ESTIMATING AGRICULTURAL COSTS OF PRODUCTION— WORKSHOP PROCEEDINGS

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The 1973 Agricultural Act requires the U.S. Department of Agriculture, through its Economics, Statistics, and Cooperatives Service (ESCS), to calculate farmers' costs of production for various crops and livestock farming enterprises. ESCS and land-grant college representatives discussed, at a June 1978 workshop, some difficulties in reaching reasonable and reliable figures and tried to resolve some of the ambiguities in the process. Major topics discussed included the method of calculating land charges, management and labor charges, the price of forage in dairy enterprises, overhead, and nonland depreciation.

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PREFACE

Since passage of the 1973 Agricultural Act, an ambitious program for estimating the costs of production for various agricultural enterprises has been underway, primarily within the Commodity Economics Division (CED) of the Economics, Statistics, and Cooperatives Service (ESCS), U.S. Department of Agriculture. ESCS sponsored a workshop on June 13 and 14, 1978, at which representatives of ESCS and the land-grant colleges, who are involved in computing the costs of production, along with policymakers who use the estimates, took the time to evaluate ESCS's cost of production work. The workshop participants reviewed the current methods of analysis and discussed the difficulties of arriving at reasonable cost of production estimates.

The papers presented at the workshop are included here. They address topics such as valuation of homegrown crops, valuation of management and labor that the operator provides to his operations, how and whether to include land charges, valuation of forages, farm overhead, depreciation of capital assets, and variability among producing units, regions, and size classes. The workshop concluded by recommending actions for ESCS to consider in its ongoing cost of production estimates.

The 1977 Agricultural Act ties the annual adjustments of target prices for some commodities directly to the cost of production of those commodities. This adds a new, significant emphasis on the quality and depth of the Department's estimates.

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Estimating Agricultural Costs of Production--Workshop Proceedings

OPENING COMMENTS

Kenneth R. Farrell
Administrator, ESCS

ESCS and the agricultural economics profession have a long history of interest in costs of production. However, no comprehensive national average series was available before ours, which began in 1974. The current heavy emphasis on cost of production estimates is based on the 1973 Agricultural Act, which mandated national weighted average estimates annually, for dairy, wheat, feed grains, and cotton.

A number of items have developed from the activity relating to the 1973 Act.

1. Annual economic surveys.

2. The Firm Enterprise Data System (FEDS), incorporating an extensive budget generator system now operating at Oklahoma State University, a cooperative effort with university personnel. FEDS originally was designed for research purposes but now is used in annual updates of cost of production (COP).

3. Various ESCS activities--The agency publishes regional and national average COP estimates, provides COP numbers for special analyses, develops responses to various COP requests, and prepares various staff reports. The ESCS COP program includes substantially more commodities than those mandated by legislation.

4. Use of COP estimates in farm legislation. COP was an important input in formulating the 1977 Agricultural Act and in the debate surrounding the demands of the American Agricultural Movement. Target price adjustments are based directly on COP levels.

5. In effect, a substantial program of work in developing and utilizing estimates of the costs of producing various agricultural commodities.

We are concerned about how cost of production estimates are used by noneconomists as well as by economists and wonder about our responsibilities in presenting COP estimates so that they will be used correctly, to the advantage of the society. We are continually faced with both conceptual and practical issues concerning what we can and should do in developing COP estimates. What uses or functions do we serve and how do we go about providing these services?

The agenda for this workshop was, by design, somewhat structured. In effect, it was dictated by issues and decisions now facing the agency. We can afford some conceptualizing and philosophizing, but primarily we must make some tough decisions. There are several areas of primary concern to us.

1. What estimates of COP beyond regional and national averages can and should we develop and publish? How does COP vary among size classes of farmers? Income

classes? Geographic regions? Should we develop standard errors (statistical ranges) for estimates of average COP? For what specific uses would COP information of these types be needed? We must think through the economic rationale for developing (or not developing) these various types of information on variability of COP. Then, for those we decide to develop, we must use the most efficient methods.

2. What land charge or allocation is appropriate? (Maybe we should ask if a land charge should be provided.) Is the same method of allocation appropriate for all commodities? Particularly, can we use the same method for crops and livestock? That has been a real issue throughout the recent history of our COP work. We must make decisions soon on this particular issue.

3. Other issues of concern to us include: assessment of a management fee or charge, estimation of labor costs, costing out feed inputs to livestock production, assessing depreciation of nonland capital, and allocation of overhead items to various enterprises.

This is a complex area of analysis. We have needed this kind of workshop for some time to give the agency more direction in this program of work.

AN OVERVIEW OF THE COST OF PRODUCTION--USES, CONCEPTS, PROBLEMS, AND ISSUES

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Agricultural economists have, since the very beginning of the profession, been estimating and forecasting the costs of producing agricultural commodities. Typically, it has been done with little fanfare, but plenty of footnotes, appendices, and caveats. Modern policymakers now have brought this academic practice into the limelight; and we agricultural economists have become a reluctant supporting cast in a drama written by agricultural producer interest groups and directed by politicians. The star, of course, is cost of production, and the large supporting cast of actors includes economists, politicians, professors, and producers. The plot is built around the underdog producer who has long been victimized by villains in the marketplace and vexed by the vagaries of weather.

The poor farmer, after coping unsuccessfully with several rescue attempts by such devices as parity and the prices paid index, turns now to encounter the new cure-all, cost of production. To his surprise it's not new but an old contraption that can function only with the constant aid of economists who must keep it oiled and repaired and who must occasionally put it back together when it falls apart. We won't tell you how the final act of this drama concludes, because without suspense you might not find it very interesting.

This cost of production drama, far from being fiction, is being played out in real life. Cost of production has recently been embraced by policymakers and is the basis for funneling sizable income transfer payments to producers. That makes the stakes pretty high, for a few cents difference in cost of production may translate into millions of dollars in the pockets of producers or taxpayers.

For that and other reasons, it is important that we take stock of our role in the drama--how we got where we are, and where we ought to go.

In this paper, we do not try to present all the solutions, only to provide a setting for the papers and discussions that follow and to highlight some of the problems and issues to be addressed later. We will recount some history of the cost of production, discuss some theoretical issues and raise a number of practical questions that need to be dealt with as we carry out our responsibility under the mandate from Congress.

Our first conclusion, after reviewing past contributions, is that there is little new or original that we can add to what has already been said or written. If one takes the time to search, he discovers that the subject has been treated fairly comprehensively and most of the issues have been addressed in one form or another.

Despite the fact that we have little if anything new to say, perhaps we can perform a service by restating and recasting what has already been said in terms of the issues that face us today.

Perhaps the most valuable thing we can do next would be to present some of the history of COP, noting our assumptions as fully as possible, and then go on to state one view (theory) of public choice that is directed to sorting out the rules and functions of economists from the public decision participants. First a little history.

In 1879, Queen Victoria's government set up a Royal Commission on Agriculture to determine the cost of production of U.S. products competing with British products. 1/ Undoubtedly, earlier attempts at domestic protection led to COP activities to determine the level at which the tariff should be placed to safeguard home producers and to determine whether a foreign competitor was engaging in dumping. The low prices of the 1890's spurred interest in COP studies; in Texas and Nebraska, the experiment stations produced studies for various crops (Taylor and Taylor, p. 391). In every period of low prices, there have been calls for market intervention that have used COP as the rallying cry. In some ways, the Great Depression was unusual in that parity, a complex mechanism for assessing the purchasing power of farm commodities, was invented and then held center stage for more than three decades.

There is a tradition of criticizing COP that is almost as old as the concept itself. While we pride ourselves on our refined logic, a review of Taylor's 1919 text indicates that we are meeting in a time-honored tradition. 2/ In enumerating some disagreements about costs, Taylor noted the alternatives of market price and price of production for hay and grain. That problem is still with us, but specialization and technology have removed one 1918 problem: how to charge for seed corn, a wholly farm-produced input in that era. Taylor also wrestled with the allocation of joint costs among enterprises, but he left it unresolved in about its present condition.

In addition to the use of COP as a justification for Government intervention in farm-product markets, there is a rich tradition of farm management education and adult extension. Professor Thomas Hunt used a COP activity in 1891 (as reported by Taylor and Taylor) to illustrate the economic complexity of a multiple-product, 130-acre Pennsylvania farm. 3/ By 1902, Minnesota had begun an annual series that lasted for at least three decades. Currently, most States produce enterprise budgets periodically. The budget generator is the contribution of the computer to this process. USDA studies beginning in the 1930's also played an important role in the analysis of costs.

In most Midwestern States, quasi-public recordkeeping associations developed in the 1940's and have gradually spread to other areas of the country as income tax accounting has grown ever more complex. Most of those associations produce an annual review of the cost of production, with attention to a number of input-output ratios. While we have no solid data base at the moment, a casual survey indicates to us that the data have rarely been used in public decision processes. In North Carolina, dairy COP data are now produced for the Milk Commission, but this is a recent innovation. In retrospect, it appears that milk boards have not used supply data as much as demand data in their deliberations.

1/ Henry C. Taylor and Anne Dewees Taylor, The Story of Agricultural Economics in the U.S., 1840-1932, (Ames: Iowa State University, 1952), p. 389.

2/ Henry C. Taylor, Agricultural Economics, (New York: MacMillan, 1919), pp. 367-379.

3/ The Story of Agricultural Economics in the U.S., p. 391.

It would be a mistake to conclude an historical review of the agricultural sector COP without noting that more money has been spent on COP for nonfarm commodities. Intellectually, there are strong parallels between farm and nonfarm COP developments. At the firm level, there is the entire field of cost accounting: college courses, degrees, professional associations, and Government standards that specify the form both for corporation reports (Securities and Exchange Commission, Internal Revenue Service) and for Government bureaus and contractors. A variety of agencies study COP principles and generate studies. A 1943 study by the National Bureau of Economic Research reported the number of cost studies for various periods between 1900 and 1939. 4/ By omitting 1917-18 because of World War I Government contracting, by striking an average for multiple-year reporting periods, and by eye-fitting a semilog function, we can arrive at a prediction for 1978. From an observed mean number of studies of 10 per year from 1900-1909, to 264 per year in 1929-39, we can predict 25,000 for 1978. That is, of course, a crude, untrustworthy projection, but may not be terribly wide of the mark when you consider the activities of the Interstate Commerce Commission, Federal Communications Commission, Antitrust Division of the Department of Justice, Environmental Protection Agency, Occupational Safety and Health Administration, and others. If you add the State utility boards as another element, the annual number of COP studies outside of agriculture could exceed our projection.

How successful have COP studies been in the nonfarm sector? That is too big a question for the current paper, but let us suggest two notable failures. One is the American railroad system; the other, though less obvious, is the telephone system. In the case of the railroads, there is some evidence that the computed COP (or at least the capital owners' estimates of computations) have generally been below owner-expected costs. In the presence of constrained prices (rail service rates set equal to COP computation), socially productive investment can be expected to dry up. To be sure, considerable disinvestment should have occurred as a result of technical changes in competing transportation modes. But we think that the timing and pattern would have been different under different COP estimates.

Our hypothesis is that the telephone system generally reflects an inflated COP. Everywhere possible, one sees too much capital invested. The telephone is a great instrument, but we are sometimes forced to buy a more expensive one than desired--a prima facie case for too high a return on invested capital. We are currently observing the entry of private capital for particular elements of the telephone service; that indicates that some portions of the service are more overpriced than others. Drawing from these two examples, we would assert that COP fails most where there is no reliance on supply phenomena to temper and challenge COP studies.

To return to COP in U.S. agriculture, why has the cost of production been such a sturdy fixture on the political horizon? It has been attacked and debunked a dozen times. Numerous papers point out the difficulty of arriving at a single cost of production, yet the legislative popularity seems to be increasing, not decreasing. Agricultural economists who have generated estimates of the cost of production have hedged their estimates with numerous footnotes and technical appendices. Consequently, we must question why the idea is so durable. For some background on this question, we present the sophomore's view of economic theory and will not ascribe it to any particular school or, in fact, to any professional economist. It will be a caricature rather than a portrait, intended as a hypothesis to explain the popularity and persistence of cost of production.

Beginning with a single production function and multiple inputs, but only one variable at the moment, we would demonstrate variable proportions with first increasing and then decreasing returns as the quantity of the input increases. The

4/ Conference on Price Research, "Cost Behavior and Price Policy, "New York, NBER, 1943, p. 291.

counterpart is a U-shaped diagram in which the average variable cost curve first falls, is cut from below by a marginal variable cost, and then rises. The fixed factors give rise to a fixed cost curve which takes on the shape of a rectangular hyperbola. (That brings us to a well-known anomaly in terminology for the teacher of principles: if a factor is fixed, it isn't a cost. But this fixed factor is variable if the choice is between engaging in the activity at zero level or one selected level. That distinction confuses college freshmen, but should not bother economists. To show the utility of this curve, we return to the text.) Adding the average fixed-cost curve to the average variable-cost (AVC) curve, we get the average total-cost curve, which retains the general slope of the AVC curve slightly skewed to the right, and still cut from below at its minimum point by the marginal cost curve.

Limited though this device may be, it is the producer of an awesome amount of results. Price (value) equals average total cost (ATC); there are no unearned income elements or rents and, for good measure, the number of identical firms in the industry is determined by the demand curve. To deduce this last result, simply determine the aggregate quantity demand at the cost of production (price) and divide by the output of the representative firm at its minimum ATC point. From this perfectly elastic supply curve, we get a single cost of production, income distribution in accordance with marginal productivity (at least in the sense that there are no rents), efficiency, and costs unambiguously determined from factor prices and, therefore, free from contamination from product prices.

Of course, this solution is overstated and unacceptably simple minded. We will detail its faults below; but to the extent that the adult population generally believes in cost of production and legislators call for the calculation of specific numbers, the simple model outlined is father of the thought, the theoretical basis from which it flows.

The one-variable input model and the results detailed above are unacceptable on several grounds. First, in a fundamental sense in economics, everything depends on everything else. So at base, one product price can never be determined in isolation from all demand forces. At the very least, demand for one product affects the derived demand for factors and, therefore, the costs (and prices) of other products. More appropriate to the issue of COP, firms will not have identical cost functions.

1. Not all firms face the same production function, due to the presence of specialized factors as well as choice among competing technologies.

2. There are different endowments of fixed factors among firms which cannot be redistributed in a costless fashion.

3. Factor prices for variable inputs differ, reflecting transportation costs and local demand differentials in both the farm and nonfarm sector.

4. There are different levels of risk aversion and perception of riskiness among managers which cause them to organize resources differently.

All this adds up to the fact that there is no single cost of production completely suitable for all purposes. Cost functions slope upward so that in aggregating cost curves for the short run and the long run, supply curves slope upward, giving rise to rents to low-cost firms because of specialized and other factors. Most of the strength of COP as a functional concept disappears and we are left with the inescapable conclusion that the cost depends on quantity and on price. For all but the most truly marginal firm, the opportunity costs of one or more factor in each firm will be product-price determined rather than product-price determining.

Despite all the conceptual problems and difficulties we have alluded to, we are still faced with the task mandated by the Congress of making annual estimates of the cost of production. The question is not whether but how we carry out this charge in a professional, responsible, and objective manner and still comply with the intent of Congress.

In order to make the greatest contribution as economists, we would be well advised to go beyond the specific task of estimating a single-point estimate of COP. Economists should reformulate the question to ask what set of price-quantity combinations for the commodity in question will fulfill the legislative intent with respect to income and price goals. To accomplish this larger task requires a more complete understanding of supply-price relationships and considerably more analyses. This broader analytical view can lead to a more complete and useful information system and, more importantly, lessen the likelihood of abuse and misuse of single-point cost of production numbers in policymaking. 5/

Because the values of land and fixed capital instruments are determined by expected prices, any estimation of cost is bound up with factor prices and, therefore, expected product prices. This fundamental simultaneity can be ignored, but its presence will plague COP workers unless they are able to account for it explicitly. This leads us to the conclusion that COP estimates should acknowledge factor prices and implicit future product price assumptions as well as the quantity dimension mentioned earlier.

Uses of COP

While we have alluded to some of the uses of COP, a point stressed in the past is that COP must be tailor-made for a use. The point is of sufficient import to bear restating.

Many types of decisions make use of COP. Some are at the firm level and others at the regional or national level. Some are very short run, others involve long-term investments or long-term policy. Each of these decision settings implies a particular notion of cost for a sound decision. Short-term firm decisions require only information on variable cost, but for long-term decisions, most inputs are variable. Macro-level decisions should include external economies or costs that may be inappropriate at micro level.

Issues and Problems in Empirical Estimation of COP

We turn now from the theoretical, historical, and philosophical to practical problems of estimating cost of production within the framework of the congressional mandate. For some of these problems, theory offers guidance. For others, the theory is either inadequate or suggests that the choice is arbitrary. Perhaps it goes

5/ John D. Black, "Parity, Parity, Parity," (Cambridge, Mass., Harvard Committee on Research in the Social Science, 1942), pp. 177-180, reviews the alternative definitions of the term cost of production in the 1930's (historic cost, normative or income-oriented cost, and necessary or supply cost) and concludes that different terms should be used for the various alternatives. Our review is that historic cost is of less political interest than normative costs. Professional agricultural economists have been and can be expected to be completely unsuccessful in giving objectivity to a norm and in specifying an unambiguous tie between price of a commodity and net household income. That leaves us with Black's third cost--necessary cost otherwise known as supply.

without saying that whatever procedures and methods are selected for estimating COP, they should be stated explicitly so that they may be understood and evaluated by others and they should be capable of being replicated. Accountants stress this advice in the form of accounting rules. Such estimates have the virtue of being consistent and comparable over time and among commodities and regions. We would note in passing that, unlike the business world where accounting rules prevail, the farming sector has never adopted any such standard rules of cost accounting. The FEDS, perhaps, is a step in that direction.

We now enumerate some of the major problems and issues.

Pricing Residual Income Inputs

Firm theory embodies the notion that the firm entrepreneur combines some factors that he pays for with some that are owned to produce a product. The difference between the income received for the product and the total cost of purchased inputs is a residual return to the owned or fixed factors. The residual return (or cost) can be either positive or negative. The residual return is always expected to be positive, otherwise the rational entrepreneur would not engage in the activity. At times, however, the return is negative because of uncertainty and imperfect knowledge. The residual return can never be known with any certainty in advance.

Owned-land, labor, and management are classic examples of inputs that firm theory treats as residual claimants, and they present the most troublesome practical problems for economists and cost accountants. There seem to be at least two choices: (a) price these inputs at their market value, or (b) impute the residual return to them after the price of the product is known. Neither of these methods is entirely satisfactory. In the first case, markets for these inputs may be imperfect or absent, and in the second case, the results are difficult to interpret in the context of the usually understood notion of cost (that is, costs may be negative). Perhaps both methods may be useful and the results of each should be shown as alternatives in some instances.

Pricing Durables--Inputs

Durable inputs--those yielding productive services over more than one production period--present special problems for COP estimation. The first part of the problem is to assign a value base to the input and the second part is to allocate this base over time. Assigning the value base is reasonably straightforward if the input is purchased (i.e., machinery) and the usual solution for allocating value over time is to adopt a set of depreciation rules. One must use care in selecting these depreciation rules so that they reflect the economic value of the input over time.

Pricing Inputs With Imperfect or Thin Markets

Many inputs used in farming are not commonly bought and sold; hence, they have no established market value. Some inputs have markets in only certain parts of the country or have so little volume traded that the market may be too thin to be a useful indicator of value. Forages and family labor are categories of inputs where this problem is common.

Some of the alternatives for dealing with this problem are:

1. Use cost of producing the input (in the case of forage) as a proxy for market value,

2. use thin or imperfect market information as a proxy,

3. use the opportunity cost concept to establish a value, and

4. impute a value from the residual return.

Each of those alternatives has advantages and disadvantages, and each requires care in interpreting resulting costs.

The Sampling Problem

Since we will never be able to estimate costs for every firm in the universe, we will always have to deal with problems. If the information is collected with a probability sample, the procedures, rules, and consequences are well known and we have nothing to add. If, however, only part of the information is collected on a probability basis and part is derived from other sources, there is a problem of interpreting probability statements about the total--some of which come from nonprobability samples and are subject to various kinds of errors.

We suggest this problem as a topic for further consideration in this or future workshops.

Measurement Problems

Even if we resolved all the conceptual problems, we would still be faced with a very formidable task of measurement. Quantities of inputs used in the production process are especially difficult and expensive to measure. Time and motion studies, popular a few decades ago, provide perhaps the most precise measurements, but they are expensive and time consuming. A less expensive method is to ask the farmer such questions as, "How much labor did you use?" for a particular operation. Although this method may provide answers, the answers may be little more than guesses. Still another method is to ask some experts. We can ask an engineer how long it takes to plough an acre of ground with a certain implement.

We probably will have to use all these methods and more too. Theory is of less help than common sense and good judgment in dealing with this problem.

Estimating Variations in Costs

It is usually of interest to know something about how costs vary around the point estimate. How do they vary with size and with geography and within and between commodities? Reliable answers to these questions are neither easy nor cheap. If we were able to measure the cost for each farm for each commodity, we could, quite easily, compute measures of variation about the mean of each category of interest. We do not, of course, have that luxury. We have at best partial and incomplete information from several sources, some of which are collected from a probability sample while others are not.

A challenge for this workshop is to come up with ideas to derive the maximum amount of information about variation from the hodgepodge of data available. And for the future, the challenge is to design an information-gathering system that reveals more about the nature of variance as well as the mean.

Farm Survey Data versus Economic Engineering Coefficients

Farm management analysts have long debated the relative merits of obtaining technical coefficients from two different sources. The difference between the two is that one asks the farmer and the other asks the technical expert. The latter, involving a combination of technical expertise and economics, is sometimes called economic-engineering data.

There is no clear answer as to the better source. The engineer probably knows more about the technical capabilities of a machine and a labor efficiency expert probably knows more about labor requirements for accomplishing a specific task. But the farmer may know something more about what he in fact does than either expert.

One thing is clear. It costs far less to get information from a few experts than a large sample of farmers. The high costs of surveys and the problems of respondent burden are likely to push us toward more intelligent and imaginative use of expert opinion in the future than we have in the past. The use of producer panels, the delphi technique, and other methods should be explored.

Summary Observations

The call for COP studies is a political fact. There is legislation and resources that have been and will continue to be committed to the activity. What is the most productive way for USDA to proceed in fulfilling its obligations and how should individuals regard their work as they participate in COP studies?

The first and most important fact is that the decision to intervene in the market for agricultural products is a political or public choice decision. A sizable portion of the gross national product is redistributed by the action of legislative bodies. The study of the technical way in which that redistribution is made is largely the province of political scientists. The way in which the political system and its decisions reflect the economic and other motives of citizens, legislators, and the executive branch is jointly shared by political scientists and public choice economists. The effect of public transfers on the efficiency of the entire economy is another function of the academic community, mostly left to economists. It is our view that all economists should use their special skills and training to benefit society. However, it is clear from the Hatch Act, the demise of the Bureau of Agricultural Economics, and recent legislative charges given to ESCS economists, that they are professionals and should stand aside from the political process to provide objective information on the impact of alternative public choices. We should accept neither credit nor blame for the congressional decision to intervene in the market.

The second most important fact is that the level of income transfer to be afforded by the intervention is almost entirely a legislative or administrative one. No matter what absolute level economists assign to COP, Congress reserves the right to set the level of target prices and price supports. Unfortunately, this is the point at which the water gets muddy. Congress is responsible for the decision but, given the widespread belief in an objective single COP, the research economist must guard against the appearance of justifying a particular level of market intervention.

The third fact is a restatement of the first part of this paper: There is no single COP. There are lots of COP's: one for each quantity, one for length of run, and one for level of factor restraint in those situations where there is a restraint.

The fourth fact is a fortunate one: The Congress wants more than a justification for a level of income transfer. It wants to know what each particular intervention will do to Treasury costs, consumer costs, surplus disposal, and market activity.

