THE VALUE OF INFORMATION PROVIDED BY A UNIFORM GRADING SYSTEM

J. W. FREEBAIRN

N.S.W. Department of Agriculture

The potential effects of a uniform meat grading scheme on market performance are evaluated in terms of a change in the information state. A uniform grading system may reduce the per unit costs involved in the collection and transmission of information on the characteristics of, and the price differentials for, different units of the commodity set. Under conditions of uncertainty an improved information state will increase market participants' expected utility. A general procedure for an empirical evaluation of a grading scheme is outlined.

Introduction

A system of uniform grades applied to a heterogeneous commodity set may alter the information state under which market transactions take place. This article attempts to present a basis for establishing how this changed information state might increase the efficiency of the market participants' activities.[1] It is hoped that the models developed will provide a basis for evaluating the effects of proposed meat grading schemes.[2]

Throughout the article two characteristics of the meat market are assumed to be of major importance. First, some but not necessarily all buyers distinguish between different units of the commodity.[3] Second, market participants have less than perfect, costless knowledge about the characteristics of, and the prices of, different units of the commodity. Such imperfect knowledge is perpetuated in part by frequent shifts in the underlying supply and demand functions.

To facilitate the discussion a few terms need to be defined. Grading is the process of classifying by uniform procedures most but not necessarily all units of a heterogeneous commodity set on the basis of one or more characteristics of the commodity.[4] Market participants' information

[1] In the subsequent development we will not consider two of the arguments frequently advanced in the literature for a grading scheme. These arguments suggest that the sale of unsorted products may involve some constraints on buyers' freedom, e.g. Zusman [16] and Freebairn [4], and that grading enables sellers to price discriminate and thus obtain monopoly gains. Both arguments assume a high degree of market knowledge and that most of the commodity units are presented for sale in mixed form.

[2] One of the recommendations made in the Brewer Committee Report on the Meat Industry to the Parliament of New South Wales (N.S.W. Government Printer, August, 1972) was for the implementation of a system of carcase classification for all meat marketed. Some specific carcase grading schemes under consideration include the Yeates system being evaluated on a trial basis at Armidale, N.S.W., the Australian Meat Board's Beef Classification Trial, and a proposed backfat measurement scheme for pigs.

[3] Distinguishing characteristics include carcase yield, fat content, meat colour, meat texture, and taste.

[4] This definition does not imply complete homogeneity within a grade or that grade characteristics need have a vertical ranking according to good and bad quality. The latter qualification allows generalization of the procedures reported to the study of classification as well as grading schemes.

state is specified in terms of knowledge about the price and the characteristics of the different units of the commodity which they buy and sell. In the case of imperfect knowledge we restrict our analysis to the situation in which market participants are assumed to have probabilistic information. The receival of additional information, such as might be generated by a grading scheme, induces participants to alter their estimated probability distribution function for the unknown aspects of different units of the commodity set. Better information will be reflected in improved predictions of these aspects of units of the commodity traded.

Our analysis follows a framework for evaluating the economic services of information suggested by Marschak [6]. The effects of a uniform grading scheme will be assessed in terms of effects of the information generated by the scheme on (1) the efficiency of decision making, (2) the extent and level of information communication, and (3) the resources spent on enquiry into information about the commodity set. In the following section the effects of information on individual market participant's decision making are considered. Some implications of a grading scheme on the cost of collecting and disseminating market information are noted in the next section. We then focus on some aggregate models for evaluating the pricing efficiency effects of a grading scheme. The final section summarizes our results and offers some implications for an empirical evaluation of a proposed grading scheme.

Imperfect Knowledge and Individual Market Participant's Behaviour

The potential effects on a market participant's behaviour of the information provided by a grading scheme may be traced to three factors. First, in the absence of perfect knowledge the decision maker is not always able to choose the *ex post* optimum subset(s) of the commodity set to trade and the amount of each to trade.[5] Second, under conditions of uncertainty it may be rational for market participants to expend resources on information search. Third, imperfect information may induce decision makers to undertake various forms of risk averting behaviour. In our development of these factors we will focus on the effects on a market participant's behaviour of additional information about the price and the characteristics of different units of a commodity.

Reduction of Ex Post Decision Loss

Ex post decision losses arise from actual decisions being different from those decisions which would have been optimum if the decision maker had had perfect knowledge. Imperfect knowledge is fostered in part by lags between the time at which decisions to produce or consume are taken and the time at which market transactions take place. The sub-optimal decisions arising from imperfect predictions involve some utility loss to market participants.

