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# The Size Distribution of Farm Income

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Near the end of his interesting introductory paper, Thomas Atkinson concludes that we are not yet out of the woods in determining how much of a redistribution of total income has occurred in the United States over the past two decades. My conclusion on farm income is that we are not yet out of the woods in determining for sure what its size distribution is or was at any one time, let alone determining what changes in the distribution may have taken place over time.

The two accompanying tables were constructed in part to assemble the available information relevant to the size distribution of farm income. They also provide a basis for appraising the Current Population Survey farm income data in the light of one or two of the tests applied to the 1950 census data by D. Gale Johnson in his paper in this volume.

Table 1 shows the distribution of farm-operator families and unrelated individuals by size class of net cash farm income for all available years from 1945 through 1954. In addition to the regular annual CPS distributions of farm self-employment income, the table includes for comparison the original and adjusted distributions from the 1946 survey by the then Bureau of Agricultural Economics (now the Agricultural Marketing Service) and the unadjusted distribution of farm operators by income from farm, business, or profession as reported in Farms and Farm People.[1]

Table 2 shows the distribution of rural farm families and unrelated individuals by size class of total net cash income for all years from 1944 through 1954 except 1946. In addition to the regular CPS distributions, this table includes the 1950 census distribution for the year 1949.

In both tables the distributions are supplemented by:

1. Estimates of median income taken usually from published sources
2. Estimates of mean income derived from the distributions
3. Computed totals of income obtained by multiplying numbers reporting by the calculated arithmetic means of the income distributions

[1] Farms and Farm People, Bureau of the Census, 1953.

TABLE 1

Distribution of Farm-operator Families and Unrelated Individuals by Size of Net Cash Farm Income, 1945–1946 and 1949–1954

| NET CASH FARM INCOME | 1945 CPS | 1946 BAE As Reported | 1946 BAE Adjusted[a] | 1949 CPS | 1949 1950 Census[b] | 1950 CPS | 1951 CPS | 1952 CPS | 1953 CPS | 1954 CPS |
|---|---|---|---|---|---|---|---|---|---|---|
| Total reporting[c] | 4,100 | 5,859 | 5,859 | 4,897 | 3,643 | 4,707 | 4,331 | 3,923 | 4,385 | 4,018 |
| | | | | | *(number in thousands)* | | | | | |
| Income class: Class mean:[d] | | | | | | | | | | |
| Under $ 500    $ 20 | 46.9 | 56.5 | 51.3 | 44.0 | 23.9 | 38.8 | 34.2 | 32.5 | 43.1 | 42.8 |
| $ 500– 999    750 | 17.5 | 13.5 | 10.6 | 15.6 | 18.6 | 12.4 | 15.3 | 14.2 | 13.2 | 15.3 |
| 1,000– 1,999    1,480 | 18.4 | 13.3 | 13.2 | 16.5 | 23.6 | 16.3 | 19.3 | 15.8 | 15.6 | 16.8 |
| 2,000– 2,999    2,450 | 10.0 | 6.3 | 6.9 | 10.1 | 13.6 | 12.1 | 12.8 | 13.9 | 11.6 | 11.2 |
| 3,000– 3,999    3,450 | 2.5 | 3.5 | 4.7 | 6.1 | 8.2 | 8.2 | 7.3 | 9.3 | 4.4 | 5.1 |
| 4,000– 4,999    4,450 | 2.2 | 2.4 | 3.6 | 2.2 | 4.3 | 4.2 | 3.0 | 5.4 | 4.1 | 3.5 |
| 5,000– 5,999    5,450 | 1.0 | 1.2 | 2.4 | 1.5 | 2.4 | 2.5 | 1.8 | 2.8 | 2.4 | 1.9 |
| 6,000– 9,999    7,630 | 1.2 | 2.0 | 3.3 | 2.7 | 3.7 | 2.8 | 3.5 | 3.9 | 4.0 | 1.8 |
| 10,000 and over    17,000 | 0.3 | 1.3 | 4.0 | 1.3 | 1.7 | 2.7 | 2.8 | 2.2 | 1.6 | 1.6 |
| | | | | | *(per cent)* | | | | | |
| Median income[e] | 591 | 353 | 476 | 691 | 1,260 | 948 | 1,021 | 1,217 | 758 | 737 |
| Mean income[f] | 1,039 | 1,130 | 1,839 | 1,435 | 2,003 | 1,917 | 1,947 | 2,073 | 1,665 | 1,491 |
| | | | | | *(dollars)* | | | | | |

