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Measuring research benefits in an imperfect market: reply to Holloway

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Voon's original claim (Voon, 1994) was that the benefits of generating through research a parallel shift in a monopolist's marginal cost curve exceeded the benefits from generating the same shift if the curve represented the market supply curve for a competitive industry. As we noted in a subsequent comment, this result was wrong, with Voon's error being due to the use of incorrect normalization procedures in his simulation analysis. We further articulated the general principle that welfare from an innovation in a monopoly industry would be greater than in a structurally-equivalent competitive industry if and only if the deadweight loss due to monopoly decreased as a consequence of that innovation. Finally, we opined that this condition will normally not be met in monopoly or other imperfectly competitive structures because, in seeking to capture benefits from the innovation, a monopoly or oligopoly industry will generate less output expansion than would occur under perfect competition, thereby causing the deadweight loss to increase.

Holloway now claims to have discovered a type of cost shift that does generate higher welfare under monopoly than under competition. He does so, however, by departing from the original model structure set forth by Voon because, as Holloway notes, the result is not attained in Voon's model. Because our original comment served merely to correct Voon's error and did not constitute an endorsement of his model, perhaps we are in a position to fairly arbitrate between the alternative model structures offered by Voon and Holloway.

The difference between the two approaches is simple. Voon considers a model wherein the same upward sloping curve, $\mathrm{MC}(Q) = b + \beta \mathrm{Q}$ is considered alternatively as the supply curve for a competitive industry and as the marginal cost curve for a monopolist. This structure is familiar to almost everyone. A quick check of various intermediate microeconomic theory texts written by some of our leading contemporary microeconomists (e.g., Katz and Rosen, Perloff, Pindyck and Rubinfeld, and Varian) reveals that each uses this basic model to compare equilibria under monopoly versus perfect competition.

In the Voon approach, costs are identical at the market level whether the industry is competitive or monopoly. Thus, implicitly the costs of individual competitive firms must differ from the costs of the monopolist. What, if any, real-world interpretations can we give to this set up? One plausible interpretation with great relevance for agriculture is that the competitive industry comes under the control of a cartel authority such as a US marketing order or a state trader, such as can be found in many countries.

Conversely, Holloway posits $N \geq 1$ firms, each with the identical, increasing marginal costs $\mathrm{MC}(Q) =$

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$b + \beta Q$. He solves for the Cournot equilibrium and uses the solution for $N = 1$ to represent monopoly and the solution as $N \rightarrow \infty$ to represent competition. The idea of viewing competitive equilibrium as a limit of the Cournot equilibrium is not new. For example, Friedman (1983) discusses the idea in some detail in his text on oligopoly. Of course, if costs are identical at the firm level, they will be different at the industry level, as Holloway's Fig. 1 aptly illustrates. With no fixed costs and rising marginal costs, the optimal industry structure involves an infinitely large number of firms, each producing an infinitesimal output.[1] A single seller incurs a substantial cost penalty relative to a market structure containing many sellers.

We saw that Voon's structure provides a meaningful basis for comparison of monopoly versus competition in various circumstances relevant to the real world. However, we fail to see the relevance of Holloway's structure. A monopoly could not sustain itself given its cost penalty relative to more atomistic market structures. Suppose, however, that a monopoly did exist in Holloway's world of diseconomies of size, sustained due to some barrier to entry. Presumably then the monopolist would seek to operate a large number of plants or stores to obviate the cost penalty associated with size. In other words, the monopoly would seek to replicate the structure of a competitive industry, and, in general, there is nothing to stop him/her from doing so.

For example, consider consumers arrayed continuously with unit density along a line of unit length. Each consumer is willing to buy one unit of a product subject to price being below a common reservation value $r > 0$. The only costs incurred by a seller are the costs of transporting the product to buyers. These costs are a linear function of the shipping distance. This set up provides a modestly plausible example of an industry that would exhibit Holloway's cost structure. A monopolist operating a single plant anywhere along the line could be supplanted by entrants who located closer to various customers and, thus, incurred lower production/shipping costs. What would a monopolist do in this market? Presumably, he/she would elect to have multiple stores/plants (in the limit, a plant/store would be located at each customer's location). And if the monopolist undertakes this simple economizing behavior, we have the result that costs under monopoly are identical to costs under the competitive industry, i.e., we have Voon's model. The only requirement is that the monopolist be able to replicate, using multiple plants or stores, the cost structure that a competitive industry could accomplish.

Thus, we find no rational basis for Holloway's comparison. His model involves different costs at the industry level depending upon whether the industry is competitive or monopoly. Of course, the different market structures also entail different behavioral rules. Thus, the difference in behavior in response to a cost shift is both due to differences in the industry cost structures and to differences in behavior. In the example Holloway offers, the pivotal shift in marginal costs does not affect the competitive industry at all because each firm is essentially operating at the unchanged intercept point b. Costs do fall for the monopolist, who responds by increasing output. Incredibly, this causes Holloway to announce that he has discovered a case where returns to a cost-reducing innovation are higher under monopoly.

Finally, we would like to call attention to a alternative model to compare returns to a cost-reducing innovation under various market structures. This model is based on work one of us did with other colleagues (Huang and Sexton, 1996; Alston et al., 1997). In brief, this model posits an upward sloping supply curve for a farm product. The product is purchased and sold by processors with constant per-unit costs. The processing industry may involve imperfect competition, both in purchasing the farm product and in selling the finished product to consumers. Because this model contains a distinct marketing sector and marketing firms have constant costs, costs are the same at both the firm level (Holloway's case) and the industry level (Voon's case), enabling the analysis to focus squarely on the effects of different forms of competition on the size and distribution of benefits from a cost-reducing innovation in the farm sector.

Although Holloway is correct that neither Voon (1994) nor Sexton and Sexton (1996) analyzed the

[1] This structure, of course, is implausible. However, rising marginal costs and zero fixed costs are necessary for Holloway's modelling paradigm to work. Although positive fixed or start-up costs would introduce an element of realism into the model, he would no longer be able to represent competitive equilibrium as the case where $N \rightarrow \infty$ (Friedman, 1983).

case of a pivotal supply curve shift (i.e., a reduction in β), ASZ did analyze this case within the model structure outlined in the preceding paragraph. This work was first presented at the Global Agricultural Science Policy (GASP) conference in Melbourne, Australia in August 1996 and later published as Alston et al. (1997). Holloway attended the GASP conference, and we are disappointed that he did not cite this prior work on pivotal supply curve shifts under imperfect competition.[2]

ASZ show that research benefits may be greater under oligopoly-oligopsony than under competition for a pivotal supply shift because the pivotal shift makes farm supply more elastic, which reduces the oligopsony distortion. However, if there is only monopoly or oligopoly power as in the cases analyzed in this exchange, research benefits from a pivotal supply shift are less under imperfect competition than under perfect competition. This result is not especially surprising because it reaffirms the basic intuition that firms with market power will restrict output in order to raise price. Thus, in seeking to convert a cost-reducing innovation into profits, these firms will expand output less than a competitive industry, cause deadweight losses to increase, and generate less total research benefits than the competitive industry. Voon was wrong in 1994 when he said otherwise, and Holloway is wrong now.

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[2] Other recent work that examines pivotal and other forms of supply shifts under imperfect competition is Hamilton and Sunding (1998).