In the following two examples we will illustrate the nature of *ex post* decision losses for a single producer. These examples are based on two forms of imperfect information which we denote as market uncertainty and technological uncertainty. The former refers to market price of the

[5] By perfect knowledge we mean that the probability distribution function collapses on the actual value of the variable.

commodity traded while the latter refers to knowledge about physical returns from alternative activities.

The framework of these illustrative models is that of statistical decision theory.[6] We consider a single producer who is assumed to be a price taker and whose objective is to maximize expected utility. As an approximation we assume the utility function to be linear in the variable short run profit, π. The producer is assumed to be involved in the production of only one commodity. We consider the simple case where only two grades, which we denote by subscripts 1 and 2, are involved. Finally, it is assumed that the variable cost function for each grade can be approximated by a quadratic function.

In the first example we consider the situation for market uncertainty. The producer has imperfect information about the prices to be received for the two commodity grades; he has perfect knowledge about all other aspects of his decision problem. We denote the market prices received for each of the two grades P_1 and P_2, as

$$(1) \quad P_1 = P + D_1 \text{ and } P_2 = P + D_2$$

where P is some "average" price reported by the information service, and D_1 and D_2 are the grade price differentials.[7] Under uncertainty the producer is assumed to have independent probability distribution functions for these price variables. We denote this information as:

$$(2) \quad f(P),\ f(D_1),\ \text{and } f(D_2).$$

For our assumptions the short-run profit function will be given by:

$$(3) \quad \pi(X_1, X_2) = P_1X_1 + P_2X_2 - (a_1X_1 + b_1X_1^2 + a_2X_2 + b_2X_2^2)$$

where X_1 and X_2 are quantities produced of the two commodities and P_1 and P_2 are defined in (1) above, and the a's and b's are parameters of the cost function. The producer's decision problem is to find values for X_1 and X_2 which maximize $E(\pi)$, where E is the expectation operator.

We denote the output levels which maximize $E(\pi)$ as X_1^1 and X_2^1. These are derived by using (2) to take the expectation of (3), and then applying classical optimization procedures. The expected utility maximizing decision rules will be:

$$(4) \quad \begin{aligned} X^1 &= (\hat{P}_1 - a_1)/2b_1 = (\hat{P} + \hat{D}_1 - a_1)/2b_1 \quad \text{and} \\ X_2^1 &= (\hat{P}_2 - a_2)/2b_2 = (\hat{P} + \hat{D}_2 - a_2)/2b_2, \end{aligned}$$

where the superscript hat (^) denotes the expected value of the probability distribution functions in (2). These output decisions may be compared with the perfect knowledge output levels, X_1^* and X_2^*, which may be derived as:

$$(5) \quad \begin{aligned} X_1^* &= (P_1 - a_1)/2b_1 \quad \text{and} \\ X_2^* &= (P_2 - a_2)/2b_2, \end{aligned}$$

where P_1 and P_2 are the actual market prices. The relationship of the planned decision outputs under imperfect information and the optimum perfect knowledge decision outputs will depend, from (4) and (5), on the relationships between $\hat{P}_1$ and P_1, and between $\hat{P}_2$ and P_2.

[6] For a discussion of these procedures and of the axioms on which they are based the reader is referred to Raiffa [10] or to Dillon [2].

[7] This situation closely corresponds to the practice of existing livestock reports in Australia where an average price is reported with little or no comment as to quality differentials.

To determine the decision loss attributable to imperfect market knowledge we compare the utility which would be forthcoming using the perfect knowledge decision rules in (5) with that which would be forthcoming using the uncertainty decision rules (4). That is, we define decision loss as:

(6) $L(X_1^1, X_2^1) = \pi(X_1^*, X_2^*) - \pi(X_1^1, X_2^1)$

Then, the expected decision loss will be given by

(7) $E(L(X_1^1, X_2^1)) = E(\pi(X_1^*, X_2^*)) - E(\pi(X_1^1, X_2^1))$

where the expectation E is over our prior distributions of P_1 and P_2. Now for (7), using (4) and (5) to substitute into the definition of π given in (3), and applying some algebraic manipulations the expected loss from uncertainty may be derived as:

(8) $E(L(X_1^1, X_2^1)) = (E(\hat{P}_1 - P_1)^2)/4b_1 + (E(\hat{P}_2 - P_2)^2)/4b_2$

Under the more restrictive assumption that the expected "average" market price $\hat{P}$ is equal to the mean sample market price $\bar{P}$, the expected loss may be specified as:

(9) $E(L(X_1^1, X_2^1)) = \text{Var}\, P(1/4b_1 + 1/4b_2) + (\text{Var}\, D_1 + (\text{Bias}\, D_1)^2)/4b_1 + (\text{Var}\, D_2 + (\text{Bias}\, D_2)^2)/4b_2$

where $\text{Var}\, Z = E(Z - \bar{Z})^2$ and $\text{Bias}\, Z = (\hat{Z} - \bar{Z})$ with Z being P, D_1 and D_2. The loss function specified in (9) provides a useful basis for evaluating the information provided by a grading scheme.

