Draft B. L Gardner

Notes on Changes in the Quality of Agricultural Statistics--Inputs, Farm Income, Output, and Prices

Farm Inputs and Income

I would like to distinguish two problem areas: problems of accurate measurement and problems of meaningful measurement. The first category is usually narrowly statistical, the second more broadly conceptual.

With respect to the narrower issues, many farm inputs are more difficult to measure than prices or outputs. Moreover, USDA devotes less effort and resources to generating statistics on some of these. Indeed, with farm inputs we come up against measurement problems that can't be resolved simply by better sampling procedures on a more complete list frame or more accurate statements by respondents. Most notable are questions of the quality of inputs, measuring the service flows from land and capital goods, and measuring nonconventional inputs. Proper measurement of cash outlays for inputs is essential to measuring costs and hence farm income but services of owned inputs are part of a residual. Hence, the farm income task forces of AAEA and USDA (1972, 1975) emphasized problems other than input measurement. But the issue of full and complete measurement of input service flows, even for inputs supplied by the farm operator, is fundamental for productivity measurement. Therefore the AAEA task force on productivity measurement (1980), amplifying criti-

Presented at AAEA meetings, Clemson University, July 26-29, 1981.

cisms originally put forth in the 1960s, emphasized measurement problems.

On the broader conceptual side, in all the task forces, and in the early AAEA Economic Statistics Committee (1972) report and other reports such as Upchurch (1979), conceptual issues of data organization were given prominence. In both measurement and conceptual organization USDA has recently undertaken notable innovations. This section examines the progress made in improving the statistics during the 1970s.

The occasion for such an appraisal is especially ripe because USDA has just published some substantial revisions of its economic data publications. In terms of format, the former Balance Sheet of Agriculture and Farm Income Statistics have been combined in Economic Indicators of the Farm Sector, the first issue of which appeared in December 1980. In terms of conceptual organization of data, there is a substantial effort in the new report to more clearly distinguish data on farm households from data on agricultural business enterprises. For discussion of details, see Nicol (1980). In terms of the substantive quality of the underlying data, no changes have been made that I could detect, but substantial improvements were made earlier in the 1970s, notably the Farm Production Expenditures surveys.

In the AAEA Productivity Task Force report, the allegedly most serious measurement problems involved: (a) the service flows of owned inputs, notably land and labor; (b) the contribution of nonconventional inputs, such as research, infrastructure, and the environment; (c) the quality of inputs. None of these

generates any notable difficulty in measuring income, because income is a residual between receipts and expenses. The problem in productivity measurement is to allocate the residual to various sources, but for calculating income this is irrelevant.

The input data problems more serious for income measurement are measuring depreciation--capital "used up" to generate current receipts--and capital accumulation--inputs used to produce wealth rather than current receipts.

The USDA measure of capital accumulation, "total net investment in farm plant and equipment" in their terminology, has been much improved in the 1970s. Bhatia (1971) provided in my view a quite devastating critique of the estimates of that time. Investment was estimated by using a cross-sectional study from 1955 to extrapolate for later years by the formula

$$I_t = \beta \Delta Y_{t-1}$$

where β was about 4.8. Bhatia discusses the biases that are likely to arise from this approach, and points out that the errors may be very large indeed. Since gross capital accumulation amounts to about half of net farm income, each 10 percent error in estimating capital accumulation generates about a 5 percent or about $1 billion (1960 dollars) error in net farm income.

However, since the early 1970s, USDA has been utilizing the Farm Production Expense surveys to get annual data on investment in capital equipment and structures, which answers Bhatia's objection and should provide much improved data. In recent publications the pre-1970s data on capital expenditures have been extensively revised also. This is good because historical data

are often used for analytical work to aid our understanding of the economics of agriculture. For example, someone might want to use the USDA data to study investment behavior by farmers, to see if it is sensitive to interest rates. If this were done on the pre-1970 data as described by Bhatia, the student would find that a 1-year lagged accerelator model would fit very nicely, and that interest rates made no difference. This is because the data were created by a lagged-accelerator model in which interest rates made no difference.

Of course, the student could have been forestalled if the created data had been labelled as such. A general gripe I have about both the old and the new farm income statistics (and most of the other USDA statistics) is the absence, in the publication, of description of how the data were generated. Especially for constructed measures, there are serious traps for the unwary. I couldn't tell from the publications of the 1980 revised series why or how the revisions were made. For example, the 1962 Farm Income Situation shows differences from the 1980 publication in gross capital expenditures that I don't understand at all, and they are quantitatively substantial (Table 1). For service buildings and structures, the revised figures[1] are about 60 percent higher in the early 1940s, move to approximate equality in the early 1950s, and increase to about 40 percent higher in the early 1960s. Why? (I assume that the 539 figure for 1959 in the revised 1980 data is a typo. I noted also that the value of 1207

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[1]These are not revisions made along with the changes in format in 1980, but are revisions made earlier in the 1970s.

