Determinants of Farm Size and Structure

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FARM SIZE CLASSIFICATIONS AND ECONOMIES OF SIZE: SOME EMPIRICAL ISSUES

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All four of the objectives of NC-181 explicitly mention farm size. The first objective quite appropriately lists ". . . improved techniques for measurement . . . of farm size" among the research agenda of the project (NC-181 Project Outline). Furthermore, the minutes of the October 1986 meeting of the new project listed "An agreement on a definition(s) of farm size" as one of five major needs related to work under Objective 1. We wholeheartedly concur with the importance of identifying and agreeing on appropriate definitions of farm size at the outset. As will be more fully detailed below, the choice of size definitions can influence the substance of research conclusions.

Our purpose in this paper will be to share with participants some research results on the issue of farm size definitions as they explicitly relate to economies of size studies. These results, which are based on Ph.D. dissertations examining economies of size in the Pacific Northwest dryland grains and dairy industries, may also have broader relevance for non-economies-of-size applications of interest to the project.

More specifically, this paper critically evaluates the theoretical and empirical validity of the gross value of sales (GVS) criterion typically used to divide farms into economic size classes in Agricultural Census and USDA reports. A review of the farm size classification literature identifies several weaknesses of the GVS criterion, but also finds substantial support for it. The paper provides theoretical and policy arguments for substituting the farm size criterion suggested by economic theory, namely "scale of plant," for GVS in economies of size (and possibly other) analyses. Next, we present empirical average cost curves estimated from 1978 Agricultural Census data for grain farms in the Pacific Northwest, and from 1977 survey data for Washington and Oregon dairies. These analyses reveal selective, but significant, changes in the shape of aggregated average cost curves based on "scale of plant" versus GVS. Finally, we discuss conclusions, data issues, and research implications related to the results.

Review of Farm Size Classification Literature

First used to report results of the 1945 Agricultural Census, the economic classification of farms based on GVS has become the dominant criterion of farm size in analysis of Agricultural Census and USDA survey data. Family net income levels from farm and off-farm sources, receipt of government payments, debt/asset ratios, concentration ratios, and farm efficiency indices are only

a few of the many important measures commonly reported by sales class (USDA; Lee; Farmline; Hall and LeVeen). For example, recently released findings from the 1982 Agricultural Census reveal that "large farms," defined as those with over $500,000 in annual sales, represent 1.2 percent of U.S. farms but control over 10 percent of U.S. cropland and produce a third of total output value (U.S. Department of Commerce).

While GVS has endured over 40 years, agricultural economists have identified serious limitations of the criterion. It has been criticized for sensitivity to transitory price and yield fluctuations in census years, potentially poor congruence between production and sales due to inventory fluctuations, exclusion of nonmarketed farm output, and potentially poor correlation between gross sales and value added (Welsch and Moore; Hurley). One would expect sales to poorly represent value added due to extreme differences in the contribution of purchased inputs for different farm types (e.g., rapid turnover livestock feedlots versus "organic" crop farms). More recently, Stanton has quite logically criticized inferences about the changing size structure of agriculture which have not incorporated inflation adjustments into the GVS classes.

Critics of the GVS criterion of farm size have frequently considered, but not necessarily recommended, alternative input-based criteria or refinements to make GVS more accurately reflect gross value of output. Benedict et al., whose classic 1944 AJAE article contributed to adoption of the GVS farm size criterion, acknowledged, ". . . probably a classification in terms of inputs as measured by amounts of labor used, expenditures, or both would be the most satisfactory if it could be handled practically" (p. 1561). Ray Hurley, former chief of the agricultural division of the Census Bureau, considered but rejected grouping farms by the annualized cost of fixed resources plus variable costs on the basis of data collection difficulties. Acres of land operated is the only other size criterion by which U.S. Agricultural Census results have been routinely reported. The acres criterion has been repeatedly criticized, however, because it fails to reflect enormous regional differences in land quality and value and because land requirements vary greatly for different types of farms (Nikolitch and McKee; Welsch and Moore; Hurley). Stanton proposed using labor inputs as an improved farm size criterion, but others have rejected a labor criterion for quality and input proportions variability reasons similar to those for land (Welsch and Moore; Hurley). Ackerman and Riecken, Welsch and Moore, and Hurley have considered total fixed resources (TFR) controlled--including land, improvements, and machinery--as a measure of farm size. The latter two authors note that this measure would suffer, like land- and labor-based measures, from variability in proportions of fixed to variable inputs across farms, but that this problem could be minimized by making comparisons across size only within farm types. Welsch and Moore argued that TFR would be less sensitive than GVS to random price and yield variability.

