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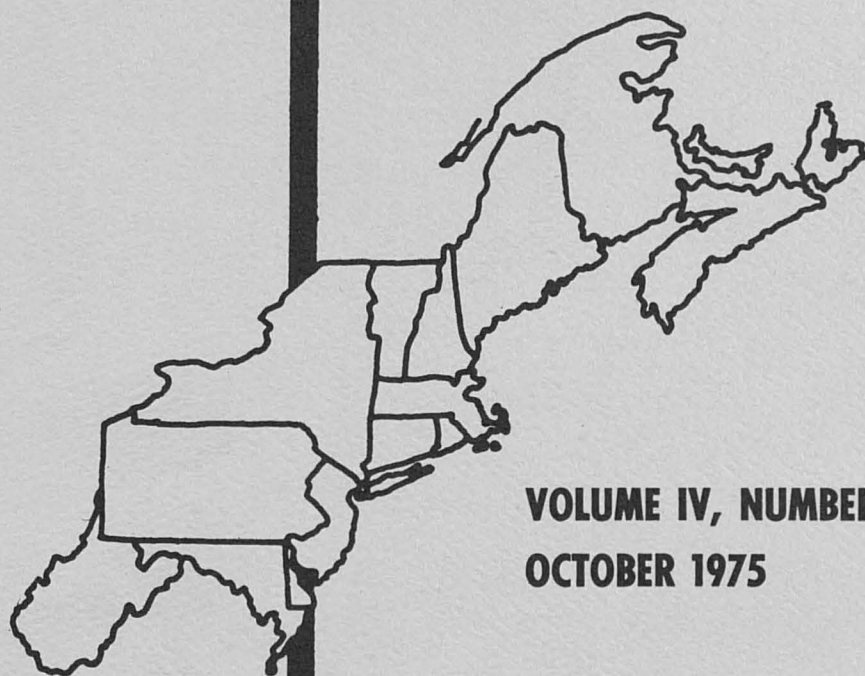
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A SYSTEMATIC APPROACH TO AGRICULTURAL ENTERPRISE DATA

Ronald D. Krenz
Agricultural Economist
Commodity Economics Division, ERS
Oklahoma State University

The Commodity Economics Division of ERS has recently embarked on the development and implementation of a systematic approach to the construction and maintenance of agricultural enterprise data. This paper describes this system, its objectives, dimensions, some problems anticipated in its operation and some of the potential direct and indirect benefits expected for the profession.

History

Although enterprise budgets have long been a major item in the tool kit of farm managers and production economists, it was not until after development of computers and particularly the linear programming algorithm that model builders began to design firm, regional, and interregional models requiring large volumes of enterprise data. At times, model builders have even pressed the upper limits of computers, but considerably agreement could be found with the opinion that our models and computers have outstripped our enterprise data. The credibility of many sophisticated regional and interregional models has suffered from the low quality of the enterprise data that was used.

Farm enterprise data have generally been deficient in two major aspects: (1) the enterprise data have not been comparable across commodities or regions and (2) they have not been maintained or updated in a consistent manner over time.

Causes of these deficiencies are apparent. With the number of different farm resource situations and the variety of production techniques found on farms, the number of enterprise budgets needed to give broad coverage of even one commodity is very large. In the past, substantial time has been required to build an enterprise budget, hence, a large number of analysts have been needed to get broad geographic coverage for a single commodity. Expanding the number of analysts added the element of different analytical approaches to the problem. Participants in the regional adjustment studies of the 50's and 60's will recall the tremendous amount of time spent building enterprise budgets and the problems involved in obtaining agreement on procedures. Like myself, you may also feel disappointed over the fact that these budgets were never updated. However, the cost in researchers' time would have been tremendous.

Hence, what is needed is an efficient method of developing and maintaining enterprise budget data. Such a system should have the following characteristics: (1) it requires minimal time of the professional economist in gathering data, (2) it uses a standardized approach to budget development (3) it should have the methodology for comparing budgets across regions and commodities, and (4) it facilitates updating of these budgets as prices and technology change over time.

The Firm Enterprise Data System has many of these characteristics. Certainly, it is not a solution to all budget data problems, but it is still in the process of refinement and it is superior to any of our old procedures.