TABLE 1, continued

| NET CASH FARM INCOME | 1945 CPS | 1946 BAE | | 1949 | | 1950 CPS | 1951 CPS | 1952 CPS | 1953 CPS | 1954 CPS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | As Reported | Adjusted[a] | CPS | 1950 Census[b] | | | | | |
| | | | | *(billions of dollars)* | | | | | | |
| Computed total | 4.3 | 6.6 | 10.8 | 7.0 | 7.3 | 9.0 | 8.4 | 8.1 | 7.3 | 6.0 |
| AMS total | 9.3 | 11.0 | 11.0 | 10.1 | 10.1 | 9.3 | 10.8 | 9.9 | 9.6 | 8.2 |
| | | | | *(per cent)* | | | | | | |
| Computed as % of AMS total | 46 | 60 | 98 | 69 | 72 | 97 | 78 | 82 | 76 | 73 |

AMS = Agricultural Marketing Service, BAE = Bureau of Agricultural Economics (now Agricultural Marketing Service), and CPS = Current Population Survey.

[a] Adjusted to account for an earlier version of the AMS total for 1946.

[b] The unadjusted distribution of farm operators by income from farm, business, or profession as given on page 33 of *Farms and Farm People*, Bureau of the Census, 1953.

[c] The BAE survey number for 1946 was expanded to the 1945 Census of Agriculture number of farms. Numbers for other years are expanded sample numbers.

[d] To allow for net losses in net cash farm income, the average for the lowest class was taken at only $20. Means assumed for the thousand-dollar classes, a little below the midpoints, were designed to give as nearly as possible the same results as would the use of midpoints of five-hundred-dollar classes. For the class from $6,000 to $9,999, an attempt was made to approximate the actual mean of the cases. An average of $17,000 was assumed for the open-end class above $10,000.

[e] Medians were derived from five-hundred-dollar classes.

[f] Means were derived on the basis of the assumed class means shown above.

4. Corresponding Agricultural Marketing Service income totals, derived as Johnson derived his 1949 totals in his Table 3

5. The computed totals (3) as percentages of the AMS totals (4)

Johnson found that aggregates computed from distributions of income of persons were larger than those computed from distributions of families and unrelated individuals. Similar calculations for the CPS rural farm distributions also indicated somewhat the same tendency, although the differences were far less than those in the 1950 census. However, for farm self-employment income alone there has been no consistent difference in the aggregates computed from the two types of distribution. Tables 1 and 2 are based on distributions for families and unrelated individuals because in Table 1 only this sort of distribution of farm self-employment income may properly be compared with the BAE distributions for 1946 and with the 1950 census distribution from *Farms and Farm People*. The class intervals used in the tables are the least common denominator for the surveys included.

### Farm Income Totals and Their Relative Coverage

The AMS totals of Table 1 are conceptually the same as the census and CPS data on farm self-employment income—insofar as the latter may be said to be conceptually fixed in the single-question approach. Doubts and uncertainties derive from the possibility that gross receipts may be reported instead of net income; respondents to a single question on farm income may or may not include the value of inventory changes; all legitimate deductions, including depreciation, may not have been taken into account; and finally, as Johnson notes, capital expenditures may be deducted instead of depreciation.

The AMS totals of farm income, themselves subject to an unknown margin of error, are, however, as accurate as thirty years of continuous work can make them. During that time the Department of Agriculture's crop and livestock reporting system, its monthly price reports, the quinquennial agricultural census, and other statistical reporting systems have been developed in part to provide data necessary for the estimation of aggregate farm income and expenditures. These reporting systems are far from perfect, and the estimates of farm income based on them are in no sense absolute in their reliability. But they are unquestionably more reliable than the Census Bureau's survey data on farm income. These data, subject to the uncertainties noted above, are also subject to the underreporting and the other response errors typical of income surveys