The following interpretations may be made of the loss functions specified in (8) and (9). Though the firm does not pay anyone the amounts represented by these functions, if the firm could predict market prices with certainty it could make this much more profit on the average. Better information, which would be reflected in reductions of the terms $E(\hat{P}_1 - P_1)^2$ and $E(\hat{P}_2 - P_2)^2$, would increase producer welfare. Further, rational firms would devote some resources to information collection and analysis activities so long as the marginal benefit exceeds the marginal cost. Turning to relation (9), the information content of a grading scheme would be evaluated in terms of information about the grade price differentials D_1 and D_2. The potential gains would be of two types: (a) a reduction in the bias of the firm's prior estimate of the grade price differentials, and; (b) a reduction in the variance term of the grade price differentials.

More information on grade price differentials may reduce the bias and the variance components of the loss functions in (9). These would arise from a reduction in measurement errors, a reduction of ambiguity about grade classifications, and the information might enable firms to make conditional estimates of the market prices. With respect to the latter point, for example, suppose a grading scheme reveals that the grade price differential D_1 follows a seasonal pattern. Then, the conditional variance term ($\text{Var}\, D_1 |$ season) may be less than the unconditional variance term ($\text{Var}\, D_1$) specified in (9).

In the second example we consider a situation associated with technological uncertainty. In this case the producer makes imperfect predictions about the grade classification of his output, but he has perfect knowledge about all other aspects of the decision problem. In the context of the general assumptions noted above the firm has two activities producing Y_1 and Y_2. He is uncertain as to whether these outputs are grade 1 or grade 2. We represent this uncertainty by a binominal distribution defined as follows:

(10)
$$f(Y_1) = \begin{cases} \text{grade 1 with probability } q_1 (0 \leqslant q_1 \leqslant 1) \\ \text{grade 2 with probability } 1 - q_1 \end{cases}$$
$$f(Y_2) = \begin{cases} \text{grade 1 with probability } q_2 (0 \leqslant q_2 \leqslant 1) \\ \text{grade 2 with probability } 1 - q_2 \end{cases}$$

Planned profit for the firm will be given by:

(11) $\pi(Y_1, Y_2) = P_{y_1} Y_1 + P_{y_2} Y_2 - (a_1 Y_1 + b_1 Y_1^2 + a_2 Y_2 + b_2 Y_2^2)$

where P_{y_1} and P_{y_2} are the prices on which the decision is planned. Under imperfect knowledge these prices need not be the same as the actual market prices.

The decision outputs Y_1^1 and Y_2^1 maximizing the expected value of $\pi(Y_1, Y_2)$ specified in (11) are obtained by using (10) to take the expectation of (11) and then applying classical optimization procedures. These decision output levels will be:

(12)
$$Y_1^1 = (E(P_{y_1}) - a_1)/2b_1 \quad \text{and}$$
$$Y_2^1 = (E(P_{y_2}) - a_2)/2b_2,$$

where $E(P_{y_1}) = q_1 P_1 + (1 - q_1) P_2$ and $E(P_{y_2}) = q_2 P_2 + (1 - q_2) P_1$ and P_1 and P_2 are the actual market prices for grades 1 and 2, respectively. These output decisions may be compared with the perfect knowledge[8] optimum output levels, Y_1^* and Y_2^*, which may be derived as:

(13)
$$Y_1^* = (P_1 - a_1)/2b_1 \quad \text{and}$$
$$Y_2^* = (P_2 - a_2)/2b_2,$$

where, as before, P_1 and P_2 are the actual market prices received.

Following procedures analogous to those followed for the example of market uncertainty the expected loss from technical uncertainty in our example may be derived as:

(14) $E(L(Y_1^1, Y_2^1)) = (\text{Var } P_{y_1})/4b_1 + (\text{Var } P_{y_2})/4b_2$

where $\text{Var } P_{y_1} = q_1(1 - q_1)$ and $\text{Var } P_{y_2} = q_2(1 - q_2)$.

