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Livestock Estimates and the Search for Further Improvement

By Arnold V. Nordquist

In the following article is another of a series of progress reports published in Agricultural Economics Research *on the research program of the Agricultural Estimates Division, AMS, that is being conducted to develop more objective methods of obtaining data on trends in acreage, livestock numbers, and crop yields. This paper analyzes check surveys of livestock estimates recently made in the South and in the North Central States.*

THE CONTINUED UPSWING in cattle numbers and production in the face of record slaughter has created more than the usual interest in methods used by the United States Department of Agriculture in estimating livestock numbers. Even though the Census of Agriculture for 1954 substantiates the record level of cattle numbers on January 1, 1955, a broad interest in the methodology will persist as long as inventories and production remain at present levels, or continue to increase.

For the last few years a statistical research project has been exploring sample design and estimating methods in 10 Southern States.[1] This project has been pointed at livestock as well as crops. A general interest in the explorations of this research as it relates to livestock exists on the part of those engaged in producing or developing statistical data. Many users of statistical data are also interested in these new developments, and whether or not new and better estimating procedures and more accurate estimates will result.

Present estimating procedure can be briefly outlined. Most inventory estimates and some production estimates are based on periodic census enumerations, taken at 5-year intervals, which provide benchmarks by which to project annual estimates of yearly changes translated from annual surveys of livestock producers who provide information on their own holdings.

In this procedure, census totals are essential to the accuracy of estimates. They provide a basis for checking the level of past estimates, as well as for an accurate starting point. When the census is taken at some time other than January 1, it is necessary to ascertain changes in livestock numbers that occur between the census date and January 1, the date to which official estimates relate. At these times a special livestock survey is made to obtain information on these changes. For example, about January 1, 1955 more than 250,000 producers whose names were drawn in systematic sample from the 1954 census questionnaires were mailed a special livestock inquiry. Voluntary response from this inquiry, and a followup interview survey of nonrespondents to the mailed inquiry, provided information which the Department used to adjust the 1954 census, taken in October and November, to a January 1, 1955 basis.

If inventory estimates are to reflect properly the yearly trend in livestock numbers, they must relate to the same date every year. In some States the January 1 population of livestock may be different from an October inventory. Marked changes occur in location of feeder and migratory livestock and changes come about through births, deaths, and marketings.

How Livestock Survey Is Made

The main annual livestock survey is made as of December 1 each year. Rural mail carriers help to distribute—and to collect—livestock survey cards to thousands of producers along their routes. Direct mail is used to obtain voluntary reports on

[1] HENDRICKS, WAITER A., and HUDDLESTON, HAROLD F. A FOUNDATION FOR OBJECTIVE FORECASTS OF COTTON YIELDS. Agricultural Economics Research. 7: 108–111. 1955. VICKERY, RAYMOND E. AN APPRAISAL OF INTERVIEW PROCEDURES IN FARM SURVEYS. Agricultural Economics Research. 8: 59–65. 1956. HENDRICKS, WALTER A. VALIDITY OF OBJECTIVE ESTIMATES OF CORN YIELDS. Agricultural Economics Research. 7: 69–72. 1955.

sparse rural routes or in areas in which routes are lacking or not representative. The December 1 survey covers about 150,000 producers who report on their own holdings. Another survey made in all except the Western States early in January obtains 65,000 replies on the calf crop, farm slaughter, deaths, and several other items needed for making livestock production and income estimates. Western sheepmen receive a special inquiry on wool production, inventories, births, and disposition of sheep and lambs.

Considerable information is collected and analyzed for the purpose of checking the estimates. For example, current estimates are checked later, usually the following year, against trends in the number of livestock assessed in the 32 States that have such records. Taxation records provide a basis for evaluating the accuracy of the estimated year-to-year change in livestock numbers. During the present upswing in cattle numbers, taxation data are giving strong support for the annual increases shown in the estimates.

