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A Farm Panel as a Source of Income and Expenditure Data

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To investigate the possibilities of establishing a representative sample of farms, using a system of data collection wherein farmers would report monthly their farm business expenses and receipts over a 12-month period, the U.S. Department of Agriculture entered into a cooperative agreement with Michigan State University in 1956. The Cooperative Extension Service had already established a farm record-keeping project wherein volunteer Michigan farmers submitted monthly financial reports to the Agricultural Economics Department of the University, which in turn processed the data currently using punched card equipment. The general success of this project and the need for current and accurate farm data by Government agencies led to the decision that such a system be offered to a group of farms selected on a probability basis. The study reported in this article was concerned more with the technical problems involved in establishing and maintaining a representative sample reporting certain data monthly than it was with the data so collected. If the technical problems could be economically surmounted, further consideration could be given to establishing such a system over a wider area—or an entire State or region, or even nationally. In this paper, the author describes the method of data collection used and the type of information obtained, discusses the problems of establishing and maintaining the sample, and evaluates the system in terms of one year of experience and its future potentialities.

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THE METHOD used in the study reported in this paper is one that was developed on an experimental basis at Michigan State University during 1955 and 1956 and adapted for the entire State in 1957. It is now used in an extension record-keeping project involving about 1,200 participating farmers in Michigan.

The sample in the study constituted 299 of the total 1,700 that used the method during 1957. Routine procedures in this study were the same as for the extension "volunteers," but the 1,400 extension cooperators received more individual attention than our sample because of the service aspects of that project. The procedures described below apply identically for all participants.

The cooperators provide both monthly and annual data. The annual information includes a beginning and ending inventory of real estate, machinery and equipment, feed and growing crops, and livestock by age and kind, plus such other pertinent data as cropping program, livestock performance, and family labor used in the business.

The monthly information is provided by the cooperators as a listing of all financial transactions on standardized printed forms which keep receipts separate from expense items. These forms provide space for the farmer to list without classification or in any particular order (usually chronological), the expenses, receipts, and capital

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investments for the month, showing amount and date of the transactions. Original copies of these listings are mailed in preaddressed envelopes to Michigan State University, and the duplicate copy is retained for reference by the farmer.

When the farmers' reports are received, the following operations take place:

1. The report is "checked in." This involves recording the date received, making sure the farmer has used the correct identification number, perusing the report for problems that may require special handling, and routing it either to a supervisor for special preliminary handling or to a coding clerk.

2. A code number is assigned to each transaction; the number is based on the description recorded by the farmer. It contains 5 digits, the first of which represents 1 of 9 possible major categories, such as farm operating expense, machinery purchased, improvement investments, livestock purchased, farm receipts, and so on. The second and third digits represent 7 of 34 intermediate types of farm operating expense, 23 intermediate types of farm receipts, and so on. The fourth and fifth digits represent further detail within the intermediate class. To illustrate, a baling expense is coded 10902 in which "1" means farm operating expense, "109" means the ninth type of farm operating expense (machine hire and custom work), and "10902" means the second type of custom expense (baling). This classification scheme permits stratification and tabulation by major, intermediate, or minor classes. There are approximately 550 possible code numbers in use for all farms, but ordinarily not more than 100 of these are active for any one farm.

3. Tabulating cards are punched and verified for each transaction. When punched, these cards contain the farm identification number, item code, item quantity, and dollar value of the transaction divided between farm operator and landlord.

4. Standardized alphabetic descriptions of expense and income of investment items are gang-punched in each card using a predetermined wording assigned to each number.

5. The cards are arranged by code number and tabulated quarterly to show quarterly totals and totals-to-date for all categories of expense, income, and farm investment for each cooperator.

6. The individual quarterly reports are mailed to the cooperator for his use.

7. Annual summaries for each cooperator are prepared from the cards and mailed to the cooperator. These summaries include annual totals and a detailed breakdown of certain categories for use in income tax reporting.

Establishing and Maintaining a Probability Sample

We depart now from the total on-going record-keeping activities at Michigan State University to consider only that group of farmers selected by random sampling techniques.

A sample of 299 farms was drawn from four counties. The counties were selected by judgment to represent differences in levels of income, type of farming followed, and extent of off-farm employment. The sample of farms within counties was designed by Earl E. Houseman, Director, Statistical Standards Division, AMS, U.S. Department of Agriculture. Probability area sampling techniques were followed.[1] Area segments within counties were drawn at random and it was intended that each farmer within each segment drawn be contacted by an interviewer.