The loss function in (14) may be interpreted analogously to the interpretation given to relations (8) and (9) above. In particular, relation (14) indicates that better information on the precise characteristics of the output from alternative production activities would increase producers' expected welfare.

These examples illustrate the argument that more information on the market prices and on the characteristics of different units of a heterogeneous commodity set might increase producers' welfare by a reduction of *ex post* decision errors. Different, and more general assumptions might have been considered, and we could have considered similar situations for the buyer. The examples treated are tractable problems and they illustrate the principal argument of interest.

Since information provided by a grading scheme is useful to market participants and they are assumed to be rational, why would it be necessary to initiate a formal grading scheme?[9] In the case of many

[8] Under conditions of perfect knowledge q_1 and q_2 are either zero or unity. With no loss of generality we will assume $q_1 = 1$ and $q_2 = 0$.

[9] This question was suggested to me by J. G. Ryan.

commodities we find evidence of private activities involved in the collection of information similar to that which would be supplied by a formal grading scheme, e.g. consumers tend to rely on particular butchers for the type of meat they prefer, and several butchers and particularly wholesalers have established formal and informal quality measurement and feedback arrangements among themselves and with some producers. Several arguments might be advanced for it to be rational for society to introduce a formal grading scheme which provides more, and more accurate information than current private activities in this direction. These arguments include the cost economies made possible by a uniform grading scheme and the difficulties of individuals being able to appropriate all the social benefits for their information search and analysis activities.[10]

Information Search Activities

A second aspect of the potential effects of a change in the information state associated with a uniform grading scheme on individuals' behaviour patterns relates to information search activities. Already we have noted the potential rationality for resource expenditure on information search under conditions of imperfect knowledge. Other models along this line include Stigler's [13] model of consumer search and the various models of job search behaviour, e.g. Stigler [14] and McCall [7]. These studies indicate that the expected gain from a marginal increase in resource expenditure on information search will be greater the greater the dispersion of the decision maker's probability distribution function for the price and/or characteristics of the commodity (or service) being traded.[11]

It may be argued that the information provided by a uniform grading scheme would reduce the dispersion of the decision maker's prior probability distribution for the grade price differential and for the characteristics of the units he buys or sells. Such a situation would be fostered by generally known and consistently applied grading or characteristic measurement procedures. The importance of this argument would be enhanced if market participants believe that the current informal grading procedures do not have fixed classification criteria. If the additional information provided by a uniform grading system leads to a reduction in the dispersion of the decision maker's prior probability distribution function we would expect him to allocate a smaller portion of his resources to information search. This saving should be treated as a benefit of a uniform grading scheme.

Risk Aversion

A third aspect of the potential effects of a uniform grading system on individual market participant's behaviour is related to risk averting behaviour under conditions of uncertainty. In the typical case where firms

[10]These include the problems and the cost of internalizing externalities and the problem of revealing true preferences.

[11] For example, in Stigler's [14] model of job search behaviour in which he assumes a normal distribution for wage offers the expected gain from a further search, say the n-th, is given by $0.24\sigma n^{-0.63}$, where σ is the standard deviation. It might be noted that Stigler makes the unlikely assumption that the probability distribution function for wage offers is known with certainty.

have concave utility functions,[12] the firm output which maximizes expected utility has been shown to be less than the perfect knowledge output level. Further, the more dispersed the firm's perceived probability distribution function for the unknown terms of his decision problem, the smaller will be the output level which maximizes expected utility.[13] Changes in the information state, therefore, would be expected to shift the aggregate supply function for the different grades of the commodity set. If a grading system does not change producers' estimate of the average market price, the greater level of market knowledge facilitated by a grading scheme would shift the supply curve outwards.

Extension to Public Policy

In a similar manner this information might be used to facilitate the effectiveness of public policy making with respect to the production, consumption and trade of the commodity.

Effects on the Cost and Effectiveness of Providing Information

A uniform grading scheme may reduce the aggregate cost incurred in acquiring information and of communicating it to market participants. To some extent a grading scheme would replace information search activities by individuals. This would occur only if market participants find the information provided by the grading scheme to be a satisfactory substitute for that being obtained by their current information search activities. Potential information cost savings would flow from two broad directions.

First, a uniform grading scheme may give rise to cost economies in the collection and transmission of information. Under a uniform grading scheme the characteristics of each unit of the commodity set would be evaluated once only, and this information would be transmitted to all market participants. This situation may be compared to one of personal inspection by market participants. Potential cost savings would be associated with specialization and size economies, and also savings from avoiding duplication.

