【Articles】

Differentiated Mixed Duopoly with Two Cities under Cournot and Stackelberg Competition

クールノー及びシュタッケルベルク競争下の2都市差別化混合複占

OSHIMA Kosuke
大　島　考　介

Contents

(**Abstract**)

In this paper, we consider centralization and decentralization in the Cournot competition model of differentiated mixed duopoly with two cities, and compare it with the Stackelberg competition. In the Cournot competition, as shown in previous studies, the level of privatization chosen by the government exhibits a mountain-shaped graph in the degree of substitutability of the two varieties (in the decentralized solution, the mountain is lower and the privatization level becomes zero in corner solutions where the substitutability of varieties is relatively high). On the other hand, in the Stackelberg competition, the level of privatization is always zero for both the centralized and decentralized solutions. However, various variables such as amounts of production and prices, and social welfare in the equilibrium are the same as those in the Cournot competition. In the Stackelberg competition, the public firm can take advantage of being a Stackelberg leader and determine the amount of production, while in the Cournot competition the government achieves a desirable equilibrium by adjusting the privatization level. The social welfare of decentralization, however, is lower than in the Stackelberg competition where the substitutability of varieties is high.

1. Introduction

Mixed oligopoly is a market where a small number of firms, public and private, compete with each other. While private firms maximize profits, a public firm acts in order to maximize social welfare. If it is privatized it acts as a private firm and hence affects the social welfare. Privatization has been a world-wide trend since 1980's. Many public firms, however, still exist and are competing with private firms in various oligopolistic markets, and there are discussions about how the government should handle those firms. Therefore we need to pay attention to the studies of mixed oligopoly.

The literature of mixed oligopoly has been growing since De Fraja and Delbono's (1989) seminal paper. Matsumura (1998) took into account partial privatization in mixed duopoly model and showed that partial privatization can be more desirable than full nationalization or full privatization. Matsumura and Kanda (2005) considered the case where firms can enter the market freely. They showed that the public firm should produce goods so that the price equals its marginal cost, and in order to do so the government should fully own the public firm. Fujiwara (2007) introduced product differentiation into the model and showed that partial privatization is optimal except in extreme cases. The optimal privatization level in the short run is mountain-shaped in the degree of substitutability of products, while it is monotonically decreasing when private firms can enter the market freely.

Researchers such as Bárcena-Ruiz and Garzón (2005) and Dadpay and Heywood (2006) considered multiple countries. Han and Ogawa (2008) allowed for partial privatization and showed that the governments are less eager to privatize in the international mixed oligopoly market than in a single-country framework.

On the other hand, little attention has been paid to the issues of centralization and decentralization in the literature of mixed oligopoly, while central and local governments may make different decisions in providing public goods and services. Examples of differentiated local goods and services include museums, tourist facilities, and airports. Oshima (2018b), based on Fujiwara's (2007) short-run case, considered a differentiated mixed duopoly in a two-city model where a public firm operate in one city and a private firm in the other, and compared decentralized and centralized solutions. Then it was found that the privatization level is higher under centralization in most cases, and it is zero under decentralization if the substitutability is higher than a certain threshold. Oshima (2018a) allowed for multiple private firms, and the number of firms are either fixed (short-run case) or endogenous (long-run case). While the results of centralized solution and short-run case of decentralized solution are generally in line with earlier studies, in the long-run case of decentralized solution the privatization level varied depending on parameters such as fixed and marginal costs.

One of the issues which have been left is the timing of firms' decisions: what would become if the public firm is a Stackelberg leader? The present paper investigates this issue under centralization and decentralization.

The rest of the paper is organized as follows. In section 2 we set up the model. Section 3 briefly reviews the centralized and decentralized Cournot competitions. In sections 4 and 5 we investigate the optimal privatization levels under centralized and decentralized Stackelberg competitions, respectively. Section 6 concludes.

2. The model

Suppose a country that consists of two cities, city 1 and city 2 with the same population. The residents are homogeneous and we standardize the total population to unity. Hence the population of each city is 1/2.[1)] A public firm (firm 1) is located in city 1, and is owned by the national government (centralization) or by the government of city 1 (decentralization). A private firm (firm 2) operates in city 2. The firms produce different varieties of a good, or differentiated goods. The public firm produces variety 1 and the private firm produces variety 2. In addition, a homogeneous good which is a numeraire is produced in both cities.

