

## **Title: Cost-reduction innovation under mixed economy**

### **Discussion Paper No. 2015-68**

Thank you for your detailed and helpful comments. We would improve and clarify the manuscript accordingly. The followings are our replies and ways to reflect your comments.

1. The standard assumption in the literature of mixed oligopolies is that the public firm maximizes social welfare. However, in this paper, this is not the objective of the (semi) public firm when  $\tau = 1$ , because no weight is given to the profits of the private firm. Some comments about why the paper departs from the traditional papers are warranted.

**Reply:** As stated by Matsumura (1998), in a market structure with mixed oligopolies, the objective of a (semi-) public firm is to maximize its profits plus the weighted social welfare. We follow the settings with further modification in our manuscript. Denote  $\tau$  to be the degree of the public ownership, and the objectives of the firm could be clarified into three cases. When  $\tau = 0$ , the firm is totally private without public ownership, implying that it only concerns about its profits instead of social welfare. When  $0 < \tau < 1$ , the firm is semi-public and its maximization objective is integrated by its profits and social welfare. There is no difference between the model in our draft and other existed literature in the two cases mentioned above. Instead, the difference arises when  $\tau = 1$ . In this case, the firm becomes a complete public one and no weight is given to the profits in the objective function in the traditional papers like Matsumura (1998). We argue that this standard assumption should be modified for the following reason. In our opinion, even a complete public firm still need to take profits into consideration besides social welfare. For instance, the evaluation of Economic Value Added (EVA) is applied in some countries like China to assess the profitability of public firms, including complete public ones. As a result, the objective of most public firms is integrated by profits and social welfare, while complete public ones

give more weight to social welfare than semi-public ones. That is why the settings in our manuscript depart from the traditional papers.

2. The fact that both the outputs and the investment of both firms increase with  $\tau$  is surprising. In a Cournot setting, if a firm becomes more aggressive (in this case the (semi) public firm when  $\tau$  increases), the output of this firm increases and the output of the competitor decreases. The authors should explain why this logic does not apply in their paper. I figure out two possible reasons: the fact that firms also invest in order to reduce costs and the chosen objective of the (semi) public firm.

**Reply:** As presented in Proposition 2 in the paper, the equilibrium output and innovation of both firms increase with the degree of public ownership. The findings differ from the general cases under standard Cournot settings and thus interesting and surprising. As the referee mentioned in the comment, several possible reasons arise for explanation. First, regardless of the degree of the public ownership, both firms aim to reduce their marginal production costs. More outputs and innovation investment do help to achieve this objective, while the former one brings about scale economics and the latter one improves productivity. Especially, as the (semi-) public firm becomes more aggressive with an increase of  $\tau$ , the private one has to invest more in innovation to enhance its productivity and reduce its production costs. Otherwise, it may quit production under the pressure of competition. As a result, not only the (semi-) public firm but also the private one invest more and produce more than before. Second, the chosen objective of the (semi-) public firm is comprised of two parts, namely its profits and consumer surplus. Obvious, more total outputs and innovation investment of both firms bring about more consumer surplus. Therefore, as the (semi-) public firm concerns more about consumer surplus when  $\tau$  increases, it is willing to enhance the total production and investment of the market but not only itself. That is, with a larger  $\tau$ , producing more and investing more are beneficial to both firms. Third, in some industries depending on basic research heavily, like telecommunication and semiconductor, most private firms prefer to invest in application research but not basic research because of low expected return. In contrast, (semi-) public firms are

willing to carry out basic R&D activities since their objective is to maximize integrated profits and social welfare. In these industries, basic research implemented by (semi-) public firms is also beneficial to private firms because of technology spillover effect. Hence, both the outputs and the investment of both firms increase with  $\tau$ . Due to the possible reasons presented above, the standard settings and conclusions of Cournot model do not apply in our paper.

3. As far as the presentation is concerned, there is a lot of math in the paper. I would try to lighten the presentation.

**Reply:** We would try to lighten the presentation of math in the revision of the manuscript as suggested.

#### REFERENCE

Matsumura, T. (1998). Partial privatization in mixed oligopoly. *Journal of Public Economics*, 70, 473–483.