The European Economic Community has officially adopted a "standard gross margin" (SGM) measure of farm size, essentially equal to total value of output minus specified variable costs (Commission of the European Communities). SGM provides one estimate of value added as a farm size measure.

In spite of its acknowledged deficiencies, many critics have defended GVS over its input-based competitors on largely practical grounds (Nikolitch and McKee; Hurley). Arguments for alternative criteria have obviously been insufficient to convince Census and USDA analysts to replace or modify GVS over the past 40 years.

Farm Size: A Theoretical and Policy Perspective

The review of literature on farm size classification criteria uncovered a curious absence of appeal to the generally accepted measure of firm size in economic theory, namely, "scale of plant." Microeconomic theory texts routinely present the long-run average cost (LRAC) curve as an envelope of successive short-run average cost (SRAC) curves, characterized by successively larger bundles of fixed resources or larger scales of plant (see Figure 1). The least cost firm size or scale of plant, if one exists, is identified by the SRAC curve which is tangent to the LRAC at its minimum point (SRAC$_2$ in Figure 1). Theoretically, the existence of economies (diseconomies) of size is indicated by the negative (positive) slope of the LRAC curve.
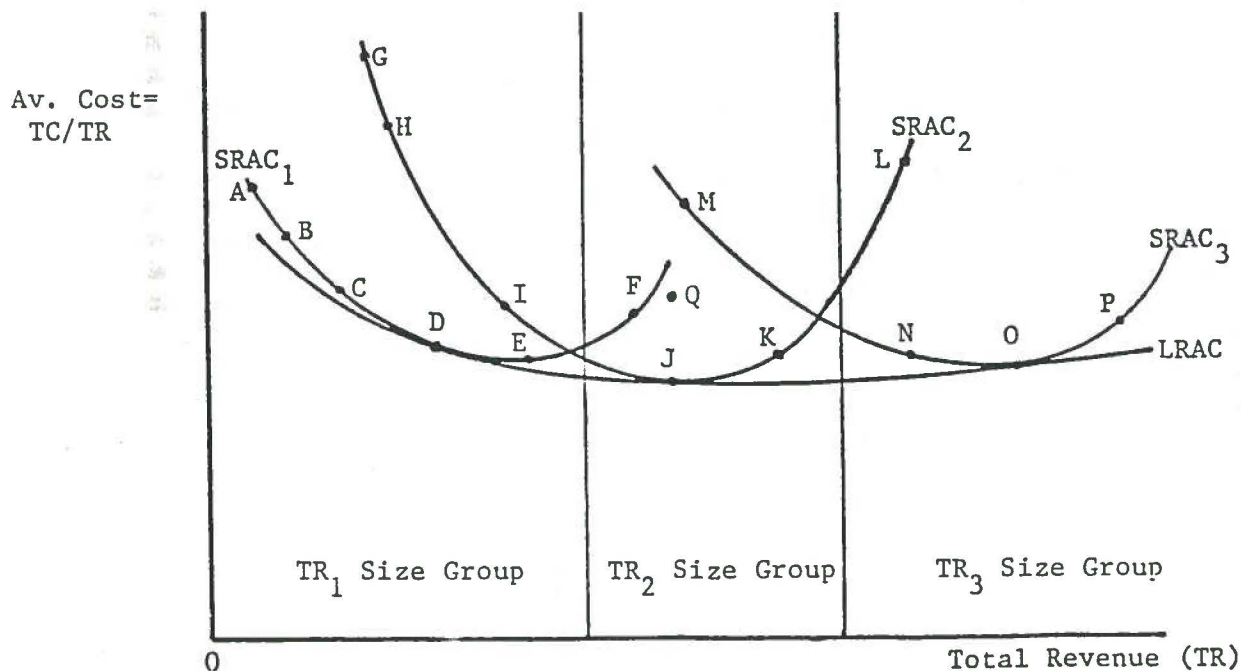

Figure 1.