Second, a uniform grading system based on fixed classification standards may reduce the errors of information transfer and simplify the analysis of the data. The simplifying aspects of such a procedure may be compared to a multitude of trade names and to informal evaluation procedures based on local and perhaps more pliable classification criteria. As an illustration of this argument a U.S.D.A. study [15, p.24] noted that "United States beef grading has tended to eliminate the variable quality as a factor in the (market) bargaining process. Grades make it possible to clearly identify prices by grade and weight groups".

Some Effects of a System of Grades on Aggregate Market Performance

So far we have focused our analysis of the effects of a uniform grading system on the behaviour and welfare of individual market participants. In this section we shift our focus to an evaluation of the

[12] It is generally considered that most farm operators and also consumers are risk averters. For a discussion of this issue with respect to Australian farmers the reader is referred to Dillon [2].

[13] See, for example, Leland [5], Sandmo [11], or McArthur and Dillon [8].

potential effects of the information generated by a system of uniform grades on aggregate market performance.

The models to be presented represent a break from the simplified market analysis models developed in economic text books. The text book models assume that the market demand and supply curves determine a unique market outcome at the intersection price and quantity co-ordinates. Some actual market experiments reported by Chamberlin [1], Smith [12], and others suggest that such behaviour is not revealed in practice.[14] Within a particular market period the prices at which individual transactions take place were found to vary and the average price of these transactions was not necessarily the intersection price. The experiments indicated that the volume of transactions made in the market period was usually other than the equilibrium quantity of conventional theory. [15] In other words, if we were to run a sequence of market experiments for the same underlying supply and demand functions and plotted the prices and quantities at which transactions occurred we would observe a set of price-quantity co-ordinates rather than a unique coordinate at the intersection point. This set is illustrated by the hatched area A in Figure 1. Some of the reasons suggested for these results include imperfect information, the cost of acquiring information, and the costs of re-negotiating contracts.[16] The results of these experiments are not inconsistent with personal experience in the market place.

Under a set of simplifying assumptions we will illustrate the applicability of the type of market model represented by Figure 1 for analysing some potential effects of the introduction of a system of uniform grades. We consider a commodity with two grades which we denote as 1 and 2. In Figure 2 is shown the perfect knowledge supply and demand functions for each of the grades.[17] Under the assumption of constancy of these functions over time let the sets A_1 and A_2 denote the sets of price quantity co-ordinates observed for the two grades under the current market information system. With the advent of a system of uniform grades, and of the additional information it supplies, suppose the sets of price quantity transaction co-ordinates can be represented by the hatched areas B_1 and B_2. These two sets illustrate two aspects of the information effects of a grading system. First, as illustrated for grade 1, a grading system may help eliminate some of the bias in the market information on which participants base their decisions.[18] Second, as illustrated for grade 2, the relatively smaller area of set B_2 (as compared to set A_2) indicates that a grading system may enable decision makers to increase their ability to predict grade price differentials so that the *ex post* forecast variance of these predictions is reduced.[19]

[14] Market experiments have been conducted under a wide variety of conditions. These conditions refer to transaction procedure, e.g. bazaar or auction, number of buyers and sellers, and prior information provided to the participants.

[15] This arises because of so called detractive exclusions and inclusions which are made possible by transaction prices being other than the equilibrium price. For details see Chamberlin [1].

[16] These arguments are developed in the "New Microeconomics" literature, e.g. Phelps [9].

[17] In practice there must be some doubt as to whether these functions can be quantified.

[18] This is analogous to a reduction of Bias D_1 in (9).

[19] This is analogous to a reduction of Var D_2 in (9).