The utility function of the representative consumer is expressed as follows:

$$u = a(x_1 + x_2) - \frac{(x_1)^2 + (x_2)^2}{2} - bx_1x_2 + z, \tag{1}$$

where x_j is the amount of variety j of the differentiated good, and z is the amount of homogeneous good. We assume $a > 0$ and $b \in [0,1)$. Parameter b shows the degree of substitutability of the differentiated good.

Let p_j, $j = 1,2$ denote the price of variety j. Given the budget constraint $I = p_1x_1 + p_2x_2 + z$, solving the maximization problem of consumers we have the inverse demand function for varieties 1 and 2 as below:

$$p_1 = a - x_1 - bx_2, \;\; p_2 = a - x_2 - bx_1. \tag{2}$$

Using (1) and (2) we obtain the consumer surplus of the country as follows:

$$CS = u - p_1x_1 - p_2x_2 - z = \frac{(x_1)^2 + (x_2)^2}{2} + bx_1x_2. \tag{3}$$

Now we consider the producers. Suppose that the firms face the same technology and the cost function $C_j = cx_j + f$, $j = 1,2$, where c is the marginal cost, $c < a$, and f is the fixed cost, which are usual assumptions in the literature.[2) 3)] Then the profit of firm i is as follows:

$$\pi_i = p_ix_i - cx_i - f, \;\; i = 1,2. \tag{4}$$

The welfare of the country, W, is defined as the sum of consumer surplus and profits of the two firms:

$$W \equiv CS + \pi_1 + \pi_2. \tag{5}$$

Because the two cities are symmetric in consumption, consumer surplus for each city is $CS/2$. Therefore the welfares of the two cities, W^1, W^2 are defined as follows:

$$W^i \equiv CS/2 + \pi_i, \quad i = 1, 2. \tag{6}$$

We consider two-stage games. In the first stage the government (national or city) chooses the privatization level of its public firm. In the second stage the firms determine the quantities supplied simultaneously (Cournot) or in turn (Stackelberg). Then we solve the game by backward induction.

3. Centralized and decentralized Cournot competitions

Suppose that the national government owns the public firm (centralization) and maximizes the welfare of the country, W. The public firm maximizes the weighted average of its profit and the welfare of the country:

$$\max \theta\pi_1 + (1-\theta)W = \pi_1 + (1-\theta)(CS + \pi_2),$$

where $\theta \in [0,1]$ is the level of privatization. $\theta = 0$ means that the public firm is fully owned by the government while it is fully privatized if $\theta = 1$. Then using (3) and (4), we obtain the first-order condition as follows,

$$a - c - (1+\theta)x_1 - bx_2 = 0. \tag{7}$$

On the other hand, the private firm maximizes π_2. Using (4), the first-order condition is,

$$a - c - 2x_2 - bx_1 = 0. \tag{8}$$

From (7) and (8) we have the equilibrium consumption of two varieties as follows:

$$x_1^{CC} = \frac{(a-c)(2-b)}{2(1+\theta) - b^2} \tag{9}$$

$$x_2^{CC} = \frac{(a-c)(1-b+\theta)}{2(1+\theta) - b^2}, \tag{10}$$

where the superscript CC denotes centralized equilibrium under Cournot competition.

Substituting (9) and (10) into (2)–(4), from (5) we obtain the welfare of the country as the function of θ, $W(\theta)$. The first-order condition is as follows,

$$W'(\theta^{CC}) = -\frac{(a-c)^2(2-b)\left[4\theta^{CC} - b(1+3\theta^{CC}) + b^2\right]}{\left[2(1+\theta^{CC}) - b^2\right]^3} = 0, \tag{11}$$

where θ^{CC} is the optimal level of privatization under centralized Cournot competition. Solving (11) for θ^{CC} yields,

$$\theta^{CC} = \frac{b(1-b)}{4-3b}. \tag{12}$$

Substituting (12) into (9) and (10), and from (2) and (4) we have,

$$x_1^{CC} = \frac{(a-c)(4-3b)}{4-3b^2},\ \ x_2^{CC} = \frac{2(a-c)(1-b)}{4-3b^2},$$

$$p_1^{CC} = \frac{ab(1-b)+(4-b-2b^2)c}{4-3b^2},\ \ p_2^{CC} = \frac{2a(1-b)+(2+2b-3b^2)c}{4-3b^2}, \tag{13}$$

$$\pi_1^{CC} = \frac{(a-c)^2 b(4-3b)(1-b)}{(4-3b^2)^2}-f,\ \ \pi_2^{CC} = \frac{4(a-c)^2(1-b)^2}{(4-3b^2)^2}-f.$$

