

**“Controlled Competition”: Dynamic Tournaments  
as Economic Development Strategy:  
A Viewpoint from Incentive Design**

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# Highlights

- A model analysis of "**controlled competition**" under "**state capitalism**" where the government participates in the market as an active player, as in China, Singapore and the industrial policies of former Japan.
- **A dynamic tournament between heterogeneous players with different bargaining powers (ownership ratios) under an incomplete contract situation in relation to the Chinese ownership system.**
- Close investigation of **the incentive mechanisms** built into "**controlled competition**" and **their problems**.
- The overly anti-competitive and discriminatory prizes ("**cronyism**") have greatly reduced investment incentives (efficiency) for both state-owned and private-owned firms, and the institution needs to be redesigned to a more level playing field in order to maintain competitive pressures.

# 1. Introduction

- **The overall view of the model** is that the government participates as a "player" in the institutional design of the two-stage tournament and strengthens the functioning of the innovation organization consisting of the government and two firms.
- The facts that Japanese-style competition had played an active role in achieving rapid postwar growth, which had been analyzed for various industries.

1. The form of competition under high economic growth, termed "growth competition in a greenhouse". In the automobile industry from the mid-1950s to the early 1970s as oligopolistic competition (in greenhouses) under industrial policy, the government created the "greenhouse, that is, organization" through policy, and indirectly induced the investment incentives of oligopolistic firms through the temporary protection policy.

2. The competition between parts suppliers in the transaction between the assembly manufacturers and parts suppliers. Buyer took the form of "**controlled**" **competition** in which multiple potential suppliers compete for the position of parts supplier, thereby maintaining the quality of competition. This form of competition had been introduced in the automotive and parts industries in Europe and the United States since the mid-1990s.

- In the above cases, described as typical "Japanese-style" competitive schemes, **the role of the "visible hand" of the government or the buyer** is important to lead the competition.
- In this paper, based on **the motivations** consisting of **an attention to "Chinese state capitalism" in the diversity of Asian capitalism, the promotion of capitalism by the government (state), and a reference to the case of "controlled competition" in Japan),** **the following four points** would be considered as **the common features** of "controlled competition."

(1) The presence of **multiple, but a small number of fixed agents** and a **third party (a Visible Hand, such as the government or the buyer)** who ranks them.

(2) Under uncertainty situations with high transaction costs where **complete and state-contingent contracts cannot be written**, organizations (in a broad sense) have been formed to conduct **ranked competition** in the long term.

(3) This is a "**competition without losers,**" meaning that even if a player loses once in the competition, he is not eliminated from the competition, and unlike competition harsh for the loser in the selectively eliminating type, **the loser has an incentive to try again.**

(4) In the midst of the competition, "**dialogues**" are held, **technological information is exchanged**, spillover of knowledge and technology takes place during each period, and there are **devices to maintain the quality of a small number of members.**

To model these four points in a simple form without losing the essence, it is necessary to introduce a **multi-agent model under an incomplete contract situation** in which **the third party (government, the visible hand) guides the competition or the race in a way that does not exclude the loser.**

**Konishi, Okuno-Fujiwara and Suzuki (1994, 1996)** proposed the “**endogenized tournament**” which explicitly introduces **the viewpoints (1) through (3)** of the "Japanese -style" form of competition, showing that even in a situation of competition without losers under incomplete contract situations, a third party can intervene in the competition and induce firms to run ahead to expand investment in advance if the environment allows it.

In today’s paper, we **additionally** introduce **the viewpoint (4)**, because, in the controlled competition, a mechanism in which competitive companies transfer technology to each other is prepared at the end of each period, and companies could raise their own accumulation ex-post using the assets accumulated by other companies, thereby raising their ranking (share).

- We analyze **the two-stage tournaments between heterogeneous players with different bargaining powers (ownership ratios)** in connection with **China's ownership system**.
- The role of government in economic development (**Market-enhancing view by Aoki, Kim, Okuno -Fujiwara(1996)**) deals with **the Chinese government in the Decentralization era** since reform and opening-up (1978). On the other hand, reflecting **the recent view of "State Capitalism" in the Centralization Era**, the role of government will be changing to a form where it leads **the introduction(promotion) of capitalism**. The government in this paper is **a more active and proactive player than in the "Market Enhancing View"** (mid-1990's) presented by Aoki et al (1996) in "The role of Government and Economic Development in East Asia".

Aghion and Tirole 1994 QJE

- **Government promotion of R&D** is one of the most important areas of public policy.
- Analyzing the government as a customer ought to shed light on efficient ways of channeling government money into R&D. They had not considered competition among research units.

**Our paper** may be viewed as merging **the property rights approach** and **the literature on strategic vertical integration** ala Riordan (1991) together with **the traditional patent race analysis**.