Given those facts, we can derive a prescription for activity by COP workers. The objective of this prescription has been implied in the foregoing: We think COP activities should allow the professional economist the following:

1. To function professionally while fulfilling a political mandate,

2. to stand aside from the political process as much as possible without bias for or against the transfers that are being undertaken, and

3. to produce scientific results in the sense that the study results can be replicated by other economists and tested for accuracy against market data.

Our prescription is to treat the COP mandate as a call for a more comprehensive supply analysis; that is, COP should be a part of a broader study of supply and cost functions rather than confined to single-point estimates. The analysis can and must include accounting procedures similar to the ones produced in recent years. In submitting the results to the Congress and the Secretary, however, the dimensions and limitation of the procedure should be (and have been) supplied; among which:

1. There are multiple COP's dependent on factors noted earlier, and

2. there are distributional impacts related to various levels of price supports.

Finally, there are other supply projection methods that can be used to buttress projections put forward in the COP framework. These can and should be presented to put COP numbers in perspective. Under this prescription, USDA workers can fulfill their individual and collective obligations, gain professional dignity by standing aside from the political process, and generate needed conventional supply analyses.

Additional Reading

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COST OF PRODUCTION VARIABILITY--ISSUES AND PROBLEMS

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This paper covers a range of questions and problems much broader than simply measuring the variability of costs. Since the underlying issues are complex, and since the signals are unclear concerning what should be done, this paper focuses on the uncertainties and the unknowns associated with the topic. It attempts to divide the issues into a reasonable set of questions and to provoke a discussion toward decisions on what (if anything) should be done with CED's Firm Enterprise Data System (FEDS) in response to those questions.

My early conversations with the organizers of the workshop revealed a number of concerns about the current FEDS series. For example, the following quote from questions recently submitted to the ESCS Administrator suggests a range of issues and problems: 1/

> Two Senate Agriculture and Forestry Committee reports in recent years provide data on costs of producing selected crops in the U.S. The reports...do not display a distribution of production by cost per bushel classes. Neither report displays data by size of farm (either gross sales size class or net farm income class). Neither report relates returns from sales of crops to cost of production. Accordingly, it is not presently possible to identify those classes of farm producers which are having low to negative net returns from production. Consequently, it is not presently possible to define problem target groups for attention and possible assistance. National aggregate data availability forces solutions which produce excessive benefits for some producers and inadequate assistance for others. A more detailed and disaggregated data base appears to be required for focusing farm program assistance where needed. This could prove of great benefit in a situation we are facing today--some farmers striking while others are doing very well.

Others have suggested that the current COP estimates are inaccurate, or that standard errors and confidence intervals should be provided.

The range of such concerns suggests that it would be unwise to make major changes or additions to FEDS data and procedures without (a) a clear understanding of the underlying issues and the relationship of COP estimates toward these issues, and (b) a hard look at alternative data or research strategies that would relate to these issues.

1/ U.S. Dept. Commerce, Bureau of the Census, 1974 Census of Agriculture: United States Summary and State Data, vol. 1, part 51, December 1977.

The background and perspective of the author have had important influences on this paper. Three tenets, in particular, should be mentioned.

1. Economic research is a much more robust activity than gathering and reporting data. Economists have primary responsibility for design of economic research--specific questions asked by policymakers often are not suggestive of the appropriate research approach. In most cases, a substantial judgment filter is required to design research that will efficiently serve the policymaking process.

2. Interest (returns) on the land investment should not be considered a cost of production in the development of COP estimates to aid farm-price and income-support policies. That is my professional conviction, and is held by at least one other economist. 2/ That is important to this paper from two standpoints: (a) It binds the paper to a manageable subject by separating it from the more complex (and more important) issues of land ownership and use rights, and (b) specifically ignoring land allows a clarification, conducive to their resolution, of some of the remaining issues.

3. The FEDS activity is one of the most important activities of CED--the integrity of FEDS and its continuity are of primary importance. Changes and additions should be seriously considered, conservatively implemented, and evolutionary rather than revolutionary. 3/

Definitions To Clarify the Discussion

Numerous terms have been used in the discussion of cost of production variability--terms that have specific and often different meanings to each of us. I will try to avoid adding to the confusion by adhering to the following definitions.

Stratification. Defining strata within the population of farms and making separate COP estimates for each strata. Sampling theory suggests that separate samples should be drawn for each strata.

Classification. Census of Agriculture uses this term in presenting data for different categories of farms. The basic sample is usually drawn from the entire population.

Mean Square Error and Standard Error. Measures of the total error associated with a specific estimate. Standard error is the square root of mean square error. The standard error of FEDS estimates is made up of (a) sampling error, (b) measurement error, and (c) specification error--see below.

Variance. A statistical term measuring the deviations of individual items around the mean for the population.

For purposes of this discussion, it is useful to divide the standard error of FEDS estimates into three components, sampling error, measurement error, and specification error.

2/ U.S. Dept. Agr., Econ., Statis., and Coop. Serv., "Notes on Agricultural Policy Issues: Discussions at the 1977 Meeting of the American Agricultural Economics Association," ESCS-16, April 1978, p. 23.

3/ The importance of FEDS suggests that a first step in the research for this paper should be to look at the stated objectives of FEDS. The current issues concerning FEDS involve both (a) ways to better achieve the stated objective and (b) the possible addition of other objectives.

Sampling error derives from basing estimates on a sample of farms rather than on every farm in the population. Sampling error is estimated by normal statistical procedures and is derived from the variance of individual farms around the population or strata mean.

Measurement error is described in the Census of Agriculture: 4/

> Every census or survey has some errors. These can arise from such sources as incorrect or incomplete reporting, processing errors, and the inability to obtain a response from all farmers. Reported data may be incorrect due to misunderstanding of questions or the use of estimates in reporting. During processing, adjustments are made to data items which appear to be inconsistent with other items. Respondents may fail to provide all of the information requested. In some cases, the respondent may indicate the presence of an item but not the amount.

In FEDS surveys, enumerator carelessness and respondent memory bias may be high. After studying the questionnaires taken during the recent livestock survey, some analysts felt that the measurement error was very large. In fact, the magnitude of this error may be so large that no other improvements are warranted until it can be eliminated.

Specification error is the difference between (a) the COP estimates made using each individual farm's actual cost function and (b) the COP estimate made using the budget generator to represent the typical function. The budget generator represents a simplification and assumption concerning how separate variables relate to enterprise costs on individual farms. If this relationship is viewed as a functional form, we would hypothesize that a different function actually exists on each individual farm.

While users' concerns about the accuracy of the current FEDS estimates are unclear, some comments and requests implicitly suggest that the issue is present. To the extent that the accuracy of the current FEDS estimates is an issue, something should be done either to reduce the standard error of the estimates or to increase their credibility.

Analysts working with the data undoubtedly possess judgment about the relative accuracy of the various FEDS estimates. If accuracy is not high enough by usual research standards, techniques and procedures should immediately be implemented to improve accuracy. Actual estimates of standard errors do not increase accuracy, they only provide a relative measure of it. However, standard error estimates may contribute to credibility if the standard errors are small.

Questions About Farm Income

Some questions from clients suggest that they are trying to use FEDS data to provide information about the income of farmers. The inquiry received by ESCS during the recent Senate budget hearings mentions net farm income and implies that net returns can be evaluated if adequate cost of production information is available. 5/

Clearly, FEDS estimates of specific enterprise costs do not provide information about farm income. Nothing is presented about the size of the enterprise or other

4/ 1974 Census of Agriculture, p. A-11.

5/ U.S. Dept. Agr., Econ., Statis., and Coop. Serv., "Costs and Returns Data for Producing Selected Crops in the U.S.--Data Needs for Improved Price Support Program Decisionmaking," U.S. Senate Committee on Agriculture, Nutrition, and Forestry, March 14, 1978.

enterprises on the farm; and there is no way of determining gross receipts from either the enterprise in question or other enterprises on the farm.

To the extent that policymakers' questions about farm income are not answered by current ESCS series, a need certainly exists. A proper response should consider several approaches, only one of which relates to the FEDS activity and that indirectly--expansion of the typical farm series currently being developed by Leo Strickland of ESCS.

Beyond that point, farm income issues do not present a valid reason for modifications of the FEDS. Other responses should consider providing more classification of information in existing ESCS farm-income reports. Any surveys to support such reports should directly measure the income of different classes of farmers based on such things as income tax records and accounting records rather than become involved with enterprise costs.

Income Distribution and Equity Questions

Many policy issues concern the distribution of income, equity, and control of agriculture. Examples include the continuing public debate about the balance between small farms and large farms and between family farms and corporate farms. In search of information on such issues, some FEDS users suggest that more information be provided on different geographic regions, on different types of farms, by tenure of farm, or on different sizes of farms. The census of agriculture is a good example of information classified in this manner and some look for similar classification in FEDS estimates.

There is a growing realization among policymakers that price and income supports aimed at farmers en masse do not help the particular groups of farmers who may be having difficulties. 6/ Information is needed on which specific groups of farmers are in trouble and what might be done about it. The targeting of deficiency payments is now being discussed as a possible alternative to the current farm legislation. FEDS estimates are looked to as a basis of support for such proposals. From a slightly more theoretical standpoint, economies of size relations are always important in agriculture. Economies of size relationships define the distribution of farms that will tend to exist in a free enterprise system. The relationship between economies of size and COP is often questioned from this viewpoint.

I am convinced that issues in this area are among the highest priority concerns of policymakers looking for economic intelligence. ESCS has several options that could be explored to provide better information about income distribution and equity questions in agriculture. Two of these options involve the FEDS activity.

1. Additional stratification of the FEDS budgets could be made, with appropriate modifications in sampling and survey procedures. The new strata should be carefully defined to be of the highest use to the policymaking process; that is, the specific groups of farmers involved in policy issues should be defined as the strata. As the FEDS activity is expanded in this manner, the cost of each additional stratum should be carefully considered against the need for the information--this consideration may mean that a relatively small number of additional strata are defined. 7/

6/ "Notes on Agricultural Policy Issues," p. 10.

7/ It is possible that the current number of enterprise budgets in the FEDS system may be the most efficient number to handle by the budget generator. If so, the cost for each additional budget may be equal to or greater than the current costs per budget.

2. There may be justification for a new research activity to provide more interpretation and background information for the current FEDS estimates. Such explanation and interpretation is strikingly absent from present COP reports. The current survey questionnaires undoubtedly provide many insights into farm costs, their components, and farm characteristics associated with these costs that are not evaluated or reported with the final estimates. Research to pull together and interpret this information would represent a major step toward helping users understand cost of production, its background, and implications. Many of the current questions and concerns about FEDS could possibly be served by such research.

Beyond those possibilities, the role of the FEDS system in providing structural insight is necessarily limited. COP estimates provide little information about distributional, equity, and ownership questions in agriculture or the well-being of the farm business. In a very few cases, COP information is input for other studies. However, it is my belief that a focus on enterprise costs is an inefficient and misguided way of furnishing economic intelligence about the distributional impacts of commodity policy. Much additional information is required to fairly target deficiency payments to the farmers who are most deserving of public support. As responsible researchers, there is little justification for trying to serve this goal with enterprise cost estimates.

A proper response for ESCS in this respect must rely primarily on other research activities. Efficient research strategies will attack such issues directly, rather than indirectly through enterprise cost estimates; examples are economies of size and large-scale farming studies. Research on the general issue of the structure of agriculture and appropriate farm policy is currently under consideration as a project by the ESCS National Economic Analysis Division. 8/

Confidence Interval and Standard Error Questions

Some users ask specific questions about the confidence intervals, significant differences, and standard errors of the current FEDS estimates. 9/ At this point, I confess some lack of understanding of why policymakers are concerned with standard errors or how such information would aid the policymaking process. Others in this room are better able to make this connection than myself. Possibly some of the questions relating to standard errors may derive from a belief that the current FEDS estimates are inaccurate, as discussed earlier.

In planning a research response to such questions, we must carefully distinguish between those who specifically want standard error estimates and those who are seeking information on the farm income or distributional issues described earlier in this paper. To the extent that client questions actually involve structural and distributional policy issues, providing standard error estimates does little to answer their questions. Such estimates merely suggest that the data are not accurate or that income distribution problems cannot be solved with COP statistics.

If a legitimate policymaking need exists for information on confidence intervals and standard errors, work should be initiated toward providing this information for FEDS estimates. Judgments about standard errors could be made by the analysts

8/ U.S. Dept. Agr., Econ., Statis., and Coop. Serv., "Structure and Organization of Agriculture and Rural Areas," draft research proposal for ESCS New Thrust #7, May 11, 1978.

9/ U.S. Dept. Agr., Econ., Statis., and Coop. Serv., "Measuring Variability in Costs of Production Estimates," draft research proposal for ESCS New Thrust #10, May 19, 1978.

familiar with the work. Such an informal procedure may be appropriate in light of questions concerning whether or not definitive, statistically valid estimates of standard errors can be made within the context of the budget generator procedure.

The last section of this paper will discuss some of the unique problems involved in estimating enterprise costs (which led to the use of the budget generator in the first place) and the difficulty of making statistical standard-error estimates for COP statistics.

The Frequency Distribution of Individual Farm Costs

The earlier ERS report on cost of production, which purported to provide information on cumulative cost distributions, is often referred to as the kind of information that FEDS should continue to provide. 10/ That implies that policymakers need to know the probability distribution function or the cumulative distributions of COP, but that they are not concerned with who or which farmers are involved in different parts of these distributions.

There is a valid statistical basis for considering such requests separately from the standard error concerns just discussed. For statistical estimates containing only sampling error, the standard error can be estimated from knowledge of the second moment of the distribution (the variance). However, estimates of the frequency and cumulative distributions are much more difficult to make--they involve the third and higher level moments of the distribution. The estimation procedures are necessarily much more complex.

Even more so than for standard errors, estimates of frequency distributions point out a deficiency in the whole concept of using COP data as a basis for price supports. Basically, such information indicates the problem but says nothing about the solution; in fact, it is quite unclear that such information can improve policy decisionmaking, since frequency distributions do not provide a rigorous basis for choosing among alternative price-support levels. Of course, an advocate of a specific support level can always turn to such frequency distributions and argue that his support level is valid because it covers the cost of a certain percentage of production (farms).

My personal research background probably relates more to understanding distribution functions of costs and returns than to any other topic of this paper since I was one of the first to demonstrate a use of the concepts. 11/ I have always considered the early ERS attempts at estimating cumulative cost distributions conceptually incorrect and misleading to the public because of the practice of dividing by actual yields rather than normal or expected yields. Distributions similar to those published by ERS can always be generated from a stochastic yield component, even if all farmers have identical costs and production functions. Such distributions provide little information about the differences of costs among farmers.

Another problem is that valid frequency distributions cannot be estimated unless measurement and specification error can be eliminated because such frequency distributions reflect measurement and specification error rather than variance. Since these two errors are probably nonrandom, they represent biases that cannot be adjusted for when frequency distributions are developed.

10/ U.S. Dept. Agr., Econ. Res. Serv., "Costs of Producing Selected Crops in the United States, 1974: A Summary," ERS-620, December 1975.

11/ Miller, Thomas A., "Estimating the Income Supplement in Farm Program Payments," Econ. Res. Serv., U.S. Dept. Agr., TB-1492, March 1974.

If a legitimate need exists for estimating such distribution functions, data should be specifically collected on the factors causing such differences, such as normal or expected yields, feed costs, differences in technology, different machinery complements and machinery costs, and different sale prices. Then the expected cost of normal production of a dollar's worth of product could possibly be estimated. 12/ Such information might be useful in estimating participation in set-aside programs or in operation of a bid-system of land retirement. However, the likelihood of successfully and accurately estimating such distributions may be small, as discussed in the next section.

Enterprise Cost Estimation and the Budget Generator

The estimation of enterprise costs is a unique problem compared to many other estimates made by agricultural economists. The uniqueness of the problem led to the development and use of the budget generator in FEDS as a replacement for traditional statistical procedures.

First, enterprise costs are not readily observable at the farm level. Most individual farmers do not know their enterprise costs, since development of a FEDS-type enterprise budget requires numerous assumptions and data not normally required for sound farm management decisions. For example, estimation of enterprise costs requires that imputed values be assigned to inputs with no market value and that overhead costs be allocated among enterprises on the farm.

Second, there is no institutional or legal definition of enterprise costs. Nor is there a requirement that farmers make cost-of-production reports similar to the requirement for reporting income. As a result, survey enumeration techniques must focus on basic background variables at the farm level rather than on existing records, performance summaries, or enterprise costs themselves.

Finally, the enterprise cost of production on each farm is a unique function of many variables in an extremely complex and unknown functional form. The complexity of this functional relationship makes it extremely costly to estimate enterprise costs for each of the individual farms in a sample.

Resulting Methodological Problems and Limitations

These unique characteristics of COP estimation pose several methodological problems and limitations. Extremely long survey questionnaires are required to estimate the individual functional form so that enterprise COP can be computed for individual farms. Such a survey process would be much more complex than anything done for the Census of Agriculture. Current limits by the Office of Management and Budget on questionnaire length probably preclude ever being able to do this, even if it is theoretically possible. 13/

12/ The importance of variance in sale prices and the dollar's worth of product basis used here is often overlooked. Many high-cost producers happen to operate in areas where they are automatically compensated by higher market prices.

13/ The observation has been made that "Costs of Producing Selected Crops in the United States, 1974: A Summary," ERS-620, actually made a substantial compromise on this point. Numerous machinery cost and input price variables and parameters were actually defined by the budget generator rather than being determined for each individual farm. As a result, a substantial proportion of the actual differences existing between farms may have been overlooked by the earlier study.

Since the usual method of statistically estimating standard errors requires that enterprise cost estimates be made for individual farms, these questionnaire length restrictions probably rule out this approach. The problem of standard error estimation is further complicated by the need to estimate measurement error and any other biases arising from the procedure. Each of the individual variables in the cost function is subject to separate errors of sampling and measurement--these errors are mostly unknown and probably not independent.

These problems and limitations mean direct survey observation of individual farm enterprise costs is impossible. Within this climate, the budget generator provides many research economies by assuming the functional form of the individual farm-cost equation and by allowing that average (rather than individual farm) data be used on many items. Therefore, it is the most cost effective and probably the only affordable way of estimating average COP.

Implications for FEDS Modifications

Such characteristics and limitations pose severe restraints on what can be done toward improving or modifying FEDS. First, survey procedures may have to be substantially changed if measurement and specification error are going to be either estimated or reduced. A survey procedure involving multiple visits to a smaller sample of farms over a period of time (much like the university farm record association procedure) may be required to reduce measurement error. As discussed earlier, such measurement and specification errors must be eliminated before any progress can be made toward estimating standard errors or frequency distributions.

Second, the combination of survey information and data from secondary sources required to support the budget generator does not provide any information on the variance-covariance matrix of basic variables--the first step toward algebraic computation of the standard error of the resulting COP estimate. Even if the variance-covariance characteristics of the basic data were known, it may be impossible to estimate the standard error of the final COP estimate because of the complexity of the budget generator (and the even greater complexity of the real world functional relationship it approximates). In reference to the CED proposal ("Measuring Variability in Cost of Production Estimates"), the nature of the estimation process and the physical world surrounding COP estimates may mean that neither the synthetic process nor the direct estimation of standard errors of the current FEDS data is feasible. While the special methodological studies described in the proposed research are certainly appropriate in the face of such questions, some analysts properly question the assertion that the likelihood of payoff is good. 14/

Other modifications or expansions of the FEDS activity are less affected by the COP estimation problems discussed in this section. Additional stratification can always be made, following current or improved procedures, as long as resources available to FEDS are appropriately expanded. The typical-farm budgets could be publicized, interpretive material developed, and the number expanded. A research activity to provide background, interpretation, and understanding for the whole cost of production issue would likewise not be limited by such problems.

14/ For some single-enterprise farms, it may be possible to isolate and measure the variance-covariance of two or three basic variables and use this information to estimate standard errors for enterprise COP estimates. Commercial feedlots, where purchased labor, feed, and livestock are the main costs, may furnish the best example. Even if it is not possible to estimate standard errors directly, it would appear prudent to focus survey techniques sharply on such variables as an efficient means of increasing the accuracy of FEDS estimates.

Summary and Generalizations

Clearly, there are concerns of policymakers that are not being met by the current FEDS program. However, the underlying policy issues are extremely complex and generate few clear signals suggesting a proper research response. Strategies of how to modify the FEDS activity to relate better to these issues should be developed only after a thorough study and understanding of policymaking needs and identification of the most efficient means of providing the required economic intelligence.

Issues involving the structure of agriculture and equity among different categories of farms are foremost in the minds of many farmers and their elected representatives. The track record of agricultural economists in providing information about changing structural relationships, the impact of commodity price support programs on this structure, and the equity implications of structural change is not good. Numerous expanded and new research efforts are likely called for. However, the extent to which FEDS should be involved in any of those efforts is unclear. Some additional stratification of the FEDS procedures and estimates may be advisable, but should be carefully considered and planned.

The limitations of enterprise costs in furnishing economic intelligence about structural change and the economic well-being of farmers should be faced up to, and attempts should be made to inform the public and Congress of such limitations. Many of the issues discussed in this paper stem from looking to enterprise cost estimates for information that such estimates simply can never provide.

A high priority should be given to maintaining the integrity and continuity of the FEDS process. Most of the issues discussed in this paper were never intended to be served by the FEDS activity when it was designed. Rather, FEDS was designed primarily as a data base for research both in Washington and at universities--a mission that, in my estimation, it has served exceedingly well. As a principal data base, any changes in procedures should be carefully thought out and discussed with the research community before being implemented. Interpretive work for policymakers should not, in general, be performed by individuals associated with FEDS and not to the extent that the basic system is compromised.

This paper contains many suggestions, statements, and assertions that should not be hastily taken as fact, but rather treated as hypotheses for consideration at this workshop. However, I suggest that we be quite hesitant in choosing courses of action that run contrary to any of these hypotheses unless those specific hypotheses can be soundly rejected by workshop participants. A number of questions may serve to focus the discussion of the work group.

1. Are the current FEDS estimates of acceptable accuracy and what can be done to improve accuracy? Are rigorous estimates of standard errors necessary as a basis for improving accuracy?

2. To what extent are farm income and structural issues behind the requests for more sophisticated COP estimates? Should our program area initiate other research activities to address these issues?

3. Why are policymakers concerned about the standard error of FEDS estimates? Is the research community similarly concerned? Why?

4. Given the operational problems of estimating COP, what is the likelihood that standard errors or frequency distributions of enterprise costs can be rigorously estimated?

5. Are standard error or frequency distribution estimates likely to contribute to improved policy decisionmaking enough to justify the additional research resources required to make such estimates?

6. Can survey and enumeration procedures for FEDS be revised to reduce any of the problems discussed in this paper?

Discussion

Peter J. Barry
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I will briefly summarize Tom Miller's paper and then raise a few comments and questions for further consideration. From my vantage point as a teacher-researcher with interests in financial analysis, management, structure, and other microaspects of commercial agriculture, I value highly the COP and other secondary data that are available for analytical use.

Miller's paper can be briefly summarized as follows: The problem is cast in terms of difficulties experienced by CED personnel in responding to a wide range of questions on COP data. In general, the questions relate to how the COP estimates vary among classes of farms or farmers and how the estimates can be properly used in a wide range of issues--issues that often appear to exceed the limits of the data. Some recommendations are offered in several areas. The first area is possible inaccuracy of current COP estimates due to errors in sampling, measurement, or specification. The second area is the use of COP estimates in evaluating farmer income or well-being. The third area is use of COP estimates in evaluating various issues in farm structure--farm size, degree of specialization, tenure, ownership, location, and capitalization. These structural features influence farm economic performance and influence the effects of farm policies on distribution of income and wealth and on efficiency of resource use as well. A fourth area is the need for additional statistics to accompany the COP estimates--confidence intervals, standard errors, significance levels, and frequency distributions.

The paper then reviews the unique problems of estimating costs of production in farming and assesses the feasibility of various procedures for eliciting cost of production estimates that answer, or at least respond to, some of the questions just identified. These procedures essentially consist of farmer surveys, synthetic budget generators, or a combination of the two. Miller concludes with very perceptive observations on the wide-ranging needs for farm economic information that are not being met and the difficulty, or in many cases impossibility, of COP estimates in meeting these needs. He suggests a purposeful, well-organized, and ongoing approach to monitoring the COP activities in CED, with adjustment in procedures as clearly warranted to enhance the quality and usefulness of the data. In this light, the concluding list of questions is excellent for consideration now and in the future.

