

# Social Heterogeneity and Optimal Mix between Public and Private Provision of Public goods<sup>\*</sup>

Yongqin WANG    Haibo XU

**Abstract:** With a framework of incomplete contract, this paper shows that for provision of public goods such as Medicare and education, pure privatization can't promote competition. On the contrary, the co-existence of public and private provision can enhance *de facto* competition. Two competitive effects are identified. When consumers are heterogeneous, the co-existence of public and private ownership gives consumers freedom to choose from different ownership, improving allocation efficiency (*Tiebout effect*). While consumers are homogeneous, the co-existence can promote yardstick competition, squeezing out information rents from both ownerships, improving production efficiency (*benchmarking effect*). In either case, the co-existence dominates unique ownership. The paper ends up with some implications for China's Medicare and education reforms.

**Keywords:** social heterogeneity    public goods    optimal mix

**JEL classification:** H410, L330, L390

## 1. Introduction

The proper boundary between government and market makes for the centerpiece in economics. General consensus among economists is easily achieved on pure competitive private goods being provided by market. However, in economic theory or in real-world policymaking, there is more conflict than concord when it comes to the provision of public goods, especially the supply of "soft" public goods or public services such as Medicare and education. Partly because of the lack of general guiding theories, we can see various institutional arrangements, which correspond to different social models such as the Scandinavian model, German model, American model, etc. In recent years we have observed that in the provision of such public goods as Medicare and education, countries with varied social models are all dissatisfied with the status quo and eager to make necessary changes<sup>1</sup>.

Public services like education and Medicare have the following special properties: First, unlike search goods, the quality of experience goods is not known *ex ante*. Their quality can only be known *ex post*. Second, the provision of such public services entails complex expertise that cannot be judged or verified by consumers or a third party. Theoretically, service is a typical moral hazard (hidden action) variable; the quality of service is mostly determined by service providers' behavior and is to some extent independent of price. In this case price is not a sufficient statistic and hence cannot give full information on quality: high price does not necessarily mean high quality and in some cases high price and poor quality coexist. For these public services, simply privatization may not achieve the production efficiency and allocation efficiency. Taking into account the fact that education and Medicare have substantial influence on human capital, economic development, income distribution and social welfare, the reforms in these sectors undoubtedly become the most important and intricate part of social reforms. Both market and government failures often occur in transition or

---

<sup>\*</sup> China Center for Economic Studies, Fudan University, emails: yongqinwang@fudan.edu.cn, 042015035@fudan.edu.cn. We thank Te Bao, Zhao Chen, Ming Lu, Yew-Kwang Ng and Teague Savitch for valuable comments. The usual disclaimers apply.

<sup>1</sup> Relevant articles can be found in various issues of *the economist* in recent years.

developing economies due to imperfect information and institutions, making public service sectors even worse.

Reforms in the education and Medicare sectors have not yet been completed in China. Under China's decentralization reform, yardstick competition among same level jurisdictions based on GDP growth rate provides enough incentive for local governments to start the process of privatization, which solves the issue of reforms in the area of competitive private goods. In addition, local governments are active in infrastructure development to attract more investment. Although "hard" public goods like infrastructure are well in place, provisions for "soft" public services such as education and Medicare still leaves much to be desired (Wang *et al.*, 2006). Considering that these public service sectors play a significant part in the development of human capital and social welfare, whether their reforms are successful or not, will determine the destiny of overall economic reforms of China.

The reforms in these sectors pose some challenging questions for economists. The first question is, since public goods can be provided either by government or by private enterprises, what are the differences in the incentive structures and performances between these two ownerships? The second is, if the two ownerships coexist, what are the interactions between them? Related to the second question, the third question asks what is the relationship between ownership and competition? Does privatization promote competition? Or further, on what conditions does competition function well in these sectors?

The starting point for any theory of privatization is the benchmark result of property right irrelevance by Sappington and Stiglitz (1987): Given that the government is benevolent and unrestricted in contracting, property rights are irrelevant even if there is information asymmetry. So to examine the three questions above mentioned, one must relax the assumptions, either the assumption of complete contract or benevolent government or both. On the basis of incomplete contract theory, Hart, *et al.* (1997) and Glaeser and Shleifer (1998) addressed the first question. Hart, *et al.* (1997) argues that effort in the management can improve efficiency in two dimensions: cost and quality. However, attempts to lower cost will further jeopardize quality. Managers of state-owned firms have only part of the residual rights of control and thus have insufficient incentive to lower cost or improve quality. Their counterparts in private-owned firms have full residual rights of control. Loss in product quality due to cost reduction will be fully absorbed by the society, and benefits generated from quality improvement will be shared with the society. Hence incentive in cost dimension will be above the socially optimal while incentive in quality dimension is quite the opposite. A comparison between efficiency of public-owned and private-owned firms is in essence a cost and benefit analysis for various incentives. Simply put, private-owned firms have the incentive to reduce cost (cutting corners) and thus product quality suffers<sup>2</sup>; On the contrary, state-owned companies have no incentive to lower cost (costs) and can assure product quality<sup>3</sup>. Glaeser and Shleifer(1998) developed a theory on the role that not-for-profit organizations play in provision of public goods such as Medicare and education. There is lower incentive in not-for-profit organizations to pursue profits by any means and thus less severe moral hazard problems. However, these literatures<sup>4</sup> examined incentive characters and performance of public-owned or private-owned firms independently. They did not look at interactions between these two sectors and more delicate organization forms somewhere in between these two extremes (say, public private partnership). Also there was no clear objective function of the government. In reality, the government always chooses a certain combination of public and private sectors, esp. for the government of transition economies. So these literatures left the latter two questions unanswered.