**Short-Run Average Cost (SRAC) Curves and the Envelope
Long-Run Average Cost (LRAC) Curve Illustrating the
Derivation of Average LRAC Curve Points for Grouped Data**

In addition to providing greater consistency with economic theory, we believe that substituting TFR for GVS as a size criterion in farm structure and performance analyses would provide more useful information for policy formulation and analysis. Society has a legitimate interest in knowing whether entrepreneurial units comprised of very large bundles of fixed resources (scales of plants) or of smaller bundles are able to produce food at lower cost per unit. The value of fixed resources controlled by the farm is more relevant from a policy perspective because this resource bundle has a directly measurable opportunity cost. The resources committed to two $100,000 farm units could be reorganized into one $200,000 unit. Similarly, one five million dollar unit could be subdivided into five one million dollar units.

In economies of size studies, average cost (AC) for multiple-product farms is conventionally calculated by dividing total cost (TC) by total value of output (TR). The TFR definition of farm size has the advantage of being exogenous to the performance measure, $AC = TC/TR$. For example, if farm size group 2 in Figure 1, utilizing fixed resource bundles underlying $SRAC_2$, has an AC of 0.92; this finding tells policy makers which scale of plant achieves this average performance level. One does not know which scale(s) of plant is(are) represented by the farms in a particular TR (proxied by GVS) class. As illustrated in Figure 1, TR2 Size Group would include farms F, J, K, M, and technically inefficient Q, which originate from all three scales of plant. The TR (or GVS) size criterion does not identify the size of the bundle of fixed resources which characterize the firms in the group.

On the other hand, TFR identify farms with particular bundles of fixed resources, such as represented by $SRAC_1$, $SRAC_2$, or $SRAC_3$ in Figure 1. These resources bundles have an identifiable economic opportunity cost. In practice, of course, TFR size groups would be defined by a range of TFR values so that many SRAC curves would be included in each group.

An empirical approximation of a LRAC curve constructed from a set of "average AC" ($\overline{AC}$) points computed from censused farms grouped by either TFR or GVS will depart from the theoretical LRAC envelope (or "frontier") of SRAC curves (see Figure 1). In general, one would expect $\overline{AC}$ to lie above the theoretical LRAC because of the inclusion of undercapitalized (e.g., farm P in Figure 1), overcapitalized (N), and technically inefficient (Q) farms. Such farms might constitute a sizeable proportion of the population.

More importantly, $\overline{AC}$ based on GVS could differ significantly in shape from that based on what we have argued is the more theoretically and policy relevant TFR criterion. If our arguments favoring the TFR criterion are valid, inferences about empirical economies of size and other measures based on GVS could be misleading and lead to unsound policy.

It is not possible to deduce a priori whether use of the GVS criterion will overestimate or underestimate economies of size. Consider first a situation in which there is a disproportionate incidence of low-output overcapitalized "hobby" or "retirement" farms, such as G and H in Figure 1. This could inflate unit production costs for small GVS classes and generate a steep negatively sloped $\overline{AC}$ curve. This would likely prompt press reports that "small" farms are inefficient. However, there is no assurance that this pattern would prevail if farms were grouped by "scale of plant." Use of the latter criterion might show that low-resource farms--those operating with small land and machinery investments--have relatively low unit costs. The perceived inefficiency of small farms defined by GVS classes was generated solely by the criterion used to group farms into size groups. Overcapitalized medium-resource "hobby" farms were lumped into the small sales class.

On the other hand, if "undercapitalized" farms, like L in Figure 1, dominate the GVS "large farm" category, the empirical $\overline{AC}$ would imply serious "diseconomies of size" that might not exist

if firms were grouped by scale of plant. Of course, unbalanced frequencies of technically inefficient firms over size groups could also cause the GVS and TFR AC curves to differ in shape.