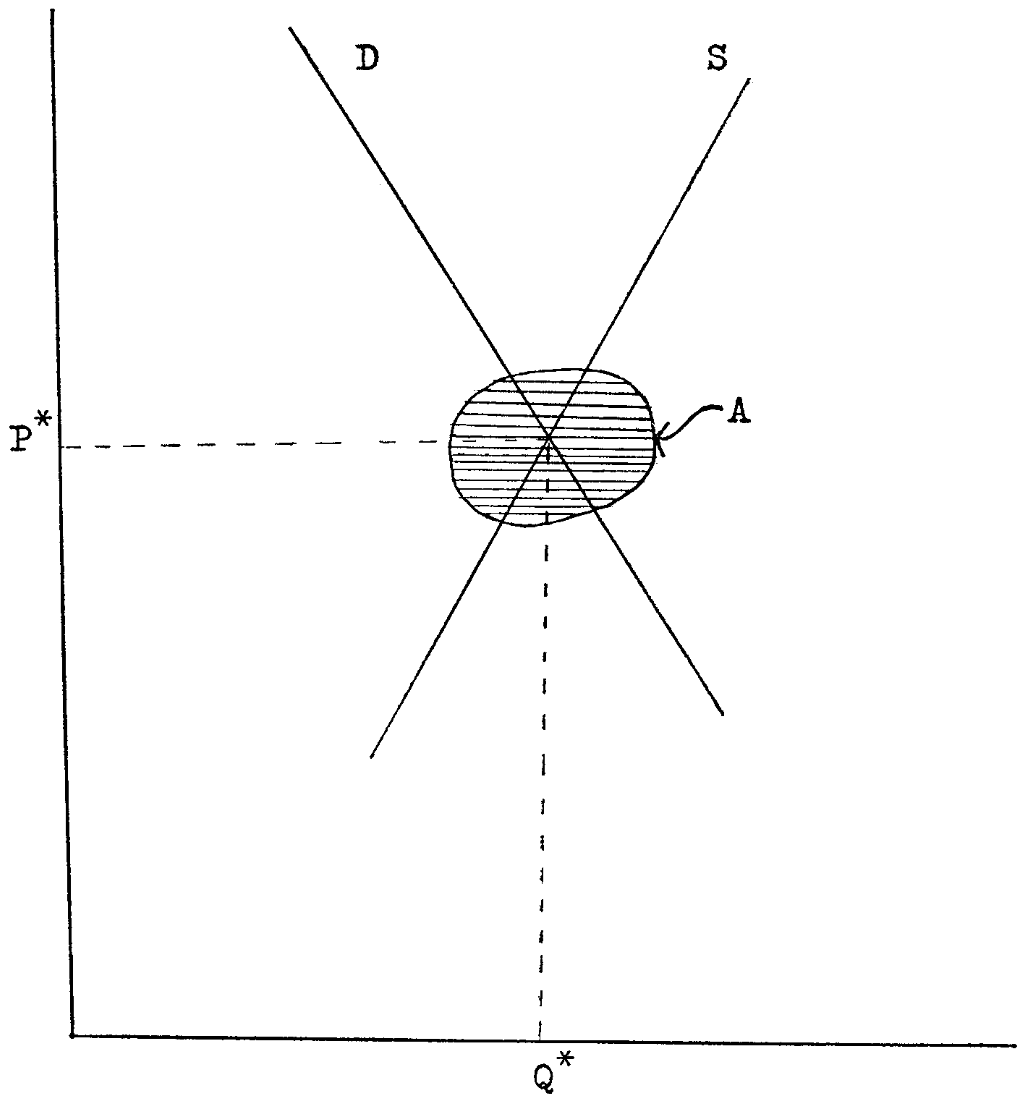

FIGURE 1

At least conceptually, the type of analysis represented in Figure 2 can be subjected to a welfare analysis. Under certain assumptions the intersection point P*-Q* represents an efficient outcome.[20] The extent of suboptimality will fall as the set of market transaction co-ordinates becomes more and more concentrated about the perfect knowledge co-ordinates. Using the tools of consumers' surplus and producers' quasi-rent we could evaluate the distributional effects associated with the introduction of a system of uniform grades. In particular, these procedures could be employed in an evaluation of the distributional effects associated with the partial or complete elimination of any biases in current market information as it relates to grade price differentials. Certainly we could use these procedures to make some qualitative

[20] In particular we refer to the marginal conditions associated with a Pareto optimum point in which we assume away externalities and second best considerations.