This paper attempts to fill the void. We introduce some key assumptions: (1) Consumers are heterogeneous and they buy goods or services directly from firms. In so doing we expand the model of Hart *et*

---

<sup>2</sup> The privatization of American prisons shows this clearly. Though privatization reduced cost, the quality of service deteriorated and abuse of prisoners became common (Hart *et al.*, 1997).

<sup>3</sup> A case for this is that Lufthansa's service is too good (Hart *et al.*, 1997).

<sup>4</sup> For a literature survey, see Wang and Bao (2006) .

*al* into a three parties game among firms, government, and consumers. The two extreme cases—totally public-owned or totally private-owned—are two optional elements for feasible sets of government mechanism design. The conclusions Hart *et al* drawn in their papers become special cases in this article. (2) As the mechanism designer, the government can directly design corresponding mechanisms to achieve social optimality. In addition, we introduce more direct incentive-punishment mechanism(s) into some modeling, for example, the model of a firm’s production decision. The richer analysis framework and implementation mechanism make this paper more robust and reality congruous.

This paper provides a normative theory that analyzes interactions between public and private provision of public goods and characterizes two effects—Tiebout effect<sup>5</sup> and benchmarking effect: When consumers are heterogeneous, multiple ownership arrangements allow consumers to “vote by feet” and thus satisfy different consumer preferences and enhance allocation efficiency. In this case Tiebout effect dominates. When consumers are homogeneous, public-owned firms and private-owned firms will take each other as a benchmark to facilitate yardstick competition. This way information rent has been squeezed, moral hazard lowered, and productivity improved. In this case benchmarking effect dominates.

The organization of this paper is as follows: Section two deals with social optimal ownership arrangement in the line of incomplete contract theory when consumers’ type is discrete. Section three examines social optimal ownership arrangement when consumers’ type is continuous and more general decision mechanism. Section four generalized the theories developed in previous sections by relaxing assumptions in some models and presents a more general theoretical explanation of coexistence of firms with multiple ownership structures. In the conclusion section, we summarize the main points of the paper and provide policy implications for China’s Medicare and education reforms.

## **2. Discrete model, separating equilibrium and Tiebout effect**

### **2.1 A framework of incomplete contract**

We assume benevolent governments maximize social welfare in choosing organizational form of the provision of public goods. There are several different ownership structures and accordingly different residual rights of control, incentive mechanism implementation and quality of the final product and service.

Case 1: Privatized firm. Due to incomplete information and unverifiable quality, the government cannot determine the quality of a product or service in the contract if the firm’s privatization contract is incomplete. In addition, after privatization, the owner of the firm (We use “manager” in stead in the following analysis based on the following assumptions: 1. The manager of a totally or partly private firm is also the owner, for example, in some small and medium-sized firms. 2. There is separation of ownership and control, but the owner can give sufficient incentive to the management, for example, a contracting mechanism with fixed rent, or stock options, etc.) has total residual rights of control, which means ex post profits derived from invention, innovation, or improvement all belong to the owner. So in this case there is highest incentive.

Case 2: Public-owned firm. Nominally, the government has the firm’s residual rights of control. However, due to incomplete contracts, the management can acquire part of the residual rights of control and enhance personal well-being by “perks”, for instance, luxurious office, expensive car, long vacation, and extravagant travel at the firm’s expense. Compared with case 1, the manager’s incentive is lower here.

Case 3: Partly private firm. In this case, the residual rights of control the manager has are between Case 1 and Case 2. The manager’s benefits are “perks” plus part of the firm’s profits in proportion to his share in the

---

<sup>5</sup> Tiebout (1956) is among the first to argue that consumers can reveal their preference for local public goods by freely choosing locations. Under restricted conditions like free mobility among others, provision of local public goods can be as Pareto-efficient as private ones. “Voting by feet” here shares the same spirit, *albeit* more in an institutional and organizational sense, rather than a spatial sense. In this regard, the school voucher initially suggested by Milton Friedman (Friedman, 1962) have the same flavor.

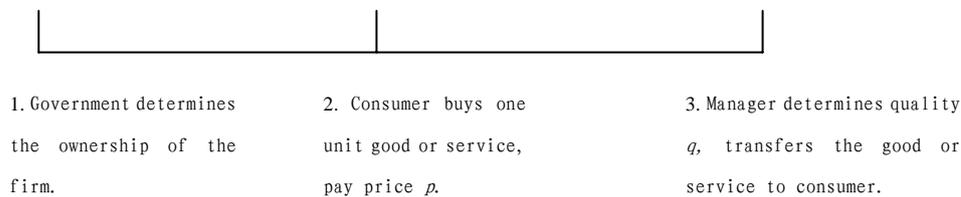
firm. Hence, the incentive level is also in between case 1 and case 2.

The other two ownership forms include not-for-profit organizations and public-private partnerships. For the former, either private organization or public organization is possible. One characteristic is that profits are allocated to managers and employees in the form of “perk” or reinvestment. From the perspective of a manager, even if he is in a private organization; he has only part of residual rights of control. As far as incentive is concerned, it is similar to the case of public owned firms. A public-private partnership, however, can be taken as a model in which government and the private sector substitute “relational contract” for spot transaction, that is to say, a series of transactions are bundled together. It has a similar effect on the manager’s incentive as mixed ownership. In the following analysis our main concern is what impact ownership has on incentive, so we focus on the previous three cases.

The number of residual rights of control the manager has determines his incentive to lower costs and improve profits. This in turn influences the quality of final products or services.

