

ECONOMIC ASPECTS OF LIVESTOCK PRODUCTION

by OMAR WAHBY, Ph.D.

Faculty of Agriculture, Cairo University

As it is known in mathematics one can maximize a given function subject to certain restrictive conditions. This problem of maximization is, implicitly if not explicitly, dealt with in reality among people having different major interests in life like production, consumption, etc., or people performing within different lines of activity like education, politics, medicine, etc. A consumer for instance tends to maximize his utility or, commonly speaking, happiness function subject to the means at his command related to the price of the units of the componets formulating his happiness vector. As for the producer there are three factors which are usually considered as affecting his behavior: the technological factor, the economic factor, and the institutional factor. A microeconomic analysis of an economic firm would reveal its manager's aim selecting the economic factor to be maximized and taking the other two factors as given at least in the, relative, short run. However, this approach is not adopted by the technical scientists since their profession requires them to ignore but the technological factor for maximization which is, admittedly, a complementary approach to and indispensable part of the long run dynamic production process.

Looking at the production process from this angle one may view the technology of production as a factory processing and improving to the maximum input-output relations or, synonymously, production functions. Applying economic tools to these production functions completes the overall production picture.

Livestock Production

Livestock production could be analysed in a micro sense, that is, from the individual firm's standpoint, and in a macro sense, that is, from the nation's standpoint. Let us follow, therefore, each approach to show the economic implications involved in the overall problem of maximum efficiency of livestock production.

Livestock Production as a Private Enterprise

Livestock production is, in a micro sense, an enterprise within the farm business utilizing agricultural resources and hence competing with other

farm enterprises for land labor and capital. Whether or not the resource manager starts up a livestock enterprise is determined by the net returns obtained from such business (including soil conservation considerations, etc.) compared with those obtained from other farm businesses over the range of the manager's economic horizon. This decision is governed by various economic theories based upon cost, price, risk, and uncertainty considerations and also by the famous biological input-output relationships (production functions).

There is, however, a simple economic device through which the resource manager can determine the scale of his livestock production, if any, relative to, say, crop production given the production functions and using a fixed amount of resource on the farm which is mainly land. This device is the iso-resource curve AB (figure 1) showing all possible combinations of two products

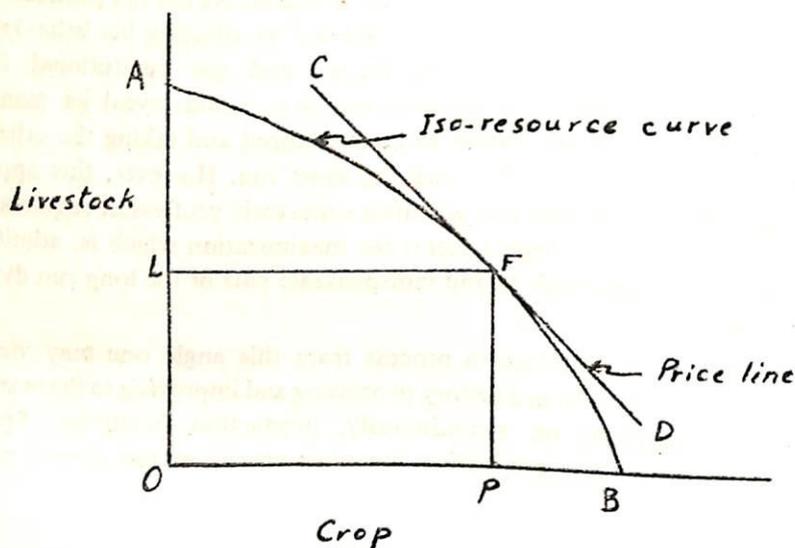


Figure (1)

that can be produced with a given amount of resource. This curve which the manager, being more economically than technologically minded, takes as given and which becomes variable through the efforts of the biological scientists is not useful by itself in solving the problem. Which combination should be produced to make the most of our resources is determined by price consideration which is represented in the price line CD. The slope of CD represents the sales-price ratio of livestock products and crop products at a given time. The point of tangency F gives us the answer which is a combination of

OL units of livestock products and OP units of crop products. The negative slope of AB shows a case of competition between livestock and crop productions. This, however, does not fully agree with reality since there is usually a degree of complementarity between agricultural enterprises, i.e., the production of one crop induces the production of the other with no additional resources. Within the livestock enterprise, for instance, there is complementarity in production between cheese and feeder stock production since some of the cheese by-products like whey are commonly mixed with concentrates in the feeder-stock ration.