In summary, the nature and magnitude of differences in empirical economies of size when farms are grouped by census sales classes (as in Hall and LeVeen) instead of "scale of plant" constitute an empirical question. The answer could differ by region and type of farm. We present empirical comparisons of GVS and TFR AC curves for Pacific Northwest small grain farms and dairies in the next section.

Before proceeding to that analysis, we call attention to two separate, but significant, issues. First, if one accepts the theoretical-policy arguments for scale of plant versus sales volume as a measure of farm size for applications other than economies of size, then conclusions relating to family income, receipt of government payments, concentration ratios, crop yields, age of operator, tenure status, etc. by economic (GVS) class of farm could also be misleading for policy formulation. Clearly, more conceptual and empirical work is needed on the implications of using GVS to report size distributions of other farm attributes.

Secondly, it should be noted that agricultural researchers who have analyzed economies of size using mathematical programming have embraced the scale of plant or TFR measure of farm size. "Synthetic firm" economies of size studies, such as those by Dean and Carter and by Miller, Rodewald, and McElroy, typically trace out successive SRAC curves by minimizing cost subject to fixed machinery and land constraints, while parametrically varying output. LRAC is then estimated as the envelope of the estimated SRAC's.

Empirical Comparisons

Pacific Northwest Grain Farms

Data for this analysis were obtained by a special request to the Bureau of the Census, with technical support and partial funding from USDA, for detailed information on all crop farms covered by the 1978 Agricultural Census in eight small grain producing counties in southeastern Washington, northcentral Oregon, and northern Idaho. Due to census confidentiality requirements, only grouped results for census farms in the study area were provided. However, a sorting program was applied to original census data files to group results into farm sizes by TFR as well as by GVS. The analysis reported below is based on the sample of 1,514 crop farms in the study area which completed the "long form" census questionnaire. This form provides more detailed information on production costs. The sample represented a population of 4,016 crop farms in the study area. All population size group means and ratios, and their associated standard errors, were estimated based upon their stratified random sampling rates in the 1978 census (May; Chapman and Rogers; Cochran).

Censused crop farms from the eight-county region were divided into nine farm size groups (see Table 1). The number of farms varied over size group, but GVS and TFR group boundaries were demarcated so that an equal percentage of the population was represented by the ith size group by both criteria. For example, the 7.99 percent of the smallest farms in the population, ranked by both GVS and TFR, are represented in group 1 in Table 1.

Table 1.

**Average Gross Value of Sales (GVS) and Average Total Value of
Fixed Resources (TFR) per Farm, and Percentage of the
Population Represented, Based on the GVS and the TFR Size Criteria**

Farm Size Group		Percent of the Population Represented[a]	Farm Size Criterion			
			Gross Value of Sales		Value of Fixed Resources	
Group No.	('000 $ GVS)		GVS	TFR	GVS	TFR
1	(0-5)	7.99	$ 1,866	$ 120,420	$ 6,508	$ 46,167
2	(5-10)	6.08	7,220	160,813	14,949	90,762
3	(10-20)	6.92	14,225	214,110	23,321	144,082
4	(20-40)	14.12	29,447	340,909	40,963	256,628
5	(40-100)	33.91	65,321	722,126	80,298	586,529
6	(100-250)	23.13	153,248	1,230,571	152,104	1,287,787
7	(250-500)	5.83	339,554	2,282,739	332,828	2,582,040
8	(500-1000)	1.27	650,171	2,876,191	391,217	4,388,432
9	(≥ 1000)	0.75	2,823,151	9,740,127	2,310,838	12,603,669

[a]The figures in this column represent the percentage of the population in each size group based on the gross value of sales size criterion of farm size. The percentage for the value of fixed resources criterion of farm size differs by less than one-fifth of one percent.

GVS size group 1 in Table 1 includes the 1978 census economic classes VI and V. GVS groups 2 through 5 correspond, sequentially, to census economic classes IV through Ib. The 1978 census lumped all farms with $100,000 and over in gross value of sales into economic class Ia, but this significant group was subdivided into GVS groups 6 through 9 in this analysis to obtain a better appraisal of economies or diseconomies of size among the largest farm sizes.

