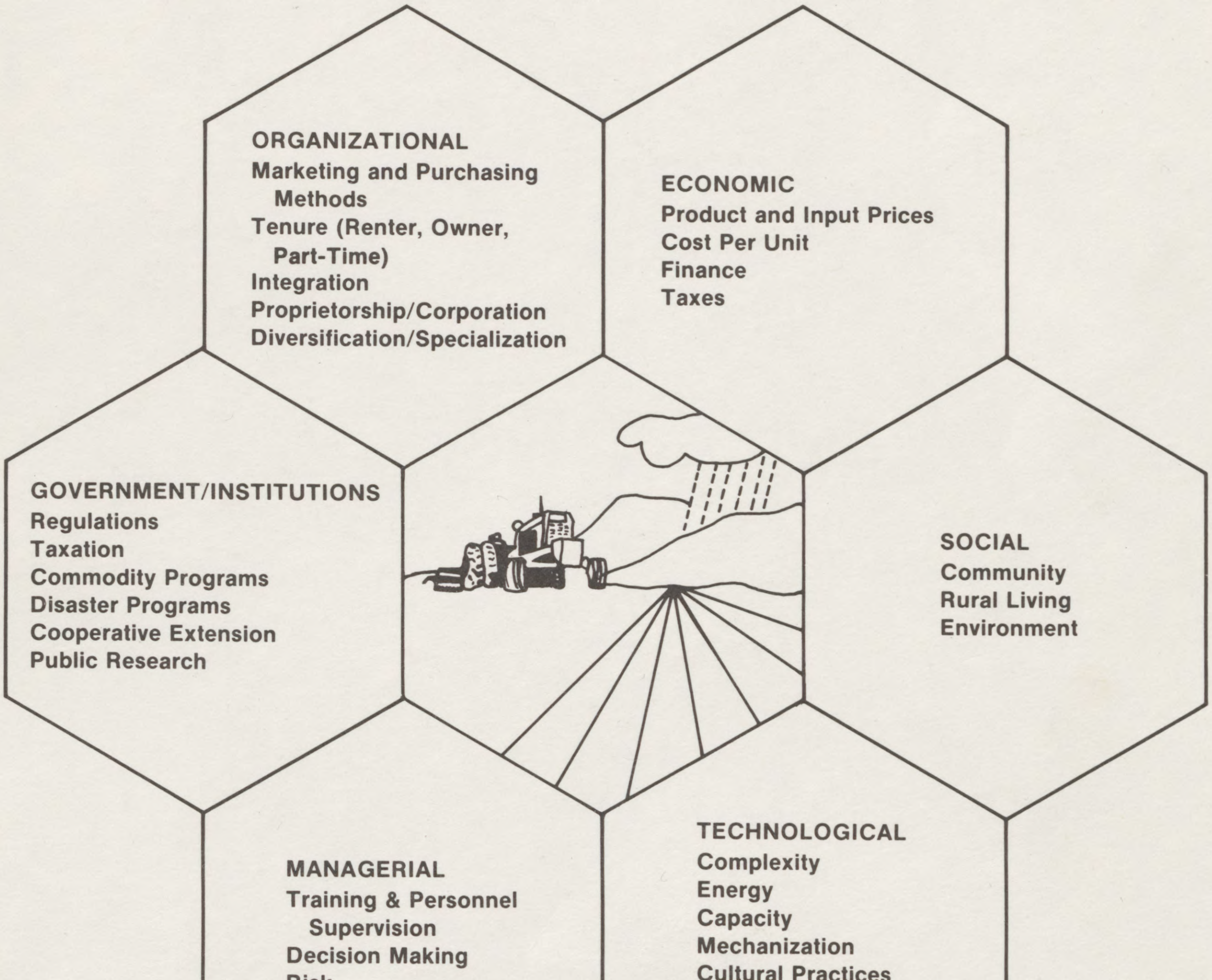
Giannini Foundation of Agricultural Economics



# FARM-SIZE RELATIONSHIPS, WITH AN EMPHASIS ON CALIFORNIA




**California Agricultural Experiment Station**
**Giannini Foundation Project Report**

Division of Agricultural Sciences
UNIVERSITY OF CALIFORNIA

# FARM-SIZE RELATIONSHIPS, WITH AN EMPHASIS ON CALIFORNIA

A review of what is known about the diverse forces affecting farm size, and additional research considerations.

