Dynamic Supply Response and Agricultural Investment: Discussion

John M. Antle

One might liken academic economic research to nouveau cuisine, in which success is measured more in terms of exotic sounding recipes than in good tasting food. In the spirit of the nouveau cuisine that is dynamic economics, these three papers offer us recipes with all the right ingredients: linear-quadratic and more general stochastic control; dynamic duality; econometrics and time-series analysis; all liberally garnished with mathematical notation. No bland partial-adjustment models from these avant-garde chefs! These papers' titles lead one to expect an appetizing menu for the sophisticated research palate. But a real chef d'oeuvre is a delicate blend of all the essential ingredients. I find these papers are heavy on technical detail, and lacking in motivation and application. The general reader who has not already acquired a taste for this fare is likely to suffer indigestion. But those who are accustomed to heavy helpings of equations should find these papers worth tasting.

Faced with the task of commenting on three papers in a few pages, it is not possible to make detailed comments on any one paper. Therefore, my remarks are limited to some general comments on dynamic production analysis as they relate to these papers.

Chambers and Lopez offer a rationalization for the cost-of-adjustment model as an approximation to a more general dynamic model. Their analysis is valid for a nonstochastic world. But I find it difficult to understand how agricultural production decisions are made over time without including the stochastic structure of the production process in the story. The duality theory Chambers and Lopez use is not defined under uncertainty, and this is a major limitation of the dual approach, whether static or dynamic. The dual approach might be more useful in the aggregate in which individual producers' decisions are not being modeled. Of course many static aggregate analyses have used the dual approach, but the aggregation problems Chambers and Lopez discuss are worrisome. One wonders, for example, what sense it makes to impose the symmetry restrictions of microtheory on aggregate models.

Karp and Shumway ask why the profession has been slow to jump on the dynamics bandwagon. My guess is that agricultural economists, as primarily applied researchers, have recognized the fact that the pooled time-series and cross-section data needed to implement dynamic production analysis do not exist, especially at the disaggregated level of greatest interest to most agricultural economists. (Try to find an empirical study of rational expectations based on microeconomic data.) Indeed, it is surprising that none of the three papers in this session address the critical data issue in espousing one dynamic model or another. I believe this is the most important constraint on our ability to do applied dynamic production economics, even though the models themselves pose serious problems of complexity and tractability. I suggest that those who believe dynamics are important get out in the field and collect the kind of detailed primary data needed to implement their ideas. Otherwise, the schism between theoretical and applied production economics will become increasingly wide.

Weaver and Stefanou argue that fully rational optimization models, and by implication their behavioral restrictions, probably are unreasonable in a dynamic, nonrepeating world. They advocate the use of unrestricted time-series models to empirically explore the dynamic properties of the data. I believe this approach is useful as a descriptive exercise, but would caution that "measurement without theory" is fraught with well-known methodological problems. And I would hasten to inquire: with what data will these sophisticated time-series models be estimated?

I think agricultural economists doing research in this area need to ask two fundamental questions. First, in what specific research

Assistant Professor of Agricultural Economics, University of California, Davis.

areas will dynamic models improve our ability to test theory, understand and predict behavior, and evaluate policy? It seems clear to me, for example, that to understand farm-level production decision making, it is often necessary to understand the dynamics of the production process. The theory and measurement of technological change provides another example where theory is explicitly dynamic, yet most measurement is static. Perhaps dynamic empirical models could advance our understanding of this important issue.

Second, what properties of agricultural production and decision making cause agricultural production to be dynamic? Many explanations, such as the existence of adjustment costs, are not much more than euphemisms for our ignorance. Invoking adjustment costs is a poor substitute for careful thinking about the characteristics of agricultural technologies that actually induce production dynamics. It is important for agricultural economists to focus on the most important factors driving agricultural production dynamics because dynamic models can be very complicated and analytically intractable.

The problem of tractability of dynamic production models deserves special attention. It is at issue, either implicitly or explicitly, in all three of these papers. The problem really is a very old one in the philosophy of science: the world is very complex, yet our ability to model and measure it is limited. The more tractable and understandable are our models, the less realistic they necessarily become. The best solution I have found to this seemingly unavoidable paradox was proposed by Arnold Zellner in his paper, "Philosophy and Objectives of Econometrics." He argues for sophisticatedly simple models which are sophisticated in terms of the principles they represent but are mathematically simple or elegant. This approach forces us to identify the underlying principles and structures that are important in agricultural dynamics. I fear that the mathematical complexity of dynamic optimization models is leading the profession to believe that dynamic relationships are necessarily more complicated than static ones. This is not necessarily true. Zellner suggests that "when we say that something is complicated, it is equivalent to saying that we have something which is not understood. In my view understanding involves simplification not complication and thus I am unhappy with these complicated, little understood models . . .". The challenge to researchers in this field, then, is to show how a dynamic framework can help us understand producer behavior, not to develop complicated dynamic mathematical models that no one can understand.

Contrary to the impression one might get from reading these three papers, a very general representation of a dynamic production model is not necessarily complicated. Bellman's Principle of Optimality implies that dynamic production models have a simple recursive structure which is dictated by the logical time ordering of events over the course of the production process. Input decisions and stochastic events such as weather are thus linked sequentially over time to outputs. I think this general view of dynamic production systems can lead to sophisticatedly simple dynamic production models. This view can also help us to avoid complicated, poorly understood models and to concentrate on the basic economic relationships that are involved. Using Bellman's principle, it is possible to devise some simple approximations to general models which can be useful in applied research. For example, the dynamic Cobb-Douglas production model happens to be quite simple, being a straightforward generalization of the static model. Steve Hatchett has found this dynamic production model useful in his recent analysis of irrigated crop production.

In conclusion, these three papers together provide the reader with a broad overview of possible approaches to modeling dynamic production processes. These papers are devoted largely to the technical issues involved in their particular approach, with little discussion of how useful these models are likely to be in studying specific theoretical or policy questions. To return to the culinary metaphor, these recipes remain to be tried in the kitchen. Until these authors can show us that these new entrées really do taste as good as they sound, I expect most chefs to stay with the traditional tried and true dishes, whether they be static or dynamic.

References

Hatchett, S. A., "Dynamic Input Decisions: An Econometric Analysis of Crop Response to Irrigation." Ph.D. dissertation, University of California, Davis, 1984.

Zellner, A. "Philosophy and Objectives of Econometrics." In *Contemporary Economic Analysis*, ed. D. Currie and D. Peel. London: Croom Helm Publishing Co., 1982.