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 above mentioned paper considers a mixed duopoly where a public (or partially privatised firm) competes with a private firm in a market with product differentiation. Firms have the possibility of investing in cost-reducing innovation in a stage prior to output competition. The public firm (firm A) maximises the weighted average of its own profits plus consumer surplus. The weight allocated to consumer surplus (tau) indicates of the degree of public ownership, with tau being 1 when the firm is fully public and 0 when is fully private. The private firm (firm B) maximises its own profits. The paper adds on to the literature on mixed oligopoly by consider product differentiation in this setting.

The authors show that the level of investment in innovation by both the public and the private firm is increasing in the degree of public ownership of firm A. The same applies to the two firms' output levels. As a consequence, prices are decreasing in the degree of public ownership of firm A.

I have a few comments to make on the current version of this paper:

- Public firm's objective function

A large part of the literature on mixed oligopoly (including many of the references cited in the literature review) assumes that the public firm maximises SW; that is, the public firm maximises the sum of producer and consumer surplus. Here, the public firm does not take into account the profits by the other firm. It would be good to check whether the results are robust to those formulations.

Reply: The standard assumption in existed literature of mixed oligopolies is that the public firm maximizes social welfare without concerning profits. 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. In addition, we suppose that each firm concerns its own profits instead of its competitor, no matter which type of firm it is. This assumption is reasonable since it matches the actual situation well. Interestingly, though the public firm does not take into account the profits by the other firm, the results indicate that an increase in the weight for the consumer surplus enlarges both the quantities of the public and the for-profit firms. That is why the settings in our manuscript depart from the traditional papers.

2. • Cost functions

Again, a large part of the literature on mixed oligopoly assumes that the cost functions are quadratic in outputs. Some contributions assume instead that the public firm is ex-ante less efficient than the private firm. Here, the cost functions are linear in output and the authors assume that the marginal cost of production for both firms is the same (see above eq. 10 where ca=cb=c; in fact it would be best to state this when the model is first presented). The reason why quadratic costs are often assumed (or differences in marginal costs) is that they allow to rule out the case of natural monopoly (which would not be interesting for a paper on mixed markets). I wonder whether the degree of product differentiation plays a similar role here. What is the degree of product differentiation that would guarantee that a mixed oligopoly is socially preferable to a single public firm operating in this industry? It would be important to clarify this point and also explain better how the paper fits or differs from the current literature.

Reply: We neglect the difference of efficiency between private firm and public firm, since it is not the major concern of the research. As stated by Barcena-Ruiz (2012), it is not necessarily that public firm is less efficient than a private owned firm. To

simplify the analysis, we assume that public firm is as efficient as private firm in the paper. The assumption is the same as that in the study of Barcena-Ruiz (2012), implying that the marginal costs of production for both firms are the same. Likewise, we assume that the cost functions are linear in output for simplification since we focus on mixed markets.

3. • Degree of product differentiation:

Related to the above point, it would be worth emphasizing why introducing product differentiation here matters. My reading of the paper is that the results hold regardless of the degree of product differentiation (please correct me if I am wrong). This should be emphasized.

Reply: As shown in the paper, the equilibrium solutions of innovation investment, production and price depend on the degree of product differentiation, while the effects are uncertain. Obviously, introducing product differentiation into the model does help to make the results more consistent with the reality. We do not emphasize on this, however, for the following two reasons. First, product differentiation is not the major concern in the paper. Second, the effects of product differentiation on the results are somewhat complicated and uncertain. In addition, we would try to analyze this in further discussion as recommended.

4. • Effect on Social Welfare.

Given the results (both investments in innovation and output increasing in the degree of public ownership of firm A), one wonders whether social welfare is also increasing in this parameter. Would the degree of product differentiation affect this result or not?

Reply: As presented in proposition 2 and 3, both investments in innovation and output increase in the degree of public ownership, while the equilibrium price decreases. For the reason that both firms and consumers benefit from this, social welfare is also increasing in this parameter. Meanwhile, the degree of product differentiation affects this result through price difference. That is, the effect of the degree of product differentiation on the result is indirect.

5. • Firm size:

In proposition 4, the authors refer to “firm size”. Do they mean equilibrium output level? This needs to be clarified.

Reply: To be precise, “firm size” mentioned in proposition 4 refers to equilibrium output level.

6. • The literature review needs improving.

The literature on mixed oligopoly is quite vast and the review seems a bit ad-hoc. For example, it is not clear to me what the authors mean with literature on “firms’ strategies” vs “other factors” or with “in practice”. A much better effort at placing the paper on the literature is needed.

Reply: We would try to improve the literature review as suggested. Meanwhile, firms’ strategies in the paper refer to pricing strategy, production strategy and innovation strategy and so on, which are further presented in the last paragraph of page 2. Also, “other factors” mentioned in the paper include firms’ endogenous objectives, uncertain demand and political manipulation. Likewise, we have already presented these factors on page 3. Notice that mixed oligopolies is not included in the “other factors”, since it is a dependent variable instead of independent variable in the model of related papers.

7. • The writing needs improving as well.

Some of the words do not seem to be used wrongly and generate confusion. For example, at the top of page 6, it says “apparently” the condition is met if…. Have the authors actually checked this? Also, there are some grammar mistakes. The text needs to be checked thoroughly.

Reply: We would check the text thoroughly to correct the mistakes as recommended.

8. • Proofs of propositions 3 and 4:

It would be best to explicitly include them in the appendix.

Reply: We would add the proofs in the appendix as suggested if necessary.

9. • Assumption in page 5:

It would be best to discuss in more detail the combinations of parameters tau and gamma that allow for this assumption to hold.

Reply: We would try to give more specific explanation and discussion of the combination of the two parameters as suggested.

Barcena-Ruiz, J.C. (2012). Privatization when the public firm is as efficient as private firms, Economic Modelling, 29(4), pp. 1019-1023.