My reaction to the paper is very positive. It effectively blends together economic, statistical, and accounting concepts in a way that explicitly recognizes the practical side of data handling and research management. I sensed some frustration in the paper's content, however, that extends beyond, but is not apart from, the variability issue. Hence, my comments are in two areas. One involves the overall framework within which COP estimates are produced--that is, what information is really needed? The second area considers some possibilities for directly addressing the variability question in terms of what COP information can really be supplied.

It is not surprising that the mandate received by USDA to estimate costs of production for major crops has led to some perplexing situations. As I understand, the demand for COP information was initially expressed in very general terms in 1973--that is, "to establish benchmark estimates of national average costs with regional variations and annual updating." In response to this mandate, the COP data supply were then created. Now, the availability of COP data has led to new demands on its use. Some of these new demands concern those who generate the data. Moreover, these are not effective demands for information, since there is no pricing mechanism to signal priorities and values on information needs. In the absence of effective demands, the responsibility--a difficult one--mainly rests with the data suppliers to evaluate the proprieties and priorities of the information needs and the suppliers' capabilities for meeting those needs.

Consider one current demand for COP estimates--their use in setting target prices on major crops in the 1977 Agricultural Act and adjusting such prices over time in response to changes in costs of production. One apparent goal of the target price concept is to achieve a means of farm income support that is not tied directly to price support. The mechanism for guaranteeing the target price is a deficiency payment to farmers of an amount equal to the difference between the target price and the higher of the loan rate or an average U.S. price received by farmers during part of the marketing year. Levels of the various target prices largely are determined by the various commodities' costs of production. One can question the propriety of this basis for determining target prices, but let's accept it and go on.

The result is one national target price applicable to all farmers for each commodity. Perhaps only a single target price is politically feasible. It may be too much to expect fine tuning of income supports to account for very many of the factors that affect farmers' well-being. But if target prices are indeed tied to costs of production (and many of us are, indeed, uneasy about the validity of producing a single cost figure--or even having an income support policy that implies a single cost figure), then it certainly seems reasonable to explore the effects of using a single cost figure and then the possibilities for disaggregation.

Consider two effects of a single target price based on a single cost figure. One effect is on the actual distribution of deficiency payments. Producers with lower costs per unit of production will receive larger benefits--perhaps because of size economies, geographic location, dry land rather than irrigated production, more specialized production, or more favorable financing. A second effect is on producers' expectations, risk perceptions, and resulting managerial actions. Lower cost producers may perceive less risk as a result of the single target price-single cost policy and be able to organize their production, marketing, and financing to carry greater risk and expected returns.

These arguments need not be carried too far. The major point is that target prices and, by implication, COP estimates now are differentiated only by commodity. Further evidence is needed to judge whether COP estimates should be further disaggregated in order to explain more of the overall variability of the estimates.

Personally, I would much prefer to have the COP estimates disaggregated along meaningful class lines. However, I have no effective demand to support my preferences. Moreover, I have had some limited experience in working with data from the 1974 COP survey and appreciate the complexity of problems involved in sheer data handling and processing, much less producing meaningful economic information. At Texas A&M, a USDA economist , a master's student, a computer programmer, and I are using the COP data (exclusive of land and management costs) to explore how variations in costs and net income per acre are attributed to 8 commodity types, 14 acreage sizes, 4 degrees of farm specialization, 5 regions, irrigated versus nonirrigated production, and presence versus absence of livestock. Results for the respective

commodities are available only in the form of mean costs and net returns per acre, along with coefficients of variation (standard deviation divided by mean) for various groupings of the explanatory factors. The coefficients of variation are good indicators of relative variabilities. Some tables of data are available to illustrate how the results can be ordered. Clearly, irrigation and region are important. Size effects are rather inconclusive, especially since the size categories are in terms of level of crop acreage rather than size of farm unit. The relatively high coefficients of variation suggest that much variability still remains unexplained, even though the use of secondary data to estimate machine costs likely tends to understate total variability. It is also interesting that acreage size and net returns appear to exhibit a stronger relationship than do acreage size and cost. Hence, gross income must be increasing with size, and results tend to show that the major source of increasing gross income with size is higher product prices.

In conclusion, it appears clear to me that the COP activity of CED is indeed a valuable one. It is valuable since good economic data are so scarce and the needs for them are so great. If only the needs could be expressed in terms of effective demand, then still more valuable data could be produced. Finally, I suggest that the following questions be added to the list at the end of Tom Miller's paper for further consideration.

1. Can or should COP estimates be feasibly disaggregated according to meaningful classes of farm structure: size, specialization, region, irrigated-nonirrigated, tenure, capital structure, and others?

2. Can or should these structurally disaggregated COP estimates also be feasibly disaggregated by meaningful components of costs, operating costs, ownership costs, management costs, and others?

3. How do the COP activity and the questions on farm income and cost coming to CED relate to the financial accounts and analysis for the farm sector that are conducted by other USDA groups?

Work Group Summary Report

The working group considered several aspects of the variability problem, including measurement error, sampling error, and variability by region, size, and scale. Questions raised by the group concerned the applications of cost of production data for research and policy analysis.

It was the consensus of the group that the lack of precision in national average cost of production data was not a primary problem or policy issue. However, they believed that continued emphasis should be given to refinement of the FEDS system with input from cost of production surveys and a refinement of the concepts that are implied in measuring average cost of production.

The group concluded, however, that it was impractical if not impossible to attempt to develop standard error or variance terms for average cost of production data as currently developed. It also recognized that data-collection guidelines imposed by OMB prohibited collection of necessary data from an individual farm or enterprise in the detail necessary to develop such estimates.

Discussion within the group then focused on the consideration of informational needs that go beyond the capability of the current cost of production system. Such questions were primarily related to the use of cost-of-production data in measuring changes in the well-being of farm operators and the earnings of farm firms.

Although cost of production is only one element in economic well-being, additional information on variations of production cost by size of firm and by region could provide valuable input into policy discussions. In addition, external market factors, such as economies of purchasing inputs and marketing output, were perhaps quite important in any consideration of size, and future research should investigate these issues.

The group recommends that the 1979 survey of cost of production proceed as scheduled with the primary purpose of improving estimates of inputs used in the current cost-of-production estimates. It further recommended that additional studies be developed to explore questions of size, equity, well-being, regional competition (including market prices), and interpretation of current cost-of-production estimates.

HOW TO PRICE LAND IN COST OF PRODUCTION STUDIES

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This topic is big enough that I could talk for days, expounding on new theories of the value of land, or examining all facets of the factors affecting land values, or explaining all the implications to society about these various assumptions. But fortunately for you, I will try to keep this paper very short. This workshop is planned to include a discussion group on land costs. That group will try to come to some final decisions on what CED should do as far as land is concerned in our cost of production estimates. Hence, to aid in getting at this decision, I will follow a very simple outline. I will talk about land costs in regard to:

1. What Federal law says about land costs in regard to cost of production estimates and target prices,

2. a brief synopsis of what economic theory says on the matter,

3. what our current CED practices are in terms of land costs, and

4. what options we have in the future.

Current Law on Cost of Production

USDA became involved with cost of production estimates on cotton in the 1960's, but the current program of estimating costs on several farm commodities began with the passage of the Agricultural and Consumer Protection Act of 1973. Section 808 of the act calls for cost of production studies. The full text of section 808 is provided as an appendix to this paper. But the portion that relates to land costs is quoted as follows: "This study shall . . . include a return on fixed costs equal to the existing interest rates charged by the Federal Land Bank." You can see that the thinking on this topic was rather fuzzy. The word "land" is not in the text. Also, you will note that no mention was made of what price of land is to be used, whether we are to use a current land price or an acquisition land price. That is all that the 1973 Agricultural Act says about land costs.

The Food and Agricultural Act of 1977 specifies target prices for 1977 and 1978 for wheat, feed grains, and cotton. Congress set target prices for 1978 at levels that would give a return to land ownership equivalent to approximately 3.5 percent of current land values. However, any changes in land and management costs over the next 3- or 4-year period will not be reflected in changes in target prices. The 1977 Act specifically states that the target prices will be adjusted starting in 1978 or 1979, depending upon the crop, and through 1981, to reflect any change in the moving 2-year average of variable, machinery ownership, and general farm overhead costs. Hence,

land costs are excluded from the process of adjustments that will be made in target prices under the 1977 Agricultural Act. 1/

The 1977 Act extended the cost of production estimates to rice, which was not included in the 1973 Act, by declaring that adjustments in the target prices for rice will be made the same way as the adjustments in the other commodities. Hence, the cost of producing rice must be estimated also.

Cost of production estimates, however, are not needed for administration of the price support program for peanuts, or sugar, or dairy products, nor for any other crops for which loan programs are available. Hence, any calculations that CED performs on estimating costs for these other commodities are not done to meet mandated requirements, and hence, no specific procedures are required. We must, however, consider the problem of comparability across commodities when we are producing cost of production estimates for any crop.

The 1978 Emergency Farm Act modifies the 1977 Agricultural Act, in that it specifies that when a crop set-aside program is in effect, the Secretary of Agriculture can then depart from the procedure of adjusting the target prices on the basis of changes in cost of production. The adjustment in target price from the cost of production level is to be based on costs of set-aside.

Please note that there are no cost of production estimates required in any of the agricultural acts for any of the meats, including poultry, beef, hogs, and sheep, and hence, in our discussions of land costs, the relevance to beef comes about only in the manner of comparability across commodities that we have mentioned above. There are no legal requirements as to how these costs are calculated, only our self-imposed constraints in regard to comparability across commodities and consistency with economic theory.

Economic Theory in Relation to Land and Cost of Production

The classical economic theory of rent is reported to us by David Ricardo and is paraphrased as follows: It is not really true that the price of corn is high because the price of corn land is high--actually, the reverse is more nearly the truth; the price of corn land is high because the price of corn is high! Its total supply being inelastic, the land will always work for whatever is given to it under competition, hence the value of land is completely derived from the value of the product, not vice versa. 2/

For a more contemporary source, I refer you to the proceedings of a symposium held at the 1977 annual meetings of the American Agricultural Economics Association. This symposium, titled Returns to Land in the Corn Belt, Government Crop Price Guarantees Based on Cost of Production, and Land Values, quite thoroughly discussed the problems at hand. 3/ This series of six papers deals with micro-production costs and returns data, simulation of impacts of farm programs, and some of the policy issues of this topic. I would strongly recommend this material for your consideration.

In fact, those proceedings would serve as a good basis for our discussions here. I will try to summarize some of their conclusions.

1/ James Johnson and Milton H. Ericksen. "Commodity Program Provisions Under the Food and Agricultural Act of 1977," Econ. Res. Serv., U.S. Dept. Agr., October 1977.

2/ Principles of Political Economy and Taxation, Ch. 2, " On Rent." 1817; rpt. London; J. M. Dent and Sons, 1960.

3/ Department of Agricultural Economics, University of Illinois, Urbana, Illinois, August 1977, AE-4448.

Marshall Martin, in his paper in the above-cited symposium, presented a long list of factors affecting land values, including land as a hedge against inflation, Government payments to farmers, off-farm income, farm product prices and farm incomes, farm mortgage interest rates, farm technology, farm enlargement, economies of size, and the prices of other farm inputs. This listing can be narrowed down into two categories, or as Martin states it: "Investment in agricultural land performs two primary functions--a hedge against inflation and a source of income." 4/ The fact that there are these two major forces affecting land values complicates the problem that we must face in estimating cost of production.

Farmland as a Source of Income

Many individuals, including myself, tend to view the capitalization of farm profits, including farm program benefits, as an evil side effect that could be, or should be, avoided. 5/ Realistically, capitalization of such expected future income into current asset values is part of the normal management process of profit-maximizing producers. 6/ Whenever farm profits increase, or the Government takes some action to guarantee farm prices, the expected average longrun return from land is likely to increase and the capitalization into land value not only can be expected to occur, but can be assumed to occur. This capitalization is a normal process in a competitive profit-maximizing industry. Martin estimates that in the Corn Belt a 10 percent increase in prices received by farmers will result in a 2.6 percent increase in farm real estate values in the short run and an 18 percent increase in the long run. 7/

Farmland as a Storehouse of Value

The fact that land serves as a hedge against inflation introduces some complications when land is to be included in the cost of production calculations. The income aspects of farmland have a logical place in economic production and price theory, but land values derived from aspects other than farm production have no logical place in production and price theory. More simply stated, if the value of land is based on nonfarming purposes, why or how should farm production be charged for the land used? Hence, to determine a cost of production estimate correctly, the aspects of farmland values that do not deal with land as a source of farm income should be separated out.

Current Practices Regarding Land Costs in Cost of Production Estimates

This section is divided into two parts: land costs in regard to crop production, and land costs in regard to livestock.

Crops

As noted previously, the 1973 Farm Act was rather vague in defining the procedures to be used in determining land costs. Hence, when the first cost of production report was prepared under that mandate, six different methods were used in determining a charge for land. 8/ Briefly, those methods can be summarized as follows:

4/ Marshall A. Martin, "Rising U.S. Farm Land Values: Some Policy Considerations."
5/ Robert D. Reinsel and Ronald D. Krenz, "Capitalization of Farm Program Benefits Into Land Values." ERS-506, Econ. Res. Serv., U.S. Dept. Agr., October 1972.
6/ Michale Boehlje and Steven Griffin. "Financial Impacts of Government Support Price Programs." Proceedings of Symposium, op. cit.
7/ Proceedings of Symposium, op. cit.
8/ Econ. Res. Serv., U.S. Dept. Agr., "Costs of Producing Selected Crops in the United States--1974," prepared for the Senate Committee on Agriculture and Forestry, Senate Committee Print No. 63-092, 1976, pp. 8 and 40-41.

1. Charging interest at the current Land Bank interest rate on current land values,

2. charging the current Land Bank interest rate on estimated average acquisition values (average acquisition values were estimated by determining an average over the last 35 years of land values in the particular State),

3. calculating the landowner's return under the typical share rental arrangement,

4. calculating the landowner's return under a cash rent arrangement,

5. determination of a composite of share rent, cash rent, and land values, with land valued at current rates (that is, a weighted average of methods 1, 3, and 4 above),

6. same as number 5 above, but using average acquisition values (a weighted average of methods 2, 3, and 4 above).

In the two recent Senate Committee Prints, the land costs were determined using methods 5 and 6, described above. 9/

Those methods have been used to calculate land costs for the 10 crops reported in these Senate Committee prints. Data were obtained from the 1974 ERS Cost of Production Survey on the percentage of land in three tenure categories, owner operated, share rented, and cash rented. These percentages are used as weights in determining the composite land values. These percentages have been used for all years for which costs have been developed.

In the 1974 COP survey, farmers were also asked to provide estimates of the agricultural value of their land. The values have been updated annually, from data reported in various issues of "Farm Real Estate Market Developments."

Livestock

Estimating the value of land used in livestock production poses more problems than for crop production. Land used in livestock production typically is land which is not suited for crop production. Livestock land, whether part of a mixed crop and livestock farm or single livestock enterprise, utilizes land with few alternative uses. Quite frequently, this type of land is not sold by itself. Consequently, on mixed crop-livestock farms, the value given the supplementary noncrop land, even with a given area, will vary widely from the average value of all land to a value near zero. Similarly, such land is not usually rented, hence the data base on rental rates of land used for livestock is very thin as well as highly variable.

In hog- and cattle-feeding production, the land item is fairly insignificant. For hogs, only land used for hog pasture and building sites were included in cost of

9/ Econ. Res. Serv., U.S. Dept. Agr., "Cost of Producing Selected Crops in the United States, 1975, 1976, and Projections for 1977," Senate Committee on Agriculture and Forestry, Senate Committee Print No. 80-606, January 21, 1977. "Cost of Producing Selected Crops in the United States, 1976, 1977, and Projections for 1978." Senate Committee on Agriculture, Nutrition, and Forestry, Senate Committee Print No. 24-607, March 21, 1978.

production estimates. 10/ Current land values and interest rates were used to calculate land costs.

Estimates on costs of feeding cattle are presently being developed as part of CED's cost of production series.

For a dairy, all feed has been priced at market values, and only land used for pastures and dairy lots have been included. 11/ This land was valued at current prices and current interest rates. Land taxes were also included.

The land question becomes a major issue in beef-raising systems. 12/ Cattle raising is land extensive, requiring approximately 8.4 acres per beef cow in 1976. The average 1976 value of an acre of pasture in the United States was estimated at $282, giving a total average current land value per beef cow of $2,371.83. At current interest rates of 8.6 percent, the cost per cow is $204.21, or $71.90 per hundredweight of beef produced. The total estimated nonland costs were $72.03, giving a total of $143.93 per hundredweight.

Private land values in 1976 averaged $2,372 per cow for the new entrant in all regions. Land values per cow for ongoing operations were assumed to be 31.8 percent of the corresponding 1976 land values, or $755 per cow. Land values per cow for new entrants and ongoing operators in 1976 by region were: North Central--$2,446 and $778; Southeast--$1,800 and $572; Great Plains--$1,500 and $477; Southwest--$3,868 and $1,230; and West--$1,450 and $461. An extensive acreage of rangeland per cow results in sharply increased costs in the Southwest. However, land charges per cow vary more within many of these regions than between regions.

Current or recent beef prices have been below the estimated breakeven cost, excluding land. Hence, any land charge at all puts beef production into the loss column.

On the other hand, in 1976 alone, the appreciation in land values was approximately 17 percent. This rate translates into a land appreciation per hundredweight of beef produced of $141.47. Hence, the beef cattle producer has lost money on beef cattle, but has gained a sizable appreciation in the net worth of his land.

In summary, we have not yet published a Senate Committee cost of production estimate for beef raising, primarily because we don't know what to do with the land charge.

What Do We Do Now?

Current legislation requires that we include land as a cost of production in the estimates prepared for wheat, feed grains, cotton, and dairy products. This is to

10/ Econ. Res. Serv., U.S. Dept. Agr., "Cost of Producing Hogs in the United States--1976." Senate Committee on Agriculture, Nutrition, and Forestry, Senate Committee Print 25-503, April 21, 1978.

11/ Econ. Res. Serv., U.S. Dept. Agr., "Cost of Producing Milk in the United States, 1975 and 1976," prepared for Senate Committee on Agriculture, Nutrition, and Forestry, Senate Committee Print No. 83-252, February 25, 1977. Econ. Stat. Coop. Serv., U.S. Dept. Agr., "Costs of Producing Milk in the United States--Final 1976, Estimated 1977 and Projections for 1978," prepared for Senate Committee on Agriculture, Nutrition, and Forestry, Senate Committee Print 25-504, April 21, 1978.

12/ Ronald A. Gustafson, Henry C. Gillian Jr., and Calvin C. Boykin Jr. "Costs of Producing Feeder Cattle in the United States, 1976--Preliminary Estimates," Econ. Stat., Coop. Serv., U.S. Dept. Agr., ESCS-25, June 1978.

comply with the 1973 Act, although the land charge estimates will not be used to adjust target prices. I presume that we must continue to include land costs in the estimates for these commodities.

However, we may have several options open to us as to how we should estimate these costs. If a land charge is needed, I would argue that, for crops, rental value is a more appropriate procedure than land value. For livestock, the rental basis is not available due to the infrequency of land rental, as discussed earlier. Rental basis does not avoid the capitalization of income into land values, but it does avoid problems with other sources of land value, such as nonfarm speculation.

CED has numerous opportunities to present economic analysis and information to a wide variety of people. We have contact with staff members throughout the administration and congressional staffs. With those contacts, we should more actively indicate the implications of including land values in the cost of production estimates. Some may argue that by doing so, we would not be acting as economic analysts, but rather as proponents. In remaining silent, however, we would be failing in our duties to inform the policymakers and the public as to the implications of such policy actions.

We have two major outlets for our published cost of production estimates. One is our FEDS budgets and the other is the Senate Committee prints. In both cases we should treat the land as a residual claimant. That is, remove land as a cost factor and list instead the residual returns as returns to land and other unnamed factors of production. I believe such a procedure is more realistic in depicting how decisions are made in agriculture. Land is generally treated as a residual claimant.

This approach is perhaps not very acceptable to farm producers or farm producer organizations. I know that extension workers are under pressure from farmers to specify land as a factor in cost of production estimates. However, the errors to be made on one side are just as great as on the other. For instance, if we include a cost of land, we are trying to help out those individuals who have paid a high price for the land, but in doing so, we are then giving a windfall profit to those who have purchased their land at lower prices.

This entire argument about land and cost of production was summarized quite well at another panel discussion held at the 1977 annual meeting of the American Agricultural Economics Association in a brief exchange between Phil Raup and T. K. Warley. 13/

Phil Raup

> My question is for T. K. Warley. I begin with the presumption that we stand at the door of a treatment of agriculture as a utility, as Tim Wallace suggests. The major policy issue in utility pricing has to do with return on capital. Most of the labor is hired in relatively competitive markets, many of the supplies required are less subject to control, but the return to capital is a crucial policy decision. With your British background and your Canadian occupation, and the fact that you can go back to Guelph instead of Washington, what do you think we should do with the price of land in computing rates of return and the cost of production based on price supports?

13/ "Notes on Agricultural Policy Issues: Discussions at the 1977 Meeting of the American Agricultural Economics Association." Econ. Stat. Coop. Serv., U.S. Dept. Agr., ESCS-16, April 1978, pp. 23 and 24.

T. K. Warley

The answer's quite simple--leave it out.

Raup

That is too simple. What do you see as the principal consequences of leaving it out?

Warley

I see the averting of worse horrors than those that we are now experiencing. That is to say, if you include it, as you all know, we have a perpetual burden on society and on certain groups within agriculture. We are moving in Canada toward full cost of production pricing for a wide range of commodities and it's a vicious circle of prices-costs, costs-prices, and diminishing competitive position of our industry, or particular sectors of our industries. At some stage, the cycle is going to collapse. That is what I was alluding to when I said that policy instability may be far worse than the price and market instability that these kinds of concepts--like cost of production pricing--are designed to alleviate.

While I have not tried to provide answers to all the questions on land, I hope I have provided some stimulus to the discussion group which will address the topic later in this meeting.

APPENDIX

SECTION 808 OF THE AGRICULTURE AND CONSUMER PROTECTION ACT OF 1973 (PUBLIC LAW 93-36) COST OF PRODUCTION STUDY

S. 808. The Secretary of Agriculture, in cooperation with the land grant colleges, commodity organizations, general farm organizations, and individual farmers, shall conduct a cost of production study of the wheat, feed grain, cotton, and dairy commodities under the various production practices and establish a current national weighted average cost of production. This study shall be updated annually and shall include all typical variable costs, a return on fixed costs equal to the existing interest rates charged by the Federal Land Bank, and return for management comparable to the normal management fees charged by other comparable industries. These studies shall be based upon the size unit that requires one man to farm on a full-time basis.

Discussion

Harald Jensen
Professor of Agricultural Economics, University of Minnesota

To begin, it may be appropriate to provide some historical perspective to the subject, to help us realize and appreciate that we are not wrestling with something new.

In the February 1945 Journal of Farm Economics (JFE), Boss relates that the cost studies set up at the turn of the century were in answer to the demand for information

on the cost of producing crops, stimulated by the long period of low prices from 1880 to 1895. He also wrote that "USDA in 1893, in response to numerous inquiries relative to the cost of raising the principal cereals, circulated a questionnaire among 28,000 practical farmers asking for estimates on the cost of raising corn and oats."

The Bureau of Agricultural Economics, USDA, organized in 1922, was set up mainly to study farmers' costs of production. After World War I, farmers felt entitled to a fair or just price which frequently was equated with cost of production. In the October 1923 JFE, Ezekiel pointed out that if we assume that the market rate of interest is equal to the actual rate earned in farming, we introduce a bias if they are not equal. If the assumed interest rate exceeds the actual net earning of capital, a bias is introduced against the larger farms.

