Report on "Monopoly Innovation and Welfare Effects"

by

Shuntian Yao and Lydia Gan.

As indicated by the title, the paper examines welfare effects of a monopoly innovation. The main difference between this paper and many of the classical papers in the literature (including e.g. Maskin and Riley, 1984, RAND J. Economics) is that this paper analyzes a general equilibrium model. The fundamental insight is that technical innovation significantly increases social welfare.

The paper starts with a detailed literature review starting from the seminal paper by Harberger (1954). This was the first paper that attempted to quantify welfare losses due to monopoly. The authors also describe the criticism of this paper and alternative ways of quantifying welfare losses that has been suggested in the literature. This background is very detailed and well written. After the literature review, the authors introduce the formal model and the decision problem for the firms and the consumers in the economy. The model is a two-sector economy where one sector includes a finite number of competitive firms and the other sector is the monopoly. The completely homogeneous consumers in the economy earn income from their profit shares in the firms and from renting natural resources to the firms. The monopoly selects a capital stock by maximizing profits, and consumers maximize utility by selecting an optimal consumption bundle.

Given the above, the main theoretical result (Theorem 1 on p.12) demonstrates that under a number of specific assumptions (I will come back to these later), the welfare effect of the innovation is positive. The paper also contains a numerical simulation and a proposition (on p. 22). This proposition basically states that given the new technology, welfare increases if resources are transferred from the competitive firms to the monopoly.

Evaluation of Theorem 1

Because the main contribution of the paper is the result in Theorem 1, this section evaluates it in detail (I will not evaluate Proposition 1 because it is only based on a single observation in a numerical example). Theorem 1 states:

1

Theorem 1 *Suppose in the economy as described above, the utility function of each consumer is strongly increasing. Suppose the new production technique $\psi(K)$ is constant returns to scale, or increasing returns to scale when $K \leq C$. And suppose that, after the innovation, the equilibrium output by the monopolist is larger than that which it was before the innovation. Then, ignoring the research and development (R&D) costs for technical innovation, the welfare effect of the innovation is positive.*

Let me first be clear on one point. Namely, each theoretical model needs a number of assumptions in order to be manageable. It is therefore important that these assumptions can be justified and that they do not affect the results too much. For example, it is very natural to assume that the utility function is continuous and monotonically increasing in consumption as the authors assume. I am however not convinced that the following assumptions from Theorem 1 are very natural (in particular, the result is heavily dependent on them):

(i) "... suppose that, after the innovation, the equilibrium output by the monopolist is larger than which it was before the innovation."

(ii) "... ignoring the research and development (R&D) costs for technical innovation..."

Let me illustrate this point by discussing (i) and (ii) and their relation to the solution of the optimization problems in more detail. The main outcome of my discussion will be that the result in Theorem 1 holds trivially. The underlying intuition is that the consumers get something which increases the welfare (i.e. a cheaper production) but they need not pay anything (i.e. there are no R&D costs). To be more specific, let us first recall a standard result from optimization theory. Suppose that function $f(x_1, x_2)$ is maximized subject to a set of constraints $\mathcal{C}$, and collect all pairs $(\hat{x}_1, \hat{x}_2)$ that satisfy all constraints in the set $\mathcal{C}$ in the set $\mathcal{F}$ (i.e. a solution must belong to the set $\mathcal{F}$). If (x_1^*, x_2^*) is a solution to the maximization problem, then $f(x_1^*, x_2^*) \geq f(\hat{x}_1, \hat{x}_2)$ for all $(\hat{x}_1, \hat{x}_2) \in \mathcal{F}$. From this observation, we conclude that one need not find the "new" equilibrium to prove Theorem 1. In fact, one need only to

find a consumption bundle $(\hat{x}_1, \hat{x}_2)$ that satisfies all constraints in the economy and in addition increases the utility of the agent (recall that all agents are completely homogeneous). That is, if (x_1^*, x_2^*) is the optimal consumption bundle before the innovation, (x_1^{**}, x_2^{**}) is the optimal consumption bundle after the innovation, and $(\hat{x}_1, \hat{x}_2)$ is a arbitrary consumption bundle satisfying all constraints after innovation such that $u(\hat{x}_1, \hat{x}_2) > u(x_1^*, x_2^*)$ then the result will hold since $u(x_1^{**}, x_2^{**}) \geq u(\hat{x}_1, \hat{x}_2)$ by utility maximizing. Given this observation, the proof of Theorem 1 follows directly from (i) and (ii). To see this, let $\hat{K} = K^*$ and $\hat{k} = k^*$. From (i) and Part (b) of Definition 1 (p.12) it now follows that there exists some consumption vector $(\hat{x}_1, \hat{x}_2)$ such that $\hat{x}_1 = x_1^*$, $\hat{x}_2 > x_2^*$ and all constraints are satisfied. Hence, by the monotonicity assumption on the utility function and the above reasoning, it follows that $u(x_1^{**}, x_2^{**}) \geq u(\hat{x}_1, \hat{x}_2) > u(x_1^*, x_2^*)$, which concludes the proof.

Two remarks are in order here. *First*, the authors use very similar arguments as above in their proof (see pp. 14-15) but they continue to search for the optimal solution. This is not necessary by the above observations. Hence, their proof can be shortened substantially and they do not need the assumption regarding returns to scale (stated in Theorem 1). *Second*, the reason for that the proof reduces to such a simple case is assumption (b) which essentially states that it is costless to develop a new technology (i.e. a new production function). In this sense there is "a free lunch" in their economy and this affects the results. I am not convinced that their result holds if the R&D costs would be positive (which is the natural assumption). The authors claim that their assumption (b) is not a problem in a footnote on page 12. However, their arguments are based on an economy consisting of multiple periods but their analysis is based on a one-period model. Hence, their arguments are not valid in their framework. If it was me, I would have considered a constraint of type:

$$mk + K = C - \alpha,$$

where α represents the R&D costs. This would make thinks far more interesting and it would be possible to identify a "critical cost" α^* where consumers are indifferent between undertaking the investment or not.

Evaluation of the paper

The way I see it, this paper contains a very nice introduction to the literature on monopoly and welfare effects. The main theoretical result (Theorem 1) is however not very unexpected given the modelling assumptions and the assumptions under which the theorem is valid. The analysis is correct (although more detailed than necessary as explained above) but the contribution is not very significant due to its simplicity. For this reason, I cannot recommend the paper for publication in *Economics*.