Once the fieldworker had made contact with the person or persons in position to make a decision about participation, he was asked (1) to determine his eligibility for participation, (2) to attempt to enroll the farmer in the project if he was eligible, and (3) if eligible, to fill out a questionnaire dealing with farm characteristics whether or not enrolled. A farmer was considered eligible if he (1) sold $250 worth of farm products in 1956, (2) farmed 3 or more acres of land, (3) intended to farm in 1957, and if (4) the farm's bookkeeper lived in the designated segment. Fieldwork was done by trained agricultural college students during the last 2 weeks of December 1956.

Results of the fieldwork are summarized in table 1. Approximately 53 percent of the contacts made were considered eligible, and 44 per-

[1] Houseman, Earl E. APPLICATION OF PROBABILITY AREA SAMPLING TO FARM SURVEYS, in U.S. Department of Agriculture, Agr. Handb. 67, Washington: U.S. Govt. Print. Off. May 1954.

TABLE 1.—*Enrollment rate and response to interview by farmers contacted in the establishment of the Michigan State University probability sample of record-keeping farms, December 1956*

County	Number of farmers						Enrollment as percentage of—	
	Calls made	Contacts made [1]	Eligible	Refused [2]	Schedule only [3]	Enrolled w/ schedules	Eligible contacts	Total contacts
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Percent*	*Percent*
Huron	317	261	159	30	39	90	57	34
Kalamazoo	631	424	198	61	62	75	38	17
Mason	324	224	103	15	28	60	58	27
Shiawassee	456	348	218	84	60	74	34	21
Total	1, 728	1, 257	678	190	189	299	44	24

[1] The number of "face-to-face" contacts made with farm operator or his wife.
[2] The number refusing to answer schedule questions or to enroll.
[3] The number answering schedule questions but refusing to enroll.

cent of this number were enrolled (at least considered so by the fieldworker). It was found later that 81 of the 299 enrolled failed to submit their first report and hence could not be considered officially a part of the project. Of the 678 considered eligible, 28 percent refused to enroll but answered the survey questions, while the same number refused both to enroll and to provide the needed supplementary information.

Discussion with the fieldworkers yielded general agreement on the following experiences: (1) Consent to participate in a 12-month program of this type required more thoughtful consideration than most farmers were willing to give to it. It was easier for a farmer to say "no" and let the matter drop than to consider seriously the advantages to him as an individual or to others who might make use of the information collected. (2) Once the prospect decided not to enroll he tried to terminate the interview, and it was difficult for the fieldworker to obtain enough of the necessary information to complete a field schedule. (3) In general, farmers refused any information until the objectives of the project were explained and the proposition to enroll in the project was presented. (4) Many older farmers and part-time farmers could see little value to themselves in the program. Whereas the rules for eligibility were relatively lax, there was a tendency for prospects prematurely to declare themselves ineligible and for the fieldworker to accept this judgment. This led to a higher proportion of "ineligibles" than was anticipated.

On the basis of the sampling experience, one is inclined to conclude *a priori* that the methods used cannot yield a representative sample. However, further study of the sample was made. The characteristics of the enrolled group were compared with the characteristics of the refusals who responded to the enumerative survey. Also, the characteristics of the enrolled group who sent in 12 reports were compared with those of this group who did not complete the year.

The comparison of enrollees with those refusing to enroll yielded the following results: (1) The average (arithmetic mean) age of farm operators who enrolled was 6 years less than those responding to the survey but refusing to enroll. (2) The tillable acres per farm averaged 121 for those enrolled and 81 for those not enrolled. Those enrolled operated on the average 20 more acres in Mason County, 31 more in Huron County, 34 more in Kalamazoo County, and 58 more in Shiawassee County than those not enrolled. The farms were classified into groups—1 to 59, 60 to 119, 120 to 790 acres, and so on. Chi-square values were computed—they indicated a significant difference at the 10-percent level for Shiawassee County only.[2] (3) When farms were classified by type of farm according to source of income and chi-square values were computed to compare the distributions, it was found again that only Shiawassee County indicated significance at the 10-percent

[2] Probability of 9 out of 10 that a difference no larger than the observed was due to chance alone.

TABLE 2.—*Number of reports submitted by enrolled farms in the Michigan State University probability farm sample, 1957*

Number of reports submitted	Number of farms
None	81
1 to 3	28
4 to 6	19
7 to 11	10
12	161
Total "enrolled"	299

level. (4) When farms were classified by the amount of 1956 sales of farm products and the chi-square values were computed to compare these distributions, it was found that all counties indicated significance at the 10-percent level.