In the January 1926 JFE, Holmes, in commenting on cost of production studies, said that it is unfortunate that the method is backward looking, since it depends on facts of the past for the development of a future program. Moreover, he observed, because of the nature of the farm business with its large proportion of fixed costs relative to immediate cash outlays, a large amount of estimating is needed to arrive at these values. The result, he said, is that our cost of production figures have failed us as a guide to production.

J. D. Black noted that different concepts of cost of production created some problems. 1/ One concept included the amount of money actually spent in producing a unit of product plus the estimated monetary value of other inputs. Another included the amount necessary to provide producers of the product with a given content of living as deemed desirable, which might be interpreted to mean a cost equal to a fair or just price. A third concept was a unit cost equal to the amount required to cause producers to produce a given quantity of product. Black also outlined certain conditions he considered necessary if cost of production studies were to be useful.

1. Hired labor wages must be distributed among products using such labor on the basis of alternative uses for it at the particular times of the year and of the day. If this is not done, then enterprises using labor at peak load times will appear more profitable than they are.

2. Allowances for proprietor and family labor must be distributed similarly.

3. Allowances for machines and buildings and other inputs used for more than one enterprise must be distributed in the same way.

4. Charges for land use must be adjusted for different types and grades of land used for different crops combined in rotation. Land charges depend on amount of plant food taken out or added, effect on physical condition of the soil--such as tilth and weed control, contributions received from other crops, and the opportunity cost of land.

5. Evaluations must be made on products or byproducts of an enterprise used by another enterprise--feed grains, forages, etc.

Referring to the basic elements of costs (wages on labor, interest on capital used, rent on land, and earnings of management), Hopkins and Taylor, outlined the

1/ Black, J. D. "Unit Cost of Production of Farm Products." Social Service Research Council Bulletin No. 13, 1932.

difficulties in placing a valuation on these factors. 2/ They argued that much of the labor was done by the farmer or his family, part or all of the capital was owned and much of it represented previous investment that would not be repeated, rent could not be used as an element in determining price or cost of land as that price was determined by the prices of farm produce, management varied from farm to farm, and there was a problem of arriving at costs where joint products existed. They raised the question of whether price should equal unit costs. Their answer was, in a longrun static framework, yes, but in the shortrun dynamic situation, the firm will operate as long as it meets operating expenses and some payment on fixed costs. They added that the wide-awake businessman operates on future expectancies more than on past investments. Hopkins and Taylor noted other problems in uses of cost of production figures. As a basis for price guarantees, cost of production was unsatisfactory because, since farmers costs varied, there was some uncertainty as to whose costs the price should approximate. Moreover, they wondered why the level of costs previously incurred should be used as a basis for artificial price setting.

Current Law on Cost of Production

First, I have some comments on Ron's paper and then some general comments about the legislation. He has said that "estimating costs for these other commodities (is) not done to meet mandate requirements (emphasis added)." I suppose by these other commodities he means wheat, feed grains, and cotton. Yet later, he has said that "current legislation requires that we include land as a cost of production in the estimates prepared for wheat, feed grains, cotton, and dairy products."

Ron is concerned about comparability across commodities when we are producing cost of production estimates. I presume his concern is that lack of comparability may affect resource allocation, but he does not elaborate. I would like to know what he means.

Ron has suggested that the crop set-aside program makes it possible for the Secretary of Agriculture to depart from the procedure of adjusting target prices on the basis of changes in cost of production. The implied purpose of this, he says, is to allow the target price to be raised in lieu of a payment for set-aside. On the basis of his statement preceding that, it would seem that it would be the other way around.

Now for some general comments about the legislation. This is a complex set of legislative acts--difficult to interpret and, therefore, difficult to administer. I cannot help but ask what the objective is behind the acts. Is it to assure adequate incomes for one-man farms? Is it to stabilize farm incomes? Is it to stabilize land prices? Is it to assure establishment of young, capital-limited farmers? Are the acts trying to meet a set of conflicting goals? What are the expected consequences of the various acts? Perhaps we need to try to answer these questions first.

Ron mentions that the wording of Section 808 is unclear. Let me add that "a return on fixed costs" is difficult to interpret. Moreover, because the cost of production studies are to be based on a farm that can be operated by one man working full-time, that method may provide a windfall to larger than one-man farms because of economies to size.

In setting target prices for 1978, Congress included a land cost at 3.5 percent of current land values. This requirement appears to provide a windfall to farmers who acquired land earlier at lower prices. Boehlje and Griffin in their base case study

2/ Hopkins, J. A., and P. A. Taylor. "Cost of Production in Agriculture," Iowa Experiment Station Bulletin 184, June 1935, Ames, Iowa.

assume that 90 percent of the cost of production is supported by the Government with a price support program, 2 percent inflation in corn prices, a risk parameter based on 8 percent opportunity cost of capital, a return to land calculated in the cost of production at 3.5 percent of the current market value, and an initial land price of $1,770 per acre. Their analysis, with the use of a simulation model, shows that after 20 years the total cost of production has increased from $2.02 per bushel of corn to $6.03, and land values (on a 160-acre farm) have been pushed to $7,052 per acre by the support program. 3/

But even if land is not included in computing changes in cost of production, it seems to me that land costs can still be pushed up because in any 1 year, operator and family labor, and machinery and equipment bought in earlier years, can be viewed as residual claimants, part of which may be shifted to land.

Ron's section on theory is a little thin. Part of our problem is that the value of land is not completely derived from the value of the product as Ricardo said it was. John Scott, Jr. has pointed out that the value of land incorporates many forces--tax shelter, open space, nonagricultural development potential, inflation hedge, permanent repository value (land is always going to be there), pride of ownership, and job security (ownership versus rental of land). 4/ Thus, investment in agricultural land serves more than the two functions Ron has listed--hedge against inflation and a source of income. Later Ron does allude to other functions.

Ricardo and neoclassical theory state that, in the aggregate, land is largely fixed. However, the distribution of that land among firms is not fixed, and from this fact stems part of our problem of costing land. If land were fixed to the firm, the value of an acre of land in corn would be what that acre could earn in alternative crops on that farm. But since it is not fixed to the firm, land does have an acquisition cost, a salvage value within the industry, and it presumably has a value of marginal product. 5/

Whether land is included in cost of production for commodities, certain theoretical and technical difficulties do exist which I shall merely enumerate as reminders. The theoretical difficulties stem mainly from the fact that (1) marginal costs, as well as average costs, are considered to be important in decisionmaking and (2) the need to consider all input and product prices simultaneously where multiple or joint products are being produced. The technical difficulties stem from empirically defining and allocating fixed and variable costs among individual enterprises in multiproduct firms, empirically accounting for economies to size in estimating unit costs, and estimating the effects of different climatic and soil conditions, along with the impact of use of different techniques, for example, irrigated versus nonirrigated crop production.

Ron comments briefly on Marshall Martin's paper. I should like to sharpen these comments somewhat. Martin discusses a statistical model where the price of land is a function of the ratio of prices paid (PP) to prices received (PR), average mortgage interest rate, the ratio of price of fertilizer (PF) over prices received, farm size, land price lagged one year, tax rate per $100 valuation, and trend. All independent

3/ American Agricultural Economics Association, August 1977 paper for symposium, Returns to Land in the Cornbelt, Government Crop Price Guarantees Based on Cost of Production, and Land Values.

4/ John T. Scott, Jr., "Land Returns and Land Values Affected by Grain Prices and Government Supporters." Series E, Agricultural Economics, University of Illinois, No. 78 E-501, May 1978.

5/ If the objective of cost of production for target prices was to obtain the desired aggregate supply response, then salvage value for the farm sector is relevant, which, except in our urban fringes, would be zero.

variables are statistically significant as explanations of the dependent variable, except the mortgage rate of interest and trend. Possibly, the price farmers are willing to pay for land is determined by variables other than the interest rate or perhaps the variable was misspecified. Trend was a surrogate for technological change and it may be a poor surrogate. The positive sign for the regression coefficient for PR/PP suggests that, other things being equal, an increase in farm product prices relative to input prices encourages farmers to bid up the price of land.

The positive sign for the regression coefficient for PF/PR supports the hypothesis that fertilizer is a substitute for land on the assumption that total output is held constant. Hence, one might assume that the sharp increases in fertilizer prices relative to commodity prices in 1974/75 reinforced the increase in agricultural land values.

The regression coefficient for farm size is an indication of the increase in farmland values due to farm enlargement as a way of capturing greater economies to size. Thus, a 1-percent increase in farm size will in the short run result in a 3-percent increase in farmland prices in the United States.

The lagged land price variable was highly significant and appears to suggest that farmers are formulating their future price expectation for land on past land prices.

The property tax rate was inversely related to farmland values.

I shall complete my comments on the Martin paper with a quote from his paper; this excerpt illustrates what we need to emphasize increasingly and that is to point out as well as we can the expected consequences of estimating costs of production in alternative ways.

> The manner in which the cost of production is calculated and used to determine target prices and perhaps loan rates can also influence future land values. If the target price is equal to the variable cost, and if market prices should fall to the income support level, continued production would be assured in the shortrun, but no return is guaranteed for land, management, and owner operator and family labor. If this situation should persist for very long, the value of land would fall and operator and family labor and management resources would tend to shift to other endeavors.
>
> If the level of support covers both variable and fixed costs, the residual income claimants would be guaranteed a minimum return. Part of this guaranteed return would most likely be bid into the price of land. If the escalator for adjusting support prices over time includes a return to land, an upward land price spiral would occur. This would provide a windfall profit to those landowners who wish to sell land. However, it would make it more difficult for non-land owning farmers to acquire land.
>
> Another way to link target prices to the cost of production is to set the target price equal to all non-land costs plus a fixed return to land. Land values would increase, but the impact would be once and for all, since the land charge would remain unchanged in the target price escalator formula. This is essentially what Secretary of Agriculture Bergland has suggested in the Administration's proposal. For the 1978 crop year, target prices would cover variable costs, machinery ownership costs, overhead costs, a return to management, and a return to land ownership

equivalent to 3.5 percent of the current land values. Changes in the target prices after 1978 would only be adjusted by changes in variable machinery and overhead costs and changes in yields.

Policymakers are faced with two basic dilemmas as they consider the proposed farm legislation. First at what level should the target prices and loan rates be set? The higher they are set relative to the long-run equilibrium prices, the greater the probable necessity of set aside program and/or an accumulation of stocks. This set of actions could result in an increase in agricultural land values. Second, the manner in which land costs are incorporated into the cost of production, support price escalator forces policymakers to face a trade-off between helping landowners who have high land costs and a potential cash flow problem vs. providing low cost landowners with windfall profits and possibly encouraging an upward land price spiral. (sic).

In the section titled "Farmland as a Storehouse of Value," Ron argues that those aspects of farmland values that do not deal with land as a source of farm income should be separated out. The implication of this statement is that the objective of the legislation related to cost of production is not to aid the bona fide young farmer starting out who must pay the higher land values. I am not saying this is right or wrong, merely making explicit its possible implication.

In the section titled "Livestock," I am not sure that I follow Ron's argument on the problems associated with estimating the value of land used for livestock production. Land not suited for crop production but used for livestock production simply means it has a zero opportunity cost, but it still has a value marginal product in livestock production. Also in livestock production where feed is priced at market values we really do not get away from land costs, do we? Isn't it simply being priced indirectly and as the price of feed goes up, resulting in a higher target price, won't this result in increased land prices?

In the section "What Do We Do Now?", Ron argues that, under ideal conditions, land would be omitted from cost of production estimates. For longrun policy objectives, there are strong arguments in support of this position to which I have alluded. For a short-term policy objective, the argument may go the other way if the objective is to aid the capital-short farmers who have cash flow problems due to purchases of high-cost land or other durable assets, followed by falling product prices. I think Ron feels that leaving land out of the computation may not be politically feasible and therefore suggests a rental charge. Since contractual rent is relatively stable, and since it supposedly reflects the value of land in farm production, it does seem to have some advantages over a fixed percentage of current land prices. But I wonder if rental rates completely avoid the speculative values in land. In negotiating a rental contract, both tenant and landlord will want to be sure that they cover their out-of-pocket costs. Beyond that, there is room for bargaining. For the tenant, his labor and that of his family, along with the depreciation and interest on his investment in machinery and equipment, are shortrun residual claimants. If rental land is scarce, the tenant may be willing to bargain away some of this residual in the form of higher land rental rates. It seems appropriate for economists to ask: Are rental rates equal to the value marginal product (VMP) for land? A factor should be worth its VMP. Hence, as economists, ideally, we prefer the use of VMP's as measures of the productive worth of a factor.

If land is to be included in cost of production estimates, perhaps the best we can do is to analyze with the use of several methods but to do our best in tracing out the expected consequences of using one method instead of another. Martin's paper provides us with a good beginning.

In conclusion, I should like to ask one more question of Ron. He suggests that for both the FEDS budgets and Senate Committee prints we should treat land as a residual claimant, that is, remove land as a cost factor and list instead the residual returns as returns to land and other unnamed factors of production. But how many of these unnamed factors might there be? In the short term, operator and family labor, machinery and equipment, buildings and other durable assets can also be considered residual claimants, and it becomes an arbitrary matter how the total residual is distributed among these factors.

Work Group Summary Report

Dick Crom reported that when land was charged at interest on current land value for raising feeder cattle, the land charge was $71.90 per hundredweight sold. That figure is so ridiculous that it would destroy our credibility if it were put out. No immediate solution was found for this problem.

What do we do about land costs generally? The work group considered omitting land but agreed that land had to be treated. Showing returns to land as a residual would be most consistent with economic theory. Although some consideration was given to showing returns to all factors that do not have a price as a residual, that was rejected largely because we do not have adequate data to separate operator and hired labor. Also, when operator and hired labor are used on the same farm, it may not be meaningful to separate them because operator and hired labor are interchangeable for some operations. Including a management charge should answer the argument that operator labor is more valuable than hired labor.

The publication of returns to land as a residual requires the publication of prices received and gross receipts. Except for cotton, this would be the first time that prices received and gross receipts have been published in connection with the cost data. Projected returns to land from cotton production cannot be published because the law prohibits forecasting the price of cotton.

It was suggested that the following additional information be published about land: current value of land used for the enterprise, value and interest 35 years ago, 35-year average value and interest, value and interest 5 years ago, value and interest last year, Federal Land Bank interest rate on new loans, acreage of land used for the enterprise, rental rate 35 years ago, value of marginal product and land tax. From those data the capital gain from land ownership can be determined and added to the return from production.

The 35-year average value and interest differs from the present land charge, based on acquisition land values, in that taxes would be excluded and the interest rate based on the 35-year average Federal Land Bank rate for new loans. The average interest would correspond with land values.

We will have difficulty publishing data on cash rent for some crops such as rice because of a limited number of observations.

Consideration was given to showing cash flow which is different from cash costs. But we do not have sufficient data to show cash flow. Because some resources are owned and some hired, the user may not be able to split out returns to some factors.

An example of costs and returns of producing feeder cattle was presented showing cash and noncash data for a supplementary enterprise in both the short and long runs.

With the present detail of cost data excluding land and the residual return to land, short-, intermediate-, and long-term returns can be determined, depending on what items are included in costs.

WHAT PRICE FOR MANAGEMENT AND LABOR CHARGES?

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The 1973 Agricultural and Consumer Protection Act specified that a "return for management comparable to the normal management fees charged by other industries" be charged in estimating the cost of producing farm products. Because large specialized units such as commercial cattle feedlots and many horticultural operations commonly use paid managers, management charges for such operations can be determined. Most crops and livestock, however, are produced by farmers who supply both labor and management on an unpaid basis, drawing their compensation from the residual after all other expenses have been paid. Even if salaries were known for the few cases where average-sized crop or livestock farms are operated by hired managers, the cost would not be directly transferable to the unpaid manager because the two have different interests, and thus may function differently. Valuing the management input has to be done without a competitive guide from the marketplace.

Several options are available for putting a price on unpaid management. None are without fault. No one is provable as resulting in the right price as opposed to all others.

Professional Management Fees

A substantial number of farms are controlled by professional managers, especially in the North Central States. Fees they charge are readily identifiable. Professional management fees are thus a starting point. Professional managers commonly charge a percentage of gross income for their services. When farms are operated by tenants, as is the usual case, the management fee usually ranges from 5 to 10 percent of the gross income accruing to the landowner (client), less purchased feed and livestock. Typically, rates are higher for livestock than grain farms and greatest for the smaller or less conveniently located farms. Six to eight percent of the adjusted gross income due the landowner is typical.

Converting the professional management fee to a whole-farm basis is simple. Assume the management of a hog-grain farm for which the rate is to be 8 percent of the adjusted landlord share. Typically, the farm will be rented to a tenant on a 50-50 livestock share basis, though the proportions will vary depending upon the contributions of the two parties. For the farm as a whole, the management fee reduces to 4 percent of adjusted gross income.

Use of a percentage of adjusted gross income relates the management fee to one measure of the volume of business, hence the magnitude of the job of management. Differential rates reflect complexities, economies of size, and convenience. This method of pricing professional management has held for many years, thus it must be considered acceptable to clients who pay the bill.

Professional management fee rates cannot be used directly to price the services of unpaid managers who operate farms. First, professional managers perform some client-related functions that the unpaid manager does not encounter. They may also engage in volume buying of inputs and some marketing strategies beyond the power of an individual farmer. Some functions effectively increase the fee; others reduce it.

Second, management priced on the basis of a percentage of gross income varies more according to product prices than services rendered. In volatile price periods, gross income may double or halve as a result of aggregate supply-demand relations, shifting the management fee accordingly, though the job of management remains essentially unchanged. Such shifts in gross income (and resulting fees) are totally beyond the control of the manager.

Third, and probably most important, the service received from professional managers is only part of the management needed in the operation of a farm. Typically, the professional manager contracts with a tenant to operate a farm. The manager, together with the tenant and landowner, commonly makes broad production and marketing decisions such as crop combinations, cultural practices, rations, disease control programs, and the like. He supervises progress, keeps records, and prepares tax returns. He may also engage in volume buying of inputs and marketing strategies.

The on-site operator (tenant) is left with a far greater job than that of a laborer. He must make all the management decisions regarding the resources that he provides to the business. He must make all the day-to-day operating decisions, handle labor and machinery problems, supervise and coordinate the work to be done. The value of this management, for which no market prices are available, must be added to the fee charged by the professional manager, less services he performs that are strictly client related, to set a fair price on the total management package. Thus, knowledge of professional management fees alone is of limited value in pricing total management.

Residual Claimant

A second method of pricing management is to assume that the earnings of management are its worth. Illinois farm records provide an example. Records of one-man farms (16 to 19 months of labor input) show average management earnings for the 1968-76 period ranging from negative values to nearly $30,000 a year, depending upon the type of farm (table 1).

Such a measure of management embodies several limitations. First, it is a residual, leaving returns for management only after the cost of all other inputs have been met. Such returns may be substantially more than enough to hold the management involved or they may be less than enough. Further, problems occur in the pricing of other inputs leading to the residual for management.

Two inputs are involved in the Illinois accounts for which there is latitude in the cost rates. First, an allowance is made for unpaid labor. This ranged from $325 per month in 1968 to $775 per month in 1976. The result is a considerably higher charge for unpaid labor (hence a smaller residual for management) than if the average wage rate for hired farm labor were used. Some management may therefore be embodied in the specified labor cost.

The second factor having a major impact on the residual for management is the value of land and associated interest charges. In the Illinois accounts, land is adjusted to its current value each year, and interest on this amount at 4 or 5 percent is charged as a cost before management receives its allowance. The choice of interest rate could be questioned, and different rates would affect the residual for management accordingly. But of greater importance during the 1968-76 period was the appreciation

Table 1--Management returns for one-man farms, by type of farm, Illinois, 1968-76 1/

Type of farm	SPR or area 2/	1968	1969	1970	1971	1972	1973	1974	1975	1976	1968-76 average
		Dollars									
Grain	H	-2,918	6,577	5,370	10,333	21,150	56,804	61,863	28,881	35,789	29,649
Grain	M	607	7,719	4,906	7,565	17,729	47,541	44,513	23,168	18,955	19,055
Grain	L	2,139	3,302	850	1,609	11,729	23,722	19,986	3,730	4,304	7,930
Hog	H	-1,507	13,752	-4,495	2,068	22,053	47,133	13,062	43,224	5,522	15,646
Hog	M	1,525	12,356	-3,398	1,047	17,044	36,275	-2,270	26,191	-6,611	9,129
Hog	L	3,952	10,661	-4,140	2,770	23,890	21,120	-3,214	20,299	-2,910	8,047
Dairy	No	-9	1,459	700	-2,085	1,138	10,192	-2,335	-5,405	-6,997	-371
Dairy	So	3,180	3,588	1,931	2,316	6,651	7,619	-52	-2,547	2,167	2,762
Beef	No	1,192	7,611	-5,803	4,576	7,652	19,551	-26,385	14,501	-30,183	-810
Beef	So	622	5,723	-3,718	3,628	12,361	13,684	-8,027	4,229	-19,299	1,023
Poultry	All	-1,482	16,229	12,893	-5,027	-2,381	25,156	9,807	-4,215	-6,046	4,993

1/ Farms used 16 to 19 months of labor with 2 to 4 months hired; the remainder was unpaid operator and family labor. Poultry farms were an exception, using 27 months total labor, of which 10 months were hired. Management returns are the residual after all costs are deducted, including an allowance for unpaid labor which ranged from $325 per month in 1968 to $775 per month in 1976, and interest on all investments, including land at current year values with interest at 4 percent during 1968-71, and 5 percent during 1972-76.

2/ Soil productivity ratings (SPR) are indicated as high (H), medium (M), or low (L), or as northern (No) or southern (So) Illinois, with the latter being the less productive portion of the State.

in land values and the rising interest cost associated with them (table 2). Leaving land investment (and interest) at some early acquisition period would result in a much greater residual for management. Or the capital gains in land might be counted into the residual return. Neither would be reflective of the management service provided on these farms.

Generally, the residual method, as demonstrated by the 9 years of Illinois farm records, appears to offer little as a guide for pricing management. Grain farms with productive soils yielded rather high management returns (by definition only, as some of the residual may be profit or returns in excess of the amount necessary to hold the management resource) while some of the livestock farms left management with a negative return. Such differing levels of returns do not reflect differing amounts of management used on the farms.

The residual for management would change with price bases for land different from the current levels used in the farm accounts, alternative interest rates, different values set on unpaid labor, or consideration of capital gains (or losses). It does not appear, however, that any such adjustments would improve the pricing of management by the residual method. Too many input prices are arbitrary. Multiple returns accruing to farmers from several sources are interlocked. Possibly, the 9 years examined reflect radical adjustments, especially in crop prices. A longer or more stable period might result in establishing a more accurate price for management via the residual method, but prospects are not promising.

Cost Basis

Management must acquire the necessary resources, combine them into a production unit, see that production activities are performed, and market the resulting products. The job of management varies directly with the amount of resources handled. Presumably, larger amounts of resources require more management, though the increase in the job for management may not be proportional to the increase in resources employed.

Cost is the only common denominator for the mix of resources used in farming. Therefore, a percentage of cost can be used both to measure the job for management, and to set a price on it. Use of a percentage of cost as a price for management has merit in that it matches the management charge to resources managed. The price varies with the amount (as measured by cost) of resources and not according to product prices, which generally fluctuate more than cost rates and for reasons beyond the control of management.

Use of a percentage of cost as a management charge has limitations. It makes no distinction in the relative importance of the various resources in terms of the burden on management. A dollar input of labor results in the same management charge as a dollar spent for fuel. This causes little concern for a given type of farm, but different enterprises, or different types of farms, may require different rates to price the management input properly. For example, a given amount of dollar inputs in a livestock business is more demanding of management than the same dollar inputs in a highly productive grain farm. The former involves both crop and livestock problems, plus multiple labor activities, while a cash grain farm is more specialized. Professional management fees suggest this relationship.