Table 1

Farm Gross Capital Expenditures

Year	Farm operators' dwellings		Service buildings and other structures	
	A	B	A	B
1940	139	139	165	108
1941	147	147	183	123
1942	126	126	217	135
1943	109	109	269	164
1944	111	111	347	203
1945	125	125	362	249
1946	409	409	752	621
1947	554	554	880	760
1948	702	702	938	877
1949	683	683	887	777
1950	642	739	880	841
1951	665	788	934	897
1952	665	885	949	1,008
1953	619	848	908	965
1954	572	788	853	896
1955	532	766	853	872
1956	529	740	863	842
1957	537	737	874	840
1958	514	700	841	796
1959	539	728	539	829
1960	485	700	1,207	797
1961	592	735	1,156	837

A: USDA estimate of 1980

B: USDA estimate of 1962

for 1960 is the only other "backcast" that was changed between the 1979 and 1980 publications, so I infer a typo there, too. There should not be typos in officially published tables of government statistics. My small smaple indicates more problems in 1980 than earlier. This looks like a decline in productivity in the government sector.)

Revisions can cause special problems when only part of a series is changed. Recently the series on investment in farm operators' dwellings was revised substantially for the 1950s but not at all for the 1940s. This would cause problems for anyone trying to explain this series by a regression equation, especially if one worked with annual changes. The old data show a 10 percent decline in investment between 1949 and 1950, while the revised data show a 6 percent increase!

Depreciation continues to present serious measurement problems even after the 1980 revisions (which did not change the procedures used). Essentially, USDA substracts a fixed percentage of the capital stock which varies from category to category (4.87 percent for dwellings, 7.22 percent for service buildings and equipment, 12 percent for tractors, 14 percent for other machinery, 21 percent for trucks). But it is not adjusted for age of the existing capital stock or changes in its quality. The latter point is important not so much because the durability of specific items has changed but because of heterogeneity within the categories. In particular, it seems likely that structures and equipment have changed over time in that the share of simple buildings, which are relatively durable, has fallen, while the

share of complex equipment like milking parlors or automated grain-handling equipment, which is less durable, has increased. So the depreciation rate should rise. Also, there is the question of obsolescence due to technical change. In short, I don't have much confidence in the depreciation statistics and recent reforms have not taken steps to improve them.

On the issue of conceptual obsolescence, the main issues are: (a) provision of inputs through contractual arrangements that preclude either identification of the price paid pertinent to farm income or identification of returns to inputs as part of farm or nonfarm income, (b) the growth of nonconventional purchased inputs such as legal services or tax advice, (c) counting nominal interest costs as expenses when an expected-inflation premium accounts for most of these costs, and (d) identification of an appropriate set of economic agents whose income to measure.

The new revisions give most attention to item (d), and end up with two alternatives: farm production establishments and farm households. Income of the former is "net farm income" and of the latter "farm operators' income." The old net farm income is essentially "farm operators' income <u>from farming</u>," a smaller number than either of the two new measures. The new net farm income includes returns generated by the activity of farming but accruing to people who do not live on farms, such as nonfarm landlords. (But hired farm workers or providers of custom services who do not live on farms are still excluded.) And the new farm household income excludes income in kind not generated from farming, in particular housing services, which used to be

included.

Schematically, the data choices can be depicted as follows:

	income of farm residents (U.S. Census definition)	income of nonfarms residents
income from farming activities	A	B
income from nonfarming activities	C	D

All would agree that income in cell D should be excluded, but from there things become less clear. The new definitions are, roughly, net farm income = A + B, and farm operators' income A + C, compared to old net farm income = A. The AAEA Economic Statistics Committee (1972) concluded that the farm was obsolete as a basic unit of account for agricultural statistics, and the AAEA task force (1975) and Upchurch (1979) recommended its replacement by establishments, of whatever kind, that produce agricultural products. This is essentially accomplished with the new net farm income concept (Nicol 1980).

The conceptual problems that remain involve items (a) and (b) above. At the practical level, they involve drawing the line between farm and nonfarm residents, and farming and nonfarm activities. Since any boundary will be arbitrary, we might say just pick one and stick with it. Unfortunately, this is impossible. With respect to the residential criterion, we rely on sales of $1,000 to draw the line between rural farm and rural nonfarm.