The gross value of sales included all crop and livestock products sold from the farm during 1978 as reported on the census questionnaire plus any reported payments for custom work. Inclusion of custom work in GVS is consistent with Madden's conceptualization of the farm as a provider of "goods and services" from its fixed complement of machinery and labor.

Total fixed resources included the total value of land, buildings, improvements, and machinery used by the farmer. This included both owned and rented resources, net of any resources rented to others. The "current market value of land and buildings" was elicited jointly in the census questionnaire. Respondents were not instructed whether they should include or exclude residences or other nonproductive buildings in their response. Probably, most respondents included nonbusiness buildings in their value estimates. Agricultural land is generally valued jointly with improvements and buildings. This lack of disaggregation in the census data represented an

important challenge to the research. In the absence of any nonarbitrary basis for estimating the value of nonbusiness buildings over size groups, the total value figures from the census were used as received for purposes of classifying farms into TFR size groups. If the value of nonbusiness buildings per farm were the same over all size classes, or was monotonically rising over size classes, inclusion of these values would simply shift all TFR class boundaries to the right, but would not result in reclassification of farms among classes. To further insulate results from any bias induced by the land and buildings value estimates, land costs as detailed later are estimated as a function of sales rather than land values. This is consistent with the common practice in the study region of basing land rents on crop shares.

Total costs for each farm size group were equal to the sum of all variable costs plus estimated fixed costs. Variable costs collected in the census include fuel and other energy, seeds, fertilizer, agricultural chemicals, hired labor, custom work, livestock and feed purchased, and animal health costs. Farmers were not required to estimate machinery and land fixed costs for the census so these were imputed by the authors. Straight-line depreciation and interest on average investment were computed as a function of the total value of machinery reported to the census, assuming enumerated machinery values were at 60 percent of new values (May). Annual land costs were estimated as 23 percent of gross value of sales reported in the census. This ratio was based on a survey of typical crop share rents in the region, net of shared expenses, over the years 1972 to 1980 (Kirpes). It was not possible to include a charge for operator and family labor in variable costs because the Agricultural Census provides no information on either the quantity or value of this labor. Excluding a charge for operator and family labor could bias the results against larger farms if these farms have a higher proportion of <u>hired</u> labor, which is included in census production costs. Indeed, hired labor costs averaged 29 percent of variable costs on the three largest TFR size groups, but only 21 and 18 percent, respectively, on the smallest and middle three size groups. To correct for this potential bias, average <u>costs</u> for all farm size groups excluded reported hired labor costs. Finally, the mean average costs ($\overline{AC}$) for a size group was necessarily computed from the census grouped data as the total costs for the size group divided by the gross value of sales for the size group.

Table 1 reports average GVS and average TFR per farm by size group for both size criteria. These results strongly suggest that high incidence of overcapitalized and low-output "hobby" farms in the small GVS categories might seriously distort efficiency estimates for small farms. The smallest farm size, based upon the value of its land and machinery, sold 3.5 times more output than the smallest farm based upon the sales criterion. However, total fixed resources on the smallest TFR group were only 40 percent of those on the smallest GVS group.

