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Price versus quantity in a mixed duopoly with foreign penetration ☆

Junichi Haraguchi [a,*], Toshihiro Matsumura [b]

[a] Graduate School of Economics, The University of Tokyo, 7-3-1, Hongo, Bunkyo-ku, Tokyo 113-0033, Japan
[b] Institute of Social Science, The University of Tokyo, Japan

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ABSTRACT

We characterize the endogenous competition structure (in prices or quantities) in a differentiated duopoly between a public firm that maximizes domestic welfare and a private firm that can be owned by domestic or foreign investors. The market for which they compete can be domestic or integrated: in the first case Bertrand competition emerges endogenously and in the second case Cournot competition can emerge if the fraction of domestic consumers in the integrated market is low enough. We also determine the optimal degree of foreign penetration showing the optimality of a partial foreign ownership. Finally, we extend the model to increasing marginal cost confirming the robustness of the results.

1. Introduction

The comparison between price and quantity competition has been extensively discussed in the literature. In oligopolies between private firms it is well known that price competition is tougher, resulting in a lower level of profits, compared to quantity competition.[1] Ghosh and Mitra (2010) have revisited this classic result in a mixed oligopoly, namely when a welfare-maximizing public firm competes with a profit-maximizing private firm.[2] They have shown that, in contrast to the private duopoly, quantity competition is tougher than price competition, resulting in a smaller profit for the private firm.[3]

A related literature, started by Singh and Vives (1984), has endogenized the structure of competition (in prices or in quantities). As they pointed out, firms often choose whether to adopt a price contract or a quantity contract. In a private duopoly where both firms maximize profits, assuming linear demand and product differentiation, Singh and Vives (1984) have shown that the choice of a quantity contract is the dominant strategy for each firm when goods are substitutes, and the choice of a price contract is the dominant strategy when goods are complements. Cheng (1985), Tanaka (2001a,b) and Tasnádi (2006) have extended their analysis to asymmetric oligopolies, more general demand and cost conditions, and

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* Corresponding author. Tel.: +81 5841 4932; fax: +81 5841 4905.
E-mail address: 7299572051@mail.ecc.u-tokyo.ac.jp (J. Haraguchi).

[1] See Shubik and Levitan (1980) and Vives (1985).

[2] The pioneering work on mixed oligopolies was by Merrill and Schneider (1966). This and many other studies in the field assume that a public firm maximizes welfare (consumer surplus plus firms' profits) while private firms maximize profits.

[3] See also Nakamura (2013) under network externality.

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vertical product differentiation, confirming the robustness of the results. Recently, Matsumura and Ogawa (2012) have obtained a contrasting example in case of a mixed duopoly: when one of the two firms is public, the choice of a price contract is the dominant strategy for both private and public firms, regardless of whether goods are substitutes or complements.

All the mentioned papers, including Ghosh and Mitra (2010) and Matsumura and Ogawa (2012), assume that private firms are domestically owned and firms compete in the domestic market. In other words, they ignore any aspect of international competition, while we know that the nationality of private firms is often crucial in shaping mixed oligopolies (see the literature starting with Corneo and Jeanne, 1994, and Fjell and Pal, 1996)[4] and the nationality of the consumers for which private and public firms are competing is equally crucial (see the trade literature staring with Brander and Spencer, 1985, even if the existence of public firms is usually neglected in that literature).

In this work we present a general model of the endogenous form of competition where the ownership of the private firm can be domestic, foreign or mixed, and consumers can be entirely or partially domestic. Therefore the model covers the standard case of domestic firms competing in the domestic market (as already in Ghosh and Mitra, 2010, and Matsumura and Ogawa, 2012) and cases that are typically analyzed in the international trade literature, as when domestic and foreign firms compete in the home market, when they compete in a fully integrated market, and when they compete in a third market (without domestic consumers, as in Brander and Spencer, 1985).