- In sum, this paper presents **a model of "controlled competition" under "state capitalism"** in which **the government participates in the market as an active player**, and identifies **its perceived flaws** in economic theory.
- Our model analyzes **how the government will dynamically induce the form of competition between multiple agents (SOEs, POEs, or SOEs and POEs) in the long run, as a national economic development strategy** incorporated into "controlled competition" under "state capitalism."
- The purpose of this paper is **to clarify the diachronic incentive mechanisms and their problems from the viewpoint of the theory of incentive design, and to derive implications for institutional reform**, e.g., the necessities and implications of creating **a fair competitive environment**.



## 2. Model

(1) Players: Principal-----Government (G)

Agents 1, 2 ----- Two Companies (Firms)

Private Owned Enterprise (POE), State Owned Enterprise (SOE)

(2) Strategies:

- The principal G designs an incentive scheme ('commitment')

Two Strategies( $\lambda$ ,  $W$ ), where  $\lambda$  --"Allotment"

$W$  --Monetary Prize, Bonus

- The strategy of the agent  $i = 1,2$  consists of two components

- $h_i$ : First-period Investment, with cost  $g(h_i)$ ,  $g' > 0$ ,  $g'' \geq 0$ .

- $e_i$ : Second-period Investment, with cost  $C(e_i)$ ,  $C' > 0$ ,  $C'' > 0$ ,  $C''' \geq 0$ .

(3) Time Structure Figure

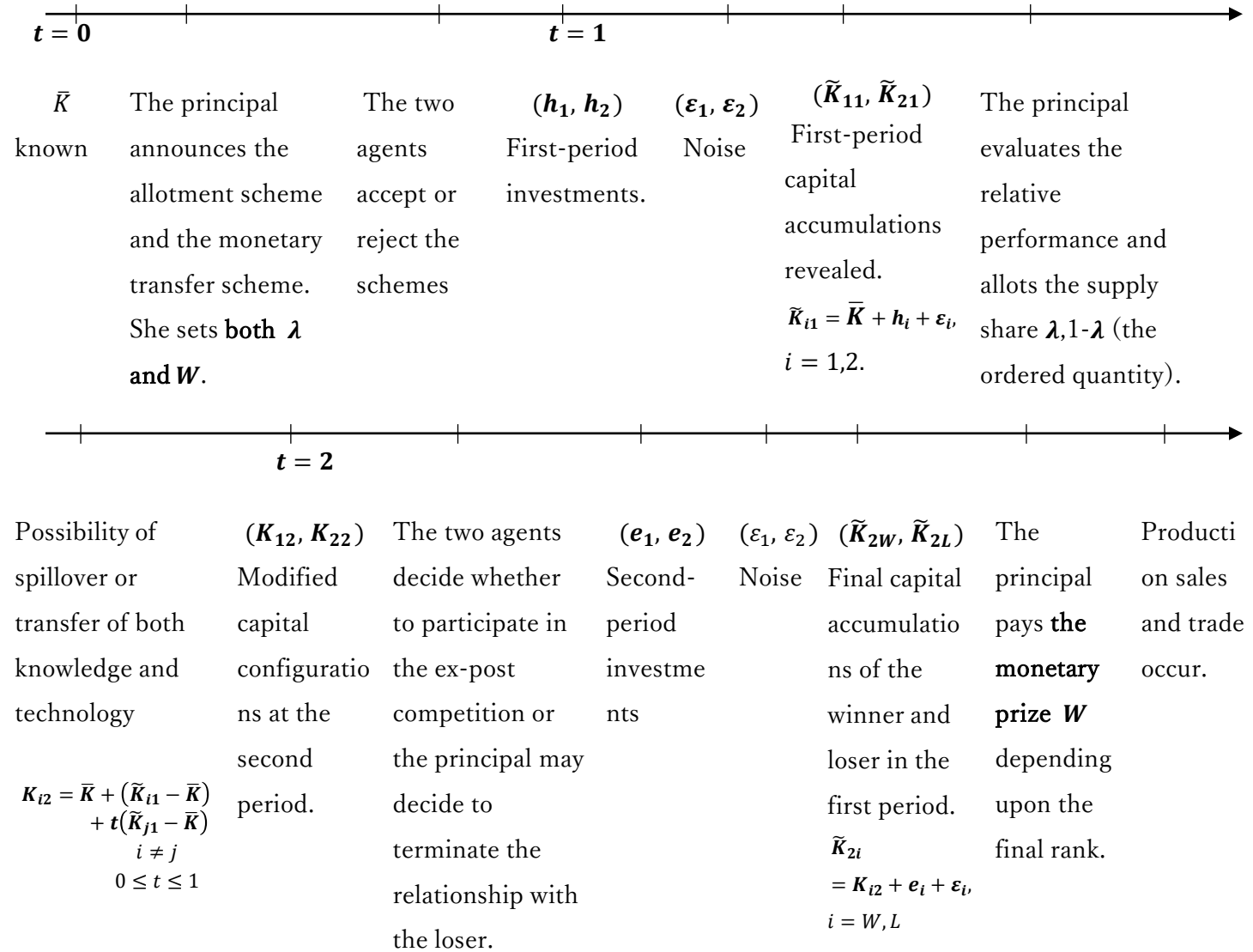


Figure 1

(4) **Objectives:** Ex-post Payoff Functions

$$\widehat{U}_i = \left\{ \alpha Q \cdot E_{\varepsilon_i}(\tilde{K}_{i2}) \cdot \hat{\lambda} + \widehat{W} - C(e_i) \right\} - g(h_i) \text{ for } \mathbf{Agent } i = 1,2$$