The expected contrast in the pattern of average unit cost efficiency between the two criteria is confirmed in Figure 2. The GVS criterion portrays the familiar L-shaped $\overline{AC}$ curve indicating pronounced economies of size. The TFR curve, in contrast, shows generally similar unit production costs over all size groups. Indeed, statistical hypothesis tests of the equality of all possible pairs of farm size group average costs for the TFR criterion failed to reject the null hypothesis of equality for all but a few of the largest size groups which had low sampling variance due to very high sampling intensities (May). The L-shaped GVS $\overline{AC}$ curve, of course, contributes to the frequent conclusions based on Agricultural Census data that U.S. "small" farms are relatively inefficient and frequently generate negative net farm incomes. As shown in Figure 2, total nonlabor costs exceed revenues for GVS size groups 1-3 from this 1978 census data on Northwest grain farms. In contrast, revenue exceeds costs for all TFR size groups. The GVS grouping criterion will underestimate the efficiency and the percentage of gross output produced on small Pacific Northwest grain farms if one accepts scale of plant as the theoretically correct and/or more policy relevant criterion of farm size.
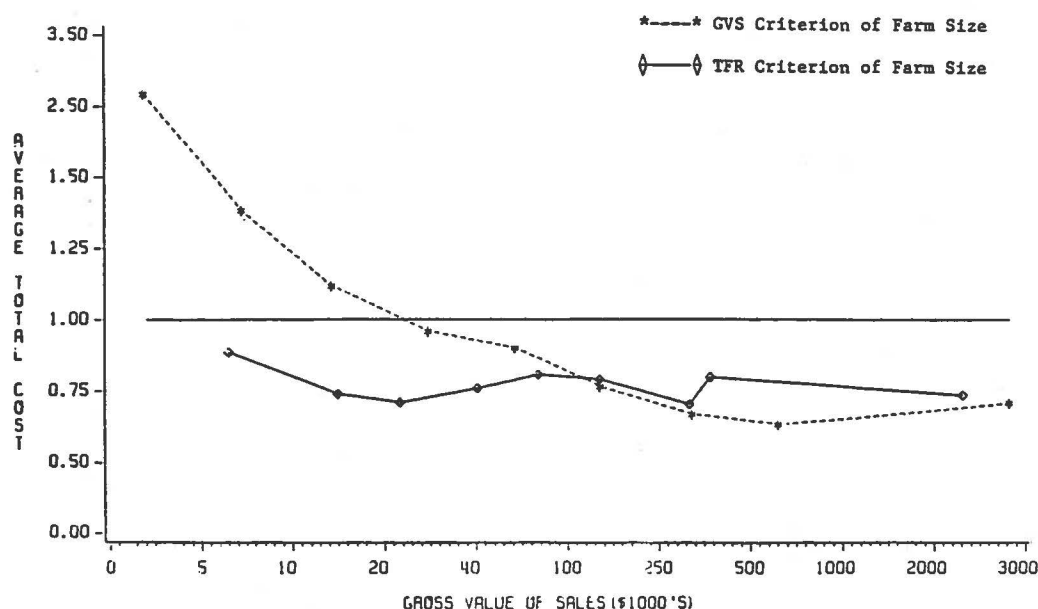
Figure 2.

**Farm Size Group Ratios of Total Costs Excluding Hired Labor
to Gross Value of Sales Using the Gross Value of Sales (GVS)
and the Total Fixed Resources (TFR) Criteria of Farm Size**

The L-shaped GVS $\overline{AC}$ curve in Figure 1 corresponds closely to results computed by Hall and LeVeen over GVS classes of California crop farms using 1974 Agricultural Census data. Hall and LeVeen calculated that California cash grain farms with between $5,000 and $10,000 of sales averaged $1.07 of production costs per dollar of sales but that this ratio dropped to .55 for farms with $100,000 and over of sales. Hall and LeVeen found similar L-shaped $\overline{AC}$ curves for California cotton, vegetable, fruit and nut, and other field crop farms as well. The Pacific Northwest results presented in this study suggest that the conventional GVS grouping criterion used in the census data analyzed by Hall and LeVeen might have strongly influenced their results.

Even the TFR $\overline{AC}$ ratios in Figure 2 may underestimate the average cost efficiency of smaller farms relative to larger farms. This will occur if GVS, a proxy for total output in computing $\overline{AC}$, underestimates output to a greater extent on smaller farms due to proportionately more home consumed production on these farms. However, given the strong dependence of both small and large U.S. farmers on retail markets for their food needs, this is not likely to be a major source of distortion.

Oregon and Washington Dairy Farms

The special data request from the 1978 Agricultural Census included data for crop farms only. To examine whether the same sharply different portrayal of economies of size persisted for a different farm type, a similar study was conducted based upon data from a 1978 survey of 118