FEDS System

The basic tool of the FED System is the Oklahoma Budget Generator.^{1/} The Oklahoma Budget Generator is a computerized program with the following components: (1) a machinery complement listing of all machines that might be needed in a series of budgets including repair and depreciation coefficients, estimated hours of life of machines, purchase prices, fuel parameters, etc. (2) a set of standardized names for inputs and products, (3) a set of parameters including labor prices, interest rates, machinery prices, fertilizer prices and other standardized parameters that can be varied from region to region to reflect regional differences or can be standardized across regions as desired and (4) for each individual budget a list of the items produced, the purchased inputs required and the field operations performed with each machine used by the enterprise.

The machinery complement contains such items as depreciation coefficients, repair coefficients, estimated hours of annual use, length of life of machine, fuel parameters, speed, width and field efficiency and machinery prices. These are standard engineering coefficients commonly used in development of budgets by hand.

With this data specified, the computer calculates the hours required and per hour costs for interest, taxes, insurance, depreciation, repairs, and fuel for each machine used by the enterprise. To these costs are added other purchased input costs. Total receipts are computed and a summary output form printed. The data used in developing the budget are stored in the computer on a disc or tape

^{1/} Walker, Rodney L. and Darrel D. Kletke "The Application and Use of the Oklahoma State University Crop and Livestock Budget Generator", Res. Report P-663, Ag Econ. Dept., OSU, July, 1972.

and procedures are available for modifying any of these items. Hence, the Oklahoma Budget Generator provides us with standardized procedures that we need and with a facility for storing and updating these data.

The format of the budget printout itself is quite flexible. Obviously, any style of format can be written so the problem becomes essentially one of deciding what output format is desired. An example of the output format currently being used by FEDS is presented in Table 1.

An estimate of the acreage to which a crop applies or the number of head to which a livestock budget applies is stored with each budget. This estimate serves two purposes. It indicates the relative importance of each budget, and secondly it provides an aggregation factor.

Recently an aggregation program was developed for the crop budgets. With this aggregation program the acreages of each budget can be multiplied by either an input requirement in the individual budget or by the final costs and returns figures. For example, we can estimate the total gallons of fuel used to produce corn in the United States during the month of June or the total amount of nitrogen fertilizer used on a particular crop in a state, region or in the United States. This program can also be used to provide state, regional or U. S. weighted average total cost of production estimates. In some cases this procedure provides some of the best estimates that are available on input use. In other cases, it constitutes a bridge across the gap between micro and macro and allows comparisons between estimates available on aggregate input use and individual budget assumptions.

Recently, data in the FEDS system was used to produce estimates of energy use on major crops in the United States. The aggregation program was used to estimate gallons of diesel fuel, gasoline and other types of fuel used in field operations by crops in the United States. These estimates were made by month, by crop, by state, and totals for regions and the U. S. Crops included were the major feed grain crops plus wheat, soybeans, cotton, rice and peanuts.

The FEDS staff is currently at work on development of another computer program to be used primarily for comparing budgets. This is simply a sort and print routine which will tabulate input items across commodities or regions and present them in a condensed form to facilitate comparisons. Comparability of budgets is considered to be one of the major tasks of the FEDS staff.

Since it was anticipated that the major uses of the FEDS budgets would be in interregional supply and competition models and for aggregate supply questions relative to government supply management programs, budgets have been developed that attempt to reflect average