Another limitation of using a flat percentage of cost for a management charge (this also applies to the use of a percentage of gross income) is that it tends to obscure quality of management. This impacts specifically on the livestock budgets that have been constructed by CED staff because they cover enterprises of different sizes (crop enterprise budgets have not been sized). For example, a 40-head hog enterprise charged with management at a given percentage of cost will have a high

Table 2--Value of land and interest on land investment, by type of farm, Illinois, 1968-76 1/

Type of farm	SPR or area 2/	1968	1969	1970	1971	1972	1973	1974	1975	1976
						Dollars				
		(10,947)	(11,063)	(15,149)	(15,013)	(19,714)	(22,977)	(31,032)	(37,594)	(47,042)
Grain	H	273,671	276,570	378,714	375,319	394,277	459,531	620,639	751,877	940,840
		(10,807)	(11,713)	(11,630)	(11,983)	(15,651)	(18,480)	(26,556)	(32,324)	(39,829)
Grain	M	270,171	292,819	290,746	299,567	313,016	369,593	531,111	646,490	796,579
		(3,840)	(3,863)	(3,889)	(6,004)	(9,170)	(8,798)	(12,802)	(15,990)	(19,366)
Grain	L	96,012	96,570	97,228	150,107	183,405	175,961	256,031	319,802	387,325
		(7,113)	(7,767)	(7,638)	(7,938)	(10,477)	(12,182)	(16,182)	(19,699)	(24,475)
Hog	H	177,832	194,185	190,957	198,451	209,532	243,642	323,649	393,983	489,503
		(5,174)	(5,598)	(5,616)	(5,937)	(7,636)	(8,888)	(12,572)	(15,049)	(18,855)
Hog	M	129,351	139,954	140,392	148,435	152,721	177,753	251,439	300,980	377,100
		(3,463)	(3,614)	(3,622)	(4,956)	(8,619)	(5,684)	(8,374)	(10,348)	(13,399)
Hog	L	86,586	90,352	90,552	123,888	172,373	113,672	167,488	206,950	267,983
		(4,290)	(4,547)	(4,519)	(4,347)	(5,705)	(6,788)	(9,029)	(10,721)	(13,122)
Dairy	No	107,262	113,677	112,976	108,680	114,099	135,760	180,581	214,415	262,440
		(1,997)	(1,873)	(1,867)	(3,107)	(4,629)	(4,837)	(7,027)	(9,010)	(10,881)
Dairy	So	49,934	46,834	46,686	77,663	92,575	96,732	140,534	180,209	217,611
		(6,746)	(7,118)	(8,762)	(9,635)	(11,903)	(13,517)	(19,617)	(22,757)	(27,070)
Beef	No	168,647	177,960	219,046	240,882	238,056	270,338	392,348	455,137	541,401
		(2,804)	(2,774)	(2,837)	(4,320)	(6,728)	(6,529)	(8,692)	(11,162)	(14,033)
Beef	So	70,106	69,338	70,925	107,989	134,557	134,571	173,839	223,241	280,653
		(5,549)	(6,374)	(6,921)	(7,370)	(12,002)	(10,205)	(11,462)	(14,514)	(21,515)
Poultry	All	138,737	159,347	173,037	184,250	240,038	204,094	229,234	290,272	430,304

1/ Land is at current value each year. Numbers in parentheses are interest at 4 percent during 1968-71, and 5 percent during 1972-76.

2/ Soil productivity ratings (SPR) are indicated as high (H), Medium (M), or low (L), or as northern (No) or southern (So) Illinois, with the latter being the less productive portion of the State.

management charge per unit of production simply because many of its unit costs, especially labor, are high. Large enterprises encounter the reverse with respect to management cost for the same reasons. Some compensating results occur, however, that support, at least in part, the use of a given percentage of costs for a management charge for enterprises of all sizes within the scope of a family farm. Though unit management cost is high for the small enterprise, the total charge for the manager-laborer is low because unit labor inputs are high and volume produced is low. The operator of a large enterprise is likewise charged (or credited) with a sizable total management fee for the same reason.

The meat animals budget is presently on the FEDS price management as a percentage of cost. The cost base was used because management is closely related to resource use and cost is the only common denominator for resources. Costs provide a measure of the magnitude of the job that management must do. Further, given a specific type and size of operation, income from year to year is largely a result of prices for products over which management has little control. Costs also vary, but are relatively more stable on a year-to-year basis than is gross income. Management is not twice as difficult, twice as costly, when soybeans move from $5 to $10 per bushel because of a foreign crop failure. Nor would there be zero management input were drought or pests to wipe out a crop.

The meat animals budgets do not include all costs in the basis for the management charge. Purchased feeder animals create artificially high total costs, often for only a short period. Costs of purchased livestock were therefore deducted from the total cost. Interest on the investment in land was also deducted from cost. Management was then based on monetary measures of the sum of improvements and variable inputs.

If an adjusted total cost is the proper basis for measuring resources and forming a basis for pricing management, as was done in estimating the cost of producing meat animals, what should the percentage rate be? CED staff have charged 7 percent of adjusted total cost in the meat animals budgets. The basis for this rate is largely judgment with limited supporting evidence.

Suppose a professional manager charges 8 percent of the gross income that a client receives from a hog-grain farm with a 50-50 lease. That converts to 4 percent of gross farm income, less whatever livestock are purchased. 1/ The equivalent in dollar charges for this management service would probably be at least 4 percent of adjusted cost as income over cost is normally expected.

The resulting 4 percent of cost going to the professional manager does not transfer equally to owner-operators or renters performing their own management. Some of the fee to the professional manager is for his ability to purchase inputs in quantities for discounts, his knowledge of marketing, his tax service, recordkeeping, and rent collecting for the landowner. The individual manager may not be able to perform some of these services regardless of ability; some are unnecessary when a farm business is not operated on a rented basis.

If, on balance, 4 percent of adjusted cost is accepted as a fair charge for the general off-farm management, then what is the value (or price) of the on-site management performed by the operator? Use of a 7-percent rate assumes that it has a price equal to 3 percent of adjusted total cost.

Results of Illinois farm accounts 1968-76 show the ratio of management, computed as a residual, to total cost (table 3). When only purchased livestock were deducted

1/ Costs of purchased feeds have not been deducted in any of these calculations.

Table 3--Management returns as a proportion of selected costs of production, one-man farms, Illinois, 1968-76

Type of farm	SPR or area 1/	1968-76 average		1976	
		Total cost 2/	Less interest on land	Total cost 2/	Less interest on land
		Percent of cost			
Grain	H	34.3	47.1	24.7	36.5
Grain	M	22.8	29.9	14.5	20.9
Grain	L	14.3	17.2	4.9	6.3
Hog	H	13.7	15.5	2.9	3.3
Hog	M	9.4	10.4	-4.2	-4.8
Hog	L	9.1	9.8	-2.3	-2.5
Dairy	No	-.5	-.6	-5.9	-6.6
Dairy	So	3.9	4.2	1.9	2.1
Beef	No	-.6	-.7	-15.2	-17.5
Beef	So	1.2	1.4	-17.2	-19.7
Poultry	All	3.8	4.1	-3.4	-3.8

1/ Soil productivity ratings (SPR) are indicated as high (H), medium (M), or low (L), or as northern (No) or southern (So) Illinois, with the latter being the less productive portion of the State.

2/ Total cost excludes purchased livestock and management.

from cost, the residual to management ranged from 14 to 34 percent of cost on grain farms, 9 to 14 percent on hog farms, and zero to 4 percent on beef, dairy, and poultry farms. The rates move upward when interest on land is not included in cost, sharply so on cash grain farms.

These data neither prove nor disprove the 7 percent charge for management. First, the recordkeeping farms may have better than average management. Second, the cash grain farms, and hog farms in part (which also produce substantial amounts of grain), may have just gone through an exceptionally profitable period unlikely to be experienced again, while the beef farms are just coming out of a severe oversupply situation. Also, there has been a lag in land values (and associated interest charges) relative to returns. Land values had risen sharply by 1976, but grain farms with highly productive soils still had a high percentage rate for residual management, even though it was down from the 9-year average. Management returns for all other types of farms were sharply lower in 1976 than the average for the period. Data for 1977 will show them lower still. Remember, though, that these are residuals for management and not specifically measures of the management input.

Competitive Income

Another way to evaluate a price for management is to look at competitive incomes--careers individuals might have chosen instead of active farming--and compare them with the combined unpaid labor and management charge being assessed against production. Management is really worth what it takes in terms of income to bring it into farming and hold it there as compared with alternatives that might be chosen. The question then reduces to judgment as to the reasonableness of the allowance for management.

Measures of the reasonableness of income provide no proof as to the price to set on management. They only help decisions as to fairness and acceptability. The problems of an automobile service station manager or operator of a retail store are different from those of a farmer. They may handle a similar amount of resources measured in dollars and have a similar total labor input, but there are not many other similarities.

Since the measure of the value (or price) of farm management is to be the price of the service rather than returns to a risk taker, hence residual claimant, the only gage as to reasonableness is the salary people have been willing to work for. Professional staff associated with the Illinois Farm Business Farm Management Service (which handles the business aspects of over 7,000 farms) begin at salaries of $11,500-$14,000 and move to the $20,000-$25,000 range with increased experience. Members of the Production Credit Association, agricultural employees of banks, the agricultural extension service, and similar agencies connected with farming have similar salary ranges. Seldom do salaries exceed $30,000, except for top level administrative staff. Present salaries of so called middle management (U.S. News And World Report, May 28,1978) are reported to be $18,000. Whether those salary ranges reflect activities similar to the management of a farm cannot be proven. They do, however, reflect the ranges in salaries that a large number of people are willing to accept, and as such may be used as a gage to reasonableness of management allowances.

Computation of the combined allowance for unpaid labor and management is made from a selected list of 1976 crop and livestock budgets now on the FEDS (table 4). In these cost budgets, labor is charged at the average rate paid hired farm labor as reported by the Statistical Reporting Service. Most rates are $2.50 to $2.60 per hour, but some exceed $3.00, and a few are below $2.50. All management charges are set at 7 percent of total cost, less interest on land and purchased livestock. For comparison, management is computed again at 7 percent of gross income, less the cost of purchased livestock (table 4).

The size of each enterprise is identified along with the hours of labor charged to it. All labor is assumed unpaid until the total reaches 2,500 hours for livestock and 2,000 hours for crops. Thus a maximum of 2,500 hours of labor (or 2,000 hours) is allowed as return to the operator, plus a management charge.

Some enterprises require only a part-time worker for labor (all crops were sized equal to one full-time worker); some use more. The labor above 2,500 hours (2,000 hours) is assumed cash labor. Labor-management charge where labor input approximately equals that of one full-time worker range from $8,000 to $10,000 for the listed crop enterprises and dairy and beef cattle raising. The total is generally $10,000 to $13,000 in hog production, and would exceed $18,000 in cattle feeding were size of enterprise extended to one full-time worker of 2,500 hours of labor input.

Except for crops and cattle feeding, most enterprises require more than one full-time worker equivalent: nearly 3 workers in farrow-to-finish hog production, 2.5-workers in cattle raising and nearly 10 workers in dairy. Charges for the management input (the unpaid labor component is constant at full-time and above) rise sharply with the larger operations--$33,000 for a 5,000-head farrow-to-finish hog operation; $23,000 for a 5,000-head pig finishing enterprise; $42,000 for a 370-cow dairy; but only $7,500 for the 2.5-worker cattle ranch. Are these reasonable management charges for the multiworker operations--along with the credit (or charge) for unpaid labor of the manager?

The last column of table 4 is 7 percent of gross income less purchased livestock. This is an alternate to the cost basis. A management charge computed on this basis is smaller than the cost-based management for enterprises not covering cost in 1976, larger for those that did. Generally, the two methods result in similar levels of

Table 4--Unpaid labor and management charges for selected crop and livestock enterprises using hired farm labor wage rate for unpaid labor, 1976 1/

Enterprise and region	Size	Total hours	Labor cost 2/		Management charge (7 percent adjustment cost)	Total unpaid labor and management	Management charge 7 percent gross (less purchased livestock)
			Total	Unpaid			
	Head	Hours	Dollars				
Feeder pig production:							
Southeast	140	1,342	3,019	3,019	732	3,751	424
	300	1,420	3,195	3,195	1,266	4,461	902
	650	2,046	4,604	4,604	2,408	7,012	2,033
	1,600	2,509	5,625	5,645	4,811	10,436	4,896
Farrow to finish:							
Western Corn Belt	140	984	2,598	2,598	1,255	3,853	1,022
	300	1,334	3,522	3,522	2,357	5,879	2,190
	650	2,272	5,998	5,998	4,504	10,502	4,555
	1,600	3,936	6,600	10,391	11,890	18,490	11,309
	5,000	7,113	6,600	18,778	32,930	39,530	35,520
Feeder pig finishing:							
Western Corn Belt	140	735	1,940	1,940	877	2,817	513
	300	725	1,914	1,914	1,546	3,460	1,182
	650	1,513	3,994	3,994	3,314	7,308	2,559
	1,600	1,920	5,069	5,069	7,413	12,482	5,330
	5,000	3,403	8,984	6,600	22,755	29,355	17,658
Diary:							
Northeast-3	50	4,113	10,159	6,175	4,115	10,290	4,591
Northeast-6	50	4,234	10,584	6,250	4,353	10,603	4,882
Southeast-1	80	5,961	13,590	5,700	8,346	14,046	10,292
Southeast-10	370	24,346	74,255	7,625	42,304	49,929	47,659
North Central-11	85	4,706	11,953	6,350	5,314	11,664	6,126
North Central-2	35	3,620	9,703	6,700	3,285	9,985	3,262
West-9	303	11,340	36,288	8,000	27,456	35,456	29,215
Beef raising:							
Great Plains-1	64	700	1,876	1,876	828	2,704	567
	132	1,265	3,390	3,390	1,556	4,746	1,164
	257	2,185	5,856	5,865	3,211	9,076	2,330
Great Plains-2	253	1,811	4,654	4,654	2,649	7,303	2,102
	643	3,808	9,787	6,425	5,663	12,088	5,695
Southwest-2	700	6,226	16,561	6,650	7,417	14,067	6,371
Cattle feeding:							
North Central	35	372	982	982	758	1,740	473
(yearling steers)	140	1,092	2,883	2,883	2,910	5,793	1,887
	350	1,980	5,227	5,227	6,389	11,616	4,719
	700	2,172	5,734	5,734	12,030	17,764	9,437
	Acres	Hours	Dollars				
Crops:							
Corn, Illinois	613	2,000	5,120	5,120	5,367	10,487	12,162
Soybeans, Illinois	617	2,000	5,120	5,120	2,872	7,992	11,421
Wheat, Illinois	1,016	2,000	5,120	5,120	4,369	9,489	8,504
Corn, Iowa	494	2,000	5,280	5,280	4,269	9,549	7,603
Soybeans, Illinois	581	2,000	5,280	5,280	2,604	7,884	10,179

1/ Based on 1976 budgets on FEDS. Regions shown are FEDS regions.
2/ Labor is assumed unpaid to 2,500 hours for livestock enterprises, 2,000 hours for crops.

management charges except in crop production. With crops, 7 percent of gross income yielded a management charge two to four times larger than the cost-based charge. 2/

For livestock, if one result is reasonable, then so is the other, as the two are similar. For crops, however, the labor-management charge for a one-worker operation moves to $14,000 to $17,000, compared with $8,000 to $10,000 because crop production was in a favorable situation. Were three or four workers required, the combined labor-management charge would be in the $40,000 to $50,000 range. Is this reasonable?

Another possibility is to accept a given rate for management, say 7 percent of adjusted total cost, but to standardize the management rate per unit at that resulting for an enterprise of average size. This results in allowing for a higher quality (price) of management in the larger operations, less in smaller ones.

This method is applied to hog production to demonstrate the result (table 5). Enterprises with annual sales of 650 head are assumed to be the average size, hence receive the same management charge from both methods. The smallest enterprises have $150 to $300 less management charged against them when rate per unit is standardized; 5,000-head operations get about $3,000 more. Although this may be a better procedure than the flat percentage of cost, at least in principle, differences between the two methods are relatively small and there is no way to substantiate them. Results may not justify the extra cost of applying the standard rate procedure to several hundred budgets each year.

Recommendation

A combined test of reasonableness of result and simplicity of computation in a large number of budgets favors the use of 7 percent of total cost of production, less purchased livestock and interest on the investment in land, as the charge or allowance for management. This is in addition to an allowance for the unpaid labor of the manager at a full-time worker equivalent at the average hourly wage rate for hired farm labor. An upper limit is necessary for this procedure to yield a reasonable management charge. Maximum adjusted total cost of $500,000 is suggested as the limit beyond which market rates should be substituted. Data should be collected through periodic surveys of large operations.

An alternative, perhaps giving a more suitable result but requiring substantially more effort to compute and update, is to establish a dollar charge for management based on a standardized amount per unit of production in an equilibrium situation (hogs were near breakeven on all costs in 1976). This charge could be computed for a base year, perhaps 1976. Each year thereafter, the dollar charge in each budget could be updated via an acceptable index. Such a procedure would give some recognition to quality of management and remove the fluctuations in the amount charged for management due solely to fluctuation in input prices.

Labor Charges

Estimating the cost of labor for most farm production involves setting a price on the unpaid labor of the operator and family members who work in the business, and determining the compensation, including both cash and noncash benefits, that is paid to employees. Salaried personnel and hired wage earners provide all of the labor in some large operations, but most farming involves a combination of both paid and unpaid labor.

2/ Crops budgets do not carry a land charge, but use the landlord's share of income in lieu of a land charge. This share was deducted from cost in the computation of management by the flat rate method.

Table 5--Standardized unit versus flat rate management charges, selected hog budgets, western Corn Belt, 1976

Type of enterprise 1/	Size of enterprise: Head sold	Size of enterprise: Cwt sold	Management charge per cwt sold 2/	Total management: Standardized unit charge	Total management: Flat rate
	Number	Cwt	----- Dollars -----		
Feeder-pig production	140	102	5.27	538	732
	300	209	do.	1,101	1,266
	650	457	do.	2,408	2,408
	1,600	1,086	do.	5,723	4,811
Farrow-to-finish	140	332	2.91	966	1,255
	300	713	do.	2,075	2,357
	650	1,546	do.	4,504	4,504
	1,600	3,820	do.	11,116	11,890
	5,000	12,057	do.	35,086	32,930
Feeder-pig finishing	140	325	2.20	715	877
	300	696	do.	1,531	1,546
	650	1,508	do.	3,314	3,314
	1,600	3,712	do.	8,166	7,413
	5,000	11,600	do.	25,520	22,755

1/ Budgets on the FEDS.
2/ Rate for enterprises of all sizes based on 7 percent of adjusted total cost for the 650-head size.

Unpaid labor accounts for most of the labor input on grain and livestock farms. For example, in 1975, unpaid operator and family labor contributed 93 percent of the total hours of labor used in feeder pig production, 82 percent of the hours in farrow-to-finish operations, and 89 percent of the labor input in feeder pig finishing enterprises. Unpaid labor did not drop below half the total labor input until annual sales exceeded 2,500 hogs per farm. Except for commercial cattle feeding, similar relationships exist for other livestock and grain enterprises. The more critical problem, therefore, is to determine a fair price for unpaid labor.

Unpaid labor is a residual claimant in the typical farming operation. Setting a price on it therefore raises many of the same problems encountered in pricing management. Both have residual claimant status, the same person provides both.

It may be argued that unpaid and hired labor are different inputs, so that payments made to hired labor do not adequately reflect the value of unpaid labor. It is quite probable that an unpaid operator may work harder, with more dedication and greater skill than his employee. The operator has greater incentive to do so. But there are also older operators without the physical capacity to perform equally to younger employees, family members whose input counted in hours may fail to generate full man-equivalents, and many other real and suspected differences.

On balance, the rates paid to hired farm labor are the best choice for pricing unpaid labor in the average farm operation. A substantial amount of labor, unlike management, is hired for work on farms of all types. Data on cash wages paid and the value of other compensation provided is available. If a fair management allowance has been set, and unpaid labor is priced at the amount that employees receive, then the unpaid laborer-manager is being credited with the best available measure of his input.

Compensation rates are collected and published for several different categories of farm labor. Presently, Agricultural Statistics reports rates by States for field and livestock workers, workers paid by the hour receiving cash wages, and the average for all hired farmworkers. For comparative purposes, the hourly rates reported for Illinois for 1976 for each of those categories were $2.37, $2.76, and $2.56. The all-worker rate (category 3) is now used as the charge for all kinds of work for both paid and unpaid labor.

The all-worker rate, which includes a weighted input of perquisites, has some limitations. First, while it may be an adequate measure of labor costs in the average operations, there may be a direct relationship between wage rate and size of operation. Unfortunately, this can be only partially considered at the enterprise level (basis of all budgets) as a small enterprise may sometimes be part of a large business. Data on wage rates from the 1975 meat animals COP survey were insufficient to verify any trend or lack of one.

Second, work in livestock operations seems to require more specialized skills and is more demanding on a year-round basis than is work in crop production. The cost of labor should therefore be higher on livestock farms. Data from an Illinois survey (table 6) show a 5 percent higher cash wage and a 26 percent higher total annual cost of labor on livestock compared with grain farms. Much of this difference, however, may disappear if cost were computed on an hourly basis.

Third, care must be taken to assure that COP estimates include all costs associated with labor. The all-worker wage rate now being charged in the FEDS budgets appears to be on the conservative side. While that rate includes perquisites for that portion of workers receiving them, the perquisite coverage may not be complete. The 1976 Illinois survey showed salary to be only 59 percent of the total cost of labor on livestock farms and 71 percent on grain farms. Typically, the importance of nonsalary cost of labor is unlikely to be this great. The survey farms were larger than average, perhaps also more progressive, hiring above-average persons and providing them with more than usual benefits. Further, some items listed as nonsalary costs may be included in the general overhead cost charged in each budget. Nevertheless, the magnitude and composition of labor cost, and relative importance of the several items as revealed by the Illinois survey, are sufficient to call for a review of the all-worker wage rate with the Statistical Reporting Service to be certain of exactly what it includes. Some modification of either the wage rates or the allocated overhead cost may be necessary to reflect fairly the cost of labor.

Table 6--Full-time employee wage survey, selected central Illinois farms, fall 1976 1/

Item	Heavy on livestock			Grain with some livestock			Grain farms		
Average size, acres	890			916			766		
Number of farms	7			18			17		
Number of full-time employees	17			24			18		
	Average benefit	Percent received benefit 2/	Average benefit for receivers	Average benefit	Percent received benefit 2/	Average benefit for receivers	Average benefit	Percent received benefit 2/	Average benefit for receivers
	Dollars	Percent	Dollars	Dollars	Percent	Dollars	Dollars	Percent	Dollars
Yearly salary	8,407	--	--	8,201	--	--	8,009	--	--
Bonus	1,289	100	1,289	859	63	1,373	261	67	392
Housing, value	1,299	88	1,472	1,189	71	1,678	866	56	1,558
Electricity	276	82	336	289	46	499	137	33	410
Fuel oil or gas (heat)	224	76	292	138	75	550	54	11	482
Telephone	--	--	--	8	13	65	3	6	60
Car or truck, personal use	141	59	240	100	25	400	178	28	640
Gasoline for personal use	75	18	423	68	33	203	87	33	261
Heat	350	94	377	216	58	371	89	22	400
Health insurance	419	53	792	68	58	117	163	28	588
Retirement plan	214	24	910	191	17	1,143	223	22	1,005
Meals	67	24	284	38	13	300	111	22	500
Machine to farm land	--	--	--	208	13	1,666	--	--	--
Miscellaneous	159	24	657	--	--		65	22	295
Social Security pd. by employer	113	18	639	114	21	547	83	22	372
Total value to employee	13,033	--	--	11,687	--	--	10,329	--	--
Workers' compensation	581	82	706	553	92	603	443	78	570
Social Security	763	--	--	636	--	--	624	--	--
Total employer cost	14,264	--	--	12,762	--	--	11,343	--	--
Average part-time help per hour	$3.44	--	--	$3.31	--	--	$3.37	--	--

1/ Unpublished data provided by K. W. Amstutz, Executive Fieldman, Pioneer Farm Business Farm Management Service, Forrest, Illinois.
2/ The percent of employees who received the benefits tabulated.
-- = Not applicable.

