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Government-leading welfare-improving collusion☆

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ABSTRACT

We discuss government-leading welfare-improving collusion in a mixed duopoly. We formulate an infinitely repeated game in which a welfare-maximizing firm and a profit-maximizing firm coexist. The government proposes welfare-improving collusion and this is sustainable if both firms have incentives to follow it. We compare two competition structures—Cournot and Bertrand—in this long-run context. We find that Cournot competition yields greater welfare when the discount factor is sufficiently large, whereas Bertrand competition is better when the discount factor is small.

1. Introduction

Collusion among profit-maximizing firms raises prices, and thus, is harmful for consumer and economic welfare. Collusion has most often been modeled as an infinite repeated game. The simplest and most classical model of such an infinitely repeated game is a linear symmetric duopoly game with a grim trigger strategy (Friedman, 1971; Gibbons, 1992). In the model, joint-profit maximizing collusion is more stable under Bertrand competition than under Cournot competition, which suggests that Cournot competition might be better for social welfare than Bertrand competition. Deneckere (1983) showed that this is true in a differentiated product market for high levels of substitutability.

If some firms are concerned with social welfare in the market, welfare-improving and consumer-benefiting collusion might be formed. In this study, we analyze an infinitely repeated game in a mixed duopoly in which a welfare-maximizing firm competes with a profit-maximizing firm.[1] In the static mixed duopoly, the output (price) level of the profit-maximizing private firm is too low (too high), and inducing the private firm to choose a higher output (lower price) level improves welfare. Although the private firm has no incentive to choose the output (price) level that is higher (lower) than the profit-maximizing level in a one-shot game, the private firm might have such an incentive in an infinitely repeated game. The public firm might choose a lower (higher) level of output (price) than the welfare-maximizing level as long as the private firm chooses the higher output (lower price) level than profit maximizing. In such a situation, a future possible increase of the public firm's output can serve as a punishment, and thus, a welfare-improving collusion can be incentive-compatible in the infinitely repeated game.

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[1] For the examples of mixed oligopolies and recent development of this field, see Chen (2017), Chen et al. (2014), Nakamura (2015a, 2015b) and Wang and Tomaru (2015). Another interpretation is that one firm is concerned with corporate social responsibility (Matsumura & Ogawa, 2014).

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The Japanese financial market might be an example of possible collusion. Japanese financial institutions, such as the Development Bank of Japan, Japan Finance Corporation, and Industrial Revitalization Corporation of Japan, are supposed to play complementary roles to the private sector. In other words, these financial institutions become active only when supply by the private sector is insufficient (Matsumura & Ogawa, 2017). A natural interpretation of this situation is that the public firms are Stackelberg followers (Ino & Matsumura, 2010). Another interpretation is that the output expansion of the public firm caused by the insufficient supply of the private firms can serve as a punishment in long-run competition. A similar structure was observed in Japanese energy markets, where J-Power, which was held by the central government, and gas companies owned by local governments were more active when private competitors underinvested. Thus, we believe that there is room for considering such welfare-improving collusions in mixed oligopolies.

In this study, we consider the following situation. The government proposes welfare-improving collusion in which the private firm chooses a larger output or lower price than the equilibrium outcome in the one-shot game.[2] However, this is not incentive compatible unless the public firm chooses a smaller output or a higher price than the equilibrium outcome in the one-shot game. The government adjusts both firms' actions in the collusive phase to satisfy the incentive-compatible constraints for both firms.

We compare two competition structures—Cournot and Bertrand—in this long-run context. We find that Cournot competition (the quantity-setting model) yields greater welfare when the discount factor is sufficiently large, whereas Bertrand competition (the price-setting model) is better when the discount factor is small.

We show that the deviation incentive from welfare-improving collusion (one-shot gain of deviating from collusion) is greater under Cournot than Bertrand competition, in contrast to profit-maximizing private collusion. For this effect, it is more difficult for the government to form welfare-improving collusion under Cournot competition, and this is harmful for welfare. However, the punishment for the deviation is stricter under Cournot competition, which again is in contrast to a private duopoly. This punishment effect makes the collusion more stable. Therefore, it is easier to form welfare-improving collusion under Cournot competition, and this is beneficial for welfare. The former effect dominates when the discount factor is small, while the latter effect dominates when the discount factor is large.

We now review related studies on mixed oligopolies. Two research lines are closely related to our study. The first line is the literature on Cournot–Bertrand comparisons. Many works have already discussed profit and welfare ranking between Cournot and Bertrand competition.[3] Ghosh and Mitra (2010) and Matsumura and Ogawa (2012) showed that Bertrand competition yields larger profit in the private firm. Haraguchi and Matsumura (2014) showed that this holds regardless of foreign ownership share in the private firm. Scrimitore (2014) introduced strategic commitment stage into the standard mixed duopoly model and showed that profit ranking can be reversed. Haraguchi and Matsumura (2016) investigated an oligopoly and showed that the profit ranking can be reversed if there are more than four firms.[4] However, these works showed that Bertrand competition yields greater welfare than Cournot competition does under moderate conditions, whereas our study suggests that Cournot competition can be better for social welfare. More importantly, no study has discussed this problem in the context of long-run competition (an infinitely repeated game).

The second research line is the literature on infinitely repeated games in mixed oligopolies. Colombo (2016) discussed an infinitely repeated game in a mixed oligopoly. He introduced a firm partially owned by the government[5] in an infinitely repeated game and considered the situation in which a subset of private firms colludes. He showed a surprising and interesting result: an increase in the public ownership in the outsider (public firm) might help collusion among private firms. In particular, when the substitutability of the products is high, the existence of the public firm that does not participate in the collusion makes the punishment in the case of a deviation from the agreement harsher and makes the deviation of each private firm less profitable. This helps sustain collusion. Colombo's (2016) analysis is completely different to ours because he investigated profit-maximizing collusion, while we investigate welfare-improving collusion.[6]

Wen and Sasaki (2001) is the most closely related to our study in this line. They also discussed welfare-improving collusion in a homogeneous product market under Cournot competition with possible idle capacity. The authors considered the situation in which the private firm produces more than the profit-maximizing level in the collusive phase and the public firm keeps idle capacity to prevent the private firm from deviating from the welfare-improving collusion. However, Wen and Sasaki's (2001) focus was whether the public firm holds idle capacity and they did not discuss a comparison between Bertrand and Cournot competition.[7]

2. The model

We adopt a standard duopoly model with differentiated goods and linear demand (Dixit, 1979).[8] The quasi-linear utility function of the representative consumer is:

[2] This is in sharp contrast to the profit-maximizing collusion in which each firm chooses a smaller output or a higher price than the equilibrium outcome in the one-shot game.

[3] Another popular topic in the literature is private oligopolies. It is well known that under moderate conditions, price competition is stronger, yielding lower profits and greater welfare than in the case of quantity competition. See Shubik and Levitan (1980) and Vives (1985).

[4] Nakamura (2015a) investigated the bargaining between managers and owners in this context.

[5] For a discussion of partial privatization in mixed oligopolies, see Matsumura (1998).

[6] For a discussion on stability collusion among non-profit-maximizers, see also Matsumura and Matsushima (2012).

[7] For long-run analysis not based on infinitely repeated game in mixed oligopolies, see Matsumura and Kanda (2005), Nishimori and Ogawa (2005), and Ishibashi and Matsumura (2006).

[8] This demand function is popular in the literature on mixed oligopolies. See Bárcena-Ruiz (2007), Ishida and Matsushima (2009), Matsumura and Shimizu (2010), and Haraguchi and Matsumura (2014,2016).