Table 1
Soybeans - Northeastern Iowa

1973

	UNIT	PRICE OR COST/UNIT	QUANTITY	VALUE OR COST PER ACRE	COST PER UNIT OF PRODUCTION
1. GROSS RECEIPTS FROM PRODUCTION:					
SOYBEANS	BU.	5.500	32.500	178.75	
TOTAL RECEIPTS				178.75	
2. VARIABLE COSTS:					
PREHARVEST:					
GRAIN SEED	BU.	6.870	1.100	7.56	0.23
NITROGEN	LBS.	0.082	1.000	0.38	0.00
PHOSPHORUS	LBS.	0.244	3.100	0.76	0.02
POTASSIUM	LBS.	0.062	7.800	0.48	0.01
PESTICIDES	ACRE	5.150	0.860	4.43	0.14
PESTICIDE APPL.	ACRE	1.700	0.100	0.17	0.01
TRACTOR FUEL & LUBE	ACRE			1.43	0.04
TRACTOR REPAIRS	ACRE			1.15	0.04
EQUIP FUEL & LUBE	ACRE			1.90	0.06
EQUIP REPAIRS	ACRE			2.70	0.08
MACHINERY LABOR	HRS	2.210	4.095	9.05	0.28
INTEREST ON OP. CAP.	DOLS	0.080	12.177	0.97	0.03
TOTAL PREHARVEST				30.68	0.94
HARVEST:					
CUSTOM COMBINING	ACRE	7.300	0.200	1.46	0.04
CUSTOM HAULING	BU.	0.050	6.500	0.32	0.01
EQUIP FUEL & LUBE	ACRE			0.45	0.01
EQUIP REPAIRS	ACRE			0.52	0.02
MACHINERY LABOR	HRS	2.210	0.439	0.97	0.03
INTEREST ON OP. CAP.	DOLS	0.080	0.691	0.06	0.00
TOTAL HARVEST				3.77	0.12
TOTAL VARIABLE COSTS				34.45	1.06
3. INCOME ABOVE VARIABLE COSTS				144.30	4.44
4. OWNERSHIP COSTS (DEPRECIATION, TAXES, INTEREST, INS.)					
TRACTORS				3.68	0.11
MACHINERY & EQUIP				11.00	0.34
TOTAL OWNERSHIP COSTS				14.68	0.45
5. RETURN TO LAND, OVERHEAD, RISK & MANAGEMENT				129.62	3.99
6. LAND CHARGE (SHARE RENT)				82.97	2.55
7. MANAGEMENT CHARGE (5.0% OF GROSS RECEIPTS)				3.94	0.27
8. TOTAL OF ABOVE COSTS				141.04	4.34
9. RETURN TO OVERHEAD & RISK				37.71	1.16
FOOTNOTES: ACRES REPRESENTED BY THIS BUDGET ARE HARVESTED ACRES.					12/12/74
20% CUSTOM COMBINED AND HAULED.					FEDS
					01/29/75

ENTERPRISE CODE: 981009110
 AREA CODE: 3/19/3/0
 FILE NO. 421
 ACRES REP. BY BUDGET: 1028.0 (000) ACRES
 ANNUAL CAPITAL MONTH: 10

MACHINERY COMPLEMENT NO. 11
 NAME SET: 1
 PARAMETER SET: 19
 HARVESTED ACREAGE AS PERCENT PLANTED: 100.00
 EDITION NO. 0

DATE PRINTED: 01/29/75

current technology. At a later date additional budgets may be developed for other farm types or levels of technology or farm sizes.

Data to be used in the development of these budgets come from a variety of sources. Since the budgets generally reflect average production technology for a relatively large area, SRS data are used wherever possible for yields, acreages, fertilizer levels and in some cases production practices. SRS can also supply input and product price data. In addition, state experiment station and extension service staff are called on for a variety of other data items. Future data sources include surveys made by ERS to estimate the costs of producing crops and dairy products as required in the 1973 Farm Bill. The first of these surveys was taken in January, 1975. Data obtained from these surveys will be used to estimate machinery sizes, types and operations performed.

The prices and yields in the budgets will be updated annually using SRS and census data. Updating of the technological coefficients is anticipated approximately every three to five years using primarily the cost of production surveys mentioned above.

Completed budgets are considered public property available to any and all users. Currently 100 copies of each completed budget are printed with 50 copies distributed within ERS and about 25 distributed to state research and extension staff. The remainder are kept for filling special requests.

These budget data can also be obtained on magnetic tape if further computer processing is desired. Also, individual budgets may be modified on a fee basis through the Ag Econ. Dept. at Oklahoma State University.

A decision to develop this particular type of data system within ERS was made late in 1973. In early summer of 1974 a small staff was assembled at Oklahoma State for this purpose. One of the first tasks of this staff was to develop some systematic procedures for covering all of the major crop and livestock enterprises in the United States. A set of production areas were defined. Also area and enterprise coding systems were devised. These systems enabled us to selectively search and retrieve any budget or group of budgets by area or commodity for comparison or other purposes.

Since the summer of 1974, the major task of the FEDS staff has been the development of crop budgets. Currently, we have on line approximately 750 such budgets. Sufficient budgets are available to cover the bulk of the production of corn, wheat, oats, barley, sorghum, soybeans, cotton, and rice in the United States. Work is also being done on peanuts, tobacco, sugar beets, sugar cane, and potatoes. Needless to say, the FEDS staff, composed of only

four professional economists, has been helped immensely by other economists in ERS. In fact the responsibility for developing these budgets lies primarily on the commodity groups within CED rather than on the FEDS staff itself. The major responsibility of the FEDS staff is to process budgets, work on problems of comparability and update these budgets over time.

