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Partial privatization in price-setting mixed duopoly

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Abstract

This paper investigates a price-setting mixed model involving a private firm and a public firm to reassess the welfare effect of partial privatization. First, the government chooses the level of privatization to maximize social welfare. Second, observing the level of privatization, the firms non-cooperatively choose prices. The paper then demonstrates that partial privatization is not an optimal choice for the government.

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1. Introduction

In recent years, the theoretical analysis of partial privatization of state-owned public firms has been deeply and extensively studied by many economists. For example, Matsumura (1998) investigates a quantity-setting duopoly model involving a profit-maximizing private firm and a state-owned public firm. First, the government wishes to maximize social welfare and chooses the degree of privatization of the state-owned public firm. Second, the private firm and the partially privatized firm non-cooperatively choose quantities. He then shows that neither full privatization (the government does not hold any shares) nor full nationalization (the government holds all of the shares) is optimal for social welfare; that is, partial privatization is optimal. There are also many other excellent studies such as Chang (2005), Matsumura and Kanda (2005), Chao and Yu (2006), Tomaru (2006), Fujiwara (2007), Lu and Poddar (2007), Han and Ogawa (2008), Ishibashi and Kaneko (2008), and Roy chowdhury (2009). Most theoretical studies demonstrate that the optimal degree of privatization exhibits neither full privatization nor full nationalization but partial privatization.

This paper investigates a price-setting mixed model involving a private firm and a public firm to reassess the welfare effect of partial privatization. The timing of the game runs as follows. In the first stage, the government chooses the level of privatization to maximize social welfare. Observing the level of privatization, the firms non-cooperatively choose prices in the second stage.

The purpose of the paper is to assess the welfare effect of partial privatization by examining a price-setting mixed duopoly model and to show that partial privatization is not optimal in the price-setting mixed competition. This result is in marked contrast to that of the quantity-setting mixed competition.

The remainder of the paper is organized as follows. In Section 2, we formulate the model. Section 3 assesses the welfare effect of partial privatization in price-setting mixed duopoly. Finally, Section 4 concludes the paper.

2. The model

In this section, we consider a price-setting mixed model with two firms (firm 0 and firm 1) and the government. These firms produce imperfectly substitutable goods. There is no possibility of entry or exit. On the consumption side, there is a continuum of consumers of the same type whose utility function is linear. Subscripts 0 and 1 denote firm 0 and firm 1, respectively. Following Bárcena-Ruiz (2007), we assume that the representative consumer maximizes $U(q_0, q_1) - p_0 q_0 - p_1 q_1$, where q_i is the amount of good i and p_i is its price $(i = 0,1)$. The function $U(q_0, q_1)$ is quadratic, strictly concave and symmetric in q_0 and q_1:

$$U(q_0, q_1) = a(q_0 + q_1) - \frac{1}{2}(q_0^2 + 2bq_0q_1 + q_1^2), \tag{1}$$

where a is a constant and $b \in (0,1)$ is a measure of the degree of substitutability among products. The demand function is given by

$$q_i = \frac{a(1-b) - p_i + bp_j}{1-b^2} \qquad (i, j = 0,1;\ i \neq j). \tag{2}$$

For simplicity, we assume that $a = 1$ and $b = 0.5$. Each firm's profit is

$$\pi_i = (p_i - c_i)q_i \qquad (i = 0,1), \tag{3}$$

where c_i is the marginal cost of firm i. Since the result of this paper is not affected by c_i, we normalize it to zero. Firm 1 aims to maximize its profit. Furthermore, social welfare, which is the sum of consumer surplus and profits, is given by

$$W = CS + \pi_0 + \pi_1. \tag{4}$$

The objective function of firm 0 is given by

$$V = \lambda\pi_0 + (1-\lambda)W, \tag{5}$$

where $\lambda \in [0,1]$ is the level of privatization. That is, if $\lambda = 0$ firm 0 becomes purely private, whereas if $\lambda = 1$ it becomes purely public.

The game is constructed by the following two-stage decision-making. In the first stage, the government chooses the level of privatization, λ, to maximize social welfare. Observing λ, the firms non-cooperatively choose prices in the second stage. The subgame perfect Nash equilibrium of the price-setting mixed game is examined.

