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METHODS FOR EVALUATING ECONOMIC EFFICIENCY IN AGRICULTURAL MARKETING

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INTRODUCTION

What is Economic Efficiency?

An economically efficient allocation of resources maximizes consumer and producer surpluses. It can be shown that under perfectly competitive conditions, an efficient allocation of resources will evolve. It may be the global welfare optimum, but for a given set of conditions, consumer and producer surpluses can be maximized.

The conditions for an economically efficient allocation are threefold: (a) the value placed on produced goods by an individual (marginal rate of substitution) must be equal to the cost of transforming one good into another (marginal rate of transformation) (b) the value of consuming factors of production directly (marginal rate of substitution) must be equal to the cost of transforming the inputs into goods (marginal rate of technical substitution), and (c) the value placed by consumers on consumption of an input and an output (marginal rate of substitution) must be equal to the marginal product.

An immediate observation from the conditions is that the desires of consumers are paramount in the system. Consumers own all factors of production. There is only one level of exchange and consumers interact directly with producers. Prices do not coordinate the exchange process. Consumers and producers have perfect information and adjustments are instantaneous. It is a static model that does not incorporate risk and uncertainty. This perfectly competitive model departs from the real world; however, it is followed as a norm because it

results in maximizing consumer and producer surplus.

Deviation from the competitive model causes a redistribution of resources among the participants. Someone gains and someone loses; however, the gains do not outweigh the losses (assuming equal weight is given to buyers and sellers). Thus, consumer and producer surpluses are not maximized.

Based on this model, French (p. 95) indicates that "The total marketing system or an industry subsystem may be said to be efficient if: (a) all firms are economically efficient, (b) the industry is organized to utilize capacity and to take full advantage of scale and locational economies, and (c) the industry operates under exchange mechanisms that generate prices which conform to a competitive standard such as the perfect market." French further argues that we need to measure efficiency over time relative to some optimum. However, he notes that we have made limited progress in formulating a dynamic framework for such a measure. Agricultural economists have generally taken a partial equilibrium analytical approach. An evaluation of the methods used in the partial equilibrium approach follows.

Relevance of Economic Efficiency Concepts

Ladd (p. 2) recently indicated that efficiency is only defined by the criteria and constraints imposed; therefore, economists must determine objectives of policy before they can measure efficiency as a policy prescription. Bromley argued in his 1982 AAEA address that economists

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Invited paper presented at the annual meeting of the Southern Agricultural Economics Association, Nashville, Tennessee, February 5-8, 1984. Invited papers are routinely published in the July *SJAE* without editorial council review but with review of the copy editor (as per Executive Committee action June 25, 1982).

The authors gratefully acknowledge reviews by J. Walter Milon, Leo Polopolus, Timothy G. Taylor, Ronald W. Ward and an anonymous Journal reviewer.

Florida Agricultural Experiment Station Journal Series No. 5558.

cannot say anything more about efficiency than about equity, and that it is impossible to make scientific judgments about maximizing social welfare on the singular basis of efficiency criteria.

Even though economists may have an incomplete model for evaluating social welfare, they do possess a model that can provide relevant information for private and public decision-making. The importance of efficiency concepts in agricultural marketing policy has come to the forefront in the past several years with re-examination of federal marketing programs and policies. There has been pressure to use "efficiency" criteria in deciding whether economic regulation is warranted or whether federal programs in marketing are necessary.

Efficiency concepts remain relevant in an increasingly integrated production-marketing system. But applying the concepts in a consistent and useful manner requires continued diligence to assure the current state of knowledge matches the questions to be answered about the production and marketing system.

The balance of this paper will outline various methods for evaluating economic efficiency, indicate the conditions under which they are relevant, how they have evolved from earlier states, and the types of improvements or refinements needed.

EVALUATING PRODUCTIVE EFFICIENCY

Plant Level

The economic efficiency of a firm can be evaluated from an estimated: (a) frontier production function (Farrell, Kopp), (b) non-frontier profit function using duality (Forsund, et al.), or (c) frontier cost and frontier profit functions using duality (Forsund, et al.). The first two alternatives will be examined in this paper.