$$\text{where } \hat{\lambda} = \begin{cases} \lambda & \text{if } \tilde{K}_{i1} > \tilde{K}_{j1} \\ 1 - \lambda & \text{if } \tilde{K}_{i1} < \tilde{K}_{j1} \end{cases} \quad \text{and} \quad \widehat{W} = \begin{cases} W & \text{if } \tilde{K}_{i2} > \tilde{K}_{j2} \\ 0 & \text{if } \tilde{K}_{i2} < \tilde{K}_{j2} \end{cases}$$

The principal's payoff function is

$$\pi = (1 - \alpha)Q \left[ \lambda \cdot E_{\varepsilon}(\tilde{K}_{W2}) + (1 - \lambda) \cdot E_{\varepsilon}(\tilde{K}_{L2}) \right] - W$$

$\sim E_{\varepsilon}(\tilde{K}_{W2}), E_{\varepsilon}(\tilde{K}_{L2})$  the expectation of the final capital

accumulation of the winner and the loser

→ Gross Trade Gain → The principal obtains the share of  $1 - \alpha$

- **Assumption 1: Linear Transfer Technology** The principal G can offer opportunities for transfer of technology /knowledge. Through such transfer, the difference in capital stocks of the agents decreases, and the capital stock of agent  $i$  at the start of the second period is written as follows, given the end of first period stocks  $(\tilde{K}_{i1}, \tilde{K}_{j1})$ ,

$$K_{i2}(\tilde{K}_{i1}, \tilde{K}_{j1}) = \bar{K} + (\tilde{K}_{i1} - \bar{K}) + t(\tilde{K}_{j1} - \bar{K}) \quad \text{for } i \neq j, \text{ and } 0 \leq t \leq 1$$

- **The bargaining power  $\alpha$**  is deeply related to **the ownership structure** between the enterprise and the government, and is also **the distribution ratio** of the transaction profit, so the larger the proportion of the **POE** (SOE) is, the **larger** (smaller)  **$\alpha$**  is. Theoretical interest of this paper is in both **the difference in bargaining power  $\alpha$  (ownership ratio, state-owned and private-owned enterprises)** and the diachronic tournament competition. That is, this paper deals with an analysis of dynamic tournaments consisting of homogeneous and heterogeneous agents with various bargaining powers (ownership ratios).
- Tirole(1986) refers to military procurement as a good example of incomplete contracts and renegotiation, where any design change is not be specified in the initial contracts for risky research and development (R&D) projects. R&D innovation and design changes would continue until the final stage.

### 3. Homogeneous Tournaments $\alpha_1 = \alpha_2 = \alpha$

- **Solution by Backward Induction**

- (1) **Second Period: “Asymmetric Tournament”**

The expected payoff function of each agent at this stage, and the value function is,

$$V_{W2}(e_L; \Delta K; \lambda, W; \alpha, t) = \underset{e_L}{Max} \left\{ \alpha \cdot E_{\varepsilon}(\tilde{K}_{W2}) \cdot \lambda Q + \Phi(\Delta K + \Delta e) \cdot W - C(e_W) \right\}$$

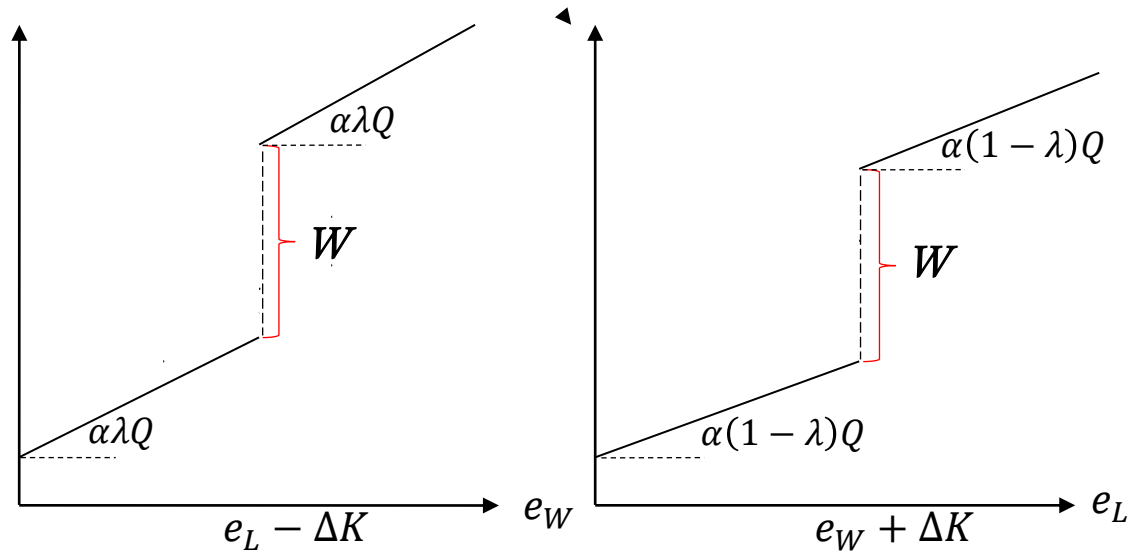
$$V_{L2}(e_W; \Delta K; 1 - \lambda, W; \alpha, t) = \underset{e_L}{Max} \left\{ \alpha \cdot E_{\varepsilon}(\tilde{K}_{L2}) \cdot (1 - \lambda)Q + \{1 - \Phi(\Delta K + \Delta e)\} \cdot W - C(e_L) \right\}$$