3. The main result

In this section, we examine the welfare effect of partial privatization in the price-setting mixed game. We obtain the reaction functions in prices of the two firms:

$$R_0 = \frac{1-\lambda+p_1}{2(2-\lambda)}, \tag{6}$$

$$R_1 = \frac{1+p_0}{4}. \tag{7}$$

From (6) and (7), the equilibrium can be derived as follows:

$$p_0 = \frac{5-4\lambda}{15-8\lambda}, \qquad p_1 = \frac{5-3\lambda}{15-8\lambda},$$

$$q_0 = \frac{2(10-3\lambda)}{3(15-8\lambda)}, \qquad q_1 = \frac{4(5-3\lambda)}{3(15-8\lambda)}.$$

Furthermore, the profits, consumer surplus, and social welfare can be expressed as follows:

$$\pi_0 = \frac{2(5-4\lambda)(10-3\lambda)}{3(15-8\lambda)^2}, \tag{8}$$

$$\pi_1 = \frac{4(5-3\lambda)^2}{3(15-8\lambda)^2}, \tag{9}$$

$$CS = \frac{2(100-90\lambda+21\lambda^2)}{3(15-8\lambda)^2}, \tag{10}$$

$$W = \frac{2(200-205\lambda+51\lambda^2)}{3(15-8\lambda)^2}. \tag{11}$$

The maximization of (11) with respect to λ is derived from $dW/d\lambda$. That is, we have $\lambda = 25/22 \approx 1.136$. W is illustrated in Figure 1 as a function of λ. When $0 \le \lambda \le 1$, W is a strictly increasing function of λ. This can be stated in the following proposition.

Proposition 1. In the price-setting mixed model, partial privatization is not a reasonable choice for the government that wishes to maximize social welfare.

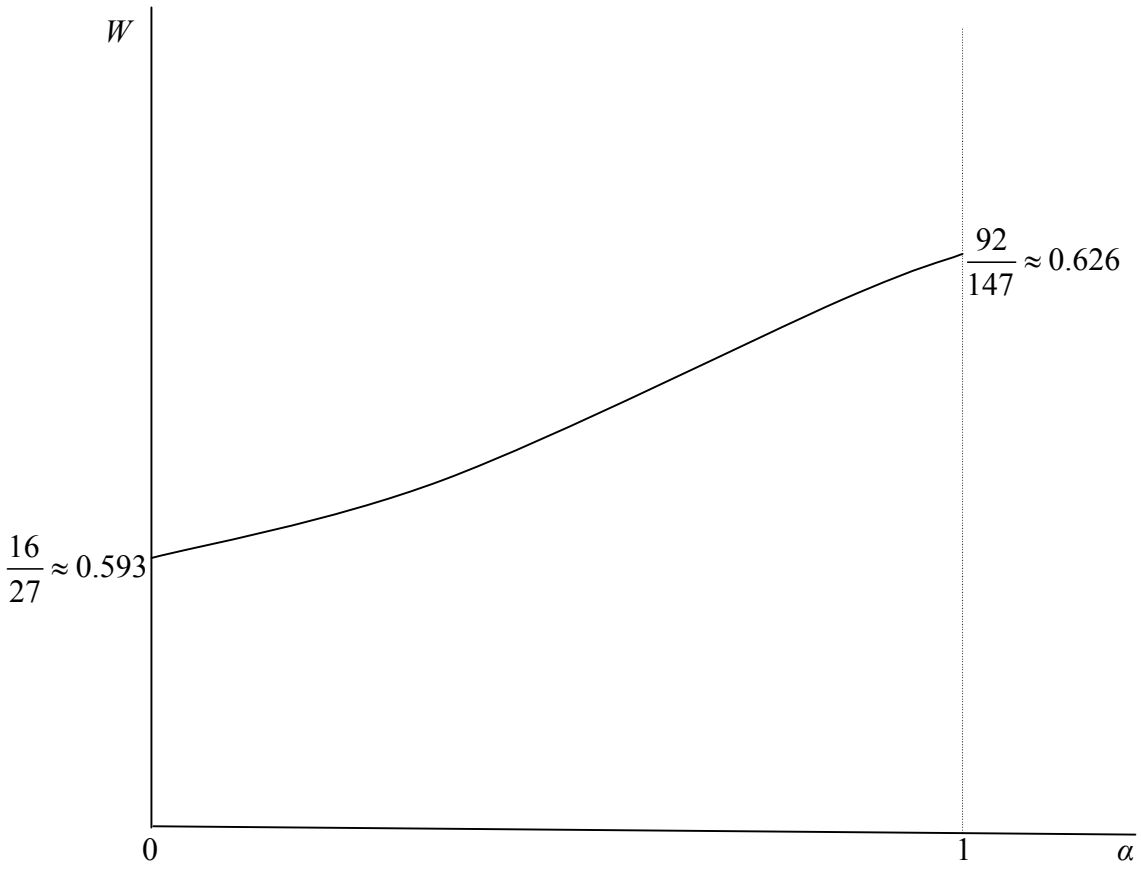

Figure 1. Privatization and Social Welfare

4. Conclusion

We have investigated a price-setting mixed model involving a private firm and a public firm to reassess the welfare effect of partial privatization and have shown that partial privatization is not optimal in the price-setting mixed competition. We have found that our result is in marked contrast to that of the quantity-setting mixed competition.

We have used a mixed model with a public firm and a domestic private firm and have examined the welfare effect of partial privatization. However, what if public and foreign private firms compete against each other? This is one of various extensions of this study that remain to be considered in future research.

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