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December, 1980

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## ACKNOWLEDGEMENTS

The following members of the Department of Agricultural Economics, U.C. Davis, accepted initial responsibility for the drafting of sections (chapters) of this review:

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The principal investigators subsequently, with the assistance of the editor, took responsibility, with author review, for editing and in some cases adding supplementary materials to meet organizational objectives and presentation uniformity. The following students served as research assistants on portions of this project: Jim Anderson, M. C. Athanassiadis, Dan Camenson, Eric Haggren, Soheila Khoii, Don Matlin, and Tom Storelli.

The manuscript benefited from comments of Professor Gene Nelson, Oregon State University, and Dr. Kent Olson, University of California, Davis, Cooperative Extension. This study is supported by California Agricultural Experiment Station funds (Project 3678), and is published with the support of the Giannini Foundation of Agricultural Economics.

# PREFACE

In recent years concern has mounted over the persistent trend toward increasing farm size and decreasing farm numbers. There are cries of alarm about the seemingly ever-growing concentration of agriculture's resources in fewer and fewer hands. It is alleged that the system of marketing for both inputs and products, government programs, and even publicly supported research have been increasingly geared to favor large producers. Moreover, escalating land prices and heavy capital requirements have raised substantial economic barriers to entry. Some contend that such structural changes have adversely affected rural communities in terms of fewer farm people and declining numbers of small-town businesses and services.

On the other hand, American agricultural production is unrivaled in the world in terms of per man-hour efficiency and productivity. American consumers capture many of the benefits of the nation's consistently abundant agricultural production in the form of low food costs. Furthermore, agricultural commodities have become an increasingly important part of this nation's international trade.

The report herein was prepared by a group of researchers in the Department of Agricultural Economics at UCD, which informally labelled itself the farm-size committee. Their expertise represents all of the major subdisciplines of agricultural economics. As a group, they focused on the issue of farm size with particular reference to California. They considered the issue of farm size in its broadest context, not just as a traditional agricultural production problem. This first report is in a sense a state-of-the-art compendium--that is, what is known about the diverse forces affecting farm size is reviewed and areas needing further research are identified. Subsequent reports are intended by members of the group dealing with some of these specific research problems. Accordingly, the report is a necessary first step in dealing with an issue that is of paramount importance in the United States and California.

J. B. Kendrick, Jr.
Vice President-Agricultural and
University Services

# CHAPTER I

# FARM SIZE RELATIONSHIPS: AN INTRODUCTION AND STATISTICAL OVERVIEW

## Introduction

There are two main objectives to this report. First, the "state-of-the-art" knowledge about cost-size relationships in California agriculture is explored. Particular attention is given to the diverse forces affecting these cost relationships. Second, potential economic research, both empirical and conceptual, that would enhance knowledge of cost-size relationships in California is specified. Such needed research, when accomplished, could provide a better basis for decision making at the firm, state, and national levels.

The approach followed in meeting these two objectives is to consider the farm as an integrated decision system. The components of the system relate to technology, government/institutions, firm organization and management, risk, as well as social/environmental factors. It is contended here that each of these components influences in some way the size configuration of farms in California, now and in the future, as in the past. In turn, the size or scale of farm organization affects the rural community and the environment in ways not entirely understood.

First, using data from the Census of Agriculture, a statistical overview of some traditional farm characteristics and size measures, is presented for California and the nation. Definitional problems are noted. In Chapter Two a review of past empirical farm-size studies in California is presented. Research gaps in commodity and geographic coverage are identified. Subsequently, Chapters Three through Eight each deal with separate identifiable components relating to size--government, taxation, marketing systems, risk, labor, and energy. Chapter Nine considers farm size in relationship to the rural community. The report is concluded with a summary chapter.

## Statistical Overview and Definitional Problems

It is common knowledge that farms in America have been getting larger and fewer in number. According to the Census of Agriculture there were almost 4.8 million farms in 1954 with an average size of 242 acres (Table 1.1). By 1974 there were only 2.3 million farms with an average size almost twice as large (440 acres). California farms are larger than their U.S. counterparts--the average size of the state's farms was 493 acres in 1974. Acreage per farm, however, is a poor indicator of size, especially in California where soils, water availability, elevation, and type of farming vary greatly among areas of the state. Data collected by the Census show "land in farms" which includes cropland, land for grazing, and even woodlots. Thus, such diverse operations as specialty vegetable production and foothill ranges are grouped together in calculating farm size, biasing the average in an upward direction. On the other hand, census data identify farms managed and owned by the same individual(s) but operated in different geographic locations as separate farms.