where  $\Phi(\Delta K + \Delta e) := Pr(\tilde{K}_{2W} > \tilde{K}_{2L}) = Pr(\Delta K + e_W - e_L > \varepsilon_L - \varepsilon_W)$   
the probability that the winner in the first period wins again in the second period competition, given  $e_W$  and  $e_L$ ,  $\Delta K = (1 - t)(h_W - h_L)$ .

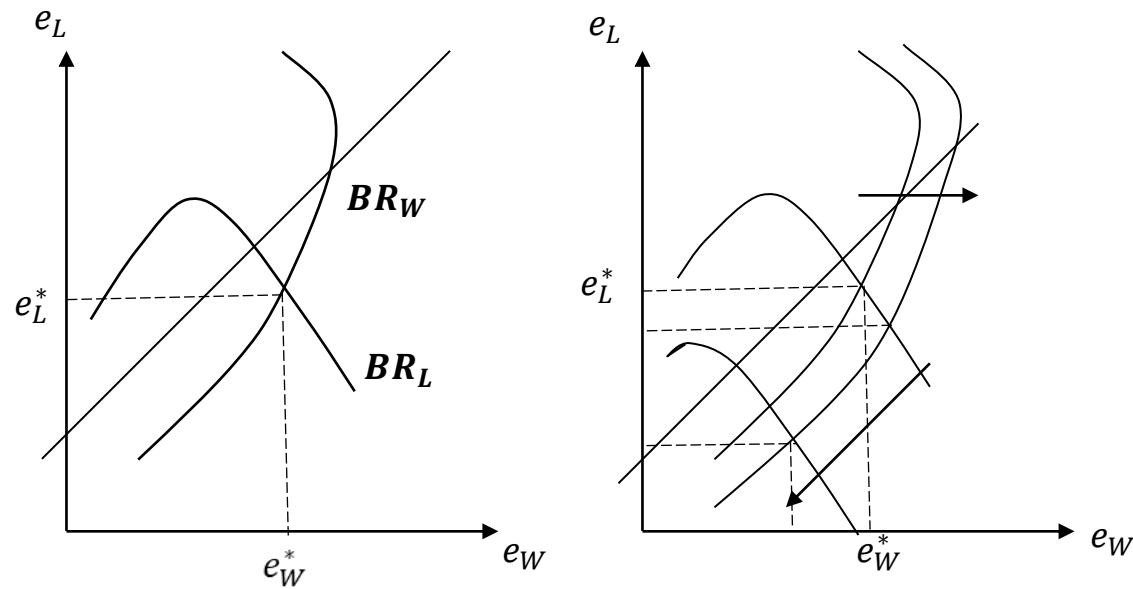
- **F.O.Cs (Second Period)**

$$\alpha \cdot \lambda \cdot Q + \phi(\Delta K + e_W - e_L) \cdot W = C'(e_W)$$

$$\alpha \cdot (1 - \lambda) \cdot Q + \phi(\Delta K + e_W - e_L) \cdot W = C'(e_L)$$



**Tournament Schemes in the Second Period with production allotments  $\lambda$ ,  $1-\lambda$**



“Asymmetric” Nash Equilibrium

Effect of the increase in  $\lambda$   
(When **Feedback Effect is greater**)

The expected equilibrium values that each agent will obtain in the second period are,

$$V_{W2}^* = \alpha \cdot \lambda \cdot Q(K_{i2} + e_W^*) + \Phi * W - C(e_W^*) \quad \text{when he won in the first period}$$

$$V_{L2}^* = \alpha \cdot (1 - \lambda) \cdot Q(K_{i2} + e_L^*) + (1 - \Phi *)W - C(e_L^*)$$

when he lost in the first period

The difference between these equilibrium profits is,

$$\Delta V^*(K_{i2}; \lambda, W; \alpha, t) = \alpha(2\lambda - 1)QK_{i2} + \underbrace{\{\alpha Q[\lambda e_W^* - (1 - \lambda)e_L^*] + (2\Phi^* - 1)W - [C(e_W^*) - C(e_L^*)]\}}_{\bar{v} - \underline{v}}$$

where  $K_{i2} = E_{\varepsilon}(\tilde{K}_{i1}) + t \cdot E_{\varepsilon}(\tilde{K}_{j1}) = h_i + t \cdot h_j \quad i \neq j, i = 1, 2$

This is ***a discrete prize, which positively induces ex-ante (first period) incentives*** from the agents when  $\lambda > 1/2$ , and this prize establishes the ex-ante competition.