The Frontier Production Function

The frontier production function is operationalized through the Farrell model (efficient unit isoquant) to measure the economic efficiency of a plant. Assuming constant returns to scale, varying factor proportions, varying factor prices among plants, the same technology, and a homothetic production function, the economic efficiency of an individual firm is determined, Figure 1.

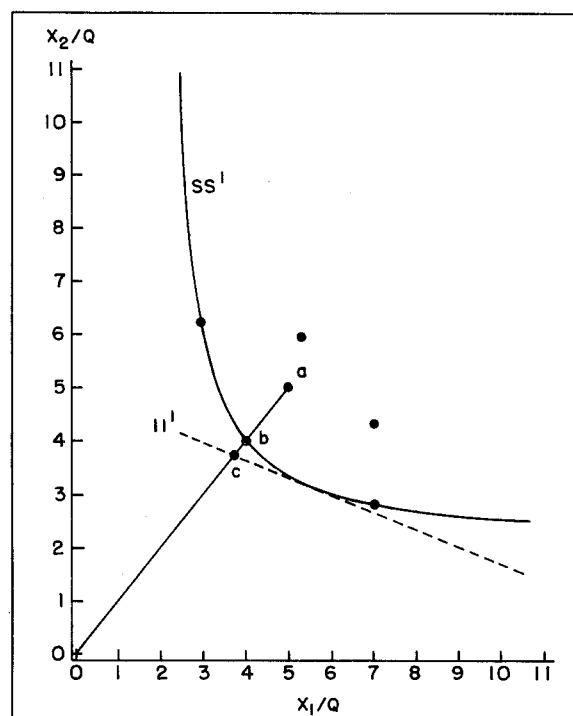


Figure 1. Efficient Unit Isoquant.

SS^1 is the efficient unit isoquant. The points represent individual plants. II^1 represents the price ratio of the inputs. Technical efficiency of firm A is ob/oa and the price efficiency is oc/ob . The economic efficiency is (ob/oa) times (oc/ob) or (oc/oa) .

Scale is taken into consideration by computing an economic efficiency index for each firm scale with respect to the efficient unit isosurface (Seitz). Taking those firms from each scale with an economic efficiency index of 1, a figure similar to Figure 1 is used to determine a technical, a pricing and a economic scale efficiency.¹

The approach allows the ranking of each firm which gives an indication of relative efficiency and how to improve efficiency. No optimizing behavior or competitive structure in the output market is assumed. Given its relative simplicity, the approach has found limited use since its inception in 1957. King recently detailed the virtues of using the frontier production function approach for decisionmaking. Boles translated the Farrell model into a linear programming algorithm that handles: (a) a single product with no economies of scale, (b) multiple products with no economies of scale, and (c) a single product with economies or diseconomies of scale. His hypothesis was that Farrell's model is not used more because of the lack of a widely available computer program.

¹These indexes assume a neutral change among the inputs for a given input price ratio as economies or diseconomies to scale are realized.

Other deficiencies of the Farrell model (not the efficiency measures) that restrict its use include the following assumptions: (a) a homothetic and homogeneous production function, (b) neutral technological change, (c) high substitutability among inputs, (d) the need for a large sample, and (e) a full frontier as opposed to a stochastic frontier. Kopp generalized the Farrell indexes by using a statistically estimated frontier production function that has a full frontier but does not limit the production function to being homothetic or homogeneous. He not only is able to compute the multiple factor efficiency measures defined by Farrell, but Kopp introduces single factor efficiency measures that "establish the minimum feasible bounds on individual input utilization, and in the case of inputs that are becoming increasingly scarce, may supply us with valuable information concerning the current efficiency of their employment and the potential for increasing that efficiency in the future" (p. 492). One of the drawbacks of the Kopp approach is the need to econometrically estimate a frontier production function and choose a functional form (Lutton, pp. 15-16).

A non-frontier profit function using duality theory allows the analyst to circumvent direct estimation of the production function and to test for equal economic efficiency among groups of plants. The ability to measure the economic efficiency of an individual plant is lost, however.