TABLE 1.1

Trends in Farm Size and Numbers, California and the U.S. 1954 to 1974

| | 1954 | 1959 | 1964 | 1969 | 1974 |
|---|---|---|---|---|---|
| Number of Farms | | | | | |
| California | 123,075 | 99,274 | 80,852 | 77,875 | 67,674 |
| United States | 4,782,416 | 3,710,503 | 3,157,857 | 2,730,250 | 2,314,013 |
| Average size, Acres | | | | | |
| California | 307 | 372 | 458 | 454 | 493 |
| United States | 242 | 303 | 352 | 389 | 440 |
| Number of Farms by Total Sales-- | | | | | |
| $2,500-$19,999 | | | | | |
| California | 47,504 | 37,278 | 26,457 | 27,464 | 21,452 |
| United States | 2,228,242 | 1,754,562 | 1,415,628 | 1,143,819 | 863,647 |
| $20,000-$99,999 | | | | | |
| California | -- a/ | -- | 18,038 | 15,917 | 16,086 |
| United States | -- | 292,162 | 370,411 | 500,687 | 646,081 |
| $100,000 and Over | | | | | |
| California | -- | -- | 7,043 | 7,382 | 11,428 |
| United States | -- | 19,979 | 31,401 | 51,995 | 152,599 |

a/ Data not available by the chosen sales categories.

Source: Census of Agriculture

There are many of these multi-unit farms in California (see Villarejo, 1980). The bias resulting from this latter procedure is to understate the average farm size.

Another indicator of size is annual gross sales. The Census categorizes farms into sales classes, but the comparability of these classifications through time has been affected by inflation. An estimate is that 60 percent of the growth in the $100,000 and over class of farms is due to inflation (Lin and Emerson, 1977). Furthermore, on the lower end of the sales spectrum, many extremely small operations such as hobby, part-time, or retirement farms have been pulled by inflation into the census definition of a farm.

Another definitional problem is trying to identify a "farm." In the first issue of the Journal of Farm Economics in 1919 a farm was defined by the Terminology Committee as "a property composed of a single tract or separate tracts of land equipped as a unit for agricultural production and which raises products equivalent in value to at least the wages of a hired man." (Stanton, 1978, p. 728) By this definition, many of the operations presently classified by the Census would no longer rank as "farms" because farm sales do not reach the level of the wages of a hired person.

There is no general consensus as to the definitions of such terms as "small farm," "family farm," "large-scale commercial farm," etc. One commonly used definition of a family farm is (USDA, Feb. 1978, pp. 2-3): "one operated by a farmer and his family where the farmer provides much of the labor needed for the farming operation, makes most of the management decisions, assumes most of the risks, and reaps the gains or suffers the losses from those decisions." There is wide acceptance of this definition for Midwest conditions, but it is less satisfactory for farming operations in California.

The requirement that the family be "dependent" on farming as the principal source of livelihood in order to be classified as a family farm has also been used. Yet, 38 percent of American and 60 percent of California farmers as classified by the Census, reported off-farm income greater than the value of farm products sold in 1974.

"Small farm" is even more difficult conceptually than "family farm." For purposes of program planning, the University of California Cooperative Extension (Fujii et al., 1978) defined a "small farm" as "a place on which agricultural operations are conducted under the immediate control of a single management entity, and which is expected to yield gross annual sales of agricultural products amounting to at least $250, but less than $20,000." This is in partial conflict with the more traditional census definitions, besides being somewhat arbitrary.

It is sufficient here to point out these definitional problems with respect to size and tenure characteristics of farms which are all too often glossed over because of the difficulty in pinning them down. There is a danger in definitional imprecision particularly in the policy arena. For example, in working toward a goal of "preserving the small family farm," one would hope that policy makers are clear about the target group affected.

## A Statistical Comparison of Size-Related Factors

As noted above, aggregate census data based on arbitrary sales classes may give some erroneous impressions of interrelationships between size and farm characteristics. For purposes of providing some insights into generally perceived size relationships, however, the following summary data are presented.