For many of the State estimates it is possible to use fairly complete records collected on marketings and slaughter, brand and health inspections, or railroad records, to arrive at an indicated change in inventories. Records of marketings, outshipments, and slaughter, and estimates of death loss during the year are subtracted from the totals of inshipments, births, and inventories at the beginning of the year to arrive at an indicated number on hand at the end of the year. Similar balance sheets can be developed on a national level, using imports and slaughter statistics.

Present operating methods, which employ mail surveys, rely heavily on regression analysis of relationship of selective sample indications of yearly changes to the official estimates of those changes, arrived at after census data, assessment records, and other check information have been used to establish the final official estimates of year-to-year change. So long as these relationships of mail sample data to official estimates hold true, current estimates of yearly changes can be expected to have errors about in line with the average, or possibly the range, for past years. It is when these relationships fail to run true to past form, or when fundamental assumptions in the analytical process turn out to be wrong, that estimating errors get larger and fall outside the range of past history.

More Objective Data Sought

In an effort to avoid problems associated with interpretations of mail samples, research work on sample design and estimating methods is directed toward obtaining more objective data on trends in acreage, crop yields, and livestock numbers. Interview surveys of probability area samples have been made periodically since 1954. In June of that year, a basic interview survey was conducted on a sample of 3,000 farms in 703 sample areas.

Segments covered 100 counties in 10 Southern States. The sample of counties was a probability sample selection according to type of farming. Sample segments in each county, drawn at random, had an average of about five farms. The procedure required all farms with headquarters in each sample segment to be covered by an interviewer. The June survey questionnaire included questions on cattle, hogs, sheep, and chicken inventories about June 1, along with questions on the calf and pig crops.

Estimates from the June 1, 1954 surveys can be compared directly with only a few official estimates. As no official estimate is prepared for June 1 inventories for cattle, all hogs, or sheep, direct comparisons of these items could not be made. But comparisons were possible with official estimates for farrowings, pigs saved, milk cows, and hens and pullets. For the inventories of cattle, hogs and sheep, an approximation of the June 1 number could be made, using the January 1 official estimates as a base, and records of livestock movements between January and June 1. The June 1 inventory numbers obtained from this approach are not too precise, but they will indicate whether estimates from sample data are within reasonable limits of the universe.

Some expanded estimates compare favorably with official estimates, others fall outside the range of sampling errors. The expanded estimates of spring farrowings and of hens and pullets were low in relation to the unrevised official estimates. This indicated that the original estimates of these items were somewhat high and, as it turned out, they were later reduced when revisions were made to the 1954 census benchmarks.

On the other hand, the sample expanded number of milk cows greatly exceeded the unrevised official estimate of June 1 milk cows. Official estimates of milk cows were revised downward,

increasing the discrepancy even further between the number indicated by the sample and the official estimates. The expanded number of all cattle exceeded by a fairly wide margin the official January 1 estimate converted to a June 1 number. Nonsampling errors were found to be rather important in this first survey. Some ineligible farms, according to later checks, were included in the sample, and some operations reported for land rented out to others.

A followup on the 1954 June survey was made by mail in December 1954 to obtain data that could be used in connection with the annual inventory estimates which relate to a January 1 date. The mailed survey approach included an interview followup on a sample of farmers who did not respond by mail. The data obtained were used to project the numbers indicated by the June sample to a January 1 basis.

In general, the estimate for cattle made by this approach held about the same relationship to the official January 1, 1955 estimate as that shown by comparisons of June 1 numbers. Thus, the procedures used appeared to measure rather accurately the changes in cattle inventories between June 1 and January 1. For hogs, however, the indicated January 1, 1955 number was larger than the official estimate for that date, in contrast with the June comparisons. This correctly pointed to the fact that original hog estimates in the 10 Southern States were too high. Why the approach measured the change for cattle but not for hogs was not evident. It may have been associated with lack of comparability on reporting by interview and by mail.

In June 1955, another interview survey was conducted in the same 10 Southern States. The sample design was similar to that for the 1954 survey, except that a large farm list of 1,000 operations was developed and enumerated separately. The introduction of a large farm list reduced the sampling errors appreciably.