## 2.2 Discrete Equilibrium and Separating Equilibrium

Firm—government—consumer analysis framework is a three-phase game. The timing is as follows:



Now we solve this game using backward induction: In phase three, based on incentive, the manager determines quality  $q$ ; In phase two, consumers rationally expect quality of product or service from the firm’s ownership structure and pay price  $p$ ; In phase one, government maximizes social welfare functions and designs the optimal firm ownership structure. In our model, we assume the quantity of consumers and firms are normalized.

### Phase 3: Firm’s decision making

At the beginning of this phase, the firm has received consumers’ paid price  $p$ , so the ex post quality is irrelevant to price. Total revenue for the firm is:

$$V = p - c(q) - b(q^* - q) \tag{1}$$

There is a two part cost for providing products or services with quality  $q$ : direct production cost  $c(q)$  and manager’s decision cost  $b(q^*-q)$ . The former satisfies the usual convexity condition,  $c' >0$ ,  $c'' >0$ ,  $c(0)=0$ ; Decision cost is equivalent to non-monetary punishment when a firm manager decides to produce low quality  $q$ . For instance, if college education and research quality are poor during a president’s administration, it must have an influence on his reputation and career.  $q^*$  is a constant which denotes the highest quality level for a given social technology. The larger  $q^*-q$  is, the bigger firm manager’s decision cost will be, which means the more punishment the manager will take.  $p-c(q)$  is the firm’s monetary profit.

Assume private share in the firm is  $\phi$ ; the ratio of firm manager’s “perk” to the firm’s profit is  $\alpha$ , then the manager’s optimal decision is:

$$\max_q \alpha(p - c(q)) + (1 - \alpha)\phi(p - c(q)) - b(q^* - q) \tag{2}$$

The first term denotes the manager’s “perk” from the firm’s profit; the second term is the manager’s earnings in proportion to his private share in the firm. The sum is the manager’s total revenue generated from

residual rights of control. The last term is the manager's decision cost. The manager's decision is based on weighting revenue against cost. Solve equation (2), we get:

$$c'(q) = \frac{b}{\alpha + (1-\alpha)\phi} \quad (3)$$

We get comparative results with regard to  $\alpha$ ,  $\phi$  and  $b$ :

$$c''(q) \cdot \frac{dq}{d\alpha} = -\frac{b(1-\phi)}{(\alpha + (1-\alpha)\phi)^2} \Rightarrow \frac{dq}{d\alpha} \leq 0 \quad (4)$$

$$\text{Similarly, } \frac{dq}{d\phi} \leq 0, \frac{dq}{db} \geq 0 \quad (5)$$

the larger  $\alpha$  and  $\phi$ , the more residual rights of control the manager has, then the more incentive for the manager to lower cost and enhance revenue. The consequence is lower quality. On the contrary, the larger  $b$  is, the more severe punishment the manager will get, and the smaller the incentive to lower cost and thus the higher the quality.

If  $\phi=1$ , the firm is wholly private. Let quality be  $q_p$ , then  $c'(q) = b$ ;

If  $\phi=0$ , the firm is wholly public. Let quality be  $q_g$ , then  $c'(q) = b/\alpha$ .

## Phase 2: Consumer's decision making

Consumer utility function:

$$U = y - p + \theta q$$

$y$  is the income of a consumer;<sup>6</sup>  $\theta$  is the consumer's evaluation of quality, or the consumer's type. In the model in this section, we assume discrete type structures: the ratio of consumer type  $\bar{\theta}$  is  $\pi$ , and  $\bar{\theta} > 1$ ;  $(1-\pi)$  consumer type is  $\underline{\theta}$ , and  $\underline{\theta} < 1$ . There is linear market price mechanism:  $p = z - (q^* - q)$ ; Assume  $z$  is sufficiently large, so the consumer will always buy this unit product or service and will not exit the market. The farther  $q$  is from  $q^*$ , the lower price the consumer is willing to pay. The consumer's optimal decision is:

$$\max_q U = y - z + q^* + (\theta - 1)q \quad (6)$$

For consumers whose  $\bar{\theta} > 1$ , the higher  $q$  the better, for when marginal unit quality increases, the increase in consumer's welfare  $\bar{\theta}$  always exceeds 1. On the contrary, for type  $\underline{\theta} < 1$  consumers, the lower quality the better. Since there are heterogeneous consumers, demand for quality is always discrete.

## Phase 1: Government's decision making

The government maximizes social welfare function:

---

<sup>6</sup> We here assume that consumers' preferences or types are exogenous and independent of incomes. For simplicity, we also assume that they have same income. Relaxation of the assumptions will not affect the conclusions of the paper.

$$W = U + V = y - bq^* + (\theta + b)q - c(q) \quad (7)$$

When increasing one marginal unit of quality generates the same social revenue and social cost, it is social optimal.