Then the welfares of the country and two cities are,

$$W^{CC} = \frac{(a-c)^2(7-6b)}{8-6b^2}-2f, \tag{14}$$

$$W^{1CC} = \frac{(a-c)^2(20-43b^2+24b^3)}{4(4-3b^2)^2}-f, \tag{15}$$

$$W^{2CC} = \frac{(a-c)^2(36-48b+b^2+12b^3)}{4(4-3b^2)^2}-f. \tag{16}$$

Let us set the parameters so that $a = 0.5$, $c = 0.1$, and $f = 0$. Then the graphs of (13)–(16) are depicted as in Figures 1 and 2.

Suppose next that the city 1 government owns the public firm (decentralization) and maximizes the welfare of city 1, W^1. The public firm maximizes the weighted average of its profit and the welfare of city 1:

$$\max\ \theta\pi_1 + (1-\theta)W^1 = \pi_1 + (1-\theta)CS/2.$$

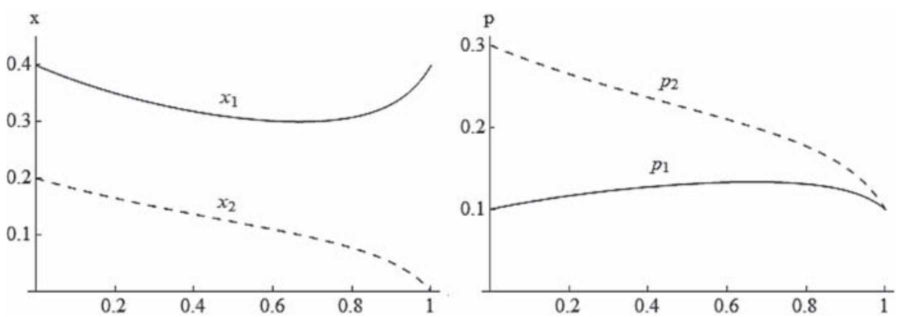

Figure 1: Amounts of varieties produced and prices under CC

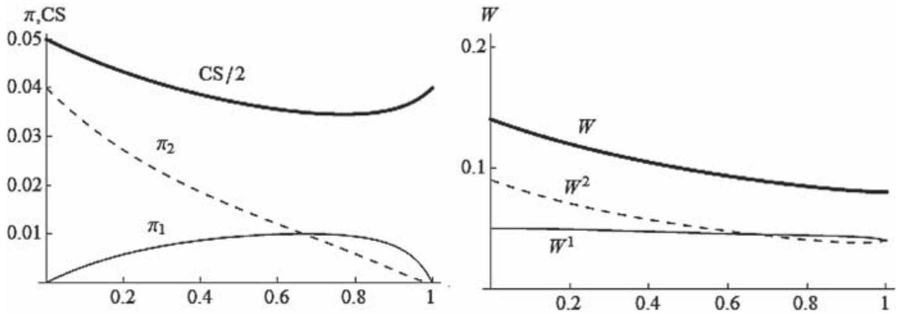

Figure 2: Profits, consumer surplus and welfares under CC

Using (3) and (4) we obtain,

$$a - c - \frac{3+\theta}{2}x_1 - \frac{b(1+\theta)}{2}x_2 = 0 \tag{17}$$

From (8) and (17) we have the equilibrium consumption of two varieties as below:

$$x_1^{DC} = \frac{(a-c)\left[4-b(1+\theta)\right]}{2(3+\theta)-b^2(1+\theta)} \tag{18}$$

$$x_2^{DC} = \frac{(a-c)(3-2b+\theta)}{2(3+\theta)-b^2(1+\theta)}, \tag{19}$$

where the superscript DC denotes decentralized equilibrium under Cournot competition.