These results appear to indicate wide differences between groups when certain characteristics are compared, but little difference when other characteristics are compared.

Of equal interest to the comparison between cooperators and noncooperators was a comparison between those who enrolled and those who did not submit 12 monthly reports. This comparison gives some insight into the problem of maintaining a sample once established.

The extent of participation is summarized in table 2. The 161 farmers who completed the year represent 51 percent of the number considered enrolled and 74 percent of the number submitting one or more reports. To study sample changes within the year, it was decided to compare the 161 completions with the 299 enrolled. Comparisons were made for age of operator, total acreage per farm, type of farm, and level of income (table 3).

Chi-square values were computed to test the hypothesis that the distributions at the beginning of the year did not differ significantly from those at the end. These conclusions were reached:

1. There was a negligible change in the sample with regard to age of operator.

2. There was a significant change in the sample with regard to total acres per farm. The farms averaged 154 acres at the beginning and 148 acres at the end of 1957. These averages betray the significant changes occurring in both the large and the small farms, which tended to offset each other.

TABLE 3.—*Chi-square values computed from selected characteristics of record-keeping cooperators at the beginning and end of 1957*

Basis for comparison	Degrees of freedom	Computed chi-square	Chi-square distribution value at 10 percent level
Age of operator	4	0. 698	1. 064
Total acreage per farm	10	17. 067	4. 870
Type of farm	4	1. 227	1. 064
Level of income	3	2. 184	0. 584

There appeared to be more change in the sample for size of farm than for any characteristic compared.

3. As the relationship between size of farm and level of income is close, the heavy losses in small farms resulted in heavy losses in low-income farms. Of the initial 65 farmers with 1956 farm receipts of less than $1,200, only 28 completed the year. All of the initial 8 farmers with 1956 farm receipts of more than $25,000 completed the year successfully. The sample changed significantly with regard to level of income.

4. Although significant at the 10-percent level, there appeared to be little change in the sample with regard to type of farming. The farms were stratified similar to census classes (dairy, livestock, poultry, cash crops, and general) and nearly proportionate losses occurred for each class.

Evaluation

Evaluation is made in terms of the prospects of establishing and maintaining a representative sample, the costs, and the potentialities of a data-collection system in which expenses, receipts, and investments are reported monthly.

It was found that farmers are slow to commit themselves to a proposal that involves a full year of reporting confidential financial information. There is reason to believe that the enrollment rate would have been higher if the persons contacted could have had a longer time in which to weigh the merits of the proposal and to get a more detailed schooling in the objectives and procedures of the system. Also, more experienced and perhaps older interviewers could be expected to obtain a somewhat higher enrollment rate.

TABLE 4.—*Costs of establishing and maintaining the Michigan State University probability sample of record-keeping farms 1956–57* [1]

Item	Total	Average per farm	
		En-rolled (299)	Com-pleted (161)
Field expenses:	*Dollars*	*Dollars*	*Dollars*
Mileage	1, 315	--------	--------
Subsistence	909	--------	--------
Salary	2, 570	--------	--------
Subtotal	4, 794	15. 98	29. 77
Maintenance and operation:			
Labor	4, 875	--------	--------
IBM charges	1, 475	--------	--------
Cooperator supplies	1, 000	--------	--------
Other supplies and services	600	--------	--------
Field followup	683	--------	--------
Professional travel	400	--------	--------
Subtotal	9, 033	30. 14	56. 09
Total field and operational expenses	13, 827	46. 12	85. 86

[1] Does not include (1) overhead costs, such as use of buildings, utilities, calculating machines; (2) about 1/10 man equivalent of residence professional time; (3) about 54 days of county agricultural agents' time volunteered.

Apparently, it is difficult to retain a high level of participation for low-income farmers who operate small farms. This suggests that, if the experiment were repeated, resources would be more effectively used if the population were defined in such a way as to exclude very low-income farms.

Careful records of costs were kept, but, as this study was merged with an on-going record-keeping program, it is not easy to say what the costs would have been had the study been conducted alone. Fieldwork and cooperator supplies were charged directly to this study. Other costs were computed by allocating part of the total Michigan State University farm accounting costs to this project (table 4). To the costs shown may be added perhaps another $9,000 for overhead.