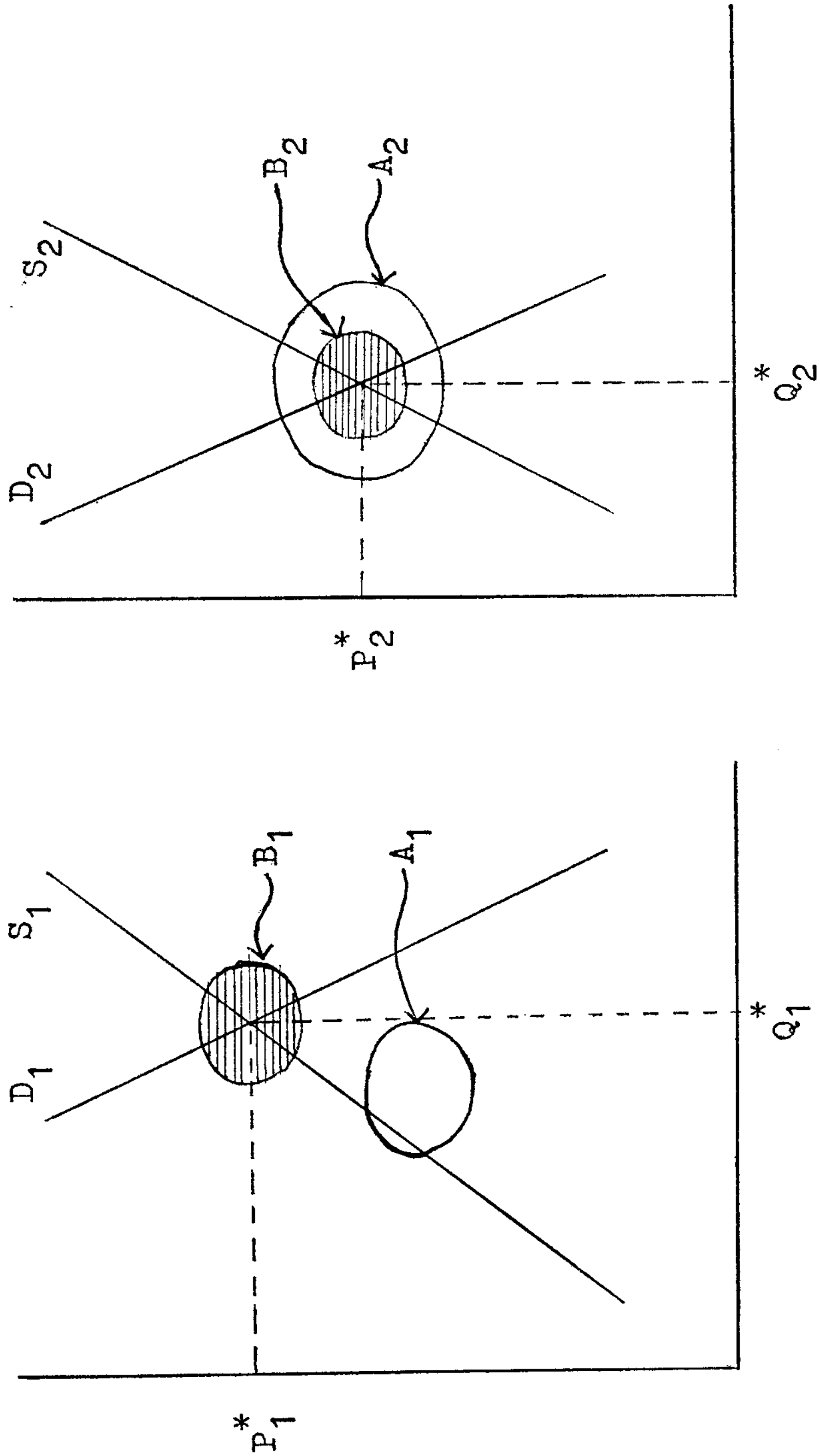

FIGURE 2

assessments even if a paucity of basic data on the perfect knowledge supply and demand functions precludes a quantitative analysis.

In the preceding analysis of this section we abstracted from the possibility that a system of uniform grades may alter the underlying supply and demand functions for the different grades of the commodity set. In the second section it was argued that the information provided by a grading system might influence market participants' *ex ante* decisions in at least two ways: first, a release of resources devoted to information search, and; second, the effects of a reduction in uncertainty on the behaviour of risk averters. Both these factors would tend to shift outwards the market demand and supply curves. In the case of a supply curve shift, consumer surplus would be increased and the effect on producers' quasi-rent would depend on the demand elasticity and on the nature of the supply curve shift.[21]

Concluding Comments

Within the context of the arguments presented above, in this section we indicate a general procedure for evaluating a proposed meat grading scheme. The precise methodology adopted will be influenced by such factors as the market situation, the availability of data, and the availability of research resources.

There are two main areas in which the information provided by a system of uniform grades might increase the efficiency of the market participants' activities. The first concerns a lower cost and more effective procedure for collecting and transmitting information on the characteristics and the market prices of different units of a heterogeneous commodity set. The second arises if the grading scheme raises the level of market information on which participants' decisions are based such that the expected utility of their decisions is increased. Our analysis suggests two necessary conditions which would have to be satisfied if these benefits were to follow the introduction of a uniform grading scheme.