## (2) First Period

- **Tournament scheme in the first period** is endogenously generated through the allotment scheme  $\lambda, 1-\lambda$ .

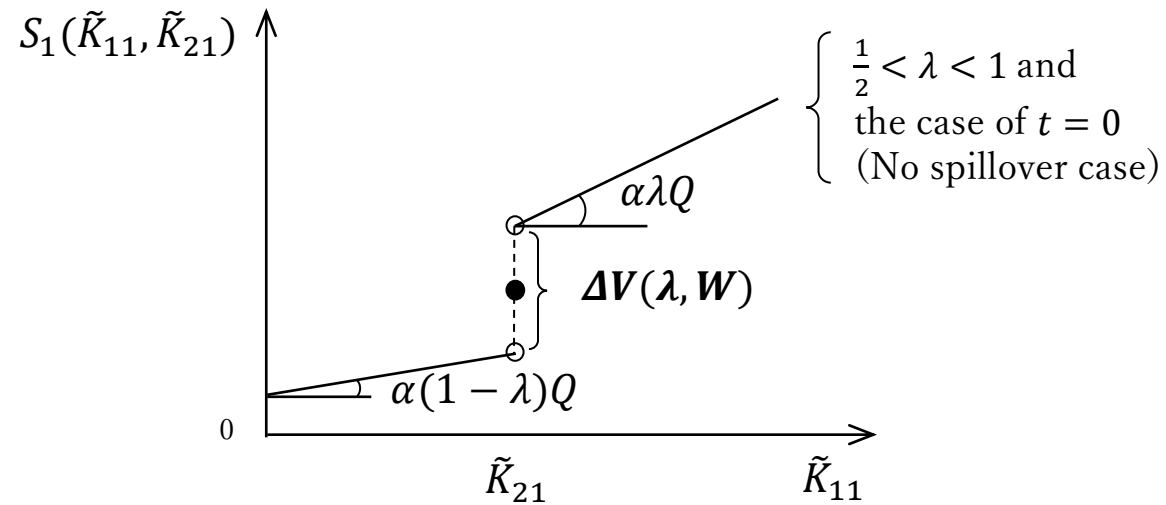


Figure 3 Tournament Scheme Faced by Agent 1 in the First Period.

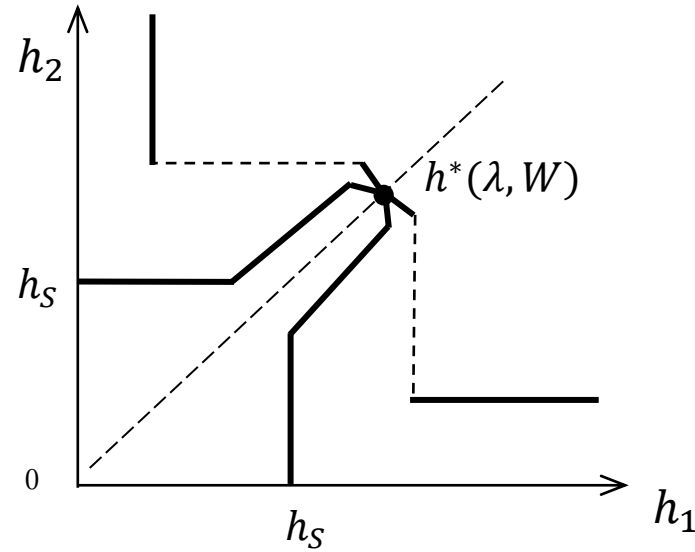


Figure 4 Equilibrium Investment Level  $h^*(\lambda, W)$  in the First Period.

$h^*(\lambda, W)$  is characterized by the F.O.C

$$\underbrace{\frac{\alpha Q}{2}}_{\text{Direct Effect}} + \underbrace{(1-t)\phi(e_W^* - e_L^*)W}_{\text{Marginal Strategic Effect}} + \underbrace{[\alpha Q(2\lambda - 1)(1+t)h^* + \bar{v} - \underline{v}]}_{\text{Discrete Tournament Effect}} f(0) = g'(h^*)$$

## 4. Heterogeneous Tournaments with different bargaining powers (ownership ratios)

We focus on **the heterogeneous tournament** between a **POE  $\alpha_P$**  and an **SOE  $\alpha_S$** ,  $0 \leq \alpha_S < 1/2 \leq \alpha_P \leq 1$ , which implies the **heterogeneous competition** under **incomplete contracting** situations suggested by Hart, Shleifer, and Vishney (1997).

POE $\alpha_P$	$\lambda$	$1 - \lambda$
SOE $\alpha_S$ ,	$1 - \lambda$	$\lambda$

### Case1: Common Prize $W$

When  $\frac{\lambda}{(1-\lambda)} > \frac{\alpha_P}{\alpha_S} \Leftrightarrow \alpha_P(1-\lambda) < \alpha_S\lambda$ , where **the difference in quantity assignment is more effective** than **the difference in bargaining powers (ownership ratios)**. Standard Case.