Another innovation for the 1955 survey was the use of a "closed" segment approach in addition to the farm enumeration. Previous surveys were designed to include in the survey all farms whose "headquarters" fell inside the sample segments. If the farm headquarters fell inside the segment, all land operated as the farm was included even if some of it was outside the segment boundaries.

In addition to this procedure for June 1955, the interviewer obtained separate data on acreages and livestock for just the land inside the segment. Results of sample expansions generally show higher estimates from the "closed" segments than from those obtained from the total "open" segment survey. The closed segment approach may have introduced an upward bias; respondents in some instances tended to classify their livestock as present in the segment when they were actually outside segment boundaries. Greater care in making the field interview would eliminate this difficulty. Indicated numbers from the whole survey, however, showed fairly close agreement with official estimates projected to June 1 for all cattle and all hogs and for the January-May calf crop.

In December 1955, another mail interview survey was made in the sample segments to obtain changes in inventories between June 1 and January 1. The December surveys covered about 20 percent of the farms included in the June 1955 survey. Separate mail and interview samples were chosen. The mail inquiry sample was conducted in a fourth of the segments and the interview sample in an eighth of those covered in the June 1955 survey. Livestock estimates obtained from these surveys were based on percentage change from June shown by matched farms.

Although the procedures employed worked satisfactorily, indicating that these methods could be used within the framework of the time schedules for the livestock reports, both samples were too thin to provide dependable indications on the changes from June to January 1.

For 1956 the June survey was expanded into 11 North Central States, and Kentucky and Virginia. The survey in these States covered 458 segments in 224 counties. The sample in the Southern States was spread into 618 segments in 324 counties. The total sample in the Northern and Southern States thus covered about 1,100 segments in approximately 550 counties. As in 1955, both the "closed" and "open" segment approach were used in obtaining livestock data. Sampling errors in data from the closed segments were much smaller than those computed from the open segments.

Full evaluation of the results of this survey will soon be completed. Early results from the June survey were available to the Crop Reporting

Board in time to be considered in connection with midyear reports on crops and livestock.

Early results on livestock data were encouraging. Expanded totals from Corn Belt samples for most items appeared well within the sampling errors and fairly close to available check information. In general, check data on livestock are more dependable in these States than in the Southern States. They offer an "acid test" for the methodology as it fits that section of the country.

Still remaining is the problem of sampling for livestock under conditions experienced in the West. One of the next steps will be to learn whether the closed or the open segment sampling method will bring satisfactory results in that region.

Book Reviews

Traité d'Économie Rurale, vols. 1 and 2. By Jules Milhau. Presses Universitaires de France, Paris. 442 pages. 1954.

THE 90-DAY travail which Ph. D. candidates undergo to acquire the rudiments of a foreign language is generally regarded as a deference to classical notions of learning that yields no further advantage. The attitude is unfortunate. Foreign literature in agricultural economics surely has more to offer than to serve as grist for a declension and syntax mill. There is little occasion for smug confidence that foreign sources can add nothing to our own, even while granting that the volume of our own literature is overwhelming. This review frankly originated in routine pursuit of a passing grade in a language tool. That quest, aided by a professor's dictum that the work read be relevant to his field, not only brought the grade, but unearthed a refreshingly lucid pair of texts by a French agricultural economist, Jules Milhau.

Milhau's twin subjects are economic theory and economic policy in agriculture. These have received exhaustive treatment in this country, perhaps commanding as much lineage as the career of Marilyn Monroe. Milhau's contribution is, first, the meticulous attention he devotes to the peculiar nature of the economics of agriculture; second, his insistence that an understanding of those characteristics must precede any review of policy; and third, the complete and equal treatment he accords both theory and policy. This balance contrasts with a number of American studies that are notably unbalanced: those on economic theory of agriculture, in which a chapter or two on policy is added almost as a footnote; and those advocating a particular policy, with a small and selective bit of theory introduced as justification and as evidence of the author's learning.

Milhau is an anticlassicist where agriculture is concerned, and he is an empiricist. He insists emphatically that the economics of agriculture is not