### Sales Per Acre and Size

The largest farms in terms of gross sales not only sell more (by definition) than smaller farms, but also sell proportionately more on a per acre basis (see Table 1.2). In California per acre sales of the $2,500-$19,999 group were less than 10 percent of those of the over $100,000 sales group. Whether the significantly greater per acre sales of the large-size group reflects better management, less home consumption, better access to resources, better access to markets, proportionately more per acre government benefits, or merely a statistical anomaly is in part the subject of this report.

There is also interest in the increasing concentration of sales in the hands of fewer farmers. In 1974, U.S. farms with sales of $100,000 and over constituted only 7 percent of the nation's farms but sold 54 percent of the total commodity sales. In California, evidence of concentration is even more striking. While there was a higher percentage of farms in the top sales group (17 percent), farms with sales of $100,000 and over captured over 87 percent of the sales.

As the larger sales class farms capture increasingly large shares of farm sales and income, smaller farmers turn to off-farm sources to supplement their incomes. Based on nonfarm income reported in the Census from various sources--nonfarm related business; wages, salaries, commissions and tips; interest, dividends, and royalties; federal social security, pensions, etc.; and rent of nonfarm property--California operators in the $2,500 to $19,999 sales class added a per farm average of $11,732 to their farm income in 1974; whereas, the $100,000 and over class added only $6,128. The comparable U.S. figures are for the smaller farm class, $6,653; for the larger, $3,812.

Hired Farm Labor on California Farms

Partly because of the labor intensity of many of California's specialty crops, over 16 percent of the total U.S. hired farm labor force was employed in California. In fact, according to one hypothesis (Fuller, 1939), the development of California agriculture on a relatively large scale compared to the rest of the nation can be attributed in part to the availability of large pools of foreign laborers. It is the larger size farms in the state (and in the nation) that hire most of the labor and pay most of the wages. California farms with sales of $100,000 and over employed nearly 68 percent of the total farm hired work force in 1974 and paid over 88 percent of the state's total farm wage bill.

Energy and Machinery Inputs and Size

Data are available for several types of energy related inputs including the purchase of gasoline and other petroleum fuel and oil, and commercial fertilizer. Large-scale farmers ($100,000 and over) in California spend substantially more for these inputs than comparable sized farms in the nation. This may be due to the fact that large California farms tend to be even larger than their national counterparts as well as being heavier energy users because of irrigation and multiple and specialized cropping rotations. In any case, they may well be more vulnerable as energy costs rise. Conversely, the per acre energy costs for the intermediate and small sales classes are lower for California than for the nation as a whole. Exactly the same cost pattern holds true for fertilizer purchases.

Large scale operators in California on the average invest considerably more in machinery and equipment per acre than do the lower sales classes of farms (see Table 1.2). In the U.S. figures, some evidence for cost economies of size can be seen, for on a per acre basis, machinery and equipment costs decline as farm size increases. The scale effect is not evident in the California data, but all farm types are lumped together by the Census in the aggregate data. High-sales-value feed lots, orchards, or vegetable farms, which are more common in California than in the rest of the nation, are generally not large in terms of acreage; thus for farms of $100,000 sales and over, average per acre costs are higher and the aggregate scale effect is lost in the California data.

## Type of Organization

Generally accompanying the concern about concentration within agriculture, is apprehension about the growing dominance of "corporate farming." Again definitional difficulties cloud the issue, for a small incorporated family farm is thereby placed in the same category as a large, diversified corporation.

While incorporation has become an increasingly important form of organization for farm firms (see Chapter Four), it is clearly an exaggeration, based on these data to assert that large corporations are taking over American agriculture. First of all as the total number of farms has declined, U.S. farms classed as individual and family operations increased from 85 percent in 1969 to 90 percent in 1974 (California 80 percent to 81 percent). The percentage of corporate farms also increased--from 1.2 percent in 1969 to 1.7 percent in 1974 (in California, from 3.6 percent to 5.2 percent). These increases were primarily at the expense of partnerships.

