviously, socially optimal outcome will not emerge under any allocation of ownership. Essentially, 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, Nash reversion strategy has E being the only owner of the firm. She is the sole party who has information about the firm's profit. G then has little choice but charges agent E as much as possible whenever E is forced to seek his service. Anticipating that predatory behaviour, E optimally hides information about the firm's profit, making this strategy profile to become a sub-game-perfect-Nash equilibrium.

Under ambiguous property rights, Nash reversion strategy has G as a shared owner of the firm. What prevents the parties to achieve first best is no longer the information problem, but solely the incentive problem. Clearly, if there were no additional institution to support the shadow of future, both parties will end up with the low equilibrium.

Now suppose there is another agent, the central government, CG, that comes to play an additional game with agent G. Being modelled as the agent who wants to maximizes fiscal revenue, CG cares about 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 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, t^*. 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 repeated game framework, the ambiguous property right may be more efficient than the private property right. This is not because one type of ownership allocation is better than other in facilitating cooperation. This issue is redundant since the parties are very impatient. But this is because the ambiguous property right releases information constraint, making contingent delegation feasible.

The local bureaucrat G now not only involves in sharing 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' 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:

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

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:

$$v_G^a = \frac{1}{1-d} P_G^a \qquad (17)$$

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

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

$$V_G^a + V_G^r > P_G^d + j + d[v_G^a + v_G^r] \qquad (18)$$

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

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

or equivalently,

$$V_G^a < P_G^d + d v_G^a \qquad (19)$$

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

$$V_G^r > j + d v_G^r \qquad (20)$$

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 central, 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 delegation of power from the central 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

j^{s}_{G} by transgressing the wealth of local firms, but he needs to make a side payment a^{s}_{CG} 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.

The two parties (as well as the local firms, which is 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. In payoffs, the latter gains residual incomes or perks $f(N,k^*)$, 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 $t(N)$[2] which also increases in *N*. For simplicity's sake, we assume that the tax burdens, $f(N,k^*)+t(N)$, are born evenly by each local firm and are included in their cost function at the first best investment, $C(k^*)$. 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[3].

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 j for personal gain. For example, local bureaucrats may collect bribes for providing permits and licences, for erecting barriers against entry of competitors (Shleifer and Vishny, 1993). In these cases, the central gets the worst outcome g. This leads to one-side prisoner dilemma, in which, the collusive state emerges as a sub-game Nash equilibrium, despite the fact that "deregulate – work" is socially optimal: $f(N,k^*)+t(N) > j^{s}_{G}+a^{s}_{CG}$.

We need to emphasize that, in reality, if delegation of power is more on the political criteria than for local bureaucrat's ability, then it is more likely that agent G abuses his power. Collusive state therefore often emerges when the central government fails to delegate its power on the basis of local bureaucrats' ability.

Next, let us assume that the central will delegate the autonomy to agent G only if the latter has proved his capability, e, to promote the local economy. Obviously, e is unknown from the beginning. But market learning will eventually eliminate the imperfection of information. For instance, mobile factors, such as capital and labor, tend to pour into the regions where the local government's capability, e, is high[4]. In other words, a labour market for local bureaucrats is created. Thus, in (20), the value V^{r}_{G} can be interpreted as the expected gain for a diligent local government in the competition with other jurisdictions to attract mobile capital

[2] Here we abuse the notation by using $t(N)$ to indicate (national) tax.

[3] Subsequently, these taxes are conceptually different with $t^{*}P^{*}$, 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.

[4] It is essentially Tibout's theory (1956).

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:

$$V_G^r = f(N,k^*) + d[eV_G^r + (1-e)v_G^r] \tag{21}$$

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

Notice the incentive constraint (20), it is clear that agent G will not shirk his duty, if $f(N,k^*) + d[eV_G^r + (1-e)v_G^r] > j + dv_G^r$ or, equivalently, if

$$e > \frac{1}{d}\frac{j - f(N,k^*)}{V_G^r - v_G^r} \tag{22}$$

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, reflecting by the rule (21). Then:

(1). If bribes j 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.

(2). The higher the on-job consumption (perks), $f(N,k^*)$, the more the farsighted orientation, d, 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].

(4). Ceteris paribus, the more innately capable is the agent G, or equivalently, the higher the value of e, the perk, $f(N,k^*)$, 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

[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).

potentially relaxes the binding constraint (19), making first best in the market-enhancing game feasible.

7. Comments on Contingent Delegation

Take into account the effect of multiple institution linkages on agent G's incentive constraint; Proposition 4 can be re-expressed as follows:

PROPOSITION 5: Assume that $d / \underline{d} < 1$. 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:

$$\underline{e} = e(d / \underline{d}, N, k^*, j, j_G^S) \tag{23}$$

Furthermore, e is monotonically decreasing in $d / \underline{d}$, N, and k^*; and monotonically increasing in j and j_G^S.