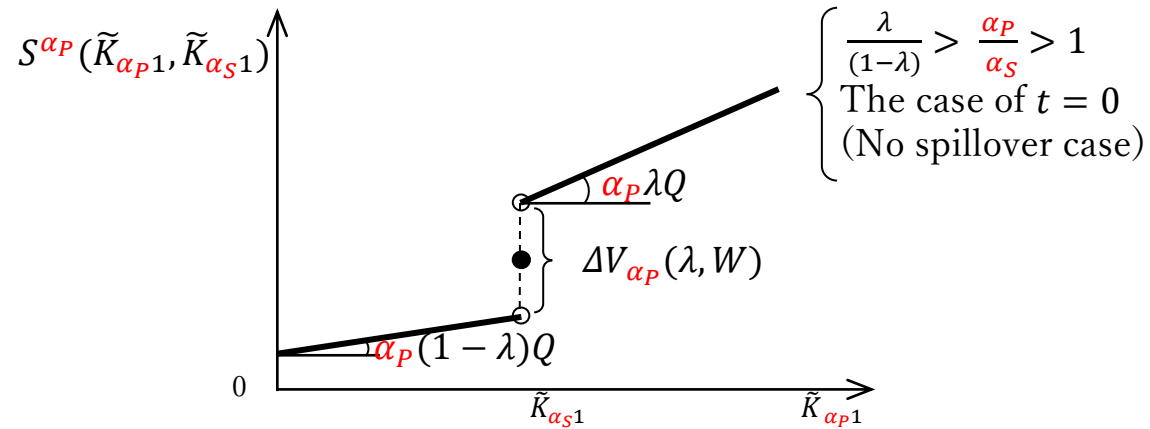


Figure 6.1 Tournament Scheme Facing Agent  $\alpha_P$  in the First period.

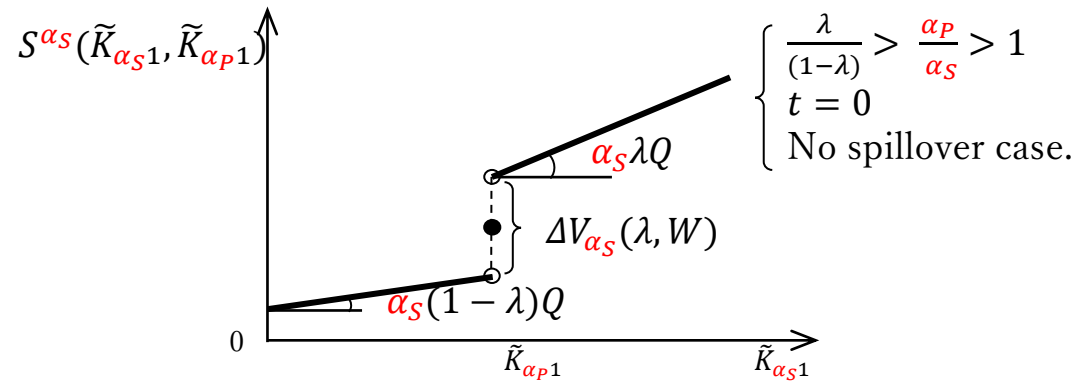


Figure 6.2 Tournament Scheme Facing Agent  $\alpha_S$  in the First Period.

In the heterogeneous tournaments, **the difference in equilibrium profits (*the prize*) is different** for both.

**Prize for POE  $\alpha_P$**  is  $\Delta V_{\alpha_P}(\alpha_P Q, K_{\alpha_P 2}, \lambda, W)$   
 $= \alpha_P(2\lambda - 1)QK_{\alpha_P 2} + \{\alpha_P Q[\lambda e_P^W - (1 - \lambda)e_P^L] + (\Phi^{\alpha_P} + \Phi^{\alpha_S} - 1)W - [C(e_P^W) - C(e_P^L)]\}.$

**Prize for SOE  $\alpha_S$**  is  $\Delta V_{\alpha_S}(\alpha_S Q, K_{\alpha_S 2}, \lambda, W)$   
 $= \alpha_S(2\lambda - 1)QK_{\alpha_S 2} + \{\alpha_S Q[\lambda e_S^W - (1 - \lambda)e_S^L] + (\Phi^{\alpha_P} + \Phi^{\alpha_S} - 1)W - [C(e_S^W) - C(e_S^L)]\}.$

**Discrete Prizes for the heterogeneous agents  $\alpha_P, \alpha_S$**  in the first period are **different** between the two.

## [Proposition 9].

In **the heterogeneous tournaments** with **a common prize  $W$**  between the POE  $\alpha_P$  and the SOE  $\alpha_S$ , each of whom faces a different tournament scheme, **the POE with greater bargaining power (ownership ratio)  $\alpha_P > \alpha_S$  will win the tournaments.**

However, at the **asymmetric equilibrium** in the first period, the increase in the winner  $\alpha_P$ 's investment may greatly reduce the loser  $\alpha_S$ 's investment, which in turn may greatly reduce the winner's investment, due to **the feedback effect**. This decline in equilibrium incentives could be a serious problem.