USING DIFFERENT OPTIONS FOR PRICING FORAGES IN DAIRY COP BUDGETS

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Three reports have been issued covering the costs of producing milk in the United States. 1/ These were done in compliance with the Agriculture and Consumer Protection Act of 1973.

The first study was based on an enumerative survey of 24 major dairy production areas of the United States. The areas surveyed accounted for approximately 65 percent of total 1974 milk production. The initial sample of 2,648 farms was screened for minimum and maximum herd size, on a percent of income from dairy sales and on a full year of operation in 1974. A total of 1,594 farms met the criteria.

The second study shifted the methodology from survey reporting to Firm Enterprise Data System (FEDS) budgets. The 1974 COP survey provided structural data on the types of milking and housing systems employed in the various regions. It also provided information on the cost and mix of feeds, veterinary and medicine expenses, milk-handling expense, artificial insemination fees, and various miscellaneous expenses and fees, typical of the various regions. These costs were updated for 1975 and 1976 using prices and indexes reported by the Statistical Reporting Service (SRS). The third study, released in April of this year continued to use the FEDS system and prices from SRS.

In the original survey study, feed was priced on two bases: cost of production and prices received by farmers. In 1974, feed accounted for 44 percent of total costs when computed on cost of production and 49 percent when valued at prices received by farmers. The forage component of feed accounted for 15 percent of total costs when valued at cost of production and 20 percent when valued at prices received by farmers. In subsequent years and studies, feeds were all costed at market prices. All feeds ranged from 45 to 48 percent of total cost, and forage varied from 19 to 24 percent of total cost.

Total feed costs are split 50-50 between grains, including commercial mixed concentrates, and forages. There is no problem with the pricing of commercial mixed feeds. Homegrown grains have some pricing problems which merit some discussion, but not in this paper.

1/ Costs of Producing Milk in the United States: 1974, Committee Print No. 72-184, Senate Committee on Agriculture and Forestry, June 11, 1976. Costs of Producing Milk in the United States, 1975 and 1976, Committee Print No. 83-252, Senate Committee on Agriculture, Nutrition, and Forestry, February 25, 1977. Costs of Producing Milk in the United States: Final 1976, Estimated 1977, and Projections for 1978, Committee Print No. 25-504, Senate Committee on Agriculture, Nutrition, and Forestry, April 21, 1978.

Forages represent almost 25 percent of total production costs and have some real problems associated with establishing a price. Dairy farm forages include silages, hay, pasture, and miscellaneous. Only hay has a quote in Agricultural Prices. To make it worse, only 18 of the 31 States represented in the 24 COP regions have monthly price quotes for hay. This lack of price quotes creates some problems in making estimates for partial years. One could also raise a question as to how representative are the hay prices reported when only marginal units of hay are traded relative to markets for corn or soybeans. Also there is the question of how representative is the hay price to use as a mover for corn silage, hay crop silage, pasture, and miscellaneous forages.

Purpose

This paper is designed to invite some discussion on forage pricing for future COP work. Specifically, it will compare milk production costs for three regions using different costing techniques. This should stimulate discussions on the general feasibility of integrating FEDS crop and livestock budgets and the allocation of research resources to FEDS budgets and farm surveys.

Procedure and Results

Three dairy COP regions were used for this illustrative analysis. They were NE-1, NE-2, and NE-3, and they were selected because FEDS crop budgets for corn silage, alfalfa hay, and other hay were on the system. The years 1976 and 1977 were analyzed. Prices and costs used in the analysis are shown in table 1.

Obviously there are some differences in forage input prices and costs using these three approaches shown in table 1. One could quickly conclude that in the short run, the cost of producing hay (option B) has little to do with the market price (option A). Also, perhaps the hay price is not closely related to the cost of producing corn silage.

Pushing these forage values through the FEDS livestock budgets permits us to observe how much change would occur in the costs of producing milk per cow and per hundredweight. Table 2 shows comparisons of the present COP costs with options A and B for 1976. The use of option A would increase costs in all regions by 15 to 71 cents per hundredweight. Using option B, the FEDS crop budgets, costs per hundredweight would be lowered by 35 to 69 cents per hundredweight. For 1977 (table 3) the direction of change is the same. The present COP costs and option A stay relatively the same since the SRS hay prices were used to adjust the 1974 survey data base. Option B costs of production increased from 1976 to 1977 in line with increases in production costs experienced by farmers.

Some Observations

For COP work, hay prices are not readily available, and do not, in my opinion, reflect production costs of farmers. Except for the dairy regions in Florida and California, most of the forage consumed by dairy cows is home produced and never reaches a hay market. Corn silage and pasture are not officially priced. The market price for hay seems to reflect local supply-demand conditions rather than the costs of production on the short year-to-year basis.

Logically, the use of FEDS crop budgets would more closely approximate forage input costs than market prices. How to integrate these budgets into the livestock budgets would present many problems. If we continued to do the dairy COP for 3 years,

we would need 394 crop budgets representing corn silage, alfalfa hay, other hay, and pasture. These would be integrated into the 24 livestock budgets--no small task. A shift to State budgets rather than FEDS regional budgets would reduce the number to 152 crop budgets.

An associated problem is one of keeping continuity between the results of the COP over several years. What can we ask farmers concerning crop costs or prices, and how does this information dovetail with previous surveys, FEDS crops budgets, and Agricultural Prices data?

If we continue our present practice of using published market prices received by farmers for hay, we still have problems. We need more than 18 out of the 31 States reporting monthly prices. Other forage prices would be useful.

In this type of paper I don't want to reach any conclusions. However, I hope you are stimulated to consider the alternatives and reach some decisions on future methodology.

Table 1--Prices and costs of forage inputs for text analysis

Crop and region	Present COP study, 1974 survey costs indexed by crop reporting board all hay price 1/		Option A-- actual crop reporting board prices for all hay 2/		Option B-- COP crop budget cost - specific alfalfa, other hay, corn silage 3/	
	1976	1977	1976	1977	1976	1977
	Dollars					
Corn silage 4/						
Region 1	17.01	17.16	17.31	17.52	11.15	13.20
Region 2	16.14	15.40	20.79	19.85	12.19	13.80
Region 3	18.25	18.10	17.51	17.36	11.00	13.63
All hay:						
Region 1	39.81	40.15	52.12	52.56	29.05	32.50
Region 2	38.20	36.45	62.36	59.55	32.94	33.29
Region 3	42.54	42.19	52.53	52.08	31.55	34.41

1/ The prices of corn silage and all hay were those used in the 1978 issue of the Dairy COP report (Costs of Producing Milk in the United States: Final 1976, Estimated 1977, and Projections for 1978, prepared by ESCS, USDA, for the Committee on Agriculture, Nutrition, and Forestry, Committee Print 25-504, April 1978). These were the 1974 field survey prices received by farmers updated using regionally weighted indexes of the price received by farmers for all hay, as reported by the Statistical Reporting Service (now a part of ESCS).

2/ Prices of all hay direct from Agricultural Prices, ESCS. Corn silage prices are estimated at one-third of hay.

3/ This series utilized FEDS crop budgets for corn silage, alfalfa hay and other hay. The all-hay price was developed using the total production of alfalfa and other hay as weights.

4/ Computed at one-third the hay price. This is comparable to 6 bushels of #2 corn times the October price plus $3.

Table 2--Costs of milk production with alternative methods of pricing forage, 1976

Item	Unit	Present COP study, 1974 survey costs indexed by crop reporting board all hay price		Option A--use actual crop reporting board prices for all hay		Option B--use COP crop budget costs, specific alfalfa, other hay, corn, silage	
		Cost/cow	Cost/cwt	Cost/cow	Cost/cwt	Cost/cow	Cost/cwt
Dairy NE-1: 1/							
Silage	Dol.	101.89	0.83	104.04	0.85	66.78	0.55
All hay	do.	125.00	1.02	163.68	1.34	91.23	.75
Total 2/	do.	1,213.45	9.94	1,255.50	10.29	1,142.50	9.36
Difference 3/:							
Absolute	Pct.	--		--	.35	--	-.58
Percent	do.	--		--	3.5	--	-5.8
Dairy NE-2:							
Silage	Dol.	127.18	1.03	163.81	1.32	96.05	.78
All hay	do.	77.16	.62	126.01	1.02	66.56	.54
Total	do.	1,178.11	9.51	1,266.15	10.22	1,135.13	9.16
Difference							
Absolute	Pct.	--		--	.71	--	-.35
Percent	do.	--		--	7.5	--	-3.7
Dairy NE-3:							
Silage	Dol.	143.44	1.15	137.64	1.11	86.46	.70
All hay	do.	101.25	.81	124.98	1.00	75.07	.60
Total	do.	1,188.79	9.56	1,207.25	9.71	1,103.13	8.87
Difference							
Absolute	Pct.	--		--	.15	--	-.69
Percent	do.	--		--	1.6	--	-7.2

-- = Not applicable.

1/ Pasture, miscellaneous forages ignored for this analysis since they average only about 0.5 percent of total costs.

2/ Includes all other costs in COP analysis.

3/ Optional minus present estimate of total cost/cwt.

Table 3--Costs of milk production with alternative methods of pricing forage, 1977

Item	Unit	Present COP study, 1974 survey costs indexed by crop reporting board all hay price		Option A--use actual crop reporting board prices for all hay		Option B--use COP crop budget costs, specific alfalfa, other hay, corn, silage	
		Cost/cow	Cost/cwt	Cost/cow	Cost/cwt	Cost/cow	Cost/cwt
Dairy NE-1 1/							
Silage	Dol.	102.79	0.83	104.94	0.86	79.06	0.65
All hay	do	126.07	1.02	165.06	2.01	102.06	.84
Total 2/	do	1,227.30	10.06	1,269.68	10.40	1,214.37	9.95
Difference 3/							
Absolute	Pct.		--		.34		-.11
Percent	do		--		3.4		-1.1
Dairy NE-2							
Silage	Dol.	121.35	.69	156.40	.77	108.74	.88
All hay	do	73.65	.59	120.33	1.82	67.27	.54
Total	do	1,188.09	9.59	1,272.88	10.28	1,169.14	9.44
Difference	do						
Absolute	Pct.		--		.69		-.15
Percent	do		--		7.2		-1.6
Dairy NE-3							
Silage	Dol.	142.08	1.13	136.26	.90	107.14	.86
All hay	do	100.41	.80	123.91	2.11	81.87	.66
Total	do	1,194.30	9.60	1,212.51	9.75	1,139.21	9.16
Difference							
Absolute	Pct.		--		.15		-.44
Percent	do		--		1.6		-4.6

1/ Pasture, miscellaneous forages ignored for this analysis since they average only about 0.5 percent of total costs.
2/ Includes all other costs in COP analysis.
3/ Optional minus present estimate of total cost/cwt.
-- = not applicable.

ASSESSING NONLAND DEPRECIATION AND ALLOCATING OVERHEAD

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Estimating costs for many variable input items is a straightforward procedure. But for fixed-cost items, the estimation process may be much more troublesome. This paper will briefly examine two of these troublesome items, depreciation and general farm overhead, both of which are relevant to the cost of production effort being made by ESCS.

Depreciation is variously defined as some portion of initial or current asset cost or some difference in asset values at the beginning and end of one accounting period. Definitions vary by author, with accountants and business interests generally stressing the asset cost arguments, while economists generally emphasize changes in asset values.

Any investigation of depreciation costs or methods leads inevitably into other subject areas of income tax accounting with the related topics of tax liabilities and goodwill, investment and replacement policies, asset valuation theory with its market, capacity and income emphases, technological change, inflation, and relative price changes. Even a cursory treatment of these subjects would be too extensive for consideration here. Therefore, concentration will be centered on depreciation concepts and procedures.

The other item of our consideration here is the category of costs included in general farm overhead expense. Costs included in this category are those that do not readily lend themselves to association with specific enterprises. Rather, these are associated more with an entire firm. Costs related to telephone service, office supplies and expense, accounting, tax and legal fees, some blanket insurance policies, association dues, farm subscriptions, shop expenses, general farm maintenance, and other similar expenses form a part of the cost of producing the firm's output, but are not easily related to specific production levels of various enterprises.

Apparently, much less theoretical work has been done in the area of general overhead accounting than in other areas of cost. What work has been done seems to apply to manufacturing situations. But one principle of allocation may be relevant and will be examined.

As I see no particular association between the two topics I am discussing, other than this mutual difficulty of allocation to specific enterprises, I shall continue the pattern already developed of discussing them separately. First, a brief review of literature will assist in clarifying the concepts and principles of depreciation and general farm overhead costs. Next, an examination of the alternatives for estimating each category of cost will be made. And lastly, the hazardous position of proposing some methodology will be assumed.

Review of Literature

A vast amount of theoretical work, much of which is of fairly recent origin, has been done in the area of depreciation theory. Several authors cite the work of Gabriel Preinreich 1/ as one of the early origins of a mathematical depreciation theory. His results indicated increasing depreciation charges for situations of increasing replacement costs. But his conclusion that depreciation is basically bookkeeping and does not affect the firm's production seems somewhat in contrast to the rigor with which he developed his article. He does acknowledge that asset book values may not correspond to value for the firm and that optimal replacement cannot be considered apart from the economic life of the asset.

Accountants would generally accept Preinreich's conclusion of depreciation being basically a bookkeeping concept. Charles Lamden's article sets a tone, typical of many in the accounting field, that depreciation is a method of allocating cost, not of valuing assets. 2/ But a number of accountants have attempted to expand depreciation cost allocation concepts, the better to address problems of inflation, technological change, and fluctuating relative prices.

C. W. Bastable, W. T. Baxter and N. Y. Carrier, and William Bradford highlight the problems associated with income overstatement when assets are depreciated at original cost during periods of inflation. 3/ To account better for rising asset costs, Harry Wolk's article explains an accounting proposal for current value depreciation which would require reappraisal of asset values in terms of current costs. 4/ Yet he distinguishes this concept from replacement depreciation.

F. K. Wright attempts to reconcile some aspects of accounting depreciation and economic depreciation by defining an opportunity value for each asset which is defined as the least-cost method of obtaining the asset's services. 5/ The opportunity value is the lesser of the replacement cost or the least costly alternative to ownership. Depreciation is then defined as changes in the opportunity value over the period. By this method he attempts to avoid the problems of valuing assets.

In a refinement of current depreciation accounting methods, John Forsyth proposed a method of pooling investment costs and varying depreciation rates by a weighted average of asset ages retired in that period. A further refinement by Yuji Ijiri and Robert Kaplan demonstrates a method of determining depreciation rates when service life is considered a random variable. 6/

1/ Gabriel A. D. Preinreich, "Annual Survey of Economic Theory: The Theory of Depreciation," Econometrica, 6, July 1938, pp. 219-241.

2/ Charles W. Lamden, "Depreciation--Reliability Gap," Journal of Accounting, 133, April 1972, pp. 67-70.

3/ C. W. Bastable, "Depreciation in an Inflationary Environment," Journal of Accounting, 142 (2), August 1976, pp. 58-66. W. T. Baxter and N. Y. Carrier, "Depreciation, Replacement Price and Cost of Capital," Journal of Accounting Research, 9 (2), Autumn 1971, pp. 189-214. William D. Bradford, "Inflation and Value of the Firm--Monetary and Depreciation Effects," Southern Economics Journal, 40 (3), January 1974, pp. 414-427.

4/ Harry I. Wolk, "Current Value Depreciation--Conceptual Clarification," Accounting Review, 45 (3), July 1970, pp. 544-552.

5/ F. K. Wright, "Toward a General Theory of Depreciation," Journal of Accounting Research, 2 (1), Spring 1964, pp. 80-90.

6/ John D. Forsyth, "Roles of Equal-Life Group Depreciation Method," Cost and Management, 46, July-August 1972, pp. 33-37. Yuji Ijiri and Robert Kaplan, "Sequential Models in Probabilistic Depreciation," Journal of Accounting Research, 8 (1), Spring 1970, pp. 34-46.

Tax considerations are prominent in articles from both business and economic journals. The impacts of various tax policies on replacement and depreciation is specifically treated in Anthony Chisholm's article and reply and Ronald Kay and Edward Rister's comment. 7/ The conclusions drawn are that the income tax rate and method of depreciation used generally have little effect on optimal replacement policy, although the investment credit allowance may have substantial effect. Paul Samuelson provides some theoretical basis for these conclusions in his succinct article which maintained that if and only if economic depreciation is allowable as a tax deductible expense will the cash receipt stream be independent of the tax rate. 8/

An interesting article by Robert Coen uses industry investment data, compares it with tax rules, and estimates implicit depreciation on a use basis. 9/ Data for machinery and equipment are analyzed separately from data for structures. His results indicate that investment patterns for industry equipment match his implicit depreciation fairly well, especially since the 1962 tax revisions. However, implicit depreciation for structures indicates that they are apparently tax depreciated much in advance of actual replacement.

An exhaustive mathematical treatment of depreciation theory was given by Oscar Burt in his attempts to unify the similar concepts of cost- and income-based depreciation theories. 10/ He provides valuable contributions by specifying the necessary conditions for both theories and by distinguishing between asset types that are appropriately considered under both theories. The analysis is presented in terms of both continuous and discrete functions.

A textbook treatment of depreciation optimization was given by William Baumol. 11/ His study uses a Lagrangian expression for net social welfare and firms' profit maximization and presents theoretical optima under both objective functions. The results are defined for a system of price setting and indicate that depreciation should be charged only in periods of full capacity and at a rate to just maintain (cover) a specified measure of investment.

The most comprehensive explanation of depreciation and problems associated with it is given in a book of essays on the subject, edited by J. L. Meij. 12/ In their essays, W. A. Lewis and Edgar Edwards present especially informative explanations of the economic perspectives on the subject. Their articles consider depreciation and

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7/ Anthony H. Chisholm, "Effects of Tax Depreciation Policy and Investment Incentives on Optimal Equipment Replacement Decisions," American Journal of Agricultural Economics, 56 (4), November 1974, pp. 776-783. Ronald D. Kay and Edward Rister, "Effects of Tax Depreciation Policy and Investment Incentives on Optimal Equipment Replacement Decisions--Comment," American Journal of Agricultural Economics, 58 (2), May 1976, pp. 355-358.

8/ Paul A. Samuelson, "Tax Deductibility of Economic Depreciation to Insure Invariant Valuations," Journal of Political Economics, 72, December 1964, pp. 604-606.

9/ Robert M. Coen, "Investment Behavior, Measurement of Depreciation and Tax Policy," American Economics Review, 65 (1), March 1975, pp. 59-74.

10/ Oscar R. Burt, "Unified Theory of Depreciation," Journal of Accounting Research, 10 (1), Spring 1972, pp. 28-57.

11/ William J. Baumol, "Optimal Depreciation Policy--Pricing Products of Durable Assets," Bell Journal of Economics and Management Science, 2 (2), Autumn 1971, pp. 189-214.

12/ J. L. Meij, ed., Depreciation and Replacement Policy, (Chicago: Quadrangle Books, 1961).

replacement concepts under a variety of changes in demand, technology, relative prices, capital maintenance, and firm growth. The mathematical solutions they derive indicate that to maintain capital at current value, the depreciation charge should be varied according to changes in prices. And Edward's article suggests that depreciation based on current value is the only meaningful measure of capital consumption in situations of capital maintenance.

In an article that is critical of the method used by USDA in estimating depreciation for the Farm Income Situation, John Penson uses engineering data to demonstrate a divergence between remaining productive capacity depreciation and geometric depreciation charges based solely on age. 13/ His study shows productive capacity for farm tractors to be fairly constant for at least the first 7 years of life and concludes that the remaining farm value (based on capacity) should be concave to the origin instead of convex as assumed by USDA.

Little work is reported in the literature on allocating overhead expenses as defined in this paper. Much of what is available applies to industrial situations. But one study by Robert Kaplan and Ulf Welam provides an intriguing principle of allocation. 14/ Presented in terms of a linear programming model, the study recommends allocating overhead in proportion to the marginal cost of resources used in production of each product. Not only does this concentrate attention on limiting resources, but it also leaves relative profitability of products unaltered, so long as factor-product prices remain constant.

Depreciation Charges

In our estimation of depreciation costs we are faced with several options. First, we may adopt the accounting point of view, attempt to develop original book values for total machinery and equipment investment, and select a standard depreciation method which could be annually or periodically updated. Or we could adopt the economic point of view, attempt to estimate discounted productive value and allocate the difference between beginning and end of year values. After the perspective is selected, we are next faced with the decision of basing depreciation cost on original values, original values inflated to current prices, current values representing the physical stock of capital investment, or replacement costs representing some portion of future expected value at replacement.

In our cost of production estimates to date, we have been using a modified double-declining balance method to estimate depreciation costs for machinery and the straight-line method for buildings and equipment. Current prices have been used to reflect investment values. Depreciation costs estimated have been allocated to enterprises according to the quantity of use each enterprise makes of the capital items.

If our estimates of asset life are accurate, if current prices reflect the sum of discounted future values, and if our depreciation methods include acceptable investment consumption levels, our depreciation costs may be reasonable approximations of the true economic depreciation. If not, our estimates present problems in addition to those we currently recognize.

13/ John B. Penson, Jr., et al., "Measurement of Capacity Depreciation Based on Engineering Data," American Journal of Agricultural Economics, 59 (2), May 1977, pp. 321-329.

14/ Robert S. Kaplan and Ulf Peter Welam, "Overhead Allocation with Imperfect Markets and Nonlinear Technology," Accounting Review, 49 (3), July 1974, pp. 477-484.

W. Arthur Lewis draws a conclusion that may be comforting or disconcerting, depending upon one's point of view. 15/ In the limiting case when the stock of capital and prices are constant, and when the average age of assets is constant because acquisitions equal disposals, all standard depreciation methods will yield identical results. However, when any of these assumptions are violated, the methods of depreciation will ultimately result in different estimates.

The impact of violating these assumptions on depreciation cost estimates may dictate the degree to which our current procedure gives bias to our estimates. We do see an environment where the general price level is rising, relative prices are changing, technological change is expected, and the capital stock is added to and subtracted from in nonuniform quantities.

The principles of depreciation allocation in the literature are necessarily limited by simplifying assumptions. Those that encompass a wide variety of situations rely on estimates of values that are not readily available or easily estimated. Comparing, then, the adequacy of our current procedure with the principles of theory is somewhat difficult because of the practical limitation that data for comparison may be unavailable.

General Farm Overhead Charges

Several options for allocating overhead costs appear to be available although few theoretical principles are found in the literature. Overhead expense could be allocated to enterprises according to the marginal cost of resources used, as suggested by Kaplan and Welam. This procedure would require the specification of representative firms with appropriate enterprise mixes in addition to estimates of firm overhead costs.

A second alternative is to allocate overhead by physical units such as acres of land. Units applicable for livestock enterprises are not as easily specified. For crop enterprises as well as for the mixture of both crop and livestock enterprises, overhead costs could be allocated according to gross product values.

A final option considered is to allocate overhead as a specified percentage of other enterprise costs. Whatever option may be accepted, the estimation of total overhead cost itself remains. Here practical considerations, rather than theoretical, may dictate procedures.

Overhead costs could be estimated from cost of production survey data, from the annual Farm Production Expenses Survey, conducted by ESCS, or merely specified as a percentage of fixed or variable costs. Once estimates are made, they could be updated annually using the same methods or indexed by the Consumer Price Index or other similar indexes.

Recommendations

One appropriate aspect of our consideration is the congressional intent, although it is doubtful that the Congress considered the tax-economic depreciation controversy or the difficulty in specifying and allocating general farm overhead expense. But since the question was given to the economics unit, we may have the right (through possession) to interpret questions in economic terms. Therefore, we have the

15/ W. Arthur Lewis, "Depreciation and Obsolescence as Factors in Costing," in Depreciation and Replacement Policy, ed. J. L. Meij (Chicago: Quadrangle Books, 1961), p. 31.

theoretical principles of economics as well as practical considerations to assist in our methods selection.