The Unit Output Profit Model

The unit output profit model is a non-frontier method for measuring average firm economic efficiency. Based on the following assumptions: (a) a well defined production technology, (b) a given endowment of fixed factors of production, (c) firms are profit maximizers, (d) firms are price-takers in both output and variable input markets, and (e) the production function is quasi-concave in the variable inputs, it can be shown that the unit output profit function (a normalized profit function defined as profit divided by output price) is a function of the normalized variable input prices (input price divided by output price) and quantities of fixed

$$(1) Q = f(x_1, \dots, x_m; Z_1, \dots, Z_n),$$

where Q is output; x_i represents variable inputs; and Z_i represents fixed inputs of production. The profit function of the firm can be written as:

$$(2) \pi = pf(x_1, \dots, x_m; Z_1, \dots, Z_n) - \sum_{i=1}^m c_i x_i$$

where π is profit; p is output price; and c_i is the i^{th} input price. The marginal conditions for profit maximization are:

$$(3) p \left(\frac{\partial f(x; Z)}{\partial x_i} \right) - c_i = 0, \text{ for } i = 1 \dots m,$$

where x and Z are row vectors. Equation 3 can be rewritten as:

$$(4) \frac{\partial f(x; Z)}{\partial x_i} = \frac{c_i}{p}, \text{ for } i = 1 \dots m.$$

Equation 4 can be solved simultaneously for all the optimal input levels resulting in:

$$(5) x_i^* = f_i(c^1; Z), \text{ for } i = 1 \dots m,$$

where c^1 and Z are row vectors and the elements of c^1 are normalized input prices. Thus, the optimal input demand functions are a function of the normalized input prices and quantities of fixed inputs.

Substituting (5) into (2), the following results:

$$(6) \pi = pf(x_1^*, \dots, x_m^*; Z_1, \dots, Z_n) - \sum_{i=1}^m c_i x_i^*.$$

In order to eliminate the output price from equation (6), both sides of the equation are divided by p and the unit output profit function as a function of normalized input prices and fixed input quantities is obtained. That is,

$$(7) \pi^* = \pi/p = f(c_1/p, \dots, c_m/p; Z_1, \dots, Z_n).$$

A set of dual transformation relations connects the production function and the profit function. These result in being able to determine the derived demand for inputs (equation 8) and the supply function for outputs (equation 9).

$$(8) x_i^* = \frac{-\partial \pi^*(c^1; Z)}{\partial c_i^1}, \text{ for } i = 1, \dots, m.$$

$$(9) v^* = \pi^*(c^1; Z) -$$

$$\sum_{i=1}^m \frac{\partial \pi^*(c^1; Z)}{\partial c_i^1} c_i^1.$$

Yotopoulos and Lau used the unit output profit model and a Cobb-Douglas production function to test for equal technical and pricing efficiency; equal economic efficiency, and absolute pricing efficiency for each type of firm. Their model uses data readily accessible from firms such as input prices, output prices and fixed capital service flow. Tests can be run to determine if the firms are profit maximizers and if technological progress is neutral.

Shortcomings of the model are that firms must be grouped by size in order to determine relative efficiency. Individual firm indexes are not available. Firms must be price takers in the input and output markets and maximize profits. Finally, non-Cobb-Dougllass functional forms should be explored along with multiple outputs as improvements to this model. Frontier profit functions and frontier cost functions for production activities with multiple outputs and inputs (Lau; Weaver) need to be extended to testing for economic efficiency (Kopp and Diewert).

All plants in an industry may be economically efficient, but the industry may not have exhausted all scale and locational economies. Therefore, the production efficiency of an industry must be evaluated in a long term as well as a spatial dimension. Plant location models have been used for this purpose.

Industry Level

Plant Location

French reviewed the plant location literature and noted its static nature. Static analysis assumes that the period of observation in the model is a "snapshot" of a long-run equilibrium. This is not an appropriate assumption when the supply and/or demand spatial pattern is changing and the closing and opening costs of plants are a significant proportion of total industry costs. Kilmer and Hahn relaxed the static assumption and projected dairy industry adjustment in size, number, and location of processing plants over time; however, the costs associated with opening and closing plants (transition costs) from one time period to another were not considered.

