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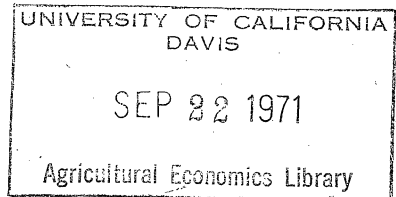
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UNITED STATES DEPARTMENT OF AGRICULTURE
ECONOMIC RESEARCH SERVICE
Farm Economics Division



IMPLICATIONS OF ECONOMIES OF SCALE TO NATIONAL AGRICULTURAL ADJUSTMENTS

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The framers of this topic on your program obviously thought that some cause-effect relationships exist between economies of scale and national agricultural adjustments. In this paper, I shall cast some doubt as to the existence of such relationships. Essentially, my argument is this: (1) Because of fuzzy techniques in defining and quantifying economies of scale, our studies of the economics of farm size provide us with no clear evidence of economies of scale. (2) Especially vulnerable is the common generalization that unit costs are high on small farms and low on big farms. Without this generalization, the supposed relationships between economies of scale and national agricultural adjustments collapse. (3) National agricultural adjustments are explained by cause-effect relationships other than economies of scale.

I. Defining Economies of Scale

Let us begin with a definition so that we will use the same words to mean the same things so far as possible throughout this discussion.

"Economies of scale" has been a favored topic for economic theorists for a very long time. In general we agree that the expression refers to changes in average unit costs that are related to changes in scale or size of the firm or enterprise. The picture of a series of average cost curves for individual firms of different sizes plotted on the chart and connected by an envelope curve comes readily to mind.

Such a set of curves implies that there is a least-cost combination of inputs for each firm and that the firm whose curve rests on the low point of the envelope curve is most efficient. I have no quarrel with

1/ The author is indebted to Dr. John Brewster, Farm Economics Division, Economic Research Service, for comments on this paper.

this picture for purposes of this paper. We differ little in our concept and acceptance of the theory, but we differ greatly in the manner and techniques with which we apply it.

Before we go further in considering the implications of economies of scale, we need to look carefully at how we get average cost curves for individual firms. Our literature reports hundreds of studies dealing in one way or another with economies of scale. The very earliest work of Spillman, Boss, and Warren showed that big farms made more money than little ones. Since their time, there have been few farm management people who have not concerned themselves with problems of scale or size. Despite vast experience with such studies, our techniques for defining and quantifying economies of scale are particularly fuzzy.

One source of our lack of precision relates to confusion between economies of scale and economies of variable proportions. It is difficult to see how one can get economies of scale without changing the input mix. This point has been debated by theorists more apt than I, and I shall not dwell upon it here. My point is simply that a review of our literature on the question of economies of scale reveals a lack of preciseness of terms and methods. Much of the time we are talking only about variable proportions when we think we are talking about economies of scale.

Another source of lack of precision relates to our bookkeeping or accounting techniques, especially as they are applied (1) to operator and family labor, management, and entrepreneurial income and (2) to pricing of relatively fixed factors in production.

A search of past studies reveals that we have handled the matter of operator income in at least three ways.

(1) In distributing gross income to the factors of production, we have left operator labor and management income as the residual claimant. (Sometimes we even let income to owned capital remain in this bag.) When we do this, we say in effect that operator labor is a free resource to the business up to the limit of working time available. This biases our notion of economies of scale -- especially for heavy labor-consuming enterprises -- toward the size of enterprise or firm that maximizes operator labor.

(2) We have calculated operator income - or a family living allowance - as a fixed cost against the business. This makes unit costs for small businesses look high. It results in an excessive charge against production when the labor of the farm operator is underemployed.

(3) Occasionally we charge operator labor as a variable cost to the business. In other words, we charge the business at some predetermined rate only with the operator labor actually used in production. This technique tends to depress the apparent advantage of bigness in the farm business. It also tends to ignore the matter of maximizing operator returns.

In addition to the problem of handling returns to operators for labor, capital, and management, we have experienced difficulty with pricing the relatively fixed capital investments in the farm business. Investment cost of machinery looms large on most farms. Usually, moreover, machinery is a rather "lumpy" input. How do we price it in our accounting techniques to reflect truly the economies of scale?