## TABLE 2

Distribution of Rural Farm Families and Unrelated Individuals by Size of Net Cash Total Income, 1944–1945 and 1947–1954

| NET CASH TOTAL INCOME | | 1944 CPS | 1945 CPS | 1947 CPS | 1948 CPS | 1949 CPS | 1949 1950 Census | 1950 CPS | 1951 CPS | 1952 CPS | 1953 CPS | 1954 CPS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total reporting | | 6,516 | 6,496 | 7,468 | 7,589 | 6,340 | 6,058 | 6,358 | 6,374 | 6,122 | 5,747 | 5,840 |
| | | *(number in thousands)* | | | | | | | | | | |
| Income class: | Class mean: | *(per cent)* | | | | | | | | | | |
| Under  $   500 | $      200 | 24.4 | 23.2 | 15.9 | 17.0 | 22.5 | 20.1 | 19.9 | 14.1 | 15.8 | 19.5 | 19.1 |
| $   500–    999 | 750 | 20.7 | 18.9 | 15.1 | 13.9 | 15.0 | 15.4 | 12.9 | 13.4 | 13.4 | 12.6 | 12.4 |
| 1,000–  1,999 | 1,480 | 25.4 | 27.4 | 25.1 | 23.0 | 25.4 | 23.8 | 21.5 | 23.5 | 20.6 | 19.2 | 23.5 |
| 2,000–  2,999 | 2,450 | 14.9 | 16.6 | 16.6 | 18.2 | 16.5 | 16.7 | 18.2 | 17.5 | 16.8 | 14.3 | 14.0 |
| 3,000–  3,999 | 3,450 | 7.1 | 6.1 | 9.8 | 12.8 | 9.8 | 10.1 | 12.5 | 12.4 | 12.2 | 11.1 | 11.1 |
| 4,000–  4,999 | 4,450 | 2.9 | 3.8 | 5.0 | 5.4 | 4.0 | 5.3 | 5.7 | 7.6 | 8.1 | 7.9 | 7.4 |
| 5,000–  5,999 | 5,450 | 1.5 | 1.5 | 4.4 | 3.3 | 2.5 | 3.1 | 3.2 | 3.6 | 4.7 | 5.9 | 3.8 |
| 6,000–  9,999 | 7,630 | 1.6 | 2.0 | 5.5 | 4.2 | 3.1 | 3.9 | 4.2 | 6.0 | 6.1 | 7.3 | 6.8 |
| 10,000 and over | 17,000 | 1.5 | 0.5 | 2.6 | 2.2 | 1.2 | 1.6 | 1.9 | 1.9 | 2.3 | 2.2 | 1.9 |
| | | *(dollars)* | | | | | | | | | | |
| Median income | | 1,157 | 1,291 | 1,752 | 1,814 | 1,462 | 1,567 | 1,785 | 1,953 | 2,011 | 1,915 | 1,760 |
| Mean income | | 1,778 | 1,699 | 2,585 | 2,481 | 2,031 | 2,240 | 2,403 | 2,648 | 2,743 | 2,755 | 2,583 |
| | | *(billions of dollars)* | | | | | | | | | | |
| Computed total | | 11.6 | 11.0 | 19.3 | 18.8 | 12.9 | 13.6 | 15.3 | 16.9 | 16.8 | 15.8 | 15.1 |
| AMS total | | 15.1 | 15.4 | 20.0 | 19.0 | 17.2 | 17.2 | 16.6 | 18.5 | 18.3 | 17.7 | 16.0 |
| | | *(per cent)* | | | | | | | | | | |
| Computed as % of AMS total | | 77 | 71 | 97 | 99 | 75 | 79 | 92 | 91 | 92 | 89 | 94 |

The notes to Table 1 on class means and the distribution medians and means apply here also, except that, for the lowest class, $200 rather than $20 was assumed as the mean on the grounds that other sources of income would at least partly offset any losses.

but perhaps more serious for farm income than for other types of income. And finally, the farm operator sample in the CPS has never been large enough to assure consistent results from one year to the next. Thus, since there can be no question of the superior reliability of the AMS estimates of farm income, both in absolute level and in year-to-year change, it is quite legitimate to use the AMS totals to check the adequacy of the census data, as in Johnson's appraisal and in the last line of Table 1.

The CPS coverage of farm self-employment income was relatively poor in 1945, the first year shown, but not much worse than that of the unadjusted BAE survey results for the following year. The CPS and the census provided about the same coverage of total farm income in 1949, despite marked differences in practically all other aspects of the income distribution for that year. The best coverage of all was provided by the CPS distribution for 1950, which accounted for 97 per cent of the AMS total. Since 1950, the CPS coverage of farm income has tended to decline in percentage terms. However, the actual dollar shortage has remained somewhere around $2 billion, and this fairly constant amount has been an increasing percentage of the declining total of farm income.