Substituting (18) and (19) into (2)–(4), from (6) we obtain the welfare of city 1 as the function of θ, $W^1(\theta)$. The first-order condition is as follows,

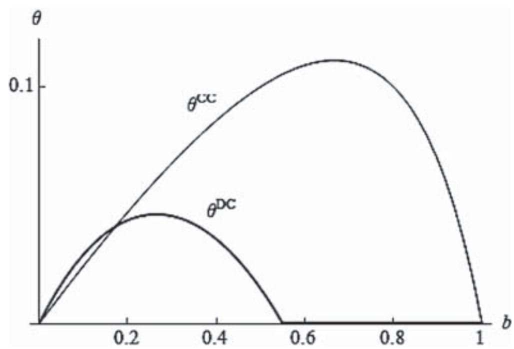

Figure 3: Privatization levels under Cournot competition

$$W^{1'}(\theta^{DC}) = \frac{(a-c)^2(2-b)(1+b)\left[-8\theta^{DC}+3b(1-\theta^{DC})-b^2(6-4\theta^{DC})+b^3(1+\theta^{DC})\right]}{[2(3+\theta^{DC})-b^2(1+\theta^{DC})]^3} = 0, \tag{20}$$

where θ^{DC} is the level of privatization under decentralized Cournot competition. Solving (20) for θ^{DC} yields,

$$\theta^{DC} = \frac{b(3-6b+b^2)}{8+3b-4b^2-b^3}. \tag{21}$$

Privatization levels θ^{DC}, as well as θ^{CC} are depicted in Figure 3. As one can see, the graph of θ^{DC} intersects with b axis at $b = 3 - \sqrt{6} \approx 0.55$ (which we call $\hat{b}$ in what follows). Because the level of privatization is nonnegative, we set $\theta^{DC} = 0$ where $b \geq \hat{b}$.

Substituting (21) into (18) and (19), and from (2) and (4) we have the equilibrium values where $b < \hat{b}$;

$$x_1^{DC} = \frac{(a-c)(8-3b)}{12-5b^2},\ \ x_2^{DC} = \frac{(a-c)(6-4b-b^2)}{12-5b^2},$$
$$p_1^{DC} = \frac{a(4-3b-b^2+b^3)+(8+3b-4b^2-b^3)c}{12-5b^2},$$
$$p_2^{DC} = \frac{a(6-4b-b^2)+2(3+2b-2b^2)c}{12-5b^2}, \tag{22}$$
$$\pi_1^{DC} = \frac{(a-c)^2(8-3b)(4-3b-b^2)}{(12-5b^2)^2} - f,$$
$$\pi_2^{DC} = \frac{4(a-c)^2(6-4b-b^2)^2}{(12-5b^2)^2} - f.$$

Then the welfares of the country and two cities are,

$$W^{DC} = \frac{(a-c)^2(236-168b-77b^2+54b^3+3b^4)}{2(12-5b^2)^2} - 2f, \tag{23}$$

$$W^{1DC} = \frac{(a-c)^2(19-12b+b^2)}{48-20b^2} - f, \tag{24}$$

$$W^{2DC} = \frac{(a-c)^2(244-192b-71b^2+48b^3+11b^4)}{4(12-5b^2)^2} - f. \tag{25}$$

For the equilibrium values where $b \geq \hat{b}$, substituting $\theta^{DC} = 0$ into (18) and (19), and from (2) and (4) we have,

$$x_1^{DC} = \frac{(a-c)(4-b)}{6-b^2}, \quad x_2^{DC} = \frac{(a-c)(3-2b)}{6-b^2},$$
$$p_1^{DC} = \frac{a(2-2b+b^2)+(2-b)(1+b)c}{6-b^2},$$
$$p_2^{DC} = \frac{a(3-2b)+(3-b)(1+b)c}{6-b^2}, \tag{26}$$
$$\pi_1^{DC} = \frac{(a-c)^2(4-b)(2-2b+b^2)}{(6-b^2)^2} - f,$$
$$\pi_2^{DC} = \frac{(a-c)^2(3-2b)^2}{(6-b^2)^2} - f.$$

Then the welfares of the country and two cities are,

$$W^{DC} = \frac{(a-c)^2(59-40b+3b^2+2b^3)}{2(6-2b^2)^2} - 2f, \tag{27}$$

$$W^{1DC} = \frac{(a-c)^2(57-36b+7b^2)}{4(6-b^2)^2} - f, \tag{28}$$

$$W^{2DC} = \frac{(a-c)^2(61-44b-b^2+4b^3)}{4(6-b^2)^2} - f. \tag{29}$$

The graphs of (22)–(29) are depicted as in Figures 4 and 5.