Sweeney and Tatham developed a methodology for handling dynamic plant location problems. A dynamic programming model is integrated with a transshipment model that has fixed quantities at supply and demand points. A finite planning horizon is specified and mixed integer programming is used for solving the optimal size, number, and location of plants in each year. Then, an arbitrary number of second best solutions for each year are solved and rank-ordered starting with the least cost solution. Each solution represents a different configuration of plants. The optimal dynamic path is the dynamic solution which minimizes the assembly, packing, and distribution costs over all years, plus the transition cost changes associated with changes in plant configurations.

Kilmer, Spreen, and Tilley extended the Sweeney and Tatham model by including both long- and short-run decisions in a dynamic model. Each static solution is a long-run solution. If investment does not earn its opportunity cost, the plant should be liquidated and the capital reinvested. In the short-run, however,

existing plants may continue to operate if cash costs are covered. Thus, the transition cost of a change from plant configuration s to configuration r should equal the investment servicing cost (debt servicing plus return on net investment) of all existing plants in configuration s which are closed in moving to configuration r . The industry moves from configuration s in period t to configuration r in $t+1$ only if the total cost of configuration r is less than that of s in period $t+1$ minus the investment servicing cost of all existing plants that are closed.

The model analyzes only the cost side of the profit equation. Model results when compared with the existing industry configuration will indicate the potential for plant size, number, and location changes. The demonstrated presence of structure altering economic forces (cost efficiencies) may not result in immediate real world changes. This results from the fact that: (a) all plants in the model are assumed to behave so as to minimize industry collection, packing, and distribution costs; whereas, in the real world, there are independent entrepreneurs making decisions, (b) firms generally maximize profits, not minimize costs, and (c) the cost efficiency of management varies among plants of the same (different) size.

Further work is needed to investigate the effect of stochastic demand, supply, and cost functions on optimum locations. Furthermore, French (p. 164) states that "We need to extend industry and area efficiency models to include vertical coordination, imperfect competition and local monopoly, uncertainty, and technological and environmental changes." This is still true today.

In order for a marketing system to be efficient, it must be productively efficient and operate with exchange mechanisms that generate competitive prices. The next section of this paper deals with methods for evaluating allocative efficiency.

EVALUATING ALLOCATIVE EFFICIENCY

Single Exchange Mechanism Market

Single and Multiple Market Levels (Homogeneous Products)

An allocation represents specific consumption levels for each consumer and specific input and output levels for each producer. An allocation is Pareto efficient if consumption cannot be reorganized to increase the utility of one or more individuals without decreasing the utility of others. An economically efficient allocation of resources maximizes consumer surplus, intermediate market profits and economic rent in the primary factor market.

The present discussion does not focus on measuring the loss in efficiency due to imperfect competition resulting from small numbers of buyers (sellers) facing a large number of sellers (buyers). That is an element of industrial organization theory and will only be noted in passing. Agricultural economists have generally dealt with trying to ensure a more competitive market by increasing the amount of information available in a market, by imposing or adjusting grades and standards or by introducing institutional arrangements to improve the coordination among farmers to enhance their bargaining position (marketing orders, cooperatives, etc.). There are methods for evaluating how closely a market conforms to the competitive standard (for example profit rates and the Lerner Index). However, only means of measuring improvements in allocative efficiency of homogeneous products (welfare economics) and means of evaluating prices among heterogeneous products will be evaluated.

Use of welfare economics to evaluate the social desirability of alternative economic states has gained credibility during the last decade (Willig; Just and Hueth). Change in the area below the demand curve and above the price line is used as a measure of change in economic welfare (consumer surplus). However, the empirical use of this theoretical concept was not well accepted because consumer surplus is not a unique money measure of utility. However, Willig shows the relative boundaries within which the consumer surplus can be used as a measure of the individual's true welfare changes (compensating and equivalent measures).

The compensation principle also is relevant in the primary factor markets (i.e., labor, land, entrepreneurial ability, capital). Since these markets have supply curves based on factor owner utility maximization, the area above the supply curve and below the price line is a measure of economic rent. It is the amount of compensation, paid or received, that will leave the factor owner in an initial welfare position following the change in price if he is free to supply any quantity after compensation (compensating variation). It is measured by a compensated supply curve. The willingness to pay measure of compensating variation is an indication of the intensity of a person's preferences.

