DISCUSSION: METHODS FOR EVALUATING ECONOMIC EFFICIENCY IN AGRICULTURAL MARKETING

Stephen E. Miller

The paper by Kilmer and Armbruster provides an overview of available models and methods for measuring efficiency. The authors discuss the circumstances in which these models and methods may be appropriately applied, some of their limitations, and some areas in which further research is needed. As such, the paper may be considered a partial update of the omnibus reviews of efficiency research by Helmberger et al., and French. Given the constraints on the length of their paper, the authors could obviously present only selected topics from among the many covered by the broad umbrella of efficiency research. I have few arguments with what the authors have said. As a consequence, I will focus my remarks on some topics which Kilmer and Armbruster have not covered to the extent to which I think they deserve attention.

DEFINITIONS

First, I have a few comments regarding definitions. In the paper, the following forms of efficiency are mentioned: technical efficiency, redistribution efficiency, price efficiency, allocative efficiency, production efficiency, cost efficiency, and economic efficiency. Unfortunately, not all authors agree on the definitions of these terms. For example, Kilmer and Armbruster along with Bressler and King (p. 404) call the product of technical and pricing efficiency (as used by Farrell) economic efficiency, whereas, Farrell identified this product as overall or productive efficiency. Lang has pointed out that productive efficiency (as used by Farrell and thus economic efficiency as used in places by Kilmer and Armbruster) is not synonymous with economic efficiency as used by Henderson and Quandt (p. 255), who identify economic efficiency as Pareto-optimality; i.e., Pareto-efficiency. To further add to the confusion, Kopp calls pricing efficiency (as used by Farrell) economic efficiency.

I recall a story, perhaps apocryphal, that Professor I. J. Good has collected more than 100 alternative definitions of probability. Counting the forms of efficiency listed above, and adding O-efficiency and X-efficiency, I have a good start on a comparable collection of efficiency definitions. My point is that the term "efficiency" conjures up many diverse images. Thus, economists should be very specific in references to "efficiency" and the particular definitions that are used. One of the problems I have with the paper by Kilmer and Armbruster is that I am not always sure of their definitions.

MEASURING PRODUCTIVE EFFICIENCY

I suppose that most would agree that among the various forms of efficiency, economists are best able to measure productive efficiency; i.e., the private, pecuniary unit cost of production (Lang). But, even here, there are problems. Pasour and Bullock have pointed out that efficiency norms should take account of the environment in which real-world decisions are made. They cite uncertainty, costly information, and the interdependence of time periods as salient features of the real-world which are too frequently ignored in attempts to measure efficiency. That is, *ex post* analyses of efficiency ignore the problems faced by economic actors *ex ante*.

To what extent have models and methods been developed and applied which take account of these complications? Consider models which attempt to evaluate the optimal configuration of plant numbers, sizes, and locations. Kilmer and Armbruster report progress in the development and application of dynamic plant location models. But what of the effects of uncertainty? An assumption of the plant location modeling process is that commodity (input) supplies are fixed at each origin. In empirical applications, the fixed supplies are usually estimated as either the average production of the commodity at each of the origins over some historic period or as projected production of the commodity at each of the origins at some future date. However, both of these approaches ignore the considerable yield variability characteristic of many agricultural commodities. For

---

Stephen E. Miller is an Associate Professor, Department of Agricultural Economics and Rural Sociology, Clemson University.

a particular origin, supplies would be expected to be above-average one-half the time, and below average during the other.

How do decisionmakers cope with uncertain supplies? One means of coping would be to diversify sources of supply, say by contracting for supplies from several origins. Thus, while plant location models which ignore supply uncertainty may indicate an "efficient" solution in which a particular plant receives supplies from only a limited number of origins, actual shipment patterns in which plants receive supplies from numerous origins may be observed. That is, plants have a "portfolio" of supply sources. Higher transportation costs are incurred, but risks are simultaneously reduced. Another means of coping would be in plant design. While economic engineering studies might indicate that a given plant design would yield lowest processing costs assuming fixed supplies, decisionmakers may well opt for plants which are more flexible in terms of the quantities that can be processed. That is, the plant designs selected may have higher, but flatter, average cost curves than the plants with lowest costs for the given processing levels indicated by plant location studies (Pasour and Bullock).