Government may use two different decision approaches. The first is: choosing different firm ownership structures, which encourages managers to provide different product or service qualities to satisfy heterogeneous consumers' demand:

$$W_1 = \max_{\bar{q}, \underline{q}} \pi(y - bq^* + (\bar{\theta} + b)\bar{q} - c(\bar{q})) + (1 - \pi)(y - bq^* + (\underline{\theta} + b)\underline{q} - c(\underline{q})) \quad (8)$$

$\bar{q}$  is high quality product or service the firm produces, and  $\underline{q}$  is the opposite. There is no adverse selection in consumers' demand for quality. That is to say, type  $\bar{\theta}$  consumers will not pretend to be type  $\underline{\theta}$  and choose quality  $\underline{q}$ . So when it is optimal, the ratio of firms with high quality must be  $\pi$ , which is matching with type  $\bar{\theta}$  consumers. Solve for separating equilibrium, and we get:

$$c'(\bar{q}) = \bar{\theta} + b \quad (9)$$

$$c'(\underline{q}) = \underline{\theta} + b \quad (10)$$

The second decision making method a government uses is: let there be only single type firms in the market, say, all public owned or private owned, and thus consumers are provided with products or services of the same quality.

$$W_2 = \max_q y - bq^* + (\pi\bar{\theta} + (1 - \pi)\underline{\theta} + b)q - c(q) \quad (11)$$

Solving for pooling equilibrium:

$$c'(q) = \pi\bar{\theta} + (1 - \pi)\underline{\theta} + b \quad (12)$$

From basic principles of mathematical programming, we know  $W_2$  is the optimal solution when  $W_1$  is under constraint  $\bar{q} = \underline{q}$ . Thus  $W_1 \geq W_2$  holds in the domain of definition. Separating equilibrium is dominant over pooling equilibrium.

At separating equilibrium firms of two different types have the following optimal ownership structures respectively:

$$c'(\bar{q}) = \bar{\theta} + b = \frac{b}{\alpha + (1 - \alpha)\bar{\phi}} \Rightarrow \bar{\phi} = \frac{b - \alpha(\bar{\theta} + b)}{1 - \alpha} \quad (13)$$

$$\text{Similarly,} \quad \underline{\phi} = \frac{b - \alpha(\underline{\theta} + b)}{1 - \alpha} \quad (14)$$

where  $\bar{\phi}$  is private share in the firms that provide a high quality product or service, and  $\underline{\phi}$  is the opposite. When it is socially optimal, the ratio of type  $\bar{\theta}$  firm is  $\pi$  in the market; and  $1 - \pi$  for type  $\underline{\theta}$

firm, which correspond to type  $\bar{\theta}$  and  $\underline{\theta}$  consumers respectively.

When consumers' heterogeneity is very large, this means  $\bar{\theta}$  is very large and  $\underline{\theta}$  is very small,

$c'(\bar{q}) = \bar{\theta} + b \rightarrow b/\alpha$ ,  $\bar{\phi} \rightarrow 0$ , High quality products or services are provided all by public owned firms.

$c'(\underline{q}) = \underline{\theta} + b \rightarrow b$ ,  $\underline{\phi} \rightarrow 1$ , low quality products or services are provided all by private owned firms.

We summarize the above analysis in the following proposition.

**proposition1:** Separating equilibrium is dominant over pooling equilibrium. When there are two discrete consumers types  $\bar{\theta}$  and  $\underline{\theta}$ , there will be firms of two corresponding ownership structures in the market —  $\bar{\phi}$  and  $\underline{\phi}$ , which can achieve social optimality. When consumers' heterogeneity is very large, the coexistence of public owned firms and private owned firms is an optimal market structure.

**proposition2:** In some special cost function cases, separating equilibrium is degraded to pooling equilibrium.

(a) Cost function  $c(q)$  is supplanted by  $\varepsilon c(q)$ ; if  $\varepsilon \rightarrow 0$ , all type firms will produce same quality product or service,  $q=q^*$ .

(b) Cost function  $c(q)$  is taken place by  $\eta c(q)$ ; if  $\eta \rightarrow \infty$ , quality also converge,  $q=0$ .

In case (a), even if type  $\underline{\theta}$  consumers with low marginal evaluation of quality consume the highest quality  $q^*$ , the socially optimal result can also be attained; Marginal revenue invariably exceeds marginal cost.

In case (b), even if type  $\bar{\theta}$  consumers with high marginal evaluation of quality consume strictly positive quality, marginal cost will exceed marginal revenue. Thus social welfare will stay in low quality level  $q=0$ .

### 2.3 Tiebout effect

Our propositions show that, when consumers are heterogeneous, multiple ownership structures allow consumers to choose from different quality and price combinations and then improve allocation efficiency. We call this effect "Tiebout effect" of public product provision. In the competitive private goods area, it is not necessary for different ownerships to coexist since market competition will lead to general equilibrium of convergent price and quality combination. A more general implication of this effect is that in nations or areas with heterogeneous social structures (different strata out of income difference), it is always better to provide public goods by multiple ownerships than by a single ownership. Competition here takes the form of Tiebout mechanism-- "voting by feet".

## 3 Continuous Model and Adverse Selection in Matching

### 1. Continuous model and separating equilibrium

Conclusions drawn from the discrete model are instinctive and insightful. This section expands the discrete

model in the following aspects: ①Consumers' type is continuous. In interval $[\underline{\theta}, \bar{\theta}]$  cumulative probability distribution is 1 and probability density is  $f(\theta)$ . ②Consumers' evaluation of quality satisfies the concave condition. Compared with linear evaluation  $\theta q$  in the previous model, a concave function is more general, which assures that consumers' optimal demand for quality will not diverge. We assume here the concave function is  $2\theta q^{\frac{1}{2}}$ .

Consumers' optimal decision:

$$\max_{q_i} U = y - p + 2\theta_i q_i^{\frac{1}{2}} = y - z + (2\theta_i q_i^{\frac{1}{2}} - q_i) \quad (15)$$

Solve the above equation, we get:  $q_i = \theta_i^2$ .  $i$  means different individual in this equation.

So consumers' demand for quality is continuous in the interval $[\underline{\theta}^2, \bar{\theta}^2]$ .let  $\underline{q} = \underline{\theta}^2$ ,  $\bar{q} = \bar{\theta}^2$ , the continuous interval of quality demand is $[\underline{q}, \bar{q}]$ .