Now that the manager determined the size of livestock enterprise relative to other enterprises on the farm he is confronted with the input-output relations of whatever stock he handles. Due to the inevitable fixation of some factors of production in the biological world, production functions are subjected to the law of diminishing returns. The problem of deciding on the point on the production function at which the manager stops applying inputs then arises. The optimum point of production is, again, a function of biological factor (production function) and economic factor (price line). Let us take feed, in steer fattening enterprise, as the variable factor. In fact, it is the most important factor of production to people engaged in this occupation. Taking other factors as given, figure 2 shows a hypothetical relation between feed input over and above the maintenance ration and meat output (gains in weight).

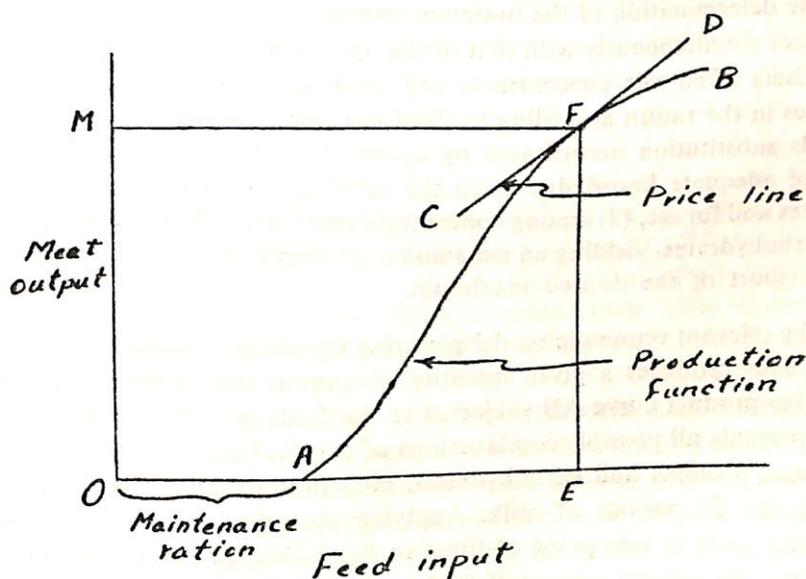


Figure (2)

The optimum level of feeding is determined by the tangency of feed-meat price line CD and production function AB at F. Thus, given the production relation and the input-output market price ratio shown in figure 2, the manager maximises his profits by feeding OE obtaining OM meat output.

The optimum level of feeding in any other line of livestock production could be similarly determined.

Dealing with more than one factor of production requires mathematical, rather than graphical, representation. One may introduce, say, milk production function for a certain breed of cows in a single regression equation containing three independent and one dependent variables, thus:

$$Y = \alpha + \beta X_1 + \gamma X_2 + \eta X_3$$

where Y stands for milk output, X_1 , X_2 , and X_3 stand for three factors of production, say, feed, labor, and housing condition. α , β , γ and η are the equation's parameters to be estimated. The outcome of this analysis shows us the relative importance of the considered factors in milk production. This is a necessary step toward the application of factor-cost-product-price considerations. The factor with the largest coefficient enjoys, presumably, the greatest consideration.

The determination of the optimum combination of feed resources should take place simultaneously with that of the optimum level of feeding. Livestock enterprisers often mix concentrates and roughage or different kinds of concentrates in the ration according to fixed practice regardless of the possibility of feeds substitution necessitated by dynamic changes in feeds price ratios. Lack of adequate knowledge as to the substitution ratios (1) between concentrates and forage, (2) among concentrate contents, and (3) between proteins and carbohydrates, yielding an iso-amount of output, holds the entrepreneur's profits short of the desired maximum.

The relevant economic model picturing the cheapest combination of feed inputs that produces a given quantity of output, thus, maximizing profits, is the iso-product curve AB subjected to the feeds price line CD in figure 3. AB represents all possible combinations of two feed inputs (concentrates and roughage, proteins and carbohydrates, etc.) producing a given quantity of output, say 20 pounds of milk. Applying the price line CD (representing feed-price ratio at one point of time) to the biological iso-product curve we determine the optimum point of feed combination F indicating the cheapest ration needed for producing 20 pounds of milk under the prevailing price conditions.