The percentage coverage in the last line of the table depends just as much on the number reported in the top line as it does on the computed average of farm income. The number obtained in 1945 was much too low, but from 1949 or 1950 to 1954 the number reporting farm self-employment income to the CPS declined about in line with the number of farms found in the 1950 and 1954 agricultural censuses. The CPS numbers are on a lower level than those of the agricultural census, however, approximately 700,000 farms having apparently been missed by the CPS. The decline in the CPS number was also rather erratic. For example, the increase in number from 1952 to 1953 was probably not a real increase, but simply the result of the new sample design first adopted in 1953.

So much for the aggregates of farm income and their relative coverage. What about the size distribution of farm income? Table 1 illustrates the uncertainties in this area better than Table 2 because the size distribution of farm self-employment income is the main issue.

## Comparison of Census and CPS Size Distributions

The census distribution for 1949, taken from *Farms and Farm People*, seems entirely out of line with all the other distributions of net cash farm income. A single question was used in all the surveys

shown in Table 1 except the BAE survey for 1946, which used a detailed questionnaire. But the question asked in the 1950 census was less satisfactory than that asked in the CPS in most years, and it was asked by comparatively untrained enumerators. The divergence in the 1950 census distribution, therefore, probably should be taken as a reason for rejecting it entirely, not for preferring it to all the others (a conclusion contrary to the concensus at the time *Farms and Farm People* was first published).

The CPS distributions, with some exceptions, tend to change from year to year about as one would expect. Since some recipients of farm income are regularly omitted, if the distributions could be adjusted for these omissions, they might tie in fairly well with the adjusted BAE distribution for 1946.

This is just a guess—not a firm conclusion. We still do not know the true size distribution of farm income, and I think we are past the point where we can continue to ignore our ignorance.

The comparison of census and AMS income totals in Table 2 provides only a rough check for consistency between the two sets of data. In fact, the percentages in the last line of Table 2 are not nearly so good a test of the adequacy of the census data as those in Table 1, because the AMS totals in Table 2 are neither exactly comparable with the census data nor are they entirely independent of them.

## Limitations of AMS Estimates

Three steps are required to translate the Table 1 data on net cash farm income to the Table 2 concept of net cash total income of rural farm families:

1. Subtraction of farm income from urban farms and farm income received by nonresident operators of rural farms

2. Addition of cash farm wages and net farm rents received by rural farm residents

3. Addition of total money income received by rural farm residents from nonagricultural sources, including transfer payments

There is not enough information available to separate and deduct item 1 from the AMS totals, but the amount is probably relatively small. The AMS totals also do not include transfer payments (item 3). The exclusion of transfer payments originated in the historical requirements for the measurement of income parity for agriculture,

but in recent years inadequate information has been the main reason for not including them.

The total of transfer payments received by the farm population may be fairly large, and their omission from the AMS totals seems to have more than offset the continued inclusion of nonresident farm income. The net result is that the dollar discrepancies between computed and AMS totals are generally smaller in Table 2 than in Table 1, even though Table 2 represents the more comprehensive income totals. If transfer payments could be added to the AMS totals in Table 2, the absolute differences in the totals might then be of about the same order of magnitude as those shown in Table 1 for farm income alone. This probability brings out the second weakness in the AMS totals—their partial dependence on census, CPS, and other survey-type sources of information.

The AMS estimates of income of the farm population from nonfarm sources are based on various survey benchmarks. For one of these the census income data from *Farms and Farm People* and the CPS income data for 1950 (when more questions than usual were asked) were actually combined to provide a benchmark estimate for the AMS series. Estimates of farm wages are based mainly on the agricultural census, but the fraction estimated to have been received by farm residents is based on CPS information also. To repeat, Table 2 does not provide any test of CPS coverage of off-farm income comparable to that provided for farm income in Table 1. Such income may be understated in both the AMS and CPS income data for rural farm families, but in the absence of independent-check data there is no way of proving it.