The firm's decision making mechanism is unchanged in phase 3; the continuous interval for quality provision is  $[q_p, q_g]$ .thus, production decision and consumption decision have different optimal quality distribution intervals.

This paper attempts to answer the question that in the feasible quality distribution intervals, whether separating equilibrium has more efficiency than pooling equilibrium. We focus on the overlapped part of  $[\underline{q}, \bar{q}]$  and  $[q_p, q_g]$  to see if there is an efficiency improvement from pooling equilibrium to separating equilibrium. Suppose now  $[q, \hat{q}]$  is the intersection of two intervals and correspondingly consumers' type interval is  $[\underline{\theta}, \hat{\theta}]$ .

In phase 1 the government's decision is still about comparison of social welfare:

$$\text{Separating equilibrium: } W_1 = \max_{q_i} \int_{\underline{\theta}}^{\hat{\theta}} [y - bq^* + 2\theta_i q_i^{\frac{1}{2}} + bq_i - c(q_i)] f(\theta_i) d\theta_i \quad (16)$$

$$\text{Pooling equilibrium: } W_2 = \max_q \int_{\underline{\theta}}^{\hat{\theta}} [y - bq^* + 2\theta_i q^{\frac{1}{2}} + bq - c(q)] f(\theta_i) d\theta_i \quad (17)$$

where  $q_i, q \in [q_p, q_g]$

Similar to the discrete case,  $W_2$  is the optimal solution of  $W_1$  under the constraint  $q_i = q_j$  ( $i, j$  belong to the definition domain). So in the continuous case  $W_1 \geq W_2$  is also satisfied and the separating equilibrium is superior to pooling equilibrium.

If  $[\underline{q}, \bar{q}]$  and  $[q_p, q_g]$  are not overlapped, say,  $\bar{q} \geq q_g$ , then some consumers' demand for quality is

beyond the highest level of quality the firm can provide and they will choose  $q_g$ . It means that at this point there will be a local pooling equilibrium, satisfying the social best under the constraints.

$$\text{Solve } W_1: c'(q_i) = \theta_i q_i^{-\frac{1}{2}} + b \quad q_i \in [q_p, q_g] \quad (18)$$

With the  $q_i$  solved from this equation and replaced into firm's decision, we can get corresponding private share  $\phi_i$  in the firm. Since optimal quality demand  $q_i$  is continuous,  $\phi_i$  is also continuous and its probability density is also  $f(\theta_i)$ .

If  $\underline{\theta} \rightarrow 0$ ,  $\bar{\theta} \rightarrow \infty$ , firm quality supply interval  $[q_p, q_g]$  is always included in consumers' quality demand interval  $[\underline{q}, \bar{q}]$ , optimal ownership structure is a continuous distribution with two extremes of totally public owned firms and totally private owned firms. At these two extremes there is consumers' local pooling equilibrium. This is summarized as the following proposition.

**proposition3:** If consumers' type is continuous in the interval  $[\underline{\theta}, \bar{\theta}]$ , there exists corresponding continuous firm ownership structure in the production interval that achieves social optimality. type  $\theta_i$  consumers and type  $\phi_i$  firms have the same probability density  $f(\theta_i)$ . When consumers' heterogeneity is very large, optimal ownership structure is a continuous distribution with two extremes of totally public owned firms and totally private owned firms.

If the cost function is like the extreme case in the discrete model, the separating equilibrium will be degraded to a pooling equilibrium.

## 2. Adverse selection in matching process.

In the discrete model, consumers' demand for quality is divergent; type  $\bar{\theta}$  consumers prefer high quality while type  $\underline{\theta}$  consumers prefer low quality. So in phase 2, there is no adverse selection in consumers' decision-making process.

However, this property does not hold in the continuous model. For type  $\theta_i$  consumers, given phase 1 social optimal quality decision  $c'(q_i) = \theta_i q_i^{-\frac{1}{2}} + b$  (marginal social cost equals marginal social revenue), at phase 2 consumers' decision making, this quality level is not optimal to consumers; Consumers' choice satisfies  $q_i = \theta_i^2$  (individual marginal cost equals marginal revenue) and thus the problem of adverse selection emerges. For example, for consumers  $i$  and  $j$ , in phase 1 government decision corresponding quality is 5 and 7 respectively that achieves greatest welfare efficiency; In phase 2 consumers' decision quality demand is 3 and 5 respectively that satisfies individual rationality. If consumer  $j$  has an information advantage or first move advantage and matches with the firm that produces products or services with quality 5, then consumers  $i$  have to choose the firm with quality 7, which will bring much distortion to personal welfare. This kind of adverse selection will not influence total social welfare, though, since no matter how much distortion there is, consumers will always buy the unit product or service. That is to say, such kinds of matching processes are ① optimal social production efficiencies and distorted personal allocation efficiencies.

The above analysis assumes consumers' type distribution  $\theta$  is common knowledge, which the government knows before phase 1 decision making. Now if we expand the game to include 4 phases with the following timing:

0. Consumer reports his type.	1. Government determines the ownership of the firm.	2. Consumer buys one unit good or service, pay price $p$ .	3. Manager determines quality $q$ , transfers the good or service to consumer.
-------------------------------	---	--	--

The matching process will generate distorted social production efficiency and optimal personal allocation efficiency. When they announce their type in phase 0, consumers can always achieve personal optimality by providing strategically false information. In the above example consumers'  $j$  may proclaim their type is  $\theta_i$ , so in the phase of government decision, the corresponding firm quality is 5, which satisfies consumer  $j$ 's *optimal* decision in phase 2. If all consumers take this strategy, there will be no "friction" in the phase 2 matching process and there will be optimal personal allocation.