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

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

An interesting implication is that, under contingent delegation, the paces of deregulation are slow and uneven across regions and sectors. This might make contingent delegation seemed to be a step back in comparison with a rapid, large-scale reform, such as the one implemented in the former Soviet Union. As we have seen, however, this policy serves reasonably well for China to solve some specific incentive problems during reform. It also mitigates the main contradiction of deregulation: local agencies blame the centre for their lack of authority while the central blames the locals for their lack of accountability.

Let us make some speculative comments on long-term effect of this policy on market development.

As already said in Proposition 4, the effective ability, $\underline{e}$, ensures cooperative behaviour of agent G decreases in the factors that increase the expected return of an diligent local bureaucrat relative to that of a shirking one. These are the size of local market, N, and the first best investment of local game, k^*. This threshold value increases in the factors that increase the relative gains from one-shot deviation (that is j and j_G^S).

Recall from Proposition 3, the more efficient the system of production, in particular, the more slowly the cost of production increases in k, the lower $\underline{d}$ or the greater the scope for cooperation. Notice that tax charged on local firms affects their cost of production. We introduce the following assumption. Let us denote $T(N,k^*) = f(N,k^*) + t(N)$.

ASSUMPTION 6: The total tax revenue, $T(N,k^*)$, increases in the size of market: $\frac{\partial T(N,.)}{\partial N} > 0$. But the tax burden per firm, $\frac{T(N,.)}{N}$, tends to converge to zero when N is sufficiently large.

ASSUMPTION 7: The lower the tax burdens per firm, the more slowly the cost of production increases in k.

Subsequently, it is reasonable to believe that if the size of the local market, N, becomes larger, local production system becomes more efficient. We then expect both lower bounds, $\underline{d}$ and $\underline{e}$, become lower as N becomes larger (Propositions 3 and 5). On the other hand, the size of market, N, itself can be assumed to be a function of $\underline{e}$.

ASSUMPTION 8: The market size, N, is a function of $\underline{e}$. That is: $N = N(\underline{e})$, where $N(.)$ is continuous, differentiable, and $N'(\underline{e}) < 0$.

The reason is that the larger the number of local agencies devote their effort to support local firms in legal front, the better the business environment is created; thus, the larger the number of new firms will enter emerging markets to serve residual demands, which were untapped prior to reform. Let us normalize the largest number of firms in the local market to unity: $N \in [0,1]$.

PROPOSITION 6 (*Brouwer's Fixed Point Theorem*): Under certain regular conditions, the market size, N, will converge to its long-term steady state.

8. Conclusions

This paper concerns about whether different types of ownership structures can encourage cooperative behaviour during reform. If the value of discount factors is

high, then 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 low. Ironically, the lower bounds can be too high. This is because the production system is inefficient. As a result, 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 firm's income subjected to tax. This information then can be used by the central government to assess future performance of and provide rewards for local bureaucrats. This contingent policy can potentially alter the payoff structure in favour of cooperation. As a large number of firms entering the market when time unfolds, we should expect 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). One may speculate that all factors that have worked in favour of ambiguous property rights may become insignificant. The ambiguous property rights regime gradually disappears in the scene of the contemporary life. This conjecture fits with the fact that a large number of state and township-village enterprises have been privatized recently in China.

Appendix

Proof of Lemma 1:

From the first order conditions (4) – (6), we can see that, if $C''(k)$ 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 $\Delta = E_q (P_E^N + P_G^d - P^*)$. Let us first calculate this expected value for the case of private ownership rights:

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

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

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

$$-[\,pqk^*+\tfrac{1}{2}(1-p)\ (1-\frac{r_0 g}{k^*})(k^*-r_0 g)-C(k^*)] \qquad \text{(A3)}$$

Let us simplify these formulas:

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

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

$$\text{(A3)} = -[\,pqk^*+\tfrac{1}{2}(1-p)\frac{(k^*-r_0 g)^2}{k^*}-C(k^*)]$$

Together, we have:

$$\Delta = E_q(P_E^N+P_G^d-P^*) = [C(k^*)-C(k^P)]-\tfrac{1}{2}\{pq(k^*-k^p) + \frac{1-p}{2}[\frac{(k^*-r_0 g)^2}{k^*}-\frac{(k^p-r_0 g)^2}{2k^p}]\}.$$

Proof of Lemma 3 is similar so it is omitted.