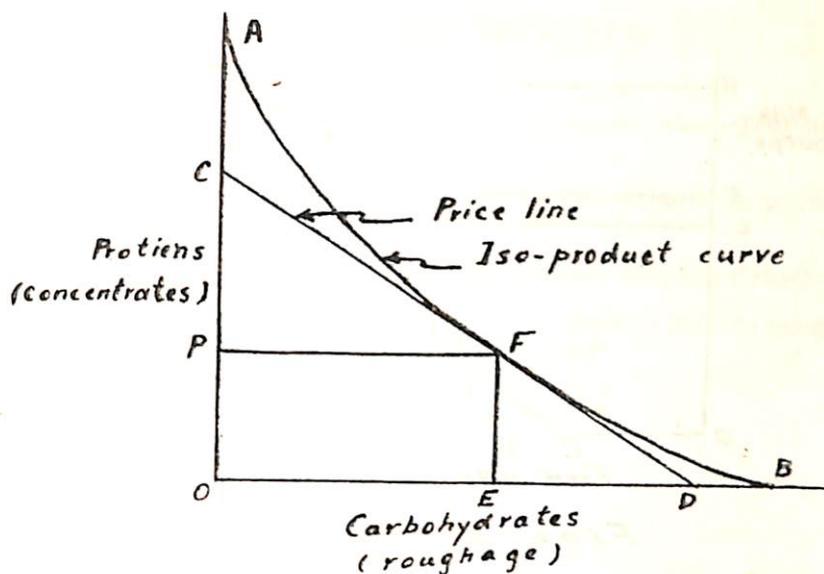


Figure (13)

Role of Animal Breeders and Geneticists in the Efficiency Process

It has frequently been mentioned that the rational livestock producer should deal with relationships which are rooted in the realm of biological fields. Those relationships like production, iso-resource, and iso-product functions are looked upon by the resource manager as invariable except through the effort of animal breeders and geneticists and not of the animal husbandmen. A production function of a certain breed of cows for instance can be shifted upward with a change in its elasticity by improving the inherent productivity of the breed (figure 4). The same result can be achieved, however and only relatively, by the dairy husbandmen through freeing the dairy stock from diseases or varying the fixed factor of production. This, of course, is a submarginal situation and should be handled before the performance of the breeders' duty. Applying the price line to the two hypothetical production functions drawn in figure 4, we determine the optimum level of feeding on each function. The man with the low-milking herd, not knowing the nature of the production function of his cows will want, like his neighbour with the high-milking herd, to feed OB to get OH . He only gets OE with additional cost more than returns caused by moving from the optimum level of feeding OA . The intersection of the two production functions in figure 4 is justified by the assumption that high producing stock requires higher maintenance feeding level OD than that required by low producing stock which is OC .

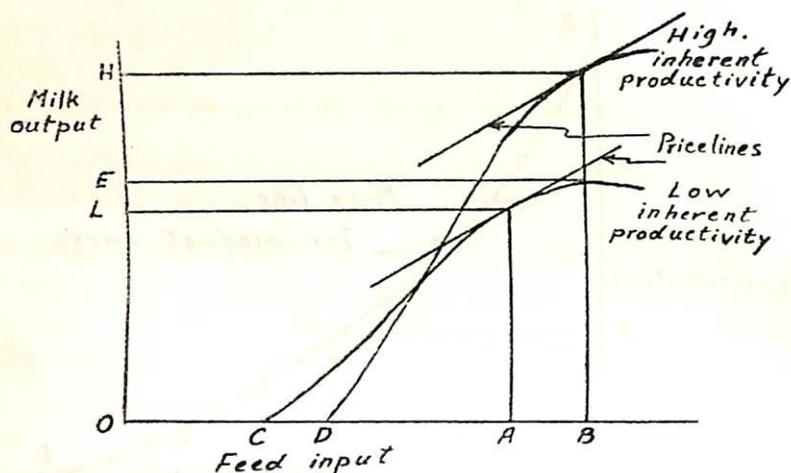


Figure (4)

Also the shape of the two production functions assumes the existence of three milk production stages, increasing, constant, and decreasing marginal productivity and a fourth stage in which the increments of milk production stop and the animal begins to gain weight. All these assumptions, however, may be hypothesized, thus subjected to empirical evidence.

Livestock Production as a National Enterprise

From the nation's standpoint livestock production is considered a part of the overall national production. Thus, the nation's economic goal regarding this type of enterprise is to make the most out of all resources devoted to livestock production, namely land, labor, and capital. More scientifically speaking, and in general, the average production which is the total production divided by the units of productive factors should be maximized. This, however, is not always the nation's desired goal. There are times when maximum livestock total production is sought regardless of cost considerations. Temporary emergency caused by a sudden increase in the country's population through refuge, for instance, may call for an unexpected need for additional amount of animal protein foods. The suddenness of the existence of such condition does not permit fixed resources allocated for livestock production to be adjusted to the new situation, thus, inducing the application of variable resources up to the point where total production begins to diminish. To the individual producer this process, as previously mentioned, is not economical. Production subsidies may, therefore, be given to livestock farmers to compensate the losses suffered from operating beyond the optimum point of input application.

BIBLIOGRAPHY SELECTED

1. BLACK, JOHN D. — Introduction to production economics. Henry Holt and Co. New York. 1926.
2. HEADY, E. O. — Economics of agricultural production and resource use. Prentice Hall Inc. New York. 1952.
3. HICKS. J. R. — Value and capital. Second edition. Claredon press. Oxford. 1946.
4. WAHBY, O. — Application of profit maximizing principles to the dairy enterprise. Unpublished M. Sc. thesis. Iowa State College. 1949.