Social welfare in this four-phase game is:

$$W_3 = \int_{\theta}^{\bar{\theta}} [y - bq^* + (2+b)\theta_i^2 - c(\theta_i^2)]f(\theta_i)d\theta_i \quad (19)$$

$W_3$  is the social welfare function when  $W_1$  is under the constraints  $q_i = \theta_i^2$  and  $q_i \in [q_p, q_g]$ . Thus,  $W_1 \geq W_3$ .

If there is an extra social cost  $C$  of "friction" in the matching process, for instance, if consumers  $i$  and  $j$  compete for the firm with quality 5, there may appear  $W_3 \geq W_1 - C$ . Social equilibrium with false type information will be superior to the social equilibrium when real type information is common knowledge. In fact this is a tradeoff between allocation efficiency and production efficiency.

## 4 Extensions

There are rather strict assumptions and constraints in the previous analysis. Comparison of influence on efficiency and social welfare of firms' ownership structures could be made in broader ways. We loosen some of the assumptions in this section to examine efficiency implication and policy significance of firms with different ownerships from a broader perspective.

### 1. Yardstick competition and dynamic efficiency

Implementation mechanism aside, in a general sense, coexistence of public owned firms and private owned firms will bring yardstick competition.<sup>7</sup> Optimal efficiency of separating equilibrium in the previous models is based on the following assumptions: ① Government pursues efficiency and maximizes social welfare function. ② Consumers are heterogeneous. ③ Static optimal comparison; There is no technical progress or dynamic efficiency. However, there will be yardstick competition even in cases where all the above assumptions don't hold. For example, the government cares more about social security or social equity, or consumers will not directly buy products or services and they are bought by the government with taxes. In these cases, heterogeneity does not play a substantial part while technology development can improve competition between public owned firms and private owned firms on a greater level and thus improve dynamic efficiency. Particularly, if they are homogeneous, the benchmarking effect derived from yardstick competition will dominate the "Tiebout effect" derived from the "vote by feet".

Assume initially public owned firm provides quality—price combination  $(q_0, p_0)$ , so consumers' reserve utility will be  $U_0 = y - p_0 + \theta q_0$ . Unless firms of other ownerships can provide quality—price combination  $(q, p)$

---

<sup>7</sup> Shleifer (1985) analysed a mechanism in which the price the regulated firm receives depends on the costs of identical firms. But such kind of competitive effect could be generalized into all of the markets, not only exists in regulated markets.

that satisfies  $U=y-p+\theta q \geq U_0$ , they cannot attract consumers from the market. In this case, public owned firms function as social security or a “valve”. Especially in experience goods market, this role is very important. If there is no public owned firm in the market, endogenous moral hazard will provide incentive for the firm to continuously lower cost and reduce the product or service quality level, which makes consumers’ utility  $U < U_0$ .

In fact, yardstick competition could internalize consumers’ reserve utility  $U_0$ , and achieve social welfare’s dynamic efficiency. From the initial  $U_0$ , unless different firms with different ownership structures provide  $U \geq U_0$ , they could not survive; To the next period, the quality—product combination  $(q_1, p_1)$ , provided by public owned firms, should satisfy  $U_1 \geq U$ , ( $U$  is the relatively low utility provided by part non-public owned firms in the first period), then the public owned firms could survive and function as social security; On the other hand, this provides incentives again for other firms with non-public ownership to adopt new technologies, provide more competitive quality—price combination  $(q', p')$ . Continued like this, public owned firms and non-public owned firms become each other’s yardstick. They compete with each other, internalize consumers’ reserve utility, and ameliorate the social welfare through the dynamic process. We conclude the ideas aforementioned into the next proposition.

**Proposition 4: If consumers are homogeneous, public service provision by multiple ownerships has a benchmarking effect out of yardstick competition. In this case, information rent of multiple ownerships will be reduced, efficiency enhanced and quality-price distribution will converge. From a dynamic perspective, it also improves technology development.**

## 2. Comparison of ownership forms and incentive mechanisms

In the previous models we assume there is no principal-agent problem between the firm’s owner and manager. This assumption lacks generality, especially for large firms and publicly listed companies. Simply put, there is also distortion of the incentive mechanism in private owned firms: the firm manager has only a small part of residual rights of control. To a large degree public owned firms and private owned firms confront the same problem in their decision making process, that is, incentive problems related to residual rights of control. The Incentive mechanism design is more important than choice of ownership structures. In principle, public owned firms could always mimic private owned firm’s incentive mechanism, and achieve the same efficiency level. On the other hand, a public owned firm has some political implicit incentives, such as promotion. Thus, public owned firm’s feasible set of incentive mechanism could be larger than private owned firm’s.

While in practice, private owned firm’s incentive mechanism could be more efficient than public owned firm’s. It could be explained from these dimensions:

(1) There exists a multilevel principal—agent relationship in public owned firms. More levers mean a less efficient incentive mechanism. To some extent, “public owned” is only a nominal fact, there is no entity that serves as a principle. Thus, public owned firms always face soft-budget constraints, and have lower incentive efficiency.

(2) A Public owned firm is a multi-tasked organization. As opposed to private firms with the single target of profit maximization, public owned firms usually need to take into consideration employment, environmental preservation, social justice, etc. These varied missions are either conflicting, such as profit pursuit and placement of the unemployed, or hardly measurable, such as social justice. Many difficulties in incentive mechanism design will emerge in this situation. Acceptable measures to take are providing weaker incentives such as fixed salary or increased use of some hidden incentive.