It must be pointed out at this time that our coverage of crops in the Northeast is practically nonexistent. This is primarily due to the fact that we have only one economist in the Commodity Economics Division for the entire Northeast. This one individual stationed at New Hampshire, George Frick, has initiated some work on crop budgets for the Northeast. It is hoped he will receive as much help as possible in the future.

The development of livestock budgets has not proceeded as rapidly. Quite clearly the basic budget generator package is more adaptable to crops than to livestock. Operations in livestock enterprises can not be specified as times over as field operations are for crops. Further, the standardization of production processes is much less advanced with livestock than with crops. As yet, a budget generator package has not been constructed to estimate the machine and man hour requirements for livestock as it does for crops. Hence, the budget generator procedure does not give us the efficiencies in livestock budget development that we have in crops. However, it does provide the facility for budget comparison, modifying and updating.

Presently, the Commodity Economics Division has five regional analysts in charge of development of budgets for beef, hogs and sheep. At this stage, budgets are under development for each of these enterprises in all regions of the country. We have put together many of the machinery and equipment requirements needed for livestock but as yet do not have all of the purchased inputs, system types and production items required by all of the enterprises.

The budget generator package does offer some unique possibilities in regard to livestock budgeting. It is visualized that once livestock budgets are on the system, these budgets can be reprocessed monthly or quarterly with new feed costs and input prices so that new break even cost of production estimates can be computed as desired.

This would be similar to the current arrangement between Oklahoma State University and Associated Milk Producers Incorporated. Their arrangement provides cost of production estimates for dairy approximately four times a year using the Oklahoma Budget Generator. Every three months new feed and other input cost data are gathered and rerun through a basic budget representing a herd of 80 cows.

producing 12,000 pounds of milk.

Typical Farm Budget Series

Under consideration at the present time is the development of a series of typical or whole farm budgets. These farms will represent major types of farming situations throughout the United States.

The whole farm budget series would meet two needs: (1) to provide estimates of the current net incomes of farmers as influenced by prices, yields and costs and, (2) to have ready access to a set of farm resource and cost data which can be used for quick analyses of impacts of various price and policy variables on net incomes of typical farms.

The first need here is one previously met by the now discontinued cost-and-return series which provided a general type of economic information highly demanded by members of the general public. It did not provide data for analytical purposes and was not intended for that purpose.

All enterprise data for the typical farms will be taken from the enterprise budget system. Hence, it will be similar to a computerized cost-and-return series. Additional data on farm resources, enterprise mix and overhead costs will be provided annually by the cost-of-production surveys and by the appropriate commodity group in CED.

Processing and Distribution Firm Budgets

Although the Oklahoma Budget Generator is designed for on-farm enterprise situations, the same type of methodology can be put to use in the processing sector. With appropriate programs, enterprises such as rice dryers, grain elevators, flour mills, feed mills, canneries, dairy plants, etc., could be budgeted. New budget generators need to be built to give the same advantages in regard to updating, automatic weighting, comparability and machine computations that is now available in the farm enterprise system.

Data on processing and distribution firms is currently needed in ERS for marketing margins work. And ERS has the responsibility for estimating cost and profit components^{2/} for 14 selected commodities and for all food in the aggregate.

I think this is a topic that represents a challenge to our profession. Cost data on these types of firms are just as useful to their owners and managers as are data on farm costs to farmers.

^{2/} See "Developments in Marketing Spreads for Agricultural Products in 1972." ERS - 14 (1973), Washington D. C., June 1973.

Similar problems of comparability across commodities, regions and over time are also faced. I would like to see members of our profession accept this challenge and tackle the conceptional and programming problems involved in development of uniform general procedures for cost estimation in these types of enterprises.

Development of Cost of Production Projections

The series of budgets that we have on the system at present can be called our historical series. They are developed using primarily data that are reported by SRS and other agencies and as a result are generally based on conditions as they existed one or two years in the past. For many policy matters more current cost estimates are needed.

Therefore, a procedure to project costs for the upcoming crop year using historical budgets as a base was initiated this past winter. The assumption was made that the size and types of machinery used could be held constant. Projected yields and input prices were applied to these budgets to provide projections for 1975. Our first attempt at this was successful but somewhat cumbersome. Further refinement of procedures is indicated.

Plans for the future call for making some types of projections periodically throughout the crop year. For instance if some policy decision is made every October, new projected cost estimates for that crop can be made one or two months before the decision date. Hence, we visualize a regular schedule of projections runs throughout the year.