Because our concern is not in maintaining book values for one firm nor in estimating optimal investments or replacement periods, we are relieved from much of the difficulty of ensuring consistent investment quantities from one year to the next. Rather, our concern is with cost estimation for an entire industry in a single year, and neither a changing price level nor changing relative prices need affect the single year's depreciation estimate.

An infinite planning horizon may reasonably be assumed as well as a fairly constant capital stock. I believe that our current procedure is capable of providing reasonable estimates of current depreciation costs. And our attention may be better spent in concentrating on the actual estimate levels themselves instead of the method used to compute them.

General farm overhead expenses have accounted for a small part of the total in our cost of production estimates to date. Unless we have erred greatly, we should continue to estimate overhead costs in an uncomplicated manner, lest we end up investing a tremendous amount of precision to produce insignificant differences in the result.

To serve as a starting point for discussion, I recommend estimating overhead expense from select data currently available from the annual farm production expense survey. With minimal effort (and relatively small additional cost), I believe data summaries could be obtained for separate regions of the country and possibly even States. These estimates could be allocated to enterprises and updated annually using the Consumer Price Index. Periodically, the estimates themselves could be compared to the farm production expenditures data and revised in sequence with our scheduled cost of production surveys.

Additional Reading

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Discussion

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Cost of production figures for farm enterprises are simple and easy to obtain if one accepts two heroic premises; (1) that income statements available from farm businesses reflect the economic and business environment in which the firm operates, and (2) cross sectional disaggregation of the farm income statement to individual enterprises can be achieved using consistent and reasonable methodology.

At the University of Illinois we have a long series of enterprise cost data utilizing the above two premises. All farms in our 7,000-plus farm record program use a consistent method of accounting for farm income and expenses and, with the luxury of 7,000 records to select from, we identify single-enterprise farms that require little or no disaggregation of the firm's income statement. Although our data may not satisfy all of the uses for cost of production data, at least they are consistent, and consistency is one of the hallowed virtues of the accounting profession.

The less acceptable of the above two premises is that the income statement contained in our accounting system reflects both the economic and business environment in which the farm operates. Because of the impact of tax regulations and the conservatism principle of accounting, which attempts to avoid overstating aftertax net income, our cost of production data come closer to reflecting the business environment of farm production. One might argue that the competitive business environment in which these farms operate is also the appropriate empirical economic situation to use for cost of production data.

For policy implications and for data requirements that go beyond individual decisionmaking and management needs for decisionmaking information, the appropriateness of the two premises rapidly deteriorates. We also face the sticky problem of how to value the residual claimants of unpaid labor and equity capital, including land and management, and recognize the true worth of the entrepreneurial function, which is also one of the residual claimants.

Costing Labor and Management Inputs

The comments by Roy Van Arsdall on labor and management charges is straightforward and covers the problem areas quite well. The value or cost of the unpaid labor of the operator and family members may be priced at the market rate for hired labor services needed to replace the labor provided. However, the problem is not that simple. The operator's input includes pure labor services, middle management services, coordinating and planning management, and the entrepreneurial function. Management includes the services of supervising and coordinating the farm business. The entrepreneurial function has been defined as that part of management which gains

control of resources, accepts the risks and uncertainties associated with the commitment of these resources to a production process, and receives a reward.

In valuing the labor resource, the problem is to separate pure labor services and that portion of the hired labor salary that goes to pay for middle management inputs. This problem is especially acute on the larger farms and was recognized by Van Arsdall. Other issues are accounting: how to value the perquisites provided in lieu of cash wages and the associated question of whether these perquisites should be embodied in labor services or aggregated with overhead costs.

Turning to management, we open a Pandora's box of problems. After reviewing several attempts at identifying the management factor in agriculture, we have concluded that we are dealing with a concept that is at best undefined and unmeasurable, perhaps unpredictable, and in some instances, we question whether it is reproducible.

In dealing with management in farm firms where the management function is embodied with labor and the entrepreneurial function, we basically agree with the suggestion by Van Arsdall that management be costed as a percentage of the other production inputs used by the enterprise. The problem remains as to which inputs to include in the input base and the amount to be added for management. Also, it may be argued that one standard formula should not be applied to all farm enterprises.

Nonland Depreciation and Farm Overhead Costs

The paper by Gail Garst develops a relevant background on the depreciation concept and suggests methods of disaggregating the depreciation charge to the individual enterprises. If we were to accept our earlier premise that the farm operates in a competitive business environment, and that this business environment is strongly influenced by regulations of the Internal Revenue Service applying to depreciation of intermediate period stock resources, we might dispense with several problems. Garst raised the question of whether to use historical costs, replacement costs, or standard costs to arrive at a depreciation charge for the bundle of machine and building services needed for the production of crops and livestock. One depreciation problem that I did not detect in Garst's paper was the tax shelter effect embodied in accelerated depreciation rates, investment credit, and the impact of these tax shelters on farms in a competitive environment. Farms that take advantage of tax shelters may have a competitive edge over those farms that either do not or are unable to avail themselves of tax shelter advantages.

A problem related to using historical costs or replacement costs in depreciation is the matter of how to treat unrealized capital gains (increases in market value of assets in excess of original costs less depreciation) due to market conditions, scarcities, and obsolescence. If we agree that this problem is one of portfolio management, and part of the increase in net worth is the unrealized income from asset appreciation, then the issue of using cost versus replacement values for annual depreciation would disappear.

I realize that the above observations do not solve the issues but they do raise interesting questions about the true nature of the costing problem associated with depreciation. The matching principle from accounting gives us guidelines on how to allocate depreciation to individual production periods. Conceptually, we should match wear and tear and obsolescence, or the lack of it, as a prorated cost of the asset to the year in which production takes place. The open question is which depreciation method best reflects this concept. From a micro viewpoint, our inclination is to accept the competitive business assumption and use business rates of depreciation as representative of the business and economic conditions that our cost of production data are supposed to measure. An aggregate or policy viewpoint might reasonably elect a different approach to costing machinery and buildings.

The problems associated with overhead costs may be divided into two areas: what items are to be included in farm overhead, and what method is to be used to allocate the aggregated overhead expenses to individual enterprises. In dealing with the former, our methodology should avoid double-accounting such as including perquisites for labor in both the labor charge and farm overhead expenses. The latter problem of disaggregating overhead costs to individual enterprises is one that might be discussed at length with little hope for agreement among all. I agree completely with Garst's observation that, since farm overhead expenses are a small part of total cost of production, we should continue to allocate overhead costs in an uncomplicated manner, lest we estimate costs to the nearest $1,000 in our farm surveys and end up allocating the estimated data to the sixth decimal point in our costing procedures.

Costing Feed Inputs to Livestock Enterprise

Economics gives us a guide to pricing feed inputs to livestock. A joint activity model, where a product of a crop enterprise is a resource input to a livestock enterprise, is the appropriate method. A land charge to livestock may be applied for the site where production occurs, but the feed input is more reasonably valued as a feed input rather than a land charge to the enterprise. Feed with readily quoted market prices should be priced at the market price, less cost of marketing. This includes all farm grains and in most cases harvested hay, albeit the price of hay may not necessarily be the quoted market price. This is because time and place utilities are as important to the market price of hay as is the total digestible nutrients (TDN) or nutrient content of the feed.

Forages with no readily quoted market price such as corn silage, hay, pastures, and crop residues represent a difficult pricing problem. Economics gives us some help in arriving at a method to bracket the price of these forages. For the user of the feed, the price should be no greater than the market value of feed replacements, or alternatively, the opportunity costs or income above direct costs for comparable resources for the crop given up to produce the forage product, if produced on the same farm.

We can illustrate this with corn silage. Let us assume a ton of typical corn silage contains the feed substitution value of about 6 bushels of corn and 300 pounds of hay. The feed replacement value of corn and hay represents the upper limit of price that a rational livestock producer would offer to pay for the privilege of feeding corn silage. Alternatively, corn silage might be priced at the income foregone by not raising 120 bushels of corn for grain, adjusted for differences in harvesting and storage costs and the potential fertility removed in the forage part of the silage.

Storage structures that are used to provide the time and place utility of this feed can alternatively be treated as a cost of the stored feed or as a cost of the buildings and equipment used to maintain the forage-consuming enterprise. The key issue here is to avoid double-accounting and to include the cost of storage structures only once in the data.

Direct pastured forage represents a different set of conditions. In this case, we prefer to use the feed replacement value, adjusted for the absence of harvesting and storage costs for direct pasturing of forage. The use of a hay yield equivalent is not acceptable as direct pasturing of forage results in utilization ranging from 30 to 70 percent of the potential mechanical harvested yields due to trampling, fecal fouling, and grazing of immature forage. An alternative pricing method might be the grazing fee (market price) if grazing rights are a regularly traded commodity in the area where costing is being done.

Salvage forage, like corn stalks, has an upper limit in value equal to the replacement feed value provided by the salvaged forage and a lower price limit represented by the replacement cost of the fertility and organic material removed by the grazing process. A modal value somewhere between these two limits should be an acceptable pricing procedure for salvage forage.

Note that nowhere have we suggested cost of production as a method of valuing forage. Aside from the usual uncertainty of whose cost of production to use, the technique of using cost of production could lead to unjustified income transfers between the crop and livestock enterprises. If cost of production is used as a transfer price and it is greater than the market value of substitute feeds, we then overestimate crop income and also overestimate feed costs to the livestock enterprise.

A careful and intelligent application of the economic concepts outlined above should provide guidelines for pricing the transfer of feed from a crop enterprise to a livestock enterprise on the same farm. The concepts are reasonably straightforward and defensible; obtaining accurate empirical data and applying the concepts to the particular enterprise situation are the difficult problems.

Discussion

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The preceding discussion by Professor Mueller was thorough but a few points may not have been sufficiently emphasized. The three issues in this part of the program are:

1. How shall the cost of management be reflected in the budget?

2. How are depreciation and overhead costs properly charged?

3. How can forages, hay, and other intermediate products be appropriately charged as inputs in livestock budgets?

The answers to these questions depend in part on the intended uses of the budgets. The uses include (a) fulfilling the legislative mandate for COP work with charges for the items cited above, (b) educational and research uses, (for example, concerning the nature of product supply and input demand relationships in agriculture), (c) farmer decisionmaking based on modifying and correctly interpreting the budget for an individual situation, and (d) evaluating income potentials (or histories) of specified farm and ranch situations across the United States.

Preparing Budget Users

Since the budgets are multipurpose and the mandate requires charges for management, depreciation, overhead, and all other inputs, careful use of the budget format and an extensive educational effort are needed to promote beneficial utilization of the budgets. The Oklahoma State budget format, on which the FEDS budget is based, conveniently groups similar items for cost or return analysis. For example, if the question is "What is the disposable income, before taxes, per acre of wheat to a farmer who owns all capital and hires all labor?", the variable cost and labor cost groups are subtracted from gross receipts to get disposable income. That residual is the amount available to pay for family living, debts, ownership and overhead expenses, and new or replacement capital items. Clearly, similar analyses can be made for any resource situation.

The point is that how to make a charge is no more important than how to interpret the charge in an analysis. Every effort should be made to educate users concerning interpretation and use of budget items. An article by Ron Gustafson et al. is a good illustration of useful interpretation of the budget. 1/ The authors specified three decision settings and estimated costs of producing feeder cattle for each of the situations. The audience for that article should be able to extend the underlying analytical concepts to other applications. However, additional efforts in educating users would be worthwhile.

Lumpy Input Costs and Size Relationships

I see a common problem among charging for management, machinery, equipment and buildings, and overhead which has not been emphasized. Each kind of cost is lumpy on an annual basis. For example, the total cost of management, personal property taxes, depreciation due to obsolescence, and several overhead items must be paid for the farm or ranch whether allocable to one production unit or to the full capacity of the input. The charge in the production budget (e.g., per acre or per head) depends on the size of firm envisioned because the input is really not perfectly divisible. Thus, size relationships for these inputs are always implicit in budgets. The level of charge per unit should be considered in relation to the size of business represented.

The Management Charge

Roy Van Arsdall indicated ways that management could be charged, including (1) professional management charges on either sales volume or cost, (2) estimates of residuals to management from farm records, and (3) competitive income estimates. I agree with him that the market-based charge for professional management is more attractive than more arbitrary residuals estimated from records. He used the competitive income approach to show how the competitive income compares with that resulting from the charges for labor and management in the FEDS budgets.

I like the competitive income approach for charging operator labor and management, partly because it probably reflects the underlying interest of the mandate. The competitive income approach could be used directly in the context of the lumpy annual cost. The cost of operator labor and management is its opportunity cost in another use or the return necessary to draw it into agriculture. As Van Arsdall pointed out, that value is difficult to estimate. If the competitive income approach were used directly, size of business would need to be explicit. The technique would be difficult to use for larger farms, as the operator increases the amount of time devoted to management and decreases labor. What is the limit on size due to management? Could hired labor embody management and labor? At what price? Although a fixed percentage of cost is easier to apply as a charge for management, it may imply overpayment of management and labor per operator on larger farms, in the sense that the operator could not sell his labor and management elsewhere for the amount implied.

Depreciation and Overhead

Garst presented a very useful overview of issues in handling depreciation and overhead costs. A small conceptual base and some research make me wary of adjusting depreciation for inflation. The research illustrates the effect of building the

1/ Gustafson, Ronald A., Henry C. Gilliam, Jr., and Calvin C. Boykin, Jr., "Costs of Producing Feeder Cattle in the United States--1976--Preliminary Estimates," in Livestock and Meat Situation, USDA, June 1978.

inflation rate of a resource (land) into cost of production which is used to determine a target price 2/. Building inflation into the system is not attractive.

Charging for interest on investment and depreciating capital items at current replacement (investment) values looks to me like a double charge. If the money market is operating well, the current interest rate used in budgets can be assumed to cover inflation plus give a required real rate of return. 3/ The interest plus recovery of the initial investment keeps the farmer even on his balance sheet in current dollars and gives a return on investment. I am not convinced that anything else is warranted.

I see some inconsistency in using current values for depreciation and initial purchase values for determining average investment on which to charge interest. If the former is warranted (I don't think it is) then the investment should be at its opportunity value. Finally, a sinking fund approach could be used in the budget generator to assure a specified rate of return and sufficient capital to replace the original investment. That would get rid of the average investment idea for charging interest.

My only suggestions concerning overhead costs are that the lumpiness of such costs be taken into account and the size of farm or ranch be considered. Additional effort may be needed in obtaining data on these costs.

Pasture-Forage Charges

Before reading George Frick's paper, I had assumed that rental prices for pasture would be readily available and used in the livestock budgets. Such market data apparently are more available in some areas than others and where available should be used for the land charge and pasture charge. Pasture rental rates are more complicated to interpret as one moves away from rangeland, for which other pasture input costs of the renter may be one mowing and some fence maintenance. Where the pasture production is intensive, the rental charge is for land and the established pasture species and the renter must add fertilizer and other inputs.

The substitution value approach must be considered the second best alternative to rental rates. For example, as mentioned by Frick, the replacement value of silage in terms of corn can be estimated. Likewise, the replacement value of pasture for hay can be used. Care must be taken to use on-farm rather than off-farm prices of hay and to charge for costs of feeding the hay. Unfortunately, most price series reflect market rather than farm prices.

Usually, input requirements are normalized in making budgets. For example, the pasture requirement specified is the average or normal amount required across good, normal, and bad years. In COP work, a specific year is assumed and survey data may implicitly reflect acreages devoted to a beef enterprise. Excess capacity may be apparent. Rather than charging for all the pasture which the survey indicates is used, a normalized value would be preferred.

2/ Boehlje, Michael, and Steven Griffin. "Financial Impacts of Government Support Price Programs". Paper presented at the American Agricultural Economics Association meeting, San Diego, 1977.

3/ Whether this result is achieved in practice depends on the interest rate used. Also, the inflation component should be compounded over time as in a sinking fund calculation.

Group deliberations resulted in four general conclusions with respect to estimates of cost of production. First, estimates should offer flexibility to the user. That means providing sufficient detail on input items, including both dollar costs and physical quantities where relevant, so that users can adjust the cost estimates to fit their particular decision situations. Although ESCS cost estimates have a primary function of providing information to policymakers, and should be so directed, the needs of policymakers are not strictly defined nor are they likely to be unchanging over time. Also, cost estimates will be subjected to many uses regardless of any specific purpose around which they are built. The needed flexibility carries with it a requirement for an intensive educational effort on the meaning and relevance of the various categories of costs in different decision settings.

Second, cost estimates lack full meaning unless they are accompanied by indicators of returns. High unit costs in one region or situation compared with another do not necessarily reflect an unfavorable economic position. Differences in returns may well offset differences in costs.

Third, decisions on input pricing cannot be made in isolation on an item-by-item basis except for purchased variable inputs. The procedure used for setting a price on one input quite often impacts the options available for pricing other inputs.

Fourth, any estimate of the cost of producing agricultural products will encounter some criticism. There is lack of complete agreement as to whether some resources are truly costs of production or residual claimants. The basis for pricing many input items is controversial. Compounding the issue are the many users of cost estimates with many different problem settings. This situation, however, is not unique to agricultural production. The only clear course is to proceed with estimates that provide sufficient detail to permit user flexibility, and to offer educational materials to guide choice of alternatives. Various levels of aggregation of the estimates can be provided for those who require only general guidelines.

Five specific categories of costs were assigned to the work group for consideration. They included management fees, labor charges, nonland asset depreciation, feed, and general farm overhead costs. Summaries of the resulting deliberations and recommendations follow.

Management Charges

Management as an input must be considered as a service and separated from its traditional status of residual claimant, except as that might be found to be the best measure of the amount necessary to hold the services of management. Farm business records which leave management as the residual claimant do not yield a defensible price for the services of management. Part of the problem is that prices must be set on other non-paid inputs, such as land, depreciable assets, operator and family labor, and risk in order to measure the residual for management. Prices of all of these inputs are arbitrary and subject to controversey. All such inputs, including management, hold residual claimant status in the real world.

The work group agreed that unpaid management should be priced as a service regardless of the residual left for it. Alternative opportunity earnings, such as salaries of employees in related occupations, are a guide to the reasonableness of any management charge.

The allowance (or charge) for the unpaid labor of the operator, who provides both labor and management, must also be considered in setting a management fee. The combined total of the two charges is then assessed for reasonableness. The problem

may be further complicated if (as is now done in FEDS) the average wage rate for all farm employees is used for all labor on multiworker farms. Then the single management charge must pick up the amount paid for middle management. Use of actual (higher) wage rates for employees with some supervisory status would void this need. This should be done whenever the data are available. Most crop-livestock farms, however, do not generate this problem.

The group recognized that the requirement for the services of management varies directly with the amount of resources handled, though probably not in proportion to the amount. The use of a percentage of gross income (as now done with crop costs) as a proxy for the price of management is considered unacceptable. There is no reason for management cost to vary with product prices. Cost is a better measure of amount of resources handled, but use of a flat percentage of cost (as is now done with livestock costs) as the charge for management still suffers from: (1) year-to-year variations in costs, especially feedstuffs in livestock and poultry production, that do not reflect change in the management inputs, (2) lack of any reflection of economies of size in management cost, and (3) an incorrect assumption that all inputs as measured by cost are equally demanding of management.

The concensus decision on the charge for management was as follows: (1) total cost, excluding interest on land and purchased livestock, should be used as the basis for applying percentage rates as proxies for the cost of management, (2) the input mix differs among commodities so the percentage rate may differ (that is, a 7-percent rate is reasonable for livestock, but crops may require a higher rate as land costs are omitted from the basis), (3) the setting of the management charge on another basis (for example, a specified amount per unit of production) is acceptable, and (4) estimates of management costs should be replaced with actual costs whenever operations are large enough to hire management and data on salaries can be obtained.

Such flexibility in setting costs for the services of management was agreed to largely because: (1) greater precision is unwarranted in the pricing of an unknown for which judgment of the reasonableness is the final measure of acceptability, and (2) building and updating a large number of budgets benefit from some routine method that uses a proxy for the pricing of management.

Labor Costs

Determination of labor costs involves selection of rates of pay for both hired and unpaid workers. Possible differences in quality and productivity of the various categories of workers--hired, operator, and family labor--were recognized. Each has strengths and weaknesses compared with the others, but there is no way to measure them precisely. The decision of the group, therefore, was to treat them as equals.

Presently, cost estimates use the all-farmworker rate of compensation for all labor in the typical farm setting. Rates obtained from special surveys are charged for labor used in the larger commercial operations. The all-farmworker rate is obtained annually from the statistical unit of ESCS data on a State-by-State basis. Labor data from special surveys must be adjusted annually by the general index of farm wage rates.

The group decision was to: (1) continue the present method of pricing labor, charging the same rates for both paid and unpaid labor, (2) adjust the State wage rates upward to include Social Security payments which are not now included in the cost estimates, (3) consult with the statistical unit of ESCS to be certain that perquisites and fringe benefits are adequately covered but not double-counted in the estimates, and (4) give consideration to future use of available wage rate data for more specialized employees such as livestock workers, irrigation workers, and supervisory personnel. This last item will become more important as enterprises increase in size and multiworker operations represent a larger part of total production.

Costs Associated With Depreciable Assets

The DIRTI 5 costs--depreciation, interest, repairs, taxes, and insurance--come with any depreciable asset used in production. The presently used method of estimating these costs associates repairs, taxes (some States do not have personal property taxes), and insurance with current replacement cost of assets. This reflects reality and was not contested by the group. Interest on investment is based on estimated original acquisition cost of the asset. This was also accepted by the group.

Asset depreciation was the controversial issue. One point of view argues that an investment is made, then written off by some method over the useful life of the asset. This annual share is part of the cost of doing business. When the asset is used up, another investment decision arises with recapture to be judged on the basis of expected future income. The business may or may not continue depending upon the appraisal of the new investment cost versus expected repayment capacity. Funds can be borrowed to make the new investment if it is deemed profitable.

The opposing view argues that depreciation, specified as a replacement reserve, should be based on current replacement cost. The result reflects the sum of discounted future values and provides for capital maintenance over time. This is the method now being used by the FEDS.

The conclusion was to continue charging a replacement reserve for use of depreciable assets rather than dividing original cost over life of the assets. A minority of group participants, however, continued to express opposition.

The choice of method of charging for use of depreciable assets has an effect on cost of production that can be significant for some enterprises. Differences in the result between the two methods will vary directly with the amount of inflation. Whichever method is chosen, it should be identified and explained, along with enough information so that the user of the cost estimates might at least approximate the outcome of the alternate method of depreciation, should the user wish to do so. This is part of the need to educate users as to the meaning and purpose of cost data.

Allocation of Overhead Costs

Many farm costs are not directly chargeable to any particular enterprise, but they must be paid by the enterprises that generate revenue. Some FEDS budgets now allocate overhead costs to enterprises, some do not. Where allocations have been made, a constant percentage of variable costs has been used as a proxy to reflect the overhead costs chargeable to that enterprise.

Group participants made three recommendations. First, all enterprises should bear a share of general farm overhead costs. Second, information on farm overhead costs is sparse, and efforts should proceed toward obtaining more data, using the farm expenditure survey if possible. Third, a constant percentage of variable costs is not an adequate proxy measure of overhead costs. Farm overhead costs include many items. Some are fixed outlays, some vary with size of business. Therefore, a constant percentage of variable costs, although yielding a satisfactory measure of overhead costs for an enterprise of average size, understates overhead costs for a small enterprise and overstates them for a large one. The recommended solution is first to quantify overhead cost more accurately, then to estimate dollar overhead charges per unit of production for the various types and sizes of enterprises. Annual updates from such benchmark estimates can then be made with the Consumer Price Index or other suitable index. The point was also made that overhead costs are a small part of total costs and that extensive refinement of such estimates is not justified.

Feed Costs

Pricing feedstuffs was by far the most significant item affecting the cost of producing livestock. Group participants debated the well-known issues and recommended an option, yet colored each recommended option with some criticism. These options and criticisms are listed below.

1. Purchased commercial feeds and grains.--Use average annual prices paid by farmers as reported by Agricultural Prices. Storage costs are included in the average annual price.

   Criticism: Average prices obscure the price discounts obtained by large volume users and the higher prices paid by small volume users. Hauling or delivery costs may be missed unless covered in general trucking or overhead.