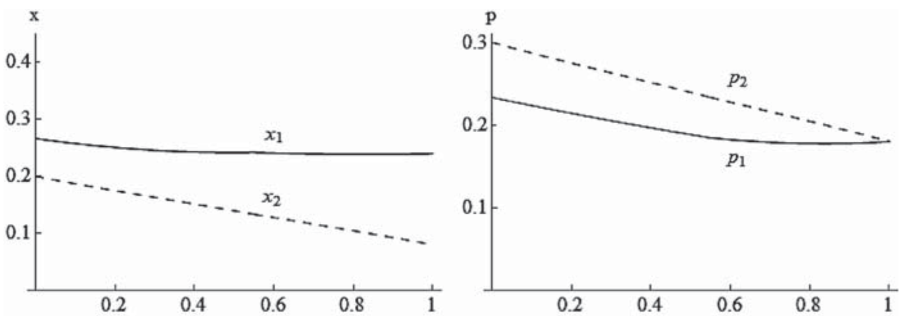

Figure 4: Amounts of varieties produced and prices under DC

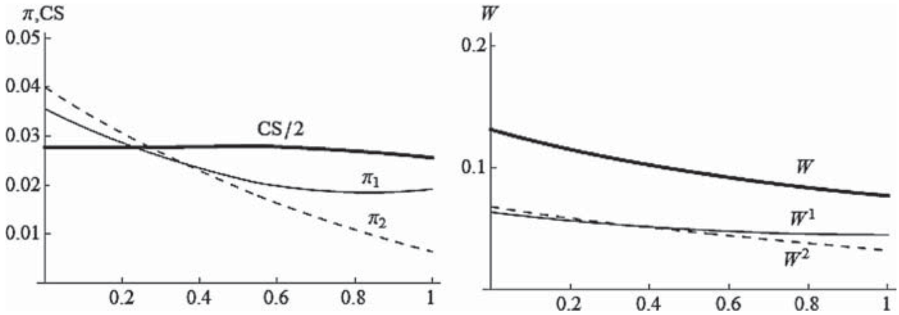

Figure 5: Profits, consumer surplus and welfares under DC

4. Centralized Stackelberg competition

In this section we suppose that the public firm owned by the central government is the Stackelberg leader and firm 2 is the follower.

From firm 2's first-order condition (8) we have its reaction function as follows:

$$x_2 = \frac{a-c-bx_1}{2}. \tag{30}$$

Substituting (30) into firms' profits (4), firm 1 maximizes its objective function $\pi_1 + (1-\theta)(CS + \pi_2)$. Rearranging the first-order condition we have,

$$x_1 = \frac{(a-c)\left[4-b(3-\theta)\right]}{4(1+\theta)-b^2(3+\theta)} \tag{31}$$

$$x_2 = \frac{(a-c)\left[2(1+\theta)-2b-b^2\theta\right]}{4(1+\theta)-b^2(3+\theta)}. \tag{32}$$

Substituting (31) and (32) into (5) the central government maximizes the national welfare. The first-order condition is as follows:

$$\frac{(a-c)^2(8-8b-2b^2+3b^3)^2\theta^{CS}}{[-4(1+\theta^{CS})+b^2(3+\theta^{CS})]^3} = 0, \tag{33}$$

where the superscript CS denotes centralized Stackelberg competition. Solving (33) for θ^{CS} yields,

$$\theta^{CS} = 0, \tag{34}$$

That is, θ does not exhibit a mountain-shaped curb, and full nationalization is optimal if the public firm is the Stackelberg leader. Substituting (34) into (31) and (32) we have the equilibrium variables as follows:

$$x_1^{CS} = \frac{(a-c)(4-3b)}{4-3b^2},\ x_2^{CS} = \frac{2(a-c)(1-b)}{4-3b^2},$$

$$p_1^{CS} = \frac{ab(1-b)+(4-b-2b^2)c}{4-3b^2},\ p_2^{CS} = \frac{2a(1-b)+(2+2b-3b^2)c}{4-3b^2}, \tag{35}$$

$$\pi_1^{CS} = \frac{(a-c)^2 b(4-3b)(1-b)}{(4-3b^2)^2}-f,\ \pi_2^{CS} = \frac{4(a-c)^2(1-b)^2}{(4-3b^2)^2}-f.$$