western Washington and western Oregon dairies (Shetewi). In this study based on primary survey data, it was possible to exclude residential buildings from TFR. Similar methodology was used for the AC comparison as that described above for grain farms except that operator and family labor costs are included. The results of this comparison are summarized in Table 2 and Figure 3. All farm size group averages show costs, including operator and family labor at operator imputed wage rates, in excess of returns. This reflects the relative unprofitability of many of the region's dairies and possibly generous cost estimates of some survey respondents. Although the size group frequencies in Table 2 are not concentrated entirely along the main diagonal, it is obvious that a fairly high correlation exists between farms grouped by the two criteria. Furthermore, in sharp contrast to the results for dryland grain farms, very similar L-shaped AC curves are generated by both the gross value of sales and scale of plant size criteria for this sample of Pacific Northwest dairies. The reasons for the differences in the results portrayed in Figures 2 and 3 may relate to fundamental differences in technology and business organization between dairying and crop farming in the Pacific Northwest. Dairying is possibly a less attractive activity for overcapitalized "hobby" farms which may have distorted the AC ratio for small GVS crop farms. Differences in the underlying survey versus census data could also contribute to the differences.

Table 2.

Allocation of Sampled Dairies Into Size Groups Defined by GVS and TFR

| | Size Group by TFR ($) | | | | | |
| | I | II | III | IV | V | |
Size Group by GVS ($)	(51,549–101,834)[a]	(103,679–129,520)	(129,893–174,189)	(177,910–265,905)	(270,272–469,746)	Total
I (26,558–74,178)	18	5	1	0	0	24
II (74,268–104,334)	5	14	5	0	0	24
III (107,702–141,552)	1	4	14	5	0	24
IV (143,073–258,408)	0	1	4	14	5	24
V (263,629–431,127)	0	0	0	5	17	22
TOTAL	24	24	24	24	22	118

[a]Values in parentheses indicate actual range of total capital investment (TFR) or range of gross value of sales for sampled dairies in specified size groups.
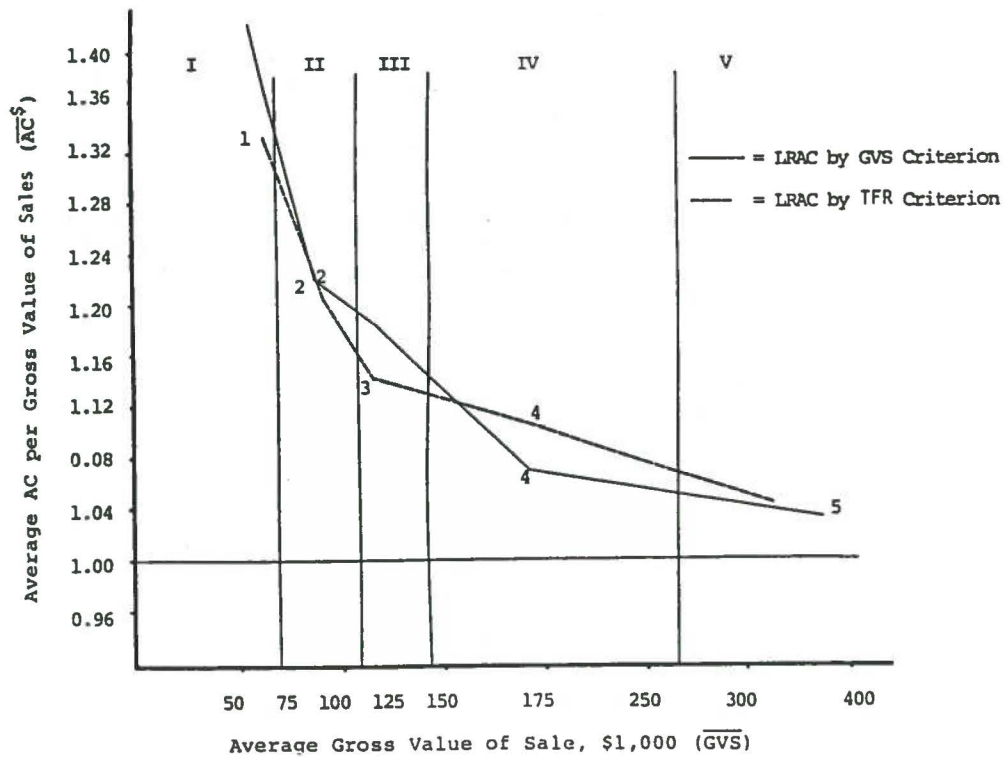
Figure 3.