What about the intermediate markets in which firms maximize profits? Changes in welfare in intermediate markets are measured under the

following circumstances. One, the sellers have at least one fixed factor of production. Two, all prices paid by sellers for factors of production are constant. Thus, as the price received by sellers increases, the increasing positive slope of the supply curve is caused by decreasing marginal product resulting from a fixed input. The fixed input, then, receives the "profit" which is the area above the supply curve and below the price line.

Just and Hueth (p. 950) use the willingness to pay concept of consumer surplus and economic rent plus intermediate market profits as measures of changes in welfare. They show that in a vertically structured competitive sector of an economy, the change in the areas below the demand curve and above the supply curve of an intermediate market (market j) is the sum of the consumer surplus in the retail market, economic rent in the initial input market, and intermediate market profits (equation 10).²

$$(10) \Delta C_j + \Delta S_j = \Delta C_N + \Delta S_0 + \sum_{n=1}^N \Delta \pi_n,$$

where ΔC_j is the change in consumer surplus in the final goods market (N) plus the profits to firms that are in the vertical market chain above market j ; ΔS_j is the change in economic rent in the primary input market (0) plus the profits to firms that sell in market j plus firms between market j and market zero; ΔC_n is the change in consumer surplus in market N caused by a change in the price of market j ; ΔS_0 is the change in economic rent in the initial resource supplier's market; $\Delta \pi$ is the change in profits of firms that operate in the intermediate markets. The welfare effects in all markets of the vertical system, caused by a change in price in market j can be measured by only looking at the change in surpluses in market j .

Gardner looks at the efficiency of redistributing economic surplus in an attempt to analyze the welfare effect of policy alternatives. Efficiency is defined as the deadweight loss (that economic surplus lost due to a policy change or area $b + c$ in Figure 2) divided by the amount of economic surplus transferred from consumers (producers) to producers (consumers), area a . Thus, the social cost per dollar of economic surplus transferred is $(a/(b+c))$. This idea was first advanced by Nerlove and Wallace in separate papers; however, Gardner's approach mathematically connects the deadweight loss per dollar distributed with its

²The assumptions are: (a) each industry produces a single product using one major variable input produced within the sector, (b) other inputs originate in other sectors of the economy, (c) prices in other sectors are not influenced by the sector being analyzed, (d) actions of an individual industry within the sector may affect all other prices and quantities within the sector, (e) all sellers within the sector have at least one fixed factor of production, (f) the supply and demand curves are general equilibrium supply and demand curves, which account for adjustments in other industries of the sector, and (g) all prices in the vertical system move monotonically.

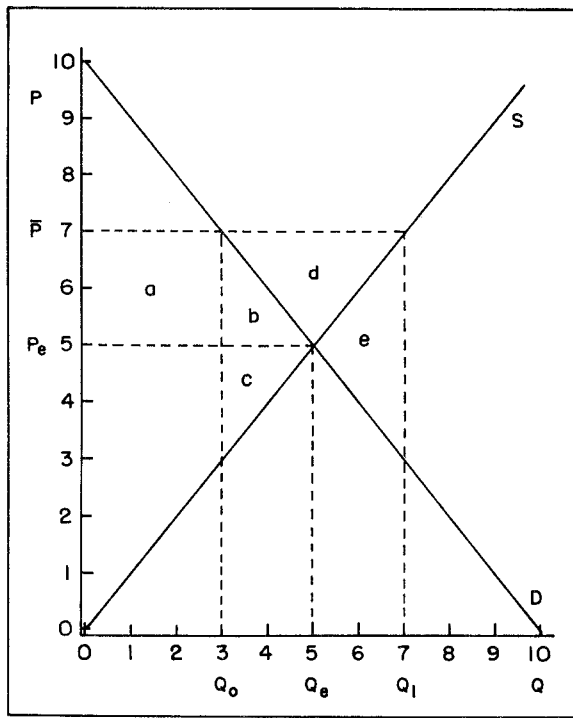


Figure 2. Illustration of Dead Weight Loss (Gardner, p. 226).

determinants which are the demand and supply elasticities and the extent of market intervention. He analyzes the redistribution efficiency of production control policies and deficiency payment programs. Gardner (p. 233) concludes that as the supply or demand function becomes less elastic, the change in producer surplus per unit change in consumer surplus tends towards a value of -1 , the most efficient redistribution point.

