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Strategic quality competition, mixed oligopoly and privatization

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ABSTRACT

The argument behind increasing privatization of public firms in developing and transition economies is that profit-driven private enterprises are more efficient than state-owned enterprises. However, when it comes to quality competition where the higher quality is considered as more environmentally friendly, the profit motive may lead to a worse outcome if it fails to incorporate the cost of negative externalities in the form of environmental damages. We demonstrate that neither partial nor full privatization leads to a better outcome in terms of environmental performance and welfare maximization than a state-owned monopoly, which is consistent with recent evidence from China.

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1. Introduction

Since the 1980s, developing countries have been witnesses to extensive reforms of state-owned enterprises (SOEs) along with a rapid growth of the private sector that has led to an increased number of private-owned enterprises (POEs). Recent evidence shows that developing countries and transition economies are increasingly privatizing their public firms (Gelvez & Heywood, 2013; Mukherjee & Sinha, 2014). The argument behind such massive privatization programs in these economies is that POEs, which are driven mainly by profits, are more efficient than SOEs because the former is more responsive to market signals than the latter. Thus the profit motive is identified as one of the incentive mechanisms.

However, when it comes to quality competition, in particular, when the higher quality is considered as more environmentally friendly, the profit motive might not lead to a better outcome as it fails to incorporate the cost of negative externalities in the form of environmental damages. One might argue, therefore, that SOEs might do better in environmental performance, as its objective is to maximize the welfare of the economy and thus internalize the cost of the negative externality. This view has been empirically supported by Wang and Jin (2007), who showed that Chinese community-owned enterprises (COEs) perform better in regional areas in terms of preserving the environment than the POEs.² It should be noted that though the COE is not different from the SOE in terms of ownership structure, the former operates in the regional area with a higher degree of local protectionism and thus with little or no competition (i.e. similar to a monopoly, except it is owned by a state) while the latter is under mixed oligopoly market structure with more competition (Jiang, Lin, & Lin, 2014).

In contrast, Arocena and Price (2002) examined the Spanish power plant industry (Europe's fifth largest power industry) and documented that, in the presence of strict laws and regulations on the environment, the private-sector power plants are doing better in

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² In terms of ownership structure, there is no difference between Chinese SOEs and COEs. See Li, Lin, and Selover (in press) for details.

terms of environmental performance by emitting less pollutants such as SO₂ than that of the public-sector power plants. Their findings confirm the *Porter Hypothesis*, which postulates that environmental regulations can open up new opportunities for private firms to innovate more environmentally friendly products to maximize their long-term gains (Andre, Gonzalez, & Porteiro, 2009).

Unlike Wang and Jin (2007), recently Jiang et al. (2014) indicated that private-owned foreign firms in China, which produce higher quality products, perform much better than the SOEs despite the fact that the Chinese government has imposed strict measures to protect the natural environment. Their empirical results also suggest that the Chinese government should not target the private-owned foreign firms in its effort to reduce industrial pollution. Indeed, the findings by Jiang et al. (2014) are completely opposite to Wang and Jin's (2007) findings. These contradictory results motivate our study to provide a theoretical framework to explain the different empirical outcomes in the literature.

In this paper the following questions are addressed: (i) Under which market structure do SOEs perform better in terms of environmental controls? (ii) Does privatization lead to better environmental performance? In addition, we ask when does a SOE emerge as a natural monopoly? To answer those questions and to keep the model consistent with the real world example of China, three types of market structures are considered: state-owned monopoly (no competition), duopoly (competition by two POEs) and mixed duopoly (a SOE competes with a POE). Furthermore, a vertically differentiated model, as all consumers benefit from the environment friendly goods (following from the definition of vertically differentiated goods considered by Shy, 1995), is adopted.

In the Industrial Organization literature, it is well known that when the entire market is served and two firms produce the vertically differentiated goods, maximum product differentiation holds, i.e. one firm chooses the highest quality and the other chooses the lowest quality (Anderson, de Palma, & Thisse, 1992, pp. 306). However, Andre et al. (2009) argued that in the case of duopoly with vertical differentiated goods, when the government intervenes in the market with an appropriate taxation policy, the maximum product differentiation disappears and both firms choose to produce the highest quality of goods at Nash equilibrium, thus confirming the *Porter Hypothesis*. Note that, Andre et al. (2009) viewed the higher quality production as more environmentally friendly.

In this paper, we consider first the benchmark case of COEs, i.e. a monopoly is owned by the state, in a two-stage, quality-then-price game: the product quality is chosen in the first stage while its price is decided in the second stage. We then extend the analysis by considering the cases of duopoly and mixed duopoly, where the former scenario provides an outcome of full privatization and the latter gives a partial privatization case. Finally, the comparison of these results for different market structures helps us understand whether competition, in particular privatization, leads to better environmental performance. Our model predicts the following results: when the entire market is served, full privatization does not lead to a better outcome in terms of environmental performance, but a state-owned monopoly does yield an efficient outcome both in terms of choosing the quality variant and welfare maximization. In addition, in the case of mixed duopoly, the SOE always chooses the higher quality variant and emerges as a natural monopolist as the POE exits from the market. This prediction is consistent with the empirical findings of Wang and Jin (2007) and Jiang et al. (2014). In particular, these results can shed light in explaining why COEs do better in environmental performance than POEs in China.

The remainder of the paper is organized as follows: Section 2 analyzes the basic model with state-owned monopoly and then extends the model to duopoly and mixed duopoly. The issues on product quality, prices of goods and economic welfare under the three scenarios will be examined and compared. Section 3 discusses the robustness of our results under alternative market structures. Finally, Section 4 concludes.

2. The model

We consider a product-differentiated model where a consumer of type θ consumes one unit of good with a quality variant i (denoted by q_i), which gives the indirect utility function:

$$V_i(\theta) = \theta q_i - p_i, \text{ for } i = \{m\} \text{ or } \{1, 2\} \quad (1)$$

where p_i expresses its price. Here, m and $\{1,2\}$ refer to a state-owned monopolist and two firms under duopoly market structure, respectively. The quality variant q_i is indexed and lies over $[q_0, q_1]$ interval such that $0 < q_0 < q_1$, while θ represents a consumer's marginal willingness to pay for the quality variant q_1 . We assume that θ is uniformly distributed over $[\theta_L, \theta_H]$. Furthermore, the entire market size is given by $(\theta_H - \theta_L) = N > 0$. We make the following assumptions:

Assumption 1.

- A. The entire market size $(\theta_H - \theta_L) = N$ is served.
- B. The marginal cost of producing each unit is normalized to zero.
- C. The marginal cost of producing a quality variant is normalized to zero.
- D. For feasibility, the condition that $\frac{1}{2}\theta_H > \theta_L$ is imposed under different market structures.

Assumption 1(A) is essential for the comparison of different market structures under monopoly, duopoly and mixed duopoly. In each market structure, we consider the quality-then-price game. In other words, the game has two stages: the product quality is chosen in the first stage while the price is decided in the second stage, and the solution of such games involves backward induction, which is carried out in each of the market structures. For simplicity and tractability of the model, we make the additional Assumption 1(B)–(D) by following Anderson et al. (1992, pp. 306). Furthermore, because of Assumption 1(B)–(D), it is possible that we may have corner solutions.³

³ See Anderson et al. (1992, pp. 306) for more details.

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