In scanning past studies, I find that many different techniques were used. Sometimes farmers were asked what their machinery was worth, item by item. Sometimes new prices for machinery were depreciated by some factor to reflect depreciation. Each of the techniques used left something to be desired. Frequently little farms have low unit costs for machinery and big farms have high costs, as well as the reverse. What we find depends a great deal upon the skill and luck of the individual farmer in meeting his needs for machinery; what we conclude depends upon the techniques we use in our accounting and upon how we analyze and report machinery costs to get at economies of scale.

Getting a price or setting a price for land is another point at which wide differences in cost accounting occur. If farmers are asked what they paid for land, discrepancies due to different dates of purchase, different terms of transfer, and others, will arise. If an imputed value is used for land, factors other than land productivity may influence our judgment. If we use values set for tax purposes, we are plagued by all the vagaries of tax assessment procedures. All of these methods, and others, have been used in farm management studies.

One other major variation occurs in the techniques of analyzing costs in relation to scale. Some studies, especially the older ones, depended entirely upon data as reported in farm surveys. If one farmer said his 12-foot combine cost \$2,000 and another said \$3,000, \$2,500 was used as the cost of the combine. Other, less obvious, illustrations could be given, but this serves to make the point. More sophisticated researchers are inclined to build hypothetical firms of different sizes, to standardize the resources and costs for each, and to program the enterprises to arrive at least-cost combinations. This technique avoids the distortions encountered in real data. An example of the latter technique is reported by Carter and Dean in the May 1961 issue of the *Journal of Farm Economics* and by Scoville and Fellows in earlier studies.

Each of the techniques for "costing" fixed capital items and returns to farm operators gives us a different view of the relationship between average unit costs and size or scale of business. Many of the published reports of past studies are not explicit as to the techniques used. Therefore, comparable or even valid conclusions regarding economies of scale cannot always be drawn from them.

My purpose in mentioning these rather elementary elements in techniques of economic analysis is simply to point out that from all our empirical research of the past, we really have very little precise knowledge about economies of scale in agriculture. We do know in a broad general way that unit costs decline as farm size increases, at least up to the size of the reasonably efficient one- or two-man farms. The cost curve generally levels out beyond that point in the size scale and may extend virtually horizontally over a wide range of sizes. Even this generalization must be accepted with considerable caution and with the recognition that in reality a great many individual firms have unit costs at considerable variance to those that would be expected from the generalized envelope curve.

II. Economies of Scale and Agricultural Adjustments

Why be concerned with economies of scale and what does this have to do with national agricultural adjustments? I suppose our concern grows out of the implication in our body of theory that high-cost firms

cannot survive in a competitive economy. The notion is widely accepted that small firms have high costs, hence small firms will not survive. There is the further implication that family farms are small and that large firms are not family farms, hence our concern over the changing structure of our agricultural economy and society.

Let us look at some things that appear to be facts in this case. In the first place, I am not at all sure that we can accept the little-farm - high-cost - big-farm - low-cost generalization. In the real world, we find so many deviations from the rule that the rule itself is questionable. One reason for this doubt lies in our techniques for calculating costs, especially as they relate to operators' labor and management. If operators of little farms charge the farm business only for the time actually needed in farming, their unit costs may be comparable to costs on larger farms. If such an operator has other remunerative use for his time not spent in farming (as many do, according to data on off-farm employment), it is proper for him to calculate costs in this way. If, in addition, his costs for machinery and land are low, he may quite well be producing at unit costs equal to or below those of larger farms. In reality, many little farms do survive in the highly competitive business of farming.

But, you will say, look what has happened to the size of our farms in the last 30 years and look at the dire straits of our farmers, particularly the small farmers. I readily agree with what you are thinking, but let us speculate as to some reasons for the trends we observe.

General statistics about trends in size of farm in this country are too well known to this audience to dwell on them here. Numbers of farms have decreased about 1 million in the last decade - to use a round number. The number of farms grossing more than \$10,000 has increased 65 percent since 1945 while the number of those having sales of less than \$2,500 has decreased 40 percent.