Solutions to plant location models and observed plant numbers, sizes, and locations do not conform. It may be that our models are correct and the world is wrong, but I suspect that incorporation of risk considerations into the modeling process might well reduce the disparity between model outcomes and observed configurations.

Kilmer and Armbruster point out that our attempts to measure productive efficiency generally have ignored the problem of multiproduct relationships. Given the trend toward product diversification by agricultural marketing firms (Conner), this would appear to be a serious shortcoming of our methods for measuring productive efficiency. An explanation for the lack of empirical research in this area has been our lack of theoretical cost concepts for multiproduct firms. However, Baumol et al. have made recent advances in this regard by introducing the concepts of product-specific economies of scale (the relationship between the ratio of the addition to total costs associated with producing a given product at a given out-put level as compared to not producing it at all and the output of that product, and the marginal cost of that product) and economies of scope (the relationship between costs of producing multiple outputs jointly versus separate production). These concepts can be combined to obtain a measure of multiproduct economies of scale. Empirical studies based on these concepts are only beginning to become available. To my knowledge, no such studies have been made in the area of agricultural marketing. Development and application of empirical methods for purposes of testing the hypothesis-rich work of Baumol *et al.* would seem to be a fruitful area for further research.

MEASURING ALLOCATIVE EFFICIENCY

My reactions to the discussion of allocative efficiency by Kilmer and Armbruster are mixed. First, the number and diversity of topics lumped together in this section leaves me wondering what the authors mean by use of the term "allocative efficiency." At the outset of this section, the authors state that they are interested in the extent to which exchange mechanisms generate competitive prices. But, under this heading, a review of some recent work in the area of welfare economics that, following the terminology of Henderson and Quandt, might be better termed analyses of Pareto-efficiency is offered. No indication of how these developments have been, or should be, applied in determining the extent to which exchange mechanisms generate competitive prices is given.

The work by Carl, Kilmer, and Kenny; and Kilmer and Ward concerning the pricing of heterogeneous products would appear to be promising first steps toward a better understanding of price determination in other than traditional spot markets. However, I fear the data availability problems cited by Kilmer and Armbruster preclude widespread application of these models.

Kilmer and Armbruster conclude their paper by noting that although progress has been made in developing methods and models for evaluating efficiency, much work remains to be done. I concur.

REFERENCES

Baumol, W. J., J. C. Panzar, and R. D. Willig. *Contestable Markets and the Theory of Industry Structure.* New York: Harcourt Brace Jovanovich, Inc., 1982.

Bressler, R. G., and R. A. King. *Markets, Prices, and Interregional Trade.* New York: John Wiley & Sons, Inc., 1970.

Carl, E., R. L. Kilmer, and L. W. Kenny. "Evaluating Implicit Prices of Intermediate Products." *Amer. J. Agr. Econ.* 65(1983):592-595.

Connor, J. M. *The U.S. Food and Tobacco Manufacturing Industries: Market Structure, Structural Change, and Economic Performance.* Agricultural Economic Report No. 451, U.S. Department of Agriculture, Washington, D.C., 1980.

Farrell, M. J. "The Measurement of Productive Efficiency." *J. Royal Stat. Soc.* 120, part 3, ser. A (1957):253-281.

French, B. C. "The Analysis of Productive Efficiency in Agricultural Marketing: Models, Methods, and Progress." In *A Survey of Agricultural Economics Literature* (Vol. 1). Minneapolis: University of Minnesota Press, 1977.

Helmberger, P. G., G. R. Campbell, and W. D. Dobson. "Organization and Performance of Agricultural Markets." In *A Survey of Agricultural Economics Literature* (Vol. 3). Minneapolis: University of Minnesota Press, 1981.

Henderson, J. M., and R. E. Quandt. *Micro-economic Theory: A Mathematical Approach.* New York: McGraw-Hill Book Co., 1971.

Kilmer, R. L., and R. W. Ward. "Simulating the Performance of a Multiple Exchange Mechanism Market." *So. J. Agr. Econ.* 14(1982):17-21.

Kopp, R. J. "The Measurement of Productice Efficiency: A Reconsideration." *Quar. J. of Econ.* 96(1981):477-503.

Lang, M. G. "Economic Efficiency and Policy Comparisons." *Amer. J. Agr. Econ.* 62(1980):772-777.

Pasour, E. C., and J. B. Bullock. "Implications of Uncertainty for the Measurement of Efficiency." *Amer. J. Agr. Econ.* 57(1975):335-339.