Proof of Proposition 5

Recall that equation (21) is:

$$V_G^r = f(N,k^*)+d[eV_G^r+(1-e)v_G^r]$$

We can rewrite it as follows:

$$(1-de)V_G^r = f(N,k^*)+d(1-e)v_G^r$$

Therefore, we have:

$$(1-de)(V_G^r-v_G^r) = f(N,k^*)+(d-1)v_G^r$$

But $v_G^r = j_G^s/(1-d)$. This implies:

$$(V_G^r-v_G^r) = \frac{1}{1-de}(f(N,k^*)-j_G^s)$$

Using the inequality (22), we then have:

$$e > \frac{(1-de)}{d}\frac{[j - f(N,k^*)]}{[f(N,k^*) - j_G^s]}$$

Subsequently,

$$e > \frac{1}{d}[1 - \frac{f(N,k^*) - j_G^s}{j - f(N,k^*)}]$$

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

$$\underline{e} = \Gamma(\underline{d}/d)[1 - \frac{f(N,k^*) - j_G^s}{j - f(N,k^*)}] \qquad \text{(A4)}$$

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 $f(N,k^*)$. Subsequently, the fraction $\frac{f(N,k^*) - j_G^s}{j - f(N,k^*)}$ increases, or equivalently, $\underline{e}$ decreases. We also can see that $\underline{e}$ is decreasing in $d/\underline{d}$, and monotonically increasing in j and j_G^s.

References

Aghion, Philippe and Tirol, Jean (1997). "Formal and Real Authority in Organizations," *Journal of Political Economy*, 105 (1), 1--29.

Arrow, Kenneth (1997). "The Place of Institution in the Economy: A Theoretical Perspective," *Mimeo*, Stanford University.

Baker, George; Gibbons, Robert; and Murphy, Kevin (1999). "Informal Authority in Organizations," *The Journal of Law, Economics, & Organization*, 15, (1), 56--73.

Bernheim, Douglas and Whinston, Michael (1990). "Multi-Market Contract and Collusive Behavior," *RAND Journal of Economics*, 21, (1), 1--26.

Blanchard, Oliver and Kremer, Michael, (1997). "Disorganization," *Quarterly Journal of Economics*, November, 1090 -- 1125.

Che, Jiahua and Qian, Yingyi (1998). "Insecure Property Rights and Government Ownership of Firms," *Quarterly Journal of Economics*, May, *113*(2), pp. 467-496.

Grossman, Sanford and Hart, Oliver (1986). " The costs and benefits of Ownership: A Theory of Vertical and Lateral Integration," *Journal of Political Economics*, 94, (4), 691--719.

Holmstrom, Bengt (1999). "Managerial Incentive Problems – A Dynamic Perspective," *Review of Economic Studies*. 66 (226), 169—183

Laffont, Jean-Jaques and Tirole, Jean (1987). "Auctioning Incentive Contracts." *Journal of Political Economy*, 95: 921 – 37.

Li, David (1996). "A Theory of Ambiguous Property Rights in Transition Economies: The Case of the Chinese Non-State Sector'" *Journal of Comparative Economics* 23, 1--19.

Li, Wei (1999). "A Tale of Two reforms," *RAND Journal of Economics* 30, 120--136.

McKinnon (1993) The Order of Economic Liberalization: Financial Control in the Transition to a Market Economy, Johns Hopkins Press, 2nd edition.

McMillan, John (1997). "Market in Transition," in: Kreps-Wallis (Eds.), *Advances in Economics and Econometrics: Theory and Applications: Seventh World Congress*, Cambridge: Cambridge University Press, pp. 211--237.

McMillan, John and Woodruff, Christopher (1999). "Dispute Prevention without Courts in Vietnam," *Journal of law, Economics, and Organization*, 15 (3), 637--658.

McMillan, John and Woodruff, Christopher (2002). "The Central Role of Entrepreneurs in Transition Economies'". *Journal of Economic Perspectives*, 16 (3), 153--170.

Halonen, Maija (2002), "Reputation and The Allocation of Ownership," *The Economic Journal*, 112 (*July*), 539 – 58.

Qian, Yingyi (1994). "Reforming Corporate Governance and Finance in China," in: Aoki, M., Kim (Eds.) *Corporate Governance in Transition Economies*, World Bank: EDI Development Studies.

Qian, Yingyi (2000). "The Process of China's Market Transition (1978 – 1998): The Evolutionary, Historical, and Comparative Perspectives," *Journal of Institutional and Theoretical Economics*, 156 (1), 151--171.

Qian, Yingyi and Roland, Gerard (1998). "Federalism and the Soft Budget Constraint," *American Economic Review*, 88, (5), 1143--1162.

Shleifer, Andrei and Vishny, Robert (1993). "Corruption," *The Quarterly Journal of Economics*, 108

(3), 599--617.

Tadelis, Steven (2002). "The Market for Reputations as an Incentive Mechanism," *Journal of Political Economy*, 92 (2), 854—882.

Tibout, Charles (1956). "A Pure Theory of Local Expenditures," *Journal of Political Economics*, 64, 416--424.