A homogeneous product is not traded in all markets. As the degree of heterogeneity increases within a market, the analytical tools need to be adapted. Hedonics is an analytical tool for use in a market that has a heterogeneous product.

Single Market Level (Heterogeneous Product)

When an agricultural good is exchanged, two exchanges occur: the physical good is traded and payment is made for services associated with the vertical exchange mechanism. For example, services associated with spot markets include auction facilities, published price information, transportation to and from the market, price risk, and packaging the product for transportation. In contracts, written specifications include product quality, special treatment or handling of the product, variety specifications, and determining when harvesting occurs.

The physical good or base good may be considered perfectly homogeneous and of average

quality. Each specific action by buyers and sellers is part of the package of services associated with each vertical exchange.

Following Carl, Kilmer, and Kenny (p. 592), the buyer-seller exchange generates one price. Separate prices for the base good and for each service factor in the exchange are not directly observed except for explicit market priced services such as transportation, though each service affects the observed price. The observed price is composed of the base good price and payment for each service (Rosen). Components of the market price are:

$$(11) P_{x(i)} = f[P_B, S_{(i1)}, \dots, S_{(ir)}, P_{m(i1)}, \dots, P_{m(ih)}],$$

where $P_{x(i)}$ is the i^{th} observed exchange price per unit; P_B is the base good price per unit; $S_{(ij)}$ is the quantity of the j^{th} service per unit of x ; and $P_{m(ik)}$ is the k^{th} market-priced service (e.g., transportation costs). The observed exchange price is reduced to include the base good price and service prices:

$$(12) P_{n(i)} = P_{x(i)} - \sum_k^h P_{m(ik)},$$

where $P_{n(i)}$ is the i^{th} net product price which includes implicitly priced components. The net product price is a function of:

$$(13) P_{m(i)} = h[P_B, S_{(i1)}, \dots, S_{(ir)}]$$

and the derivatives of (13) are the implicit prices for the services (S_j). Because a contract represents an optimal exchange, a positive implicit service price equals the marginal cost to the seller of providing the service and its marginal benefit to the buyer (Rosen). Conversely, services benefiting the seller have a negative effect on price (i.e., the seller receives a benefit for which he pays the buyer by accepting a lower price).

Services benefiting both buyer and seller have an ambiguous effect. The service would expand until one party incurs a net cost. The ambiguity results from not knowing which party incurs zero benefits first.

This model can be used in empirical applications by individuals evaluating available alternatives and market analysts examining market performance. Buyers and sellers of services can use the estimated implicit prices to determine if the marginal benefit (marginal cost) being paid (charge) is sufficient. Market analysts can evaluate the implicit prices relative to an estimate of service cost to analyze the performance of the market. Further work is needed on determining and interpreting the supply and

demand structure underlying each service (Brown and Rosen; Murray).

Performing either cross-section, time-series or pooled analyses using hedonics may entail two difficulties with data. First, prices and contract specifications are generally not published. Thus, information about services and prices in contracts can be difficult and costly to obtain. Second, the more concentrated the buying and/or selling side, the more difficult it will likely be to obtain information.

In collecting time series information, availability of data of sufficient historical length can also be a problem. Central agencies often do not have a complete series of individual market characteristics, or the market services change sufficiently over time such that time-series analysis becomes exceedingly complex, if feasible.

After data are collected, there may be little variation in service characteristics, especially in contracts. This lack of variability may result from a homogeneous group of buyers and sellers in a given market, but the higher the degree of homogeneity of the production functions of buyers (sellers), the less likely will be the observation of great differences in contract specifications. Since each firm would be maximizing its profit function, as individual production functions approach uniformity, contract specifications should also approach uniformity. Variation is necessary to measure implicit prices for services.

Many products are traded in markets that have multiple exchange mechanisms (e.g., spot market, contracts). Comparing prices among the exchange mechanisms and evaluating allocative efficiency requires adapting tools for the problem at hand.