(3) There is distortion caused by political incentive mechanisms. The explicit incentive in a private owned firm has great correlation with firm’s profit; but the political incentive in a public owned firm is always affected by other factors, such as political elective cycles. The managers of public owned firms will spend

much more time and energy pursuing corruptive rent, thus impairing the firm's efficiency.

There exists another kind of "yardstick competition". Different forms of ownership structures could be studied together: public owned firm adopts more explicit incentive mechanisms, while private owned firms can mimic political incentive methods from the public owned firm. Both of them become each other's yardstick.

### **3. Corruption and paternalism**

We assumed previously the government is benevolent and maximizes social welfare. This way we omitted principal-agent relationship and incentive problems in political structure. The assumption will be relaxed in this section and the case where government officials are self-interested and pursue personal benefit will be examined. Hence we can make a comparison between efficiency of public owned firms and private owned firms from another perspective.

Similarly due to incomplete contract (government officials' incentive is a multi-task model with all tasks possibly conflicting with each other and unable to verify. Thus their responsibilities and rights cannot be well defined in the employment contract), government officials have part of residual rights of control. For instance, in phase 1 government decision-making, government officials have the discretion over what firms are privatized and what firms are kept publicly owned. This discretion creates a rent-seeking space. Assume now a government official colludes with a public owned firm manager and privatizes the firm in the form of bribery and rent seeking. In initial conditions (the firm is public-owned), the government official's revenue is 0; The manager's revenue is the part of "perk". The rest of the firm's profit is government revenue. After privatization, the firm's profit will be divided into two parts: government official's rent and firm manager's personal revenue. So in most cases, if there are no more constraints, this kind of cooperative game will always be implemented and what suffers is government revenue.

The above cooperative game only causes allocation efficiency distortion. Taking into consideration non-productive costs of rent-seeking, such as time-consuming bargaining between the government official and the firm manager and negligence of production tasks, social optimal production efficiency will also be distorted. Kaufman and Siegelbaum (1997) discussed corruption "before", "in" and "after" privatization. Generally speaking, occurrence of corruption and rent seeking is positively related to implemented government control. So in three phases of privatization, corruption occur more often than not in the privatization process, which cause serious distortions in social production efficiency and allocation efficiency.

"Soft budget constraint" is often taken as reason for low efficiency of public owned firms. But in China's transition economy it is not the only important reason. Because of the special political structure, officers will put more weights on firm's profits than consumers' surplus. Thus, monopoly firms always have huge profits, while the total social welfare could be seriously hurt.

Performance appraisal is the basis of incentive levels (such as salary grade, bonus, promotion, etc.), which is measured by indicators or statistical data. Public owned firms' profit is a definite number while consumers' welfare is hard to calculate. So the former is usually used to measure government officials' performance, which endogenously develops officials' preference to firms' profit and relevant incentive to certain behavior. Such performance appraisal mechanisms induce government officials to adopt policies that favor public owned firms and then to transfer social welfare. For example, to keep public owned firms in a monopoly position to get monopoly profit. These phenomena are commonly seen in a variety of domestic markets. According to economic theories, the stronger the monopoly power the more monopoly profit there will be. This creates a more serious distortion to social production efficiency and allocation efficiency.

"Paternalism" in China creates rather extreme phenomena. On one hand, a couple of large-sized monopoly state owned firms have huge monopoly profits; on the other hand, many firms with low efficiency

continue to enjoy favoring financial and policy support from the government. There are direct or indirect transfer of consumers' welfare in these two phenomena and enormous distortion of resource allocation and wealth allocation. From this perspective, private firms with much weaker government "paternalism" have more social efficiency in a general sense.

## 5. Policy implications

This paper provides a normative theory to analyze optimal ownership arrangements of public service provisions. The theory shows that coexistence of multiple ownership structures dominate single ownership structures no matter the consumers being heterogeneous or homogeneous. When consumers are heterogeneous, multiple ownership forms allow them to "vote by feet" and thus improve allocation efficiency. We call this effect "Tiebout effect". When consumers are homogeneous, the co-existence of various ownership forms could enhance yardstick competition, and alleviate "moral hazard" in firms of different ownership. Efficiency is thus enhanced. The theory has the following direct policy implications for public service reforms like education and Medicare reforms in China:

1. From the perspective of organization, the transition process of China can be taken as a reorganization process. Some of the public organizations in the planning economy will remain (such as government institutions). Some will be reorganized as firms in competitive areas. Others become not-for-profit organizations between the forms of government and firms. Theoretically, these three kinds of organizations (or more complex mixed forms) are all candidates for Medicare or education providers. To determine their absolute quantities and relative ratios we must take account of the interactions among them that are characterized in this paper.

One may believe that in public service provision, the more privatized (industrialized), the more competition there will be. This paper, however, shows that this belief is far from truth. Actually what improves competition most is coexistence of multiple ownerships through Tiebout effect and benchmarking effect. A new line of thought is thus presented concerning the relationship between ownership and competition. For competitive private goods provision, the more private owned firms, the more competition there will be. Coexistence of two ownership forms (or coexistence of regulated firms and unregulated firms) will cause much distortion and low efficiency.<sup>8</sup> While in public service arena, it is the appearance of various ownerships that boosts concrete competition.

Now returning to China' Medicare and education reforms. In light of the theory presented in this paper, the following two extreme reform approaches are deficient. One is complete privatization (industrialization), and the other is totally state owned. The two models do not consider product (service) characteristics, incentive structures of the public service sector and complex and subtle interactions between public and private sectors. A practical way is, on one hand, to deregulate the public service sector and invite more private organizations to compete with the public sector<sup>9</sup>; on the other to keep sufficient public organizations. In addition to pure public owned or private owned organizations, organizations with mixed ownership (such as not-for-profit organizations, public-private partnership, etc.) should also be developed.