Then the welfares of the country and two cities are,

$$W^{CS} = \frac{(a-c)^2(7-6b)}{8-6b^2}-2f, \tag{36}$$

$$W^{1CS} = \frac{(a-c)^2(20-43b^2+24b^3)}{4(4-3b^2)^2}-f, \tag{37}$$

$$W^{2CS} = \frac{(a-c)^2(36-48b+b^2+12b^3)}{4(4-3b^2)^2}-f. \tag{38}$$

Interestingly, (35)–(38) are equal to (13)–(16). One can interpret this that the central government under Cournot competition can achieve the same optimal equilibrium as under Stackelberg competition by adjusting the privatization level. The government under Stackelberg competition need not do that as the public firm can take advantage of being a Stackelberg leader.

5. Decentralized Stackelberg competition

Finally, we suppose that the public firm owned by city 1 government is the Stackelberg leader. As in the last section, substituting (30) into (4) we have firms' profits as functions of x_1. Then firm 1 maximizes its objective function $\pi_1 + (1-\theta)CS/2$. Rearranging the first-order condition we have,

$$x_1 = \frac{(a-c)\left[8-b(3+\theta)\right]}{4(3+\theta)-b^2(5+3\theta)} \tag{39}$$

$$x_2 = \frac{(a-c)\left[2(3+\theta)-4b-b^2(1+\theta)\right]}{4(3+\theta)-b^2(5+3\theta)}. \tag{40}$$

Substituting (39) and (40) into (6) city 1 government maximizes the city's welfare. The first-order condition is as follows:

$$\frac{2(a-c)^2(8-6b^2+b^3)^2\theta^{DS}}{[-4(3+\theta^{DS})+b^2(5+3\theta^{DS})]^3} = 0, \tag{41}$$

where the superscript DS denotes decentralized Stackelberg competition. Solving (41) yields,

$$\theta^{DS} = 0, \tag{42}$$

that is, full nationalization is optimal under DS, too. Substituting (42) into (39) and (40) we have the equilibrium variables as follows:

$$\begin{aligned}
x_1^{DS} &= \frac{(a-c)(8-3b)}{12-5b^2}, \quad x_2^{DS} = \frac{(a-c)(6-4b-b^2)}{12-5b^2},\\
p_1^{DS} &= \frac{a(4-3b-b^2+b^3)+(8+3b-4b^2-b^3)c}{12-5b^2},\\
p_2^{DS} &= \frac{a(6-4b-b^2)+2(3+2b-2b^2)c}{12-5b^2},\\
\pi_1^{DS} &= \frac{(a-c)^2(8-3b)(4-3b-b^2)}{(12-5b^2)^2}-f,\\
\pi_2^{DS} &= \frac{4(a-c)^2(6-4b-b^2)^2}{(12-5b^2)^2}-f.
\end{aligned} \tag{43}$$

Then the welfares of the country and two cities are,

$$W^{DS} = \frac{(a-c)^2(236-168b-77b^2+54b^3+3b^4)}{2(12-5b^2)^2}-2f, \tag{44}$$