- The effect of **handicapping more lucrative companies  $\alpha_P$**  (or giving **subsidies in favor of SOEs  $\alpha_S$** ).

- When  $\frac{\lambda}{(1-\lambda)} < \frac{\alpha_P}{\alpha_S} \Leftrightarrow \alpha_P(1-\lambda) > \alpha_S\lambda$  holds, where **the difference in bargaining powers (ownership ratios) is more effective than the difference in quantity assignment.**

### [Corollary 3].

In **the heterogeneous tournaments with a common prize  $W$** , where the difference in bargaining powers (ownership ratios) is more effective than the difference in quantity assignment, **the POE  $\alpha_P$  will win and the SOE  $\alpha_S$  will lose** in the second period, **regardless of whether they won or lost in the first period.** Thus, **the size of the discrete prize becomes smaller** for both, which makes it difficult to induce incentives in the first period. This will bring about a decrease in competitive pressure.

## Case 2: Different Prizes for the POE $\alpha_P$ and the SOE $\alpha_S$

- We change the setting of the common monetary reward  $W$ , and consider a case in which the SOE receives a greater monetary (nonmonetary) reward than the POE. In other words, the POE does not receive as much reward as the manager of the SOE. This could be an institutional situation in which the manager of the SOE has a clear path to promotion to a high position in the government and other ancillary benefits by winning the competition, while the manager of the POE does not have these benefits.
- In short, the prizes for the two enterprises are different, and let us assume that the discounted prize of the POE is  $\theta \cdot W$ ,  $0 \leq \theta \leq 1$ .



- The solution of the simultaneous equations of (13 D) and (14 D) represents **the Nash equilibrium of the second period.**

$$\alpha_P \cdot \lambda \cdot Q + \phi(\Delta K + e_W - e_L) \cdot \theta \cdot W - C'(e_W) = 0.$$

$$\alpha_S \cdot (1 - \lambda) \cdot Q + \phi(\Delta K + e_W - e_L) \cdot W - C'(e_L) = 0.$$

The threshold  $\theta^*$  for the POE  $\alpha_P$  to make larger investments in the second period equilibrium is then determined by the equality :

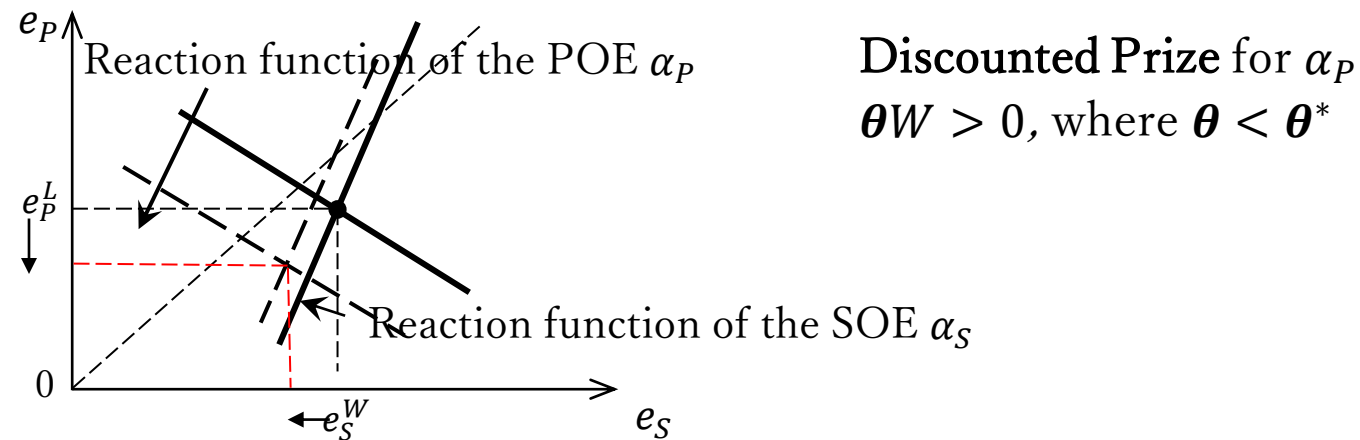
$$\alpha_P \cdot \lambda \cdot Q + \phi(\Delta K) \cdot \theta \cdot W = \alpha_S \cdot (1 - \lambda) \cdot Q + \phi(\Delta K) \cdot W. \quad (37)$$

- We have **the threshold** as  $\theta^* = 1 - \frac{(\alpha_P \cdot \lambda - \alpha_S \cdot (1 - \lambda))Q}{\phi(\Delta K) \cdot W}$ .

When  $\theta > \theta^*$ , the POE  $\alpha_P$  can invest more at the second period equilibrium, and the analysis of heterogeneous tournaments *with common prize* can be almost applied.