2. Not-for-profit organizations can be introduced into these sectors. Not-for-profit organizations, being a form of organization between public and private organizations, have long been neglected by economists. Actually to some extent not-for-profit organizations can overcome the inherent deficiencies of public or private organizations. An essential characteristic of not-for-profit organizations is that none of its stakeholders

---

<sup>8</sup>The famous "Averch-Johnson effect" in regulation economics clearly shows the point.

<sup>9</sup>Recently, Hong Kong's universities begin enrolling students from Mainland China, bringing great pressure to mainland's universities. This instance could help to explain this point.

(including the management and employees) are residual claimants. That is to say, these stakeholders don't share profits, which we call "non-allocation constraint". In other words, a not-for-profit organization is an organization without owners. For public service organizations whose quality can hardly be monitored, not-for-profit organizations may be a better choice since the fact that there are no residual claimants will avoid the strong negative incentive to benefit oneself by doing harm to others. Even in the USA, not-for-profit organizations play a great part in the social economic life. For example, 64% medical services were provided by not-for-profit organizations in the 1990s. Not-for-profit organizations contribute more and more to the US economy. In 1929, economic value created by not-for-profit organizations account for 1.1% of GDP that year. In 1974, the ratio increased to 2.8% and 3.6% in 1988 (Hansmann, 1996). It is necessary that not-for-profit organizations be introduced into Medicare. Not-for-profit doesn't mean the organization has no profits. The point is that their special ownership arrangement makes them a credible organization form in industries where service quality is hard to monitor.

3. When designing a reform plan for public service sectors, we should consider characteristics of different sectors. Two effects described in this paper——Tiebout effect and benchmarking effect will be different in different sectors, or even at different levels of the same sector. For instance, in relatively standard public service or public service with sufficient statistics, yardstick competition will have a more obvious effect.<sup>10</sup> When designing policies, we should also consider social externality and scale economic effect of public service. Generally speaking, in public service (such as basic education and Medicare) with strong externality and scale economic effect, a government should play a more important role.<sup>11</sup>

4. The above policy implications are discussed in normative respects, and now we shall look at the incentive problem of the government itself. Much of the great success of China's reform so far can be attributed to a decentralized reform approach and in light of this approach evaluation of local government relative performance based on GDP. Under this evaluation standard, to develop GDP, local governments start competition in marketization and privatization. To "invite investment", local governments also compete in infrastructure construction. However, since public services such as education and Medicare cannot contribute much to GDP in a short term, local governments have no incentive to provide them and are ready to let the market take the "hot potato". So under China's decentralization reform, there is government failure in providing a public service and no active interactions between public owned organizations and private owned organizations. Neither "Tiebout effect" nor "benchmarking effect" can function well, which weakens de facto competition. There is a turning point for China's reform. After local governments complete their historical missions in marketization, privatization, and infrastructure development, the time will be right for the central government to make a change in the GDP-based performance evaluation system and then to offer sufficient incentives to local governments to provide public services.<sup>12</sup>

## Reference

- Averch, Harvey and Leland L. Johnson, 1962, "Behavior of the Firm Under Regulatory Constraint", *The American Economic Review* Vol. 52, No. 5 (Dec., 1962), pp. 1052-1069.
- Ding, Weili and Ming Lu, 2005, Equity and Efficiency in Basic Education: A General Equilibrium Approach, *China Social Sciences*, issue 6, pp.45-57.
- Friedman, Milton, 1962, *Capitalism and Freedom*, University of Chicago Press.
- Glaeser, Edward and Andrei, Shleifer, 1998, "Not for-Profit Entrepreneurs", Mimeo, Harvard University

---

<sup>10</sup> The first situation could be some simple medical service (such as headache, cold), the second situation could be the enrollment rate of one junior middle school's students promote to a senior middle school. This kind of information serves as the school quality's sufficient statistic.

<sup>11</sup> See Ding and Lu (2005).

<sup>12</sup> See Wang *et al.* (2006).

- Hansman, Henry, 1996, *The Ownership of Enterprise*, Harvard University Press.
- Hart, O., Shleifer, A., Vishny, R., 1997. "The Proper Scope of Government: Theory and an Application to Prisons", *Quarterly Journal of Economics* 112, 1127-1162.
- Kaufmann, Daniel and Paul Siegelbaum, 1997, "Privatization and Corruption in Transition Economies", World Bank.
- Sappington, David E., and Joseph E. Stiglitz, 1987, "Privatization, Information and Incentives", *Journal of Policy Analysis and Management* 567-82.
- Shleifer, Andrei, 1985, "A Theory of Yardstick Competition", *The RAND Journal of Economics*, Vol. 16, No.3. ,pp. 319-327.
- Shleifer, Andrei, 1998, "State versus Private Ownership", *Journal of Economic Perspectives*, Volume 12, Number 4,Pages 133-150
- Tiebout, Charles, 1956, "A Pure Theory of Local Expenditures," *Journal of Political Economy*, 64, 416-24.
- Wang, Yongqin and Bao Te, 2006, "Optimal Owership for the Provision of Public Service: A Survey", Working paper, China Center for Economic Studies, Fudan University.
- Wang, Yongqin, Yan Zhang, Yuan Zhang, Zhao Chen, Ming Lu, 2006, "The Cost and Benefits of Federalism, Chinese Style", Economics Department and China Center for Economic Studies, Fudan University.