$$W^{1DS} = \frac{(a-c)^2(19-12b+b^2)}{48-20b^2}-f, \tag{45}$$

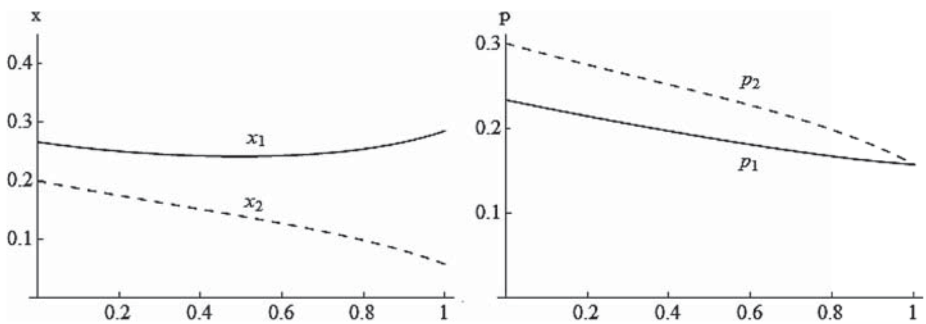

Figure 6: Amounts of varieties produced and prices under DS

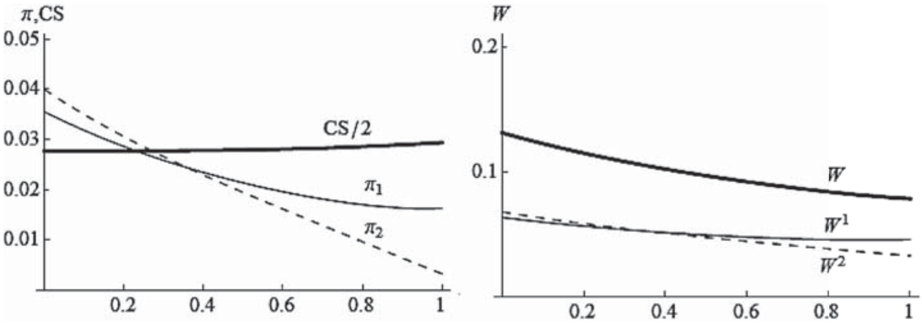

Figure 7: Profits, consumer surplus and welfares under DS

$$W^{2DS} = \frac{(a-c)^2(244-192b-71b^2+48b^3+11b^4)}{4(12-5b^2)^2} - f. \tag{46}$$

The graphs of (43)–(46) are depicted as in Figures 6 and 7.

(43)–(46) are equal to (22)–(25), but not to (26)–(29) because the latter is the equilibrium of the corner solution where $b \geq \hat{b}$ and $\theta^{DC} = 0$. Under which equilibrium, *DC* or *DS*, is the welfare larger where $b \geq \hat{b}$?

Let us see the welfares of city 1, city 2, and total welfare in turn. Using (28) and (45) we have,

$$W^{1DC} - W^{1DS} = -\frac{(a-c)^2 b^2 (3-6b+b^2)^2}{4(6-b^2)^2(12-5b^2)} \leq 0, \tag{47}$$

that is, for city 1, decentralized Stackelberg competition is better than or equivalent to decentralized Cournot competition.

Using (29) and (46) we have,

$$W^{2DC} - W^{2DS} = \frac{(a-c)^2 b(3-6b+b^2)(192-276b-8b^2+127b^3-14b^4-11b^5)}{4(72-42b^2+5b^4)^2}. \tag{48}$$

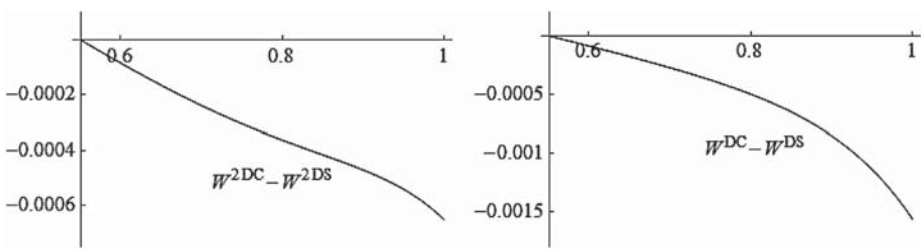

Figure 8: Welfare differences in city 2 and whole the country

Unlike (47) the sign of the right-hand side of (48) is not straightforward. Therefore we draw the graph of (48) where $b \in (\hat{b},1)$, $a = 0.5$ and $c = 0.1$, and then we have the left panel of Figure 8. One can see that it is negative and hence, also for city 2, decentralized Stackelberg competition is better than decentralized Cournot competition.

Using (27) and (44) we have,

$$W^{DC} - W^{DS} = \frac{(a-c)^2 b(288 - 1044b + 1128b^2 - 153b^3 - 424b^4 + 188b^5 - 4b^6 - 3b^7)}{2(72 - 42b^2 + 5b^4)^2}. \quad (49)$$

Drawing the graph of (49) where $b \in (\hat{b},1)$ we have the right panel of Figure 8. One can see that it is negative and hence, decentralized Stackelberg competition is better than decentralized Cournot competition as a whole. The graph is decreasing in b, which shows that the larger b is, the more relatively superior is *DS*.

