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Capacity choice in a duopoly with a consumer-friendly firm and an absolute profit-maximizing firm

Yasuhiko Nakamura *

College of Economics, Nihon University, Japan

A R T I C L E I N F O

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A B S T R A C T

This paper studies a capacity choice problem in a duopoly with substitutable goods that is composed of one consumer-friendly firm and one standard absolute profit-maximizing firm in the contexts of both quantity competition and price competition with substitutable goods. In this paper, we assume that the consumer-friendly firm maximizes the weighted sum of its absolute profit and consumer surplus. We show that in the quantity competition, for the consumer-friendly firm, under-capacity is chosen when the extent of the importance of consumer surplus to the consumer-friendly firm is high relative to the degree of product differentiation, whereas over-capacity is chosen otherwise. Moreover, we find that in the price competition, the consumer-friendly firm chooses over-capacity when the extent of importance of consumer surplus to the consumer-friendly firm is high relative to the degree of product differentiation, whereas it chooses under-capacity otherwise. Furthermore, regardless of the extent of the importance of consumer surplus to the consumer-friendly firm and the degree of product differentiation, it is shown that in the quantity competition, the absolute profit-maximizing firm chooses over-capacity, whereas in the price competition, it chooses under-capacity.

1. Introduction

Corporate social responsibility (CSR) has now become the mainstream all over the world. As described in Kopel and Brand (2012), KPMG (2008) reported that nearly 80% of the 250 largest companies worldwide issued CSR reports in 2008, up from 50% in 2005, and moreover, KPMG (2013), the most recent report, showed that this trend has continued, as the importance of CSR activities has continued to increase. As stated, in the 2007 annual report by the Tokyo Metropolitan Government Bureau of General Affairs, the Tokyo Metropolitan Government has continuously conducted projects on corporate social responsibility with the authorities of public enterprises, including the Departments of Transportation, Waterworks, and Sewage Line. More concretely, in the transportation department, biodiesel was introduced to Tokyo Metropolitan buses to preserve the environment. Moreover, in the waterworks department, the maintenance of private ruined artificial plantation was voluntarily conducted in order to preserve the forests along the Tama River, and further, in the sewage line department, the provision of reclaimed water was implemented in the Kasumigaseki Distinct.[1] This paper considers the capacity choice problem in a duopoly with substitutable goods that is composed

* College of Economics, Nihon University, 1-3-2 Misaki-cho, Chiyoda-ku, Tokyo 101-8360, Japan. Tel./fax: +81 3 3219 3497.
E-mail address: yasuhiko.r.nakamura@gmail.com.

[1] Obviously, these examples of CSR activity closely correspond to those of public firms. Thus, in this paper, we define the objective function of the consumer-friendly firm as the weighted sum of its absolute profit and the consumer surplus, taking into account that the two main components within the objective function of the public firm in the context of studies on the mixed oligopoly composed of the public firm and the private firm are the consumer surplus and the producer surplus which is defined as the sum of each firm's absolute profit. In addition, in this paper, we strictly focus on the extent of the importance of consumer surplus to the consumer-friendly firm as the weight parameter between the absolute profit and the consumer surplus of the consumer friendly firm, similar to Goering (2007), Goering (2008a), Goering (2008b), Lambertini and Tampieri (2010), Lien (2002), and Nakamura (2013c).

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of one consumer-friendly firm and one absolute profit-maximizing firm in both quantity competition and price competition. In this paper, we suppose that the consumer-friendly firm maximizes the weighted sum of its own absolute profit and consumer surplus, similar to Goering (2007), Goering (2008a), Goering (2008b), Lambertini and Tampieri (2010), Lien (2002), and Nakamura (2013c). The purpose of this paper is to check the robustness of the consequences of capacity choices in a duopoly composed of two consumer-friendly firms, as considered in Nakamura (2013c), by investigating a duopoly composed of one consumer-friendly firm and one absolute profit-maximizing firm. More precisely, this paper considers whether the consumer-friendly firm and the absolute profit-maximizing firm choose over-capacity or under-capacity when the degree of product differentiation and the extent of the importance of consumer surplus to the consumer-friendly firm are changed.

Since Dixit (1980) and Brander and Spencer (1983), many works have considered capacity choice problems under various economic situations.[2] Recently, in the context of a mixed oligopoly where a public firm and private firms coexist and compete in the same market, their capacity choices were investigated from the perspectives of both quantity competition and price competition.[3] As the seminal paper in this field, Nishimori and Ogawa (2004) considered capacity choice in a mixed duopoly with homogeneous goods and, subsequently, in a mixed duopoly with differentiated goods; Ogawa (2006) and Bárcena-Ruiz and Garzón (2007) investigated capacity choice under quantity-setting competition and price-setting competition, respectively.[4] Furthermore, in the modern economic world, the importance of corporate social responsibility can be seen from its broad coverage in journals and in public media.[5] Taking into consideration such a trend within each firm in the real world, Nakamura (2013c) explored capacity choice problems in a duopoly composed of two consumer-friendly firms whose objective functions are the weighted sum of their respective absolute profit and consumer surplus, which reflects the situation that a higher utility of consumers must be achieved by each firm as a consequence of its CSR activities. In this paper, we consider the capacity problems of the two firms in a duopolistic market with differentiated goods wherein one consumer-friendly firm and one standard absolute profit-maximizing firm coexist and compete, which is different from Nakamura (2013c).