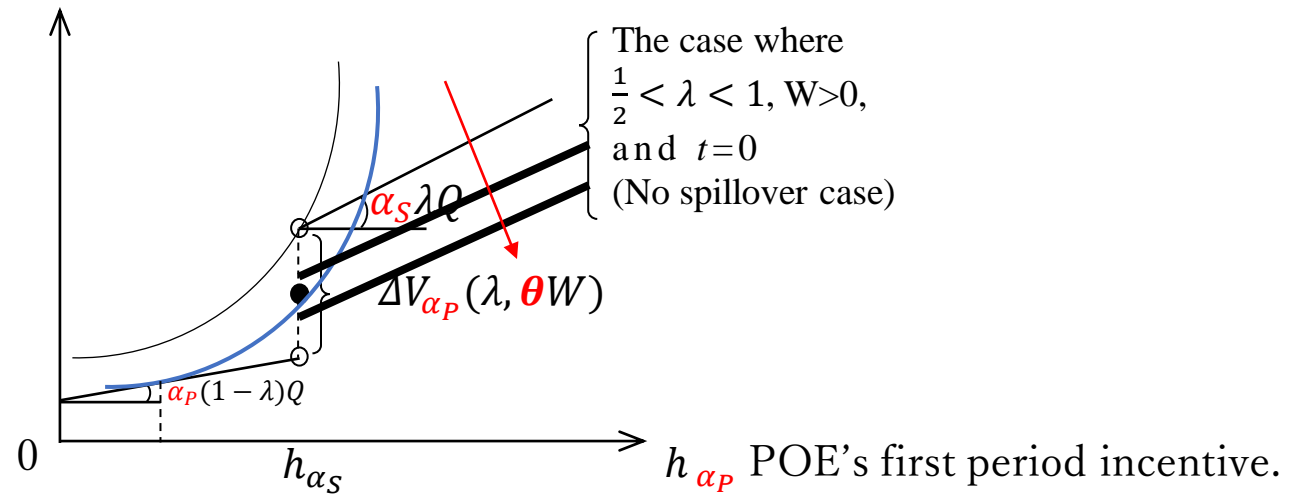
When  $\theta < \theta^*$ , the SOE  $\alpha_S$  always invests more (the winner), and the POE  $\alpha_P$  always invests less (the loser) at the second period equilibrium, which brings about the adverse effect due to the “Cronyism”.

- The unfair competitive environment (“Cronyism”)



Adverse Effect of “Cronyism”: **Decline of Competitive Pressure.**

# Tournament in the first period under “Cronyism” $\theta < \theta^*$



This artificially produces the result of “**Guo jin min tui**” (the state advances, the private sector retreats: the SOE is the winner and the POE is the loser), and imposes a large handicap on the POE  $\alpha_P$ , which should have a larger investment incentive. This policy therefore violates the principle of competition in the sense of allowing the inefficient SOE to win, with very **inefficient consequences**.

If this aspect (“**cronyism**”) exists in "controlled competition," institutional design should be rectified to create a **more equitable competitive environment, thereby improving efficiency**. The "overly discounted, competition-inhibiting, and discriminatory prize" (“**cronyism**”) can be viewed as "government failure", and should be corrected to build a fair competitive environment and appropriately revive competitive pressure.

### [Proposition 10].

In the heterogeneous tournaments with different prizes between the POE and the SOE, the adverse effect due to the “**cronyism**” (unfair competitive environment) could occur, which would bring about the large decline of competitive pressure and very inefficient consequences. Institutional design should be rectified to create a more equitable competitive environment, thereby improving efficiency.

- In terms of Acemoglu, Laibson, and List (2021), **Equity and Efficiency are not in conflict in this case**. Great inequity  $\theta < \theta^*$  due to “**cronyism**” creates distortions by preventing the POE from competing the SOE on a level playing field. When the inequity  $\theta < \theta^*$  is very high, there would be a greater benefit of reducing inequity in terms of efficiency.

# Review of the Talk

- A model analysis of "**controlled competition**" under "**state capitalism**" where the government participates in the market as an active player, as in China, Singapore and the industrial policies of former Japan.
- A dynamic tournament between heterogeneous players with different bargaining powers (ownership ratios) under an incomplete contract situation in relation to the Chinese ownership system.
- Close investigation of **the incentive mechanisms** (through **allotment scheme** and **prize**) built into "**controlled competition**" and **their problems**.
- Overly anti-competitive and discriminatory prizes ("**cronyism**") have greatly reduced investment incentives (efficiency) for both state-owned and private-owned firms, and the institution needs to be redesigned to **a more level playing field** in order to maintain competitive pressures.
- Consistent with Acemoglu and Robinson's (Why Nations Fail 2012) negative view on China's sustainable economic development. "**Cronyism**": "**Extractive**" institution by the {Government, SOE} coalition severely impedes the incentive of POE ("**crowding out**") and, through feedback effect, also reduces the incentive of SOE. This would lead to a decline in economic development, which seems to be particularly significant in the Xi Jinping administration since the late 2010s.