The Mandate Cost of Production Studies

In 1973, Congress passed an Agricultural and Consumer Protection Act which requires the Secretary of Agriculture to provide the Congress with annual cost of production estimates for dairy, wheat, feed grains and cotton. This responsibility of course came to ERS. The cost-of-production surveys initiated in January of this year are a result of this mandate. Longer run plans in ERS call for merger of this cost-of-production study group and the FEDS System. It is anticipated that the cost of production data obtained from such surveys will be used in the FEDS System although such surveys will not be taken every year. Hence, it is anticipated that the FEDS System may be used to make the annual estimates required under the 1973 Farm Bill.

Data Problems

Early in the paper I mentioned the problem of data gathering for budget studies. It is my opinion that the budget generator procedure offers us not only some economies in processing and manipulating data but also in the types of data collected. With

this budget generator, it is not necessary to survey farmers to determine time spent performing particular operations or money spent on fuel, labor, or repair bills, etc. Published sources for data on input prices and yields are used. The budget generator provides estimates for the hour requirements of labor and all machinery. Hence, the only additional information needed from the farmer is some indication of the size of equipment used and the operations performed.

This simpler type of information can be gathered quite readily with mail questionnaires rather than through personal interviews. The farm management research staff at North Dakota State University obtained satisfactory data for the budget generator through the use of mail questionnaires.^{3/} Therefore, I feel that this budget generator approach shows great promise of reducing our data gathering costs.

Basic Conceptual Problems in Computation of Production Costs

One of the major problems that still remains and that has not been solved by the budget generator is the conceptual problem in regard to evaluation of residual claimants. The major factors here of course are land and management. The land input, a major stumbling block, constitutes a large cost item.

One of the principal reasons for the importance of land is that in our current agricultural legislation, target prices will likely be established which will attempt to reflect cost of production. The problem is "Should we set target prices at levels to support returns to land at some specified level?" How should these returns be quantified?

The FEDS System has designed three ways of including land charges in the budgets. These include: (1) a value determined by multiplying an interest rate times a land price, (2) a crop share rental arrangement basis and (3) a cash rent charge. Problems are encountered with each of these methods. Since land is a residual claimant, the price of land inevitably becomes a function of either current, past or expected product prices. Personally, I prefer the crop share computation. Given the usual sharing arrangements of production and input costs, we have devised a system in the budget generator that allocates to land a share of the product minus the usual share of the expenses that the land lord pays. Thus, land would receive its usual share regardless of what the product price

^{3/} Heid, Larry J., Roger G. Johnson and Leroy W. Schaffer. A series by areas in North Dakota, entitled "Small Grain Production Practices and Size and Type of Machinery Used". Statistical Series No. 12-19, Dept. of Ag Econ., North Dakota, Agr. Ext. Stat., Fargo, North Dakota, April, 1973.

is. However, these problems are not all resolved and this remains as one of the theoretical questions that our profession needs to further address itself to.

Another unsolved problem is the allocation of farm overhead costs. This is both a conceptual and a data problem. Some data may be obtained in the cost-of-production surveys but allocation procedures are still missing. This overhead question is a mute point with regard to supply questions. Generally decisions are made in regard to production ignoring overhead costs, however, such overhead cost items are important if target prices are determined by the cost of production.

Summary

In conclusion there are three points that I would like to make. First, we do not regard this budget enterprise data system to be the sole property and responsibility of ERS. It is a system that can be useful to the entire profession and hence, I feel, should be supported by the profession. Working together with this methodological approach we can develop data that are useful to all members of the profession and data of the type that we have never had access to in the past. With such data we can do a variety of useful supply analyses and interregional competition studies. You can aid us with this system by helping to plan data gathering methods, in helping to appraise the completed budgets for accuracy and comparability, and in being considerate and understanding of our mistakes as we proceed in this developmental stage.

Secondly, with the current shift away from parity concepts towards target prices and possibly towards cost of production as a basis for setting target prices, the need is ever stronger for us to present a uniform and consistent set of cost of production estimates. If the USDA presents one cost of production figure and state people present different cost of production figures, we will be caught in a cross fire by commodity interest groups in estimating correct and proper target prices for our commodity programs. I think this behooves us to work together in presenting data that will be the best estimates our combined efforts can produce.

And finally I want to stress that what we are trying to develop in this project is a system of budgets and not just a group of individual budgets. We expect to put much emphasis on comparability of data across commodities and regions and much emphasis on keeping the budgets updated over time. I think this effort will be rewarded in terms of better analysis and better answers to our research and policy questions.