2. Farmgrown grains.--Use average annual price paid by farmers for dry grain--as reported by Agricultural Prices. Storage costs are included in the average annual price. High-moisture grain (ensiled) is charged on an actual weight basis at harvest time price, adjusted for shrinkage and drying costs, plus storage facilities. For example, high-moisture corn ensiled at 24-percent moisture would be priced at $2.075 per bushel (56 pounds of wet corn) if the October-November price of No. 2 corn averaged $2.50 per bushel. Computation: $2.50 - 2 percent of price x 8.5 points of moisture above 15.5 percent moisture = $2.075.

   Criticism: Opportunity sales prices for grain are less than purchase prices, but data are not always available on the proportions raised versus those bought. Practicality dictates use of the same price data series as for purchased grains.

3. Hay.--Use harvest-time price for the kind of hay being fed. Hay storage is an added cost to the enterprise. (See Note on Pricing Hay and Silage.)

   Criticism: In some areas little hay is sold. Price data on hay are often thin or nonexistent. Hay price series are being dropped rather than strengthened. In some regions, hay for horses probably dominates the market. If prices are mostly in the field quotes, the costly hauling charge is missed. If hay prices are above cost of production, use of market price overcharges livestock on farms where hay is not bought or sold. The value of hay can be realized only through livestock.

4. Grass-legume silage and haylage.--Use the hay-equivalent content at harvest-time price for the same kind of hay as the forage in the silage. Silos and related equipment are added costs to the enterprise. (See Note on Pricing Hay and Silage.)

   Criticism: Problems are the same as for hay. Further, silage is not a readily salable product and there are no market price guides.

5. Corn, sorghum, and small-grain silage.--Use the market value of the grain content at normal grain harvest-time adjusted for difference in harvest cost between grain and silage. For example, a ton of corn silage in the North Central States in 1976 would be priced as follows: 6 bushels of corn x October-November price of No. 2 corn + $3. If the price of corn were $2.50 per bushel, a ton of silage would be priced at $18. The harvest cost adjustment is updated annually by a composite labor-machinery index. (Due to the imprecise nature of the harvest cost adjustment, it seems advisable to omit any adjustment for drying. It is not now being used.)

Silos and related equipment are added costs to the enterprise. Whenever silage is commonly purchased, as for many commercial beef cattle feedlots, the purchase price should be obtained and used in the cost estimates. Such prices, however, are not directly transferable to silages in other regions, as crops grown specifically for sale as silage (usually corn silage) are usually high forage yielding varieties. Elsewhere, the final use is the only distinguishing characteristic. (See Note on Pricing Hay and Silage.)

Criticism: It can be argued that, as with hay, the value of silage, at least the forage portion of it, can be realized on most farms only if it is fed to livestock, since there is no market for it. Thus, the cost of producing silage is the proper cost of such feed for livestock. The estimated market price that is recommended is a mixture of the market price and the cost of production. A complete market value approach can be used by counting the grain value equivalent plus the forage value of the ensiled plant in terms of its grass hay equivalent, but this does not result in a more defensible estimate of cost.

6. Pasture and ranges.--(a) Use rental rates for grazing rights that are commonly rented, such as for use of Government lands or wheat pastures, and for all pastures and ranges in regions where rental is common enough to establish a firm market rental rate. (b) Use cost of production, exclusive of any land charges, for pastures and ranges in regions where a firm rental market does not exist. (c) In both cases, charge livestock with all of the grazing made available to them--not just the amount they may require. The decision of management as to stocking rates should be reflected in cost. (d) The option of computing feed requirements of livestock, deducting harvested feeds fed, and charging the remaining requirement to pasture at a hay equivalent value, less cost of harvesting, is unacceptable. This ignores additional pasture that is produced to minimize risk or available due to management decisions. This method would also place a high price on crop residues.

Criticism. Debatable aspects of these costing methods are numerous. Rental rates are questionable measures of cost where little grazing is rented. That covers much of the country. Further, the point at which the basis of charging for grazing should shift from rental rates to cost of production is arbitrary. Rental rates include associated facilities of fencing and water facilities, and sometimes shelter. The cost of forage production includes these facilities separately, but, by decision of the conference, excludes land costs. All other feedstuffs are priced at market value and include in their market prices some implicit cost for land. Corn silage, for example, would be priced much lower if only nonland costs of production were assessed instead of an estimated market value of the feed. The intensity of use of pastures and ranges may be overstated or understated, with cost rates affected accordingly, depending on the stage of the beef cattle cycle (other species are less affected) when use rates are determined. Finally, development of large numbers of pasture and range budgets is time consuming and costly, and little data exist to support such an effort.

7. Crop residues for grazing.--Use zero cost.

Criticism: Little objection was voiced, though placing animals on cropland may cause some damage that would not otherwise occur and use some nutrients.

8. Land costs.--The issue of land costs was not an assignment of this work group, but how it is handled obviously has a large impact on the cost of feedstuffs that are charged at cost of production--specifically, some pasture and ranges. While the group did not object to omitting land from cost of production, it is

essential that the issue and options be clearly presented. The low- and high-cost regions (from the standpoint of charges for grazing) reverse as cost of production is shifted from only nonland costs to an estimate that includes land costs. The alternative cost estimates are relevant to different questions.

Note on Pricing Hay and Silage
(Submitted subsequent to workshop)

Roy N. Van Arsdall

The pressure of time caused the group to give inadequate consideration to the alternatives for pricing hay and silages to be used in livestock production. The meat animals group believes that market price is a questionable indicator of the real cost of using hay and grass-legume silages in livestock production, especially in beef cattle raising. A review of Frick's paper shows that he also questions the market price approach, urging instead that cost of production is the better indicator of the cost of using these forages in dairy production. Only Mueller argued against the cost of production method, saying that it often leads to unjustified income transfers between crop and livestock enterprises. The final result was that we too hastily approved a recommendation to charge market price for both hay and grass-legume silage (hay equivalent content) even though the recommendation does not have the support of either the meat animals or dairy groups.

Purchased forages should be charged at market price. They are bought for cash the same as commercial feeds. The periodic surveys identify the split between purchased and home-grown feedstuffs, so the data are available. 1/ Then only the relevance of the reported market prices remains in doubt.

Cost of production seems a much better measure of the real cost of home-produced hay and grass-legume silages. Only hay enters the cash market in significant amounts (Agricultural Statistics reports that 21 percent of the 1976 crop was sold and 79 percent was fed on the farm where it was produced). Further, the highest quality hay (alfalfa) and special purpose hay (for horses) probably account for most sales, yet these kinds of hay are not representative of the hay used in cattle raising. Such a market price mix probably even injects a price bias into the hay used for dairy, though the quality of hay used for dairy is probably uniformly high. In addition to these limitations, farmers and ranchers do not actually have the option of selling all of their hay, and certainly not grass legume silages, at reported market prices based on sales of a fraction of total production.

The pricing of silages made from grain crops, chiefly corn silage, poses an even more difficult question. Silages are seldom sold except in special situations. Few farmers have a realizable option of selling corn or other grain crop silage as silage. Market price estimates do not exist. Cost of production may, therefore, seem the logical basis for setting a price on grain crop silage. Most of the feed value of grain crop silage, however, is in the grain--not the forage. There is a ready and realizable market for the grain, hence the better measure of the cost of grain crop silage for use in livestock production is the modified market value. Cost of production usually results in a price less than the market value of the grain content alone, especially if land is excluded from cost.

1/ Year-to-year variation in purchases is probable.

Regardless of the method chosen for pricing hay and silages to livestock enterprises, a problem of lack of comparability among the cost estimates for different enterprises already exists. Both dairy and beef cattle raising enterprises use large amounts of hay and silages. Except in certain regions, most of these feedstuffs are homegrown for both enterprises. Dairy production cost estimates (already published for 1974 through 1978) charge all harvested forages at estimated market price. Beef cattle raising cost estimates (tentative 1976 estimates already published) charge the proportion of hay purchased at market price; all homegrown hay and silages at cost of production. It could be difficult to argue why an identical ton of hay should cost a dairy enterprise $50, yet have a price tag of only $25 if fed to beef cows. Perhaps the only plausible defense for maintaining different pricing methods is that dairymen purchase a larger portion of their forage needs (if they do) and use higher quality hay than do cattle raisers; hence, the hay that dairymen feed has a more realizable market opportunity.

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VIEWPOINTS FROM POLICYMAKERS

House Committee on Agriculture

Jim Culver
Staff Economist 1/

In this paper, I take a policymaker's viewpoint of cost of production. The concept of cost of production was enacted into law in an attempt to measure farmer well-being. On the surface, the concept is very attractive. It is easy to explain and justify to both farm and nonfarm audiences. For political and public relations purposes, the concept is very attractive. What reasonable person could ask a farmer to sell his product for less than it costs him to produce it?

In reality, as all of you know, there is no general cost of production. What we have is a different cost of production for every farmer. You can calculate a national or regional or some other subdivision estimated average cost of production, but none of these is really very meaningful in terms of measuring farmer well-being. Because of this difficulty, the concept has caused its fair share of difficulty for agricultural legislators, the very people who decided initially that it should be used.

The problem with a national average cost of production is that it is always too low for some farmers and too high for everyone else though no one ever admits that it is too high. Every study of cost of production for a commodity that I have seen coming out of the reputable schools of agriculture has shown a higher cost than what USDA has calculated. I am not suggesting that USDA's numbers are out of line--they probably are not. But they suffer from an immediate credibility problem. It is always easier to believe something that serves your purposes better.

That is the problem for people working with agricultural legislation--but what do we do about it? Maybe the best thing would be to discard the concept completely. Politically, however, I doubt that it is realistic to expect that course of action. If we are stuck with the concept, what other alternatives do we have? Unfortunately, probably not very many good ones. But I do have two suggestions on how USDA's cost-of-production studies might be better received.

(1) Offer fewer options to choose from. Six different methods of calculating the land charge is a bit much and tends to be confusing.

(2) Publish an index of the change in cost of production, starting with the first cost-of-production report as a base, then move forward. This could be a better measure of farmer well-being than a specific cost of production--maybe not a good measure of farmer well-being, but better. Finally, let me urge you to continue to work to perfect the concept such as it is, so that it is a more useful tool. Cost accounting for business has become well established with accepted methods and procedures. Cost-of-production estimates will probably never be as established, but we do need to move as much as possible to standardization of methodology and accepted procedures. It is, after all, a tool that receives wide usage and has been very important in the agricultural policy debates of the last few years.

1/ The views expressed here are those of the author, not necessarily those of the committee.

Senate Committee on Agriculture,
Nutrition, and Forestry

Dale Stansbury
Staff Economist

The Senate put the cost of production study into the 1973 Act, in response to a desire to find an objective alternative to parity, and a price support concept that the increasingly urban Congress would understand. Cost of production seemed to fit. It is understandable and it is simple, at least in the first blush. Even though Congress thinks it has found a panacea, the concept is not new, but as others have already pointed out, is as old as farm programs. The reason for the concept's persistence can be understood, if we consider the context of policy formulation.

The first thing that has to be recognized is that agricultural policy has as its basic point the maintenance of farm income. The dilemma is that income is a relatively abstract concept compared to price. Further, everybody knows that good income is the result of good prices.

Congress originally requested USDA to determine parity farm income in the 1930's but when the Bureau of Agricultural Economics (BAE) failed to respond, Congress legislated parity prices in 1938. More recently, Congress tried to get back to the income concept with target prices--income supports--and loan levels or price supports.

Try as we will, however, we do not get income concepts implemented. We always manage to translate income changes into price. We have used three methods to establish price support levels in recent times: parity, cost of production, and selection of arbitrary or political numbers. Theoretically, the cost of production method still looks best.

As we began working on the 1977 farm bill a committee of five wheat growers came in to explain to us how we should calculate the cost of production. They were able to give us six formulas for the cost of production--their committee method and each one had an individual best method. We quickly became convinced that it was time to go back to parity.

I have heard today various accusations that policymakers misuse cost of production numbers. However, I believe that the problems with the cost of production are not just with the policymakers. In fact, much of the blame for problems with cost of production concepts has to be given to the economics profession.

I have to point out that economists misuse cost of production numbers. For example, in 1975 we solicited from all States cost-of-production numbers when we were considering the Emergency Farm Act that year. One extension economist in Minnesota had determined that it cost $3.40 to produce corn in that State. My reaction was that Minnesota wasn't going to be in the corn business if that were true.

However, Senator Humphrey was on the Committee at that time. To say the least, he was a fairly persuasive gentleman, and he felt that we should take care of his Minnesota farmers by establishing a target price that would cover their cost of production. We came within an eyelash of establishing a target price for corn at $3.40 in that legislation.

In fact, I would suggest that there has been a fairly significant misuse of economic theory in determining cost of production levels, or at least inadequate explanation of what we mean by costs of production.

For example, the Department report is using replacement cost as the basis for capital and equipment costs rather than depreciation schedules. I think this somewhat violates capital theory which suggests that capital be repaid out of generated cash flows from the capital. It is not a prepay question. I will accept current value and price expectations as the factors that determine investments, but cost is determined at the time the investment is made.

Second is the payment of prevailing wage rates to family labor. This is a return for an economic activity that is being called a cost. If there is any return here, it is a surplus available to the family to use to purchase consumption items, to save, or to invest.

The inclusion of normal management returns as a cost is fine economic theory, but the farm strike showed that people thought of the cost numbers as the floor and normal return as something above that.

I would suggest that it is only under the theorem of opportunity costs that these are costs, and then only if the individual wishes to exercise the opportunity.

Last and most important is the cost of land. In the original study, the Department gave six different levels of land cost, but none of them showed land as a negative cost. This would seem reasonable, since appreciation of land could be viewed as a supplemental product, parallel to the wheat pasture or cottonseed. It is even more reasonable, since the average rate of appreciation of land in the last 20 years is 15 to 16 percent well above prevailing interest rates. It is just possible that we don't need to add another 8 or 9 percent on top of that to show a normal return to land, and especially not 8 percent onto an inflated current value basis.

The idea of cost of production is, I think, here to stay. I further believe that it represents an opportunity for the profession. However, to take advantage of the opportunity, you need to recognize a few minor facts.

First, you have to abandon the idea of perfection. You cannot achieve perfection, but better cost of production data and explanations can be beneficial in implementing and developing reasonable agricultural policies.

The concern that some people have with misuse of cost data is an unnecessary worry. You cannot prevent misuse, so I would suggest that you not worry about it. That is the true political arena. The political players use or misuse the data you give them, depending upon the circumstances of the time. In fact, the term misuse is not germane, since it is defined in narrow economic sense rather than in a real world sense.

Remember, good data will minimize the possibility of misuse.

One thing you can look forward to is the fact that your assessments and facts will be used.

As I said before I think the profession should view this as an opportunity to provide meaningful input into policy formation. You have to be careful, however, because you know too much. Policy formulation is an art form. There is little interest or use here for double precision arithmetic.

The most important thing to remember is that we are and always will be a political economy. The economy side can be better if the available information is better.

Council of Economic Advisers

J. B. Penn
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I shall begin my remarks by commiserating a bit with those of you charged with the responsibility for preparing and disseminating the commodity cost of production (COP) estimates. The full emergence of COP in the 1977 legislation as an integral aspect of national public policy for agriculture places an even greater responsibility on you. You do not have an easy task. You can be assured that the estimates will please almost none of the protagonists in the policy process. The estimates will be roundly criticized by some who will argue they are too low, by others who will argue they are too high, and by some who will argue their irrelevance.

You are to be commended for undertaking this very timely examination of your procedures and assumptions, the concepts you use, and for exploring various ways in which significant improvements in the estimates might be effected. Given the increased importance of the estimates, it is of paramount importance that they have credibility and that your methodology and procedures be well-reasoned and justifiable.

By following the other speakers, I am able to comment selectively on several topics and issues that have not been the subject of much of the preceding discussion. I wish to turn first to a general dilemma that I see in the present situation.

A Dilemma

It appears to me that there are two distinct themes that have been interlaced through most of the papers, but have not been distinctly separated. One is, of course, the stated purpose of the workshop--how to improve the COP estimates that are now regularly made to meet the perceived needs of policymakers, thus fulfilling the congressional mandate. The second is the more basic question of the appropriateness of COP for use in agricultural price and income policy. This was touched upon in Tom Miller's paper and is related to the earlier comments of Jensen and others. That is, what information are policymakers <u>really</u> seeking? What do policymakers <u>really</u> want to know? And, are the many detailed questions more frequently being asked about COP (such as about COP distributions, variability, size-cost relationships, etc.) really an attempt to gain a type of information that COP estimates simply cannot provide?

The latter theme also relates to the question posed in the Stovall/Hoover paper--why is COP so popular now? And, one might also ask why was (and is) parity such a popular concept?

Commenting first on the latter theme and questions, I do not see that there is much mystery about this or about how it all came about. I would suggest that perhaps both the parity and COP artifacts have been embraced by policymakers because we (agricultural economists as a profession, land-grant universities, and USDA) have done such a dismal job over the years of providing information that unambiguously and fully describes the economic well-being of the many groups that make up the agricultural production sector (farmers by type, size, tenure status, geographic location, and other common groupings).

Society, through the legislative process, has evidenced a continuing commitment over the years to public programs for improving the incomes of agricultural producers. Given this commitment, the questions faced by policymakers are:

- Which farmers need income support?

- How much support is needed?

- On what basis is this support to be provided?

- How is the income transfer to individual farmers to be effected?

First parity and more recently COP were embraced by policymakers as the only available and workable indicators of the economic health of the various segments of the agricultural sector. Agricultural economists were successful in convincing the body-politic of the limitations and inherent deficiencies in the formula-calculated parity prices. But, once parity was thrown aside, we then had nothing to offer as a replacement other than COP.

What Tom Miller (and others) is saying is that estimates of individual commodity COP do not provide good indications of farmers' economic well-being or of the financial health of the farm business. Thus, COP is a poor device to use in determining if income assistance is needed and, if so, how much. I would also suggest the additional questions being raised--about farm-to-farm and regional COP variation, the distribution of costs, the quantities produced and numbers of producers at various cost levels, the size of farm-cost relationships, and others--to be implicit indications of the limitations of COP for policy purposes. They are, thus, attempts to gain information on the financial health of farmers which COP, as a concept, is simply unsuited to provide.

One of the first and most basic questions in producing statistics is, statistics for what purpose? In this case, the COP statistics are for policy purposes--for price and income program support, programs whose purpose is to enhance farmers' economic well-being. Yet, as Miller and others point out, they are severely limited in use for this purpose. This is the dilemma that I see. As a practical matter, the dilemma cannot be immediately resolved. While the two themes cannot be fully separated in this workshop, it is important that the latter be recognized as you develop your plan of work. Since policymakers have already elected to use COP, you must still discharge your responsibility to make these estimates and related information as accurate and as informative as possible.

As Roy Van Arsdall pointed out, there is in actuality no single answer to the question of COP statistics for what purpose. The estimates you produce are used not only by policymakers but also by researchers, farm managers, agricultural businesses, farmers, and others for a wide assortment of purposes. However, I would contend that the estimates produced by USDA under the congressional mandate cannot be all things for all people--the congressional mandate dictates the primary purpose (policy) that must be recognized and then all other uses must be auxillary to that. Recognizing the primary use for the estimates should serve as a guide to assist you in reaching some of the planning decisions that you must make shortly.

It was also noted in earlier papers that the Firm Enterprise Data System (FEDS) was originally designed to provide research information on COP. It was not developed to provide COP information for policy purposes, even though it has now been placed in that role. I, too, agree that the integrity of that system must be maintained, and that it should not be changed at every whim. But, some changes to better adapt FEDS to the present purpose of providing COP information for policy purposes are necessary.

I shall direct my remaining remarks to more specific topics.

Land Charges

The question was earlier raised for discussion as to whether you must include an estimate for the land input, since this is perhaps the most controversial of the cost

components. I do not think you can avoid doing so. We are all well aware of the many inherent problems in obtaining an estimate for this cost component, and of the inevitable criticism regardless of how you do it. For most crops, this is the largest single input cost and will be an important aspect of future policy considerations. If you do not provide estimates, others will do so as they engage in the policy deliberations. But you are in a better position to provide such estimates as part of your ongoing program than anyone else I know.

We are all familiar with the conceptual problems presented by land. It is both a production input providing an annual service and an investment item little different from stocks and bonds. The first question to confront here is: How is the land input to be viewed? And, again you are faced with the dilemma of COP estimates being used for purposes for which they are not well suited. If you agree with the assertion that COP estimates are not measures of economic well-being (not good ones, anyway), then it seems to me the interest is only in determining a charge for the annual use of the services of land in the production of agricultural commodities. However, to be consistent, it would seem that if you tend to the view of COP as some measure of economic health, then some account must be taken of the investment attribute of land as well. The change in wealth that occurs from the land appreciation must also be considered.

I tend to agree that providing an estimate of the annual value of the service of the land input is perhaps the most pragmatic choice, even for the present purposes. For this, using the rental value of the farmland immediately suggests itself. However, as was pointed out by Allan Mueller and others, there are practical problems with this approach even where there is an active land rental market. Even if you attempt to measure only the contribution to the production process of the services of land, many difficult problems arise with the rental market. How do you value these services when the rental market is imperfect, thin, or nonexistent, as is the case in many production regions of the country? The problem of imputing a value for this service must still be confronted.

Credibility of Estimates

The official estimates you provide will always be subject to close scrutiny and criticism, as I noted above. The only solid defense you will have is your professional base--the scientific base mentioned by Stovall and Hoover. Others must be able to understand fully what you have done and, if repeating your procedures, to obtain the same estimates. Your assumptions and procedures may be called into question, so they must be made explicit. And you must provide a rationale for the choice of one rather than another.

An important determinant of credibility is understanding. I would suggest that a concerted and continuing educational effort to increase the understanding of COP would be very worthwhile. You must continually make an effort to help the policymakers (especially their staffs) and others to understand the concepts, what is being assumed, what is being measured, the estimates and their limitations, and what they mean. The CED working paper, "Understanding Cost of Production," has proved most useful in this regard. It may merit updating and publishing with a much wider distribution.

In better informing policymakers, farm leaders, and farmers about cost of production estimates, the land grant university and extension economists can assume an important role. These economists can be most helpful to you in reaching the client groups they serve. To do so, they will need leadership from you--indications from you that this information is important, a supply of informational materials, and your assistance in making the effort. The misunderstandings surrounding COP estimates were painfully evident during the recent farm protest movement and provide strong justification for steps to assure a better understanding of COP estimates.

Variability of Costs

The inherent limitations in national average point estimates have been noted in earlier papers. I also am aware of the practical problems in going beyond this to provide distributional and other information. For policy purposes, it is important to recognize the variability among production areas and the distribution of costs (how many farmers and how much production coincide with each cost level). However, given the available funds and personnel, and given the techniques now used to gather and process the basic data, providing distributional information does not seem possible nor perhaps even feasible. To provide such information would require substantially increased resources and perhaps even a new system of providing estimates. Rather than attempt this, one could argue that the available resources would best be spent on improving the accuracy of the point estimates.

The importance of accuracy in the point estimates is illustrated by noting the magnitude of the potential payments associated with each 1 cent of the target prices. A 1-cent error in the national average target price is associated with either an added cost to taxpayers or an underpayment to farmers of the following magnitudes:

Corn--about $50 million
Wheat--about $18 million
Cotton--about $50 million

Including the other feed grains and rice brings the total associated with each 1 cent to about $150 million, underscoring the fact that the costs of errors are high.

Concluding Observations

This workshop examination of COP--the concepts and measurement problems--clearly emphasizes the inherent limitations of COP for use in agricultural policy as the basis for determining needed income support. While not the immediate concern of this workshop group, that should underscore the need for development of alternative and improved measures of the economic well-being of all segments of production in agriculture. That would also suggest the need for increased attention by economists to devise and analyze potentially feasible new public program structures to meet the objectives of national policy.

COP remains as the instrument for use in the near future. Your present efforts at improving the quality of the estimates are well directed. Along with that, however, a greater effort to increase understanding and improve the credibility of the estimates is warranted.

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