Despite these difficulties, some interest still attaches to the percentages in the last line of Table 2. The decline in recent years shown in Table 1 is not duplicated in Table 2, apparently because of the higher totals of income involved and of the stabilizing influence of off-farm income. Thus a fairly constant dollar discrepancy in both tables represents an increasing percentage of a declining total in Table 1, but a fairly steady percentage of a somewhat more stable total in Table 2.

### Limitations of Census Data

The CPS surveys for 1947 and 1948 used fewer questions than those for other years,[2] apparently as an experiment, and the procedure was followed in the 1950 census. Self-employment income was not obtained separately as farm and nonfarm income. And for these

[2] See the table provided by Edwin D. Goldfield in this volume on the characteristics of the various CPS income surveys.

two years the CPS coverage of total rural farm money income was better than for any other year before or since. There is considerable evidence that a single question on farm income obtains "more total income" than a detailed questionnaire covering both gross income and expenses. The CPS results for 1947 and 1948 carry the matter a step further and suggest that even more total income may be obtained if no separate question on farm self-employment income is asked.

There has been a tendency to accept the Census Bureau's results on farm income without too much scrutiny, probably on the simple assumption that a gift horse should not be examined too closely. In view of the new information made available by the Bureau in this volume, and in view of the comparisons presented in Tables 1 and 2, I am inclined to agree with Leon Pritzker and Alfred Sands when they argue that the best procedure is not necessarily the one that produces the most income. In fact, aside from the cost, I would now favor use of a much more detailed questionnaire on farm income. For the 1960 census, I think the minimum requirement is for a separate question on farm self-employment income, preceded by one on gross income.

Another noteworthy aspect of Table 2 is the relatively poor CPS coverage of rural farm income in 1949. It is hard to say what may have gone wrong in the April 1950 survey for the year 1949, but I am convinced that something did, and that the 1949 results are not at all comparable with the CPS farm income data for other years.

In view of these problems, I think the Census Bureau was remiss in allowing the recent publication of a time series chart showing annual CPS median incomes of rural farm families in both current and constant dollars from 1947 through 1954.[3] The text of the release contains no explicit discussion of the reliability of the annual medians of rural farm family income plotted in the chart, which follow:

| 1947 | $1,963 | 1951 | $2,131 |
| 1948 | 2,036 | 1952 | 2,226 |
| 1949 | 1,587 | 1953 | 2,131 |
| 1950 | 1,970 | 1954 | 1,973 |

These are for families alone, excluding unrelated individuals, so they are uniformly higher than the medians given in Table 2. However, they are directly related to the CPS distributions of Table 2, and the year-to-year change in the medians is similar to that in Table 2.

On the whole, I think these figures are probably fairly good, and

in any case I am not in a position to prove them definitely in error. If it is assumed that only money income is reported to the CPS, with all inventory changes excluded, and if it is further assumed that medians change from one year to the next in the same direction as arithmetic means do, then the direction of year-to-year median change seems to be in error for only two of the seven years shown in the chart—1947 to 1948 and 1949 to 1950. A look at Table 2, however, shows that from 1947 to 1948 the arithmetic mean of incomes calculated from the CPS distributions actually declined, whereas the median income rose. The rising median has to be taken on faith in such a situation, which leaves only the change from 1949 to 1950 in definite conflict with changes in economic conditions in those years.

My criticism is directed not so much at the figures themselves as at their publication as a time series in both current and constant dollars without any directly associated discussion of their reliability. Near the end of the same report appears one of the customary illustrative calculations of standard errors for the included median incomes. Use for the first time in such calculations of the median for rural farm families as an illustration provides, apparently by chance, the standard error for the 1954 median shown in the chart.

The Census Bureau usually uses the criterion of twice the standard error as a test for its textual statements about changes in income from one year to the next.[4] Twice the reported standard error for the 1954 median income of rural farm families provides an income range which includes all the medians shown in the chart from 1947 through 1954, except those for 1949 and 1952. A range of three standard errors would include 1952 as well; as previously indicated, I think the median for 1949 belongs in a different universe. What is actually needed, of course, is some measure of the reliability of the differences between medians, not of the medians themselves.[5]

The Census Bureau's reports usually include a routine statement to the effect that "the sampling variability of a difference between two estimates depends upon the sampling variability of each of the

[4] *Current Population Reports—Consumer Income*, December 1953, Series P-60, No. 14, p. 8.