These trends tend to prove the validity of the notion that small firms have high costs, and therefore do not survive in a competitive economy. And so they may, but the state of our research on economies of scale is such that I doubt whether we can prove this cause-effect relationship.

I suggest that there may be other, more potent, causes for the current trends in size of farm. Farm technology, particularly farm mechanization, gives farmers the physical capacity to operate larger enterprises than they could operate with horse equipment. They are now able to reap to themselves the net returns from larger farms. Thus they are able to increase their income, and this is a strong incentive to increasing size of farm. This incentive and this trend operates irrespective of economies of scale, in the strict sense of the word, or of unit costs. Increased size of firm may increase income to its operator independent of changes in unit costs.

The desire to concentrate income from larger enterprises is one side of the coin. Is the desire to escape small incomes from small farms the other side of the same coin? I submit that small farms do not necessarily have high unit costs, although I am sure that some do. Nevertheless, small farms do produce small incomes simply by virtue of small volume of sales.

If we are to explain changes in size of farms, we need to ask ourselves, Do the small incomes from small farms drive people out of farming? Answering this question may be like pondering whether the hen or the egg came first, but I suggest that small incomes do not drive people out of agriculture.

Rather, I suggest two hypotheses that seem more likely to explain the decline in numbers of small farms. One is that the prospect for a small income from a small farm discourages new entrants into this stratum of agriculture, and thus the small firm is not replaced with successive generations of operators.

The other is that the opportunity for larger incomes elsewhere draws people away from the small farm instead of the small income from the farm driving them from it. Thus we meet the old "opportunity cost" principle that we learned in "Econ I-A." If the opportunity cost is high for an operator to remain on a small farm and if we wish to include such a cost in our calculation of unit costs of product, we can easily show economies of scale for larger farms.

The question of whether people are pushed off farms by low incomes or pulled off by better opportunities elsewhere is not one of tweedledum and tweedledee. It is fundamental to our thinking about national agricultural adjustments and the policies or programs needed to induce adjustments. If low incomes alone would bring about adjustments in agriculture (as classical economics and some politicians claim), we would have been adjusted long ago.

If, however, we recognize that excessive numbers of small firms producing small incomes for their operators is one of agriculture's problems and that opportunity for income elsewhere draws people out of farming, we have gone a long way toward the basis for a national adjustment program. How to do this is a different matter and the subject for a different paper.

Let us get back for a moment to the question of economies of scale and national agricultural adjustments. I have implied that our empirical studies and the techniques used in them were not precise enough to demonstrate economies of scale between small and medium-sized farms except under fairly rigid assumptions with respect to pricing inputs. We are even more at a loss to demonstrate economies of scale from medium farms on up the spectrum of size.

Accepted economic theory tells us that unit costs decrease with increasing size of firm until the most efficient firm is reached; beyond this point, diseconomies set in to increase unit costs with increased size of firm. Logic supports this proposition, but we have not supported it very well, especially in the upper end of the scale range, by our research. We simply do not know where diseconomies of scale set in as size of firm progresses.

At the same time, we have little reason to believe that any substantial reduction in unit costs is achieved for most types of farming beyond those firms having gross sales of about \$25,000. Agricultural economists have studied big farms very little; they have shown more concern for little ones. It is more difficult to generalize about big farms because their numbers are few, and each is more likely to be associated with unique characteristics of management, history, or geography.

A big Montana wheat farmer says he cannot grow wheat any cheaper than his neighbors who operate much smaller farms. I believe him, and I believe that most really big farms have no cost advantage over the well-organized and well-managed "medium large family farm."

The point of this observation in the context of our subject is that while average size of farm is increasing and probably will continue to increase for a long while, there is no evidence to indicate that the huge bonanza farm will dominate agriculture, except possibly for a very few specialized types of farming. Virtually all the economies of scale - if there are such - appear to be achieved within the size range that we identify as family farms. This is explained partly by the fact that family farms are getting larger because innovations give the farmer the ability to do more work, and that farms formerly larger than family-size are becoming family farms because of shifts in enterprises and substitution of capital for labor.