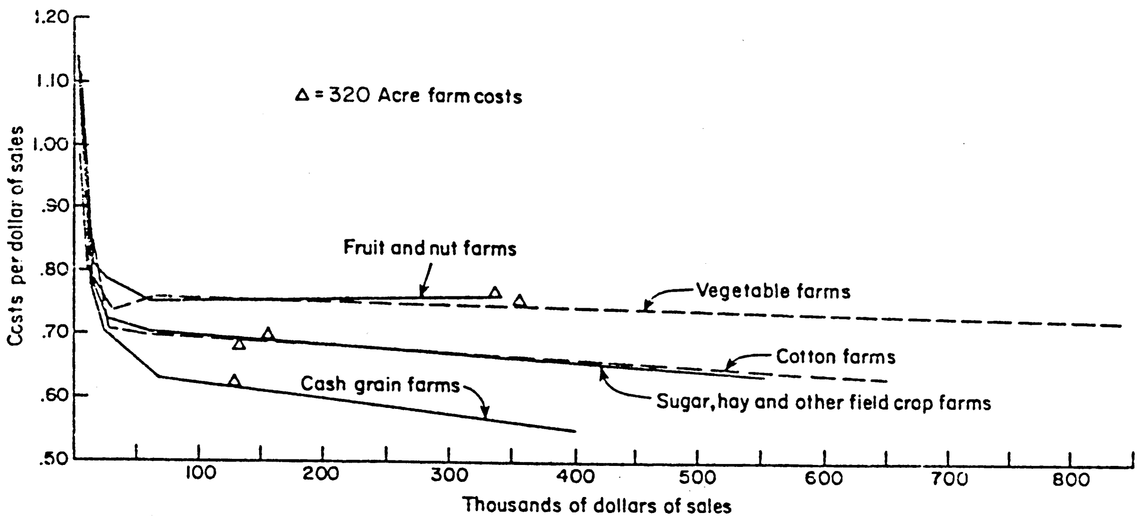
Further, of those classed as corporations, 77 percent were family corporations (71 percent in California). Seventy-six percent of U.S. corporate farms (72 percent in California) had five or fewer shareholders. Thus, most corporate farms are really family farms under the corporate form of business organization. It does tend to be the larger sales class farms which incorporate their operations (see Table 1.2), though many small farms also wish to take advantage of incorporation for tax and accounting purposes and for ease of intergenerational transfer.

## Summary of Aggregate Census Data and California Farms

A study of the relationship between farm size and production costs using 1974 Census of Agriculture data for several kinds (cash grain, cotton, fruit and nuts, etc.) and economic classes of farms in California (see Figure 1.1) was given by Hall and LeVeen (1978). The figure provides collaborative support for generally perceived notions about the nature of cost-size relationships for different types of farming. The authors conclude after their examination of the sources of declining production costs that (pp. 599-600): ". . . while there is a significant technical basis for these economies of size, other factors such as management, resource quality, and the overall institutional structure are even more important," and further that ". . . there is a great need for empirical analysis of how factors--such as risk, product market structure and performance, labor supply and organization, and financial markets--discriminate against the small producer and how these factors can be adjusted to a more equitable basis without decreasing productive efficiency."

The several aspects introduced here in relationship to farm size will be explored more fully in the subsequent chapters. This brief overview of trends and of the present structure of agriculture in the state and in the nation, has set the stage for the analysis which follows.

FIGURE 1.1 Average Cost Curves for California Farms.




Source: Hall and LeVeen, 1978.

# CHAPTER II

# FARM SIZE STUDIES: A REVIEW OF PAST WORK AND RESULTS

## Introduction

The issue of economies of size in farming is not new in agricultural economics research but was, in fact, a very topical issue during the late-1950's and early-1960's. The policy focus then was on agricultural adjustment to achieve a more economic and rational allocation and use of resources, for the agricultural sector of the economy was thought to be plagued with persistent low returns to human and land resources. In that setting, economies of size were examined with the view of determining how large firms should be (or should grow to) in order to be efficient in production and to earn adequate returns for the resources used in production. During the same period, cultural, biological, and mechanical innovations provided ample incentives for the growth of those firms which had adequate capital and managerial resources. Further, government price, income, and credit policies also did much to foster farm size expansion (see Chapter Three).

## California Farm Size Studies

California agriculture affords the researcher with several distinct types of farming and different farming areas to

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investigate. Five of the eight empirical studies for crop production and two of the four for beef feedlots, reviewed by Madden in 1967, were California studies.

The locations and types of studies from university research programs on economies of size in California agriculture are shown in Figure 2.1. With the exception of the Chino Valley dairy study in eastern Los Angeles County (Matulich et al., 1977), all of the studies were based on data collected from 1956 through 1966. Thus, the studies are very much dated and cannot be expected to portray accurately, current economic conditions in California agriculture. They are, however, of value in their examination of the technical economies of scale generally associated with increasing farm size and are, therefore, reviewed in this chapter.

The primary focus of the studies, with few exceptions, ". . . was on the interaction of machinