

## **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. This paper tries to investigate the effect of R&D competition on firm performance in a mixed duopoly in which a for-profit private firm competes with a public firm whose objective is to maximize a weighted sum of the consumer surplus and its own profit. The demand system follows that in Bowley (1924). Each firm engages in cost-reducing investment. The timing structure is quite standard (R&D, quantities).

This paper shows that an increase in the weight for the consumer surplus enlarges both the quantities of the public and the for-profit firms. If this really holds true, the result is a little surprising because I expect that an increase in the weight increases the quantity of the public firm, but decreases the quantity of the for-profit firm because of the strategic substitution between the quantities. Because this paper does not mention the reasons why the propositions hold, I have a difficulty to understand the mechanism behind the results in this paper. Detailed discussions on the propositions are needed.

**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. 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.