In this paper, we first show that in the quantity competition with substitutable goods, (i) when the extent of the importance of consumer surplus to the consumer-friendly firm is sufficiently low, both the consumer-friendly firm and the absolute profit-maximizing firm choose over-capacity, whereas (ii) when the importance to the consumer-friendly firm is high relative to the degree of product differentiation, the consumer-friendly firm chooses under-capacity and the absolute profit-maximizing firm chooses over-capacity. Thus, in the quantity competition with substitutable goods, the absolute profit-maximizing firm always chooses over-capacity irrespective of the extent of the importance of consumer surplus to the consumer-friendly firm and the degree of product differentiation.[6] The intuition behind the former case (i) is similar to that in the situation wherein the two firms maximize their absolute profits since the consumer-friendly firm is almost an absolute profit maximizer. The two firms which are absolute profit-maximizers can collude to restrict their quantity levels in both the capacity-setting stage and the quantity-setting stage. Thus, in the case wherein the extent of the importance of consumer surplus to the consumer-friendly firm is sufficiently low, both the consumer-friendly firm and the absolute profit-maximizing firm choose over-capacity. On the other hand, in the latter case (ii), the consumer-friendly firm emphasizes consumer surplus rather than its absolute profit, and thus, it attempts to enhance consumer surplus through increasing the quantity level of the absolute profit-maximizing firm by decreasing the capacity level of the consumer-friendly firm on the basis of the negative relationship between the capacity level of the consumer-friendly firm and the quantity level of the absolute profit-maximizing firm. Consequently, the consumer-friendly firm chooses under-capacity when the extent of the importance of consumer surplus to the consumer-friendly firm is high relative to the degree of product differentiation, and moreover, the difference between the quantity and capacity levels of the consumer-friendly firm tends to be positive, as the degree of product differentiation becomes higher.

In addition, in the price competition with substitutable goods, we find that (iii) when the extent of the importance of consumer surplus to the consumer-friendly firm is sufficiently low, the consumer-friendly firm and the absolute profit-maximizing firm choose under-capacity, whereas (iv) when the extent of the importance of consumer surplus to the consumer-friendly firm is high relative to the degree of product differentiation, the consumer-friendly firm chooses over-capacity and the absolute profit-maximizing firm chooses under-capacity. Similar to the quantity competition with substitutable goods, the intuition behind the result in the former

[2] After the seminal works of Dixit (1980) and Brander and Spencer (1983), Horiba and Tsutsui (2000) investigated the effectiveness of the two types of tariff policies (discriminatory and uniform tariffs) in an international duopoly in which each firm chooses its capacity level and output level. Moreover, Stewart (1991), Zhang (1993), and Haruna (1996) considered the capacity choice of each firm in labor-managed industries.

[3] As other research areas in the context of mixed oligopoly which is composed of public and private firms, most recently, Mukherjee and Sinha (2014) found that the argument that cost asymmetries between the public and the private firm create a rationale for privatizing the public firms is restrictive since it does not allow for other methods of reducing production inefficiency between them. In addition, Wang, Lee, and Hsu (2014) showed that under free entry of domestic firms, if the number of domestic private firms is small, an import subsidy may be chosen and the optimal privatization policy is full privatization, whereas if the number of domestic private firms is large, an import tariff is imposed and the optimal privatization policy is full nationalization, by investigating a privatization policy and an entry regulation in a mixed oligopoly market with foreign competitors.

[4] Subsequently, the capacity choice problems of both public and private firms have been investigated in Tomaru et al. (2009) under the assumption of separation between ownership and management within each firm à la Fershtman and Judd (1987), Sklivas (1987), and Vickers (1985). Other works on capacity choices in a mixed oligopoly include Lu and Poddar (2005), Lu and Poddar (2006), Lu and Poddar (2009), Nakamura and Saito (2013a), and Nakamura and Saito (2013b).

[5] For example, Becchetti, Giallonardo, and Tessitore (2006) indicated that more than half of the top 100 corporations based in the 16 most industrialized countries published a CSR report in the year 2005. Furthermore, Tsoutsoura (2002) reported that more than half of the Fortune 1000 companies issue CSR reports.

[6] In Appendix A, we consider the differences in the quantity and capacity levels of both the consumer-friendly firm and the absolute profit-maximizing firm in the case wherein the goods they produce are complements in both the quantity competition and the price competition.