**Farm Size Group Average AC per Dollar of Sales for
Farm Size Groups Defined by GVS and TFR Size Criteria**

Ordinary least squares $\overline{AC}$ and frontier (lower envelope) AC curves were also fit to the individual observations available for the dairy survey data. Not surprisingly, the OLS average cost curve resembled those in Figure 3. Intriguingly, however, the frontier curve exhibited a shallow U-shape (Shetewi). This result suggests that while the largest dairies achieved lower unit production costs on the average that the most efficient medium size dairies achieve lower costs than either the smallest or largest units.

Conclusions, Data Limitations, and Research Implications

This study confirmed that using gross value of sales to classify farms into size groups, as conventionally done in Agricultural Census and USDA reports, overestimated economies of size for Pacific Northwest dryland grain farms. However, both sales and scale of plant size criteria yielded similar declining average cost curves for a survey sample of western Washington and western Oregon dairies. This indicates that the magnitude and the nature of differences in economies of size due to farm size criteria are enterprise (and possibly regionally) specific. In any case, when evaluating the performance of farms over size using aggregated data, researchers should group farms by scale of plant if they desire to approximate the theoretical long-run average

cost curve. We also feel there are strong policy arguments for reporting Census and USDA survey results by TFR size groups.

While the theoretical arguments favoring TFR over GVS as a size measure for comparing farm performance are well grounded, empirical limitations characterize both measures for national use over different types of farms and production regions. Criticism of GVS as a poor proxy of output and of value added, for example, was reviewed earlier. TFR, on the other hand, is vulnerable to the influence of nonagricultural demand for land driving up farmland values in urban fringe areas. Such land price inflation will of course place farms in higher TFR-based groups. Such problems of "spurious" changes in farm size induced by temporal or geographic changes in monetary values will plague any size measure--input or output based--using market values rather than physical units. Of course, use of simple physical units such as acres, cows, or bushels of wheat is impossible for national comparisons over farms producing a broad mix of physical output with heterogenous land and other inputs.

In general, it is likely that a combination of theoretical and practical considerations will favor different farm size measures for different purposes. As scientists, we should initially rely upon theory and policy relevance to determine the conceptually appropriate measure of farm size. We should then attempt to collect primary or secondary data that approximates this measure as closely as feasible.

This approach guided this study for identifying the appropriate farm size measure for economies of size analysis. Scale of plant, as measured by the farm's fixed resources, was unambiguously identified by economic theory as the appropriate measure of firm size. Furthermore, the TFR measure of firm size is more relevant in deriving policy implications. This measure identifies the size of the bundle of resources utilized by the firm. These resources have a readily identifiable opportunity cost elsewhere in the agricultural (and broader) economy. It is possible to deduce productive efficiency implications if resource bundles were reorganized into larger or smaller entities. On the other hand, GVS has neither theoretical support nor the same policy linkage in this application.

The argument for theoretically driven farm size measures supports the use of a broader set of size criteria than currently used in Agricultural Census and USDA reports. As discussed earlier, the GVS criterion has come to dominate in government reports. Little justification, other than tradition and convenience, appears to underlie this dominance.

As a beginning, consideration should be given to adding TFR and possibly the European SGM to the current GVS and acres size criteria in selected census reports. The Agricultural Census should attempt to elicit the value of residences and other nonbusiness buildings separately to permit more accurate TFR classifications. If it proves infeasible to obtain accurate responses to questions relating to residential building values, standard adjustment factors might be derived based on survey data.

Final decisions on adjustments in census and USDA procedures for collecting and reporting results by alternative farm size criteria should be made after consulting various census user groups, and further investigation of the impacts for a broader set of regions and enterprise groups. Researchers in NC-181 could render useful assistance to this process by examining the degree of correlation between GVS, SGM, TFR, acres, and possibly other farm size measures for farm subpopulations in their respective regions of the country. If all the measures were perfectly correlated, there would be no discrepancy in the average cost curve or other performance patterns of the type observed for the Pacific Northwest grain farms in this study. The relatively similar

average cost curve obtained by GVS and TFR groupings for the dairy farm sample reported in this paper indicates that results do not always vary by size criterion. NC-181 can play a valuable role by examining how and when the issue of farm size definition is important, and in providing guidance on theoretically appropriate size definitions for different problems.

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