First, it would be necessary to establish that a significant portion of buyers differentiate between units of a commodity on the basis of some characteristics. In other words we would need to show that not all buyers regard all units of the commodity as perfect substitutes. The requirements of buyers can be traced to one of two sources. First, the ultimate consumers of the product may distinguish between units of the commodity. This distinction may be real or imagined as the result of (say) habit. Consumer requirements will be reflected through the marketing chain in accordance with the theory of derived demand. Second, buyers may distinguish between units of a commodity set on the basis of differences in processing properties, including processing cost. Procedures for assessing buyer preferences with respect to commodity characteristics include buyer panels, surveys of attitudes, and actual market experiments.

Second, it would be necessary to establish market participants' general acceptance of the grade standards as a useful measure of the characteristics which they consider important. Considerable care should be exercised in making this evaluation because market participants may require

[21] For details see Duncan and Tisdell [3].

an extended learning period before becoming familiar with, and gaining confidence in, the proposed grading system. Satisfaction of this necessary condition would enable the investigator to argue that some of the market participants' information collection and analysis activities could be phased out in favour of the comparable data suppied as a component of the uniform grading scheme.

Partial budget procedures offer a useful approach for evaluating the potential cost savings a grading scheme might introduce with respect to the collection and transmission of information. For example, it would be possible to budget the savings to butchers of buying carcases from the meat halls by telephone on description rather than by personal inspection.

A greater degree of ingenuity may be necessary to establish whether, and by how much, a uniform grading scheme might improve the information available to market participants and what value participants attach to the additional information. An important area for investigation would entail some assessment of any biases and of extreme vagueness of market participants' perception of price differentials for different units of the commodity. In addition to participant surveys, some insight into this and related issues could be gleaned from a study of market prices for meat products at different stages of the market chain. Thus, for example, it would be helpful to determine whether prices of retail meat cuts correspond to the wholesale cut prices, to the carcase prices and to the live animal prices. Comparative studies of meat markets in which differing levels of meat grading are practised, including overseas markets, may supply insights into the likely effects of a change in the way which meat products are classified for sale.

References

[1] Chamberlin, E. H., *Towards a More General Theory of Value*, Oxford, 1957.

[2] Dillon, J. L., "An Expository Review of Bernoullian Decision Theory in Agriculture: Is Utility Futility?" *Rev. of Mktg. and Agric. Econ.*, Vol. 39, March, 1971.

[3] Duncan, R. and Tisdell, C., "Research and Technical Progress: The Returns of Producers", *Econ. Rec.*, Vol. 47, March, 1971.

[4] Freebairn, J. W., "Grading as a Market Innovation", *Rev. of Mktg. and Agric. Econ.*, Vol. 35, September, 1967.

[5] Leland, H. E., *The Theory of the Firm Facing Uncertain Demand*, Techn. Report No. 24, Institute for Mathematical Studies in Social Sciences, Stanford, 1970.

[6] Marschak, J., "Economics of Inquiring, Communicating, Deciding", *Amer. Econ. Rev.*, Vol. 58, 1968.

[7] McCall, J. J., "Economics of Information and Job Search", *Qtly. J. of Econ.*, Vol. 48, February, 1970.

[8] McArthur, I. D. and Dillion, J. L., "Risk, Utility and Stocking Rate", *Aust. J. of Agric. Econ.*, Vol. 15, April, 1971.

[9] Phelps, E. S., *et al*, *Microeconomic Foundations of Employment and Inflation Theory*, New York, Norton, 1970.

[10] Raiffa, H., *Decision Analysis*, Reading, Addison, 1968.

[11] Sandmo, A., "On the Theory of the Competitive Firm Under Price Uncertainty", *Amer. Econ. Rev.*, Vol. LXL, March, 1971.

[12] Smith, V. L., "An Experimental Study of Competitive Market Behaviour", *J. of Polit. Econ.*, Vol. 70, April, 1962.

[13] Stigler, G. J., "The Economics of Information", *J. of Polit. Econ.*, Vol. 69, June, 1961.

[14] ———, "Information in the Labour Market", *J. of Polit. Econ.*, Vol. 70, October, 1962.

[15] U.S. Department of Agriculture, *Economic Effects of United States Grades for Beef,* Marketing Research Report No. 298, January, 1959.

[16] Zusman, P., "A Theoretical Basis for Determination of Grading and Sorting Schemes", *J. of Farm Econ.,* Vol. 49, February, 1967.