Therefore, where the two varieties are relatively close substitutes, i.e., $b \in (\hat{b},1)$, if the public firm is a Stackelberg leader both cities are better-off than if the two firms play Cournot.

6. Conclusion

In the present paper we investigated centralized and decentralized differentiated mixed duopoly with two cities under Cournot and Stackelberg competitions. Then we found that under Stackelberg competition the government chooses full public ownership in both centralized and decentralized solutions. Nevertheless, the equilibrium variables are equal to those under Cournot competition where the public firm is partially privatized ($\theta > 0$). While the public firm cannot take advantage of being a Stackelberg leader, the government under Cournot competition achieves optimal solution by adjusting the privatization level. The privatization level, however, equals zero (corner solution) under decentralized Cournot competition where the two varieties are relatively substitutable ($b \geq \hat{b}$). In that case the equilibrium variables are different between Cournot and Stackelberg competitions and it was shown that the welfare under the latter is larger.

Among possible extensions to the model is to assume multiple governments competing with each other. It is left for future research.

Notes

1) The model used in Sections 2 and 3 is basically the same as Oshima (2018b) except that the amount of variety j is denoted by just one variable, x_j, not by x_j^1 and x_j^2 which show the city it is consumed, and so are other variables. This is because the two cities are symmetric in consumption and hence $x_j^1 = x_j^2 = x_j/2$ in the equilibrium. The results of the two models are the same.

2) We also assume that firms cannot discriminate local consumers from consumers living in the other city.

3) In the present model we do not assume transportation costs to avoid complexities. See Oshima (2018b) for a model with transportation costs.

References

Bárcena-Ruiz, J. C. and M. B. Garzón (2005) "International Trade and Strategic Privatization," *Review of Development Economics* Vol. 9, No. 4, pp.502-513.

Dadpay, A. and J. S. Heywood (2006) "Mixed Oligopoly in a Single International Market," *Australian Economic Papers* Vol. 45, No. 4, pp.269-280.

De Fraja, G. and F. Delbono (1989) "Alternative Strategies of a Public Enterprise in Oligopoly," *Oxford Economic Papers* Vol. 41, No. 2, pp.302-311.

Fujiwara, K. (2007) "Partial Privatization in a Differentiated Mixed Oligopoly," *Journal of Economics* Vol. 92, No. 1, pp.51-65.

Han, L. and H. Ogawa (2008) "Economic Integration and Strategic Privatization in an International Mixed Oligopoly," *FinanzArchiv* Vol. 64, No. 3, pp.352-363.

Matsumura, T. (1998) "Partial Privatization in Mixed Duopoly," *Journal of Public Economics* Vol. 70, No. 3, pp.473-483.

Matsumura, T. and O. Kanda (2005) "Mixed Oligopoly at Free Entry Markets," *Journal of Economics* Vol. 84, No. 1, pp.27-48.

Oshima, K. (2018a) "Differentiated Mixed Oligopoly, Free Entry, and Decentralization in a Two-City Model," *Journal of Business, Nihon University* Vol. 88, No. 1, pp.19-32.

Oshima, K. (2018b) "Differentiated mixed duopoly and decentralization in a two-city model," *Papers in Regional Science* Vol. 97, No. 4, pp.1425-1440.

(要旨)

本論文では，消費財の差別化を考慮した 2 都市からなる混合複占のクールノー競争モデルにおいて，中央集権化と地方分権化のケースを考え，シュタッケルベルク競争との比較を行う。クールノー競争では，過去の研究で示されたように，政府が選択する民営化水準は 2 財の代替性の水準に対して山型のグラフを描く（分権解では山が小さく，代替性の高いところでは民営化水準が端点解でゼロとなる)。一方，シュタッケルベルク競争では集権解・分権解とも民営化水準はゼロとなるが，生産量や価格等の均衡での各変数や社会厚生の水準はクールノー競争の場合と等しくなる。これは，シュタッケルベルク競争では公企業がリーダーの立場を活かして生産量を決められるのに対して，クールノー競争ではそれができない分を政府が民営化水準を調整することによって望ましい均衡を実現していると考えられる。ただし，分権解の代替性の大きいところ（民営化水準が端点解となる）では社会厚生は端点解とならないシュタッケルベルク競争に劣ることが示される。