[5] Herman P. Miller defends the Census Bureau practice in his comment on this paper. But there is a simple device for indicating both the existence and size of sampling errors on a line chart. This is to add two dotted lines, one above and one below the solid line of medians, to indicate the range for one or two standard errors above and below the median for each year. The Census Bureau might well consider adopting this as standard practice. On this particular chart, however, the spread between dotted lines would have been so wide as to put the chart itself in question.

estimates and the correlation between them." Even if the ordinary lay reader understands this statement, he has no way of interpreting the correlation factor involved, and so the statement is simply another form of lip service to the formulas of the sampling specialists. I suspect that the standard error of the difference between any two of the medians shown in the chart is larger than that for either median.

A bill introduced in the Congress early in 1956 requiring the Census Bureau to develop annual data on farm income by economic class of farm would, if enacted, require the Census Bureau to do every year what has been done only once before, in *Farms and Farm People*. A greatly expanded farm sample which this bill would require may be the best possible answer to some of the problems I have been discussing. The experiments that would also be necessary before this bill could be satisfactorily implemented might well provide the basis for a proper evaluation of the relative merits of the global versus the detailed approach in the collection of farm income data.

Given a little more time, perhaps we can even provide a definite answer to the question: What *is* the size distribution of farm income?

# COMMENT

HERMAN P. MILLER, BUREAU OF THE CENSUS

In his concluding paragraphs, Ernest W. Grove criticizes the Census Bureau for publishing a chart showing the median income of rural-farm families for 1947–1954 without an "explicit discussion of the reliability of the annual medians." He amplifies this remark by adding that in his opinion publication of a time series based on sample data should provide the reader with "some measure of the reliability of the differences between medians, not of the medians themselves."

Since Grove is familiar with the fact that all statements in Census Bureau releases are thoroughly checked for statistical significance, I assume he makes this criticism because he thinks that each reader should be enabled to make such checks for himself, perhaps even to test comparisons not shown in the published report, though for this the Census Bureau would have to present measures of reliability of the differences between all possible combinations of medians. The Census Bureau does attempt to aid the reader by pointing out

significant relationships based on its interpretation of the reliability of the results, and it presents tables and specific illustrations providing a general indication of the reliability of the data. Although the Bureau has not published as much information on this subject as Grove (and many Census Bureau officials) would like to see, it probably has gone further in this area than any other organization, and looks forward to expanding its output of such information in the near future with the aid of electronic computing equipment.

Although I agree with Grove that more data on reliability are desirable, I am convinced that the informed user of census data can make his own tests of significance from the measures of reliability already appearing regularly. The established way to present estimates of reliability is in general tables which show the standard errors for a range of numbers and percentages. Such tables, permitting users to test comparisons based on any of the information shown in a report, and therefore more valuable than illustrative estimates of the standard errors for specific characteristics, appear in each of the family income reports (except in the most recent one, for which the data were not available because of expansion of the Current Population Survey sample). I suspect that Grove is searching for a simple device which would enable the "ordinary lay reader" to make his own tests of significance. The Census Bureau tries to assist people in the use of its data. But if such a reader wants to make tests of significance, he must learn some of the rudiments of statistics.

Grove may be right in his assertion that AMS farm income aggregates are more reliable than those prepared from census estimates. However, since he admits that "the AMS totals of farm income [are] themselves subject to an unknown margin of error," he cannot logically conclude that "they are unquestionably more reliable than the Census Bureau's survey data on farm income."

At one point Grove says that "the farm operator sample in the CPS has never been large enough to assure consistent results from one year to the next." Since the size of the sample affects only the standard error of the estimates and not the consistency of the results, what Grove actually means is that he thinks the standard error of the estimated median income of farm families in the CPS is too large. In view of the sizeable reporting errors which undoubtedly exist in the CPS farm income estimates, it is difficult to understand the insistence upon the further reduction of the relatively small sampling errors. In 1954 and earlier years the standard error of the estimated median income of rural farm families was only about $100. In 1955 and later years the standard error will be re-

duced because of the sample expansion from about 21,000 to about 35,000 interviewed households. As Grove well knows, income estimates derived from sample surveys are subject to response errors as well as sampling errors. With limited funds, these two types of errors can be dealt with only by striving for an optimum position, not necessarily reached by increasing the size of the sample.