Even if this is appropriate today, it won't be in a few years. We have to keep moving in order to stay in the same place, as Alice said. Everybody knows this, and USDA and Census try to make appropriate adjustments. More subtle are changes along the other boundary: what activities count as "farming." For example, if a farmer increases his income by intelligent management, the returns are counted as returns to the farming activity. But if the management services are hired, it is not counted as a return to the farming activity. But, a third twist, if the services are provided free by an extension agent, then the returns are again counted as a return to the farming activity. Similar problems arise with respect to legal services, artificial insemination or veterinary services, fertilizer or pesticide application, hired versus unpaid family labor. As with the residence dichotomy, if a boundary were constant, the problem might not be serious. But in fact the economic functions, and methods of paying for them, keep moving back and forth across the "farm gate." This raises again the questions about the farm, however defined, as an appropriate criterion for farming activity. What we really want are returns to certain economic functions, wherever performed. At the same time, the population living on farms as the Census defines them is a set of people whose economic well-being is of interest. Their income is essentially measured in the new USDA household income concept. Thus, with respect to a conceptual basis for both rural economic and social statistics, USDA has made notable progress.

With respect to item (c), the problem of full costing of

interest payments under inflation is related to the issue of counting capital gains as income. The AAEA farm income task force recommended abandoning USDA's old "realized" farm income concept, and this has now been accomplished to the extent that inventory accumulation is included in income. However, capital gains due to price appreciation are still not counted as income. Instead, the new USDA publication provides balance sheet information along with the income flow data. This seems to me the sensible approach, and parallels the data system favored by the accounting profession for economic reporting by publicly-held corporations. Nonetheless, a real problem of meaning of the income measure arises when interest costs include a substantial inflation premium. For this premium will never be offset by corresponding flows of returns in the current year. Therefore, farm income (and corporate profits) are understated when there is anticipated inflation. Gardner and Hottel (1980) estimated the understatement of farm income at about $4 billion for 1979.

Prices of farm commodities

With respect to obsolescence caused by institutional change, the key issue in farm prices is the disappearance for some commodities of an observable market price at a time and place approximating the "farm gate." This issue has been covered by Glenn Nelson. I want to mention one technical problem that arises even assuming that USDA has measured the appropriate farm price or shadow price. This is the problem of appropriate aggregation of prices for individual commodities to construct an

overall price index. USDA constructs a chain-linked Laspeyres index, which tends to overstate (or understate) price increases when relative prices are changing, because consumers (producers) gain utility (income) by adjusting their quantity bundles instead of maintaining the base-period quantities. However, one cannot tell a priori if this will be a serious problem. In order to obtain some evidence on this question, I constructed discrete-approximation Divisia indexes (recommended by Christensen 1975 and the AAEA productivity task force 1980) of the basic farm crops and compared them with Laspeyres indexes. The Divisia index is chain-linked annually with crossed value weights, and so is not subject to the Laspeyres bias. Without going into the details here, indications are that any bias in the USDA price series is very small--probably less than 1/2 of 1 percent per year in the estimated rate of change of farm prices in the 1970s.

Farm Output

The flow of farm output is inherently more difficult to measure than farm prices in that the relationship between a particular sample result and the population statistic is less straightforward. A random sample of 10 farmers' prices received for corn can be expected to tell us more about the U.S. market price of corn than a random sample of 10 farmers' outputs will tell us about U.S. corn output. However, USDA's substantial efforts to construct aggregate statistics from farm data for production, farmer-held stocks, and feeding, and from commercial sources for commercial stocks, exports, and domestic disappearance, permit

consistency checks which, at least to the outside observer looking at the published figures, inspire a good deal of confidence. (I've always wondered, though, why rice is the only commodity with a published statistical discrepancy between the supply and demand sides.) Particularly impressive is that USDA keeps revising its estimates even after the "final" annual estimates are in, yet the adjustments are rarely large. Presumably the main new source of information in "revised backcasting" is the Census of Agriculture, a wholly independent survey source and therefore a good source of data for checking.

Speaking of the Census, there is the issue of how much the quality of the benchmark data was harmed by the new procedures and nonresponse in the 1974 Census. One hears griping about this, but I don't know of a full assessment of the problem.

Finally, I want to mention a conceptual problem with farm output that I hold no hope of seeing solved. This is the aggregation of crop and livestock output. USDA makes efforts to exclude from the aggregate that volume of farm crop production (quite large) which is fed to animals, but this cannot be accomplished with great accuracy. And even if it were, we would still have an aggregate output which is a combination of two production levels like "houses and lumber output." This aggregate is economically dubious even if we subtract out the lumber used in houses from the aggregate. However, the fact that crops and livestock are jointly produced on many farms creates problems with separation, also. However, perhaps we can hope for relief from the current practice of counting fish as part of farm output

if produced on farms but not if caught in rivers, lakes, or oceans, or counting timber as farm output if sold from a farm, but not otherwise. (Simunek, p. 38).

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