Costs of fieldwork to establish the sample averaged $25.70 per worker per day. This may be compared with $24.86 per worker per day for another enumerative survey of farms, conducted at about the same time. (This was a research project to evaluate a township extension program; it was sponsored by the Kellogg Foundation.) Field costs per farmer providing a full year's records averaged about $30 compared with $23 per interview in the Kellogg survey. Costs of enrolling a farmer in this program are comparable to those for taking a one-time survey, but if properly done, it results in the generation of a continuous flow of data that would be expensive to obtain from repeated surveys. Also, the costs of enrolling farmers would not be repeated for those who participated for more than a year.

Costs encountered in this study were probably higher than would be expected if it were repeated. Lessons learned from the field experience could lead to lower costs of establishing a sample. More importantly, many improvements have been developed in the data-processing procedure of the current extension project, and these could be used. In the present extension project of about 1,200 cooperators, the maintenance and operation costs average about $17 per farm compared with $30 experienced in this study.

Speculation as to the potentialities of a successfully established sample of farms that would report all operating expenses, investments, and receipts currently, is interesting. Among other things, the sample could:

1. Provide more accurate or useful data on prices received and paid by farmers than those provided by sources or methods now being used.

2. Provide information needed in studying certain marketing problems, such as marketing costs experienced in agriculture, effect on farm income of marketing at particular times, comparative returns resulting from alternative market outlets, and others.

3. Provide the opportunity to study farmers' intentions to use capital in specific ways, and to compare these with their actual actions. A preliminary step was taken in this direction in this study. Cooperators were asked at the time of enrollment to indicate the investments in machinery and farm improvements they intended to make in 1957, and when they planned to make them. These intentions were compared with actual investments. A more detailed study of this kind is in progress with the present extension sample.

4. Provide the basis for improved outlook information. When monthly data are available through time, it is possible to observe internal changes taking place in farm operations. When we see how farmers have reacted to certain price

changes in the past, it should be possible to predict more accurately what they will do under similar conditions. Also, when a satifactory rapport has been developed between the University and individual cooperators, many types of supplementary reports from the cooperators are feasible.

The study reported has answered some questions regarding the possibilities of establishing a representative sample of farmers reporting financial information on a monthly basis. The experience gained has been valuable and is expected to lead to other investigations of a related nature.

Evaluation of Agricultural Flood Damage by Airphoto Analysis of Flood-Plain Samples

By Kenneth C. Nobe and Henry W. Dill, Jr.

The United States Department of Agriculture is cooperating in an interagency study to plan for the future development and control of the water resources of the Potomac River Basin.[1] *One assignment undertaken by the Farm Economics Research Division, Agricultural Research Service, is that of appraising both the agricultural damages from floods, and the benefits from alternative combinations of control structures on the main stem and the major tributaries of the Potomac River. Techniques were developed for using sample cross-sectional data and airphoto interpretation, rather than the conventional detailed field surveys, to help us measure agricultural damage from floods. This paper discusses the development of these techniques and indicates how they may be applied to flood-damage studies in other areas.*

ECONOMIC EVALUATION of agricultural damage from floods is an integral part of studies designed to plan for future development and control of land and water resources. It is of particular importance in the design and justification of flood-control and multiple-purpose projects in rural areas. To compute benefit-cost ratios accurate flood-damage data are required, and these in turn are necessary for economic evaluation of individual water-control structures and for comparison of alternative projects. A benefit-cost ratio as used in this type of analysis is defined as "the arithmetic proportion of estimated average annual benefits to average annual costs, insofar as these factors can be expressed in monetary terms".[2]

Background Data

Four main types of data are required for the economic evaluation of agricultural damage from floods: (1) Flood frequencies; (2) areas inundated, by stage of flooding; (3) physical data on land use, yields, management practices, and inputs of land, labor and capital; and (4) economic data on value of inputs and returns to land in the flood plain, including economic losses from past floods. Necessary also are projections of future conditions, with and without a flood-control project. Combining these data into an economic evaluation is at best a complex process; it is limited further by lack of data on flood stage-land area inundated relationships in map form.

[1] The Corps of Engineers, U.S. Army, is authorized to prepare a comprehensive plan for the development and conservation of water and related resources in the Potomac River Basin. Participating in this study are the U.S. Departments of Agriculture, Commerce, Interior, Health, Education, and Welfare, the Federal Power Commission, Atomic Energy Commission, Interstate Commission on the Potomac River Basin, National Capital Regional Planning Council, and Advisory Group for the Potomac River Basin, as well as other State and Federal agencies interested in the development of the Potomac Basin.

[2] Schwartz, H. E. DETERMINATION OF FLOOD FREQUENCIES IN A MAJOR DRAINAGE BASIN. Extrait des Compes Rendus et Rapports, Assemblee Generale de Toronto, 1957.