Multiple Exchange Mechanism Market

Heterogeneous Product

Following Kilmer and Ward, the decline of spot markets and the continual emergence of contracts and vertical integration calls for a better understanding of the economic consequences of using multiple exchange mechanisms. Most research has dealt with analysis of firm level inducements for employing alternatives to spot markets (Arrow, Buccola, Logan, Perry, Stigler, Williamson). Kilmer and Ward model the concept of a multiple exchange mechanism market, using Cobb-Dougllass type production functions. Simulated equilibrium price and market output indexes are developed to draw implications relative to the performance of a multiple exchange mechanism (M.E.M.) market relative to a spot exchange mechanism (S.E.M.) market.

The transfer of x from node k to $k+1$ through a spot transaction does not provide a mechanism for direct control of the production and transfer functions by the buyer and seller. Such product characteristics as quality, time of delivery, and quantity are left virtually uncontrolled, except by the spot price negotiated. In contrast, contracting can provide direct control over the production and transfer functions. The risk of inferior product characteristics, uncertain prices, and poor technology can be reduced. With backward integration, product characteristics and the technology used to produce x are directly controlled by the buyer (node $k+1$), thus potentially eliminating much of the risk of quality uncertainties. Such control benefits may be partially or totally offset by the transactions cost of maintaining the non-spot exchange mechanisms.

Kilmer and Ward assume that the exchange performance of alternative exchange mechanisms varies depending upon their effect on product characteristics, transactions cost, and technology. A M.E.M. market model is developed to evaluate market performance. Performance is measured by comparing prices and supplies forthcoming through M.E.M and S.E.M. markets.

Kilmer and Ward found that the price and output effects of a M.E.M. market when compared with a S.E.M. market depend greatly on the proportion of buyers using a non-spot exchange mechanism relative to the proportion of sellers using non-spot exchange mechanisms. As the proportion of non-spot sellers (m^*) increases relative to non-spot buyers (n^*), the non-spot coordination effect on product characteristics, transactions cost, and technology must be greater in order for the potential gains in output to be realized from non-spot coordination. This happens even though the price received in a M.E.M. market is greater than a price in a S.E.M. market.

When the relative demand for the use of a non-spot coordinating mechanism by buyers (n^*) is greater than by sellers (m^*), and non-spot coordinating mechanisms improve product characteristics, then (1) the M.E.M. market price is less than the S.E.M. market price, and (2) the M.E.M. market output is greater than the S.E.M. market output. Whereas, the competitive market can be shown, under certain conditions to yield the largest output among economic models, the M.E.M. market can be shown to provide a larger output and lower price under a different set of structural conditions.

The generality of these conclusions needs further research. The analytical model assumes a Cobb-Dougllass type production function, hence imposes certain restrictions on the elas-

ticity for the derived input demand. Different approaches to entering the non-spot market characteristics into the model can be considered. Risk needs to be incorporated into the model, as well as the dynamics of adjustments. Nevertheless, the Kilmer and Ward model provides the basic framework for incorporating both structural differences and degrees of coordination into one framework, from which additional variations can be analyzed. This will allow the generality of these results to be investigated.

SUMMARY

Evaluating economic efficiency has taken a partial equilibrium approach with different areas (productive efficiency, allocative efficiency) being evaluated independent of one another. French calls for productive and allocative efficiency to be evaluated in one model; however, much work needs to be done before this can be successfully accomplished.

Recent advances in estimating frontier production functions and in duality theory have improved the tools for analyzing productive efficiency. Plant location models are made more realistic by incorporating the existing industry structure and determining its impact on optimum plant location.

Tools for measuring allocative efficiency are becoming more widely understood. Credibility of welfare economics as a tool for evaluating efficiency is improved by the work of Willig and Just and Hueth. More attention to multiple mechanism markets and heterogeneous products has improved our understanding of the market exchange process; however, more conceptual modelling and empirical methods for testing conceptual models are needed in order to approximate the complex nature of the real world.

CONCLUSIONS

The volume of scientific literature written in the areas of production, spatial, consumption, market, and welfare economics during the last decade is staggering. Production economics is the most advanced with developments coming through the use of duality theory. More emphasis is needed on understanding the market exchange process as the spot market decreases in importance.

In the meantime, agricultural economists have concepts and methods available that can assist in evaluating the economic efficiency of markets. Our analytical concepts and tools employ less restrictive assumptions today than a decade ago. Thus, we are better off but have more work to do.

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