We find that foreign penetration can change radically the comparison between Bertrand and Cournot price and production strategies, but the endogenous competition structure depends on the kind of market for which the firms compete: in the traditional case of a domestic market Bertrand competition emerges always as the endogenous competition structure and independently from the ownership share of foreign owners in the private firm, but in the case of an integrated market where firms serve both domestic and foreign consumers Cournot competition can emerge as long as the fraction of domestic consumers is small enough. We also characterize the optimal degree of foreign penetration showing that it is optimal to have a minority share for foreign owners: in particular, when the firms produce almost homogeneous goods it is optimal to maintain fully domestic the private firm, while when they are independent monopolists, it becomes optimal to sell half of the stocks to foreign investors. Extending the model to increasing marginal costs we confirm the robustness of our results.

The paper is organized as follows. Section 2 describes the model and compare Cournot and Bertrand equilibria. Section 3 characterizes the endogenous competition structure and the optimal level of foreign penetration. Section 4 extends the model in different directions. Section 5 concludes.

2. The model

We adopt a standard duopoly model with differentiated goods and linear demand (Dixit, 1979).[5] The quasi-linear utility function of the representative consumer is

$$U(q_0,q_1,y)=\alpha(q_0+q_1)-\frac{\beta}{2}(q_0^2+2\delta q_0q_1+q_1^2)+y, \tag{1}$$

where q_0 is the consumption of good 0 produced by the public firm, q_1 is the consumption of good 1 produced by the private firms and y is the consumption of an outside good that is competitively provided (with a unitary price). Parameters α and $\beta$are positive constants and $\delta\in(0,1)$[6] represents the degree of product differentiation: a smaller δ indicates a larger degree of product differentiation. The inverse demand functions for goods i=0,1with $i\neq j$ are

$$p_i=\alpha-\beta q_i-\beta\delta q_j, \tag{2}$$

where p_i is the price of firm i.

The marginal cost of production is constant for both firms. Let us denote with c_i the marginal cost of firm i, assuming $\alpha>c_i$. Firm 0 is a state-owned public firm whose payoff is the domestic social surplus (welfare). This is given by

$$SW=(p_0-c_0)q_0+(1-\theta)(p_1-c_1)q_1+\left[\alpha(q_0+q_1)-\frac{\beta(q_0^2+2\delta q_0q_1+q_1^2)}{2}-p_0q_0-p_1q_1\right], \tag{3}$$

[4] Pal and White (1998) and Bárcena-Ruiz and Garzón (2005) discussed trade policies. Mukherjee and Suetrong (2009) discussed the relationship between foreign direct investment and privatization policies. Matsumura et al. (2009) used a monopolistic competition model by Anderson et al. (1997) to show that under foreign ownership privatization is more likely to improve welfare in the long run, whereas the opposite result is derived in the short run. Matsushima and Matsumura (2006), Ogawa and Sanjo (2007), and Heywood and Ye (2009) have shown that foreign ownership affects firms' locations. Han and Ogawa (2008) and Lin and Matsumura (2012) adopted the partial privatization approach formulated by Matsumura (1998) showing that foreign penetration affects the welfare implications of privatization policies; and Wang and Chen (2010) and Cato and Matsumura (2012) demonstrated the same property for free entry markets. Wang and Lee (2013) introduced foreign firms into the framework of Ino and Matsumura (2010) showing that foreign ownership matters in Stackelberg models. Matsumura and Tomaru (2012) revisited the privatization neutrality theorem presented by White (1996) showing that his result does not hold under foreign ownership of the private firms.

[5] This demand function is popular in the literature on mixed oligopolies. See Bárcena-Ruiz (2007), Fujiwara (2007), Ishida and Matsushima (2009), Matsumura and Shimizu (2010), and Nakamura (2013).

[6] If $\delta>(<)\,0$, the products are substitutes (complements). Although we restrict our attention to the case of substitute products only, we can show that our main propositions hold when $\delta\in(-1,0)$ as well.