If bonanza farms are not to dominate agriculture, the industry will continue to have a large number of firms. The number will not be 4 million or perhaps not even 2 million, but it will remain large enough so that the output of no one firm will influence total output significantly. In other words, no one firm will have a measurable monopoly on influence. This means that if and as adjustments are made in aggregate output, they will need to continue to be made through group action, probably including government action. Recognition of this fact is significant also in our thinking of national agricultural adjustments. It leads us to recognize that government has a definite place in agricultural affairs rather than just the expediency of meeting emergencies.

One factor that has strongly influenced number of farms is the continuing cost-price squeeze. Does the downward pressure of commodity prices and the upward pressure of factor prices affect farms of different sizes in different ways? The farmer with a small volume of sales may feel keenly any reduction in price of product. Conversely, the large farm operator has a higher proportion of cash out-of-pocket costs, so he feels keenly any increase in cost of inputs as well as decreases in product prices. He can go broke quicker. Firms with high unit costs

obviously are most vulnerable to the cost-price squeeze. Whether high unit costs are associated with small size remains questionable.

Before leaving our consideration of scale of farming and national agricultural adjustments, let us make a passing bow to some of the obvious relationships.

1. Acreage-allotment and acreage-reserve programs restrict the size of specific enterprises within the firm. The operator who is tooled up to till 1,000 acres and may now produce only 400 acres of his main money crop, obviously has higher unit costs in the short run unless his tools can be used for other purposes. The wheat farmer who shifts his diverted land from wheat to barley or sorghum grain probably does not experience increased unit costs because the same machinery may still be used to capacity. But if his only alternative to wheat is idle land, he does. The cotton farmer who shifts his diverted acreage to soybeans probably increases unit costs, because his cottonpicker will not harvest beans. He must "tool down" his cotton enterprise and "tool up" his bean enterprise. These factors help to explain the pressure for farm enlargement in cotton, wheat, and feed-grain areas.

2. Many policies and programs have tended to favor the small firm. FHA loans, acreage limitations on Federal reclamation projects, progressive income taxes, limits on cost-share payments and price-support commitments - to name just a few. These programs may have had some retarding influence on the trend toward larger firms, but probably it has been neither great nor measurable. In contrast, some policies and programs seem to encourage the trend toward larger firms - acreage allotments, acreage reserves, the new feed-grain program, and the similar wheat bill now before Congress. Whether either of these groups of programs affect materially the location and shape of the envelope curve of average costs is doubtful. I hasten to repeat that the shape and location of the cost curve depends a great deal upon how costs are calculated.

III. Conclusion

Where does this leave us in our review of implication of economies of scale to national agricultural adjustments? First, I question whether economies of scale have had much to do with current trends in size of

farm. At least I doubt that we can demonstrate this relationship because of the many different techniques used in calculating costs relative to scale.

Second, average size of farm is increasing, as we all know. I suggest that this is more a function of a farmer's ability to handle a bigger unit with power machinery and of his desire to get more income than it is of economies of scale - even if they exist.

Third, even with increasing average size of farm, there is no reason to believe that eventually farms will be so large and so few that each could influence volume of output and price. Agriculture will remain an industry with a large number of firms, though fewer than now. Therefore, adjustments in aggregate output and price will continue to be made through group action.

Fourth, small farms produce small incomes, regardless of the question of unit costs or economies of scale. Small incomes do not necessarily drive people off farms thereby effecting adjustments in the man-land ratio. Small farms may not perpetuate themselves with succeeding generations of operators, but, more important, people leave agriculture because of better opportunities outside it, not only because of poor opportunities within it. Thus an important basis is laid for adjustment programs designed to improve the economic status of people in farming.

Fifth, we need badly a good series of studies aimed at measuring differences in costs as related to scale of farming. Such studies should cover many different types of farming and the same techniques of "costing" should be used throughout the series. With such studies, we could be more precise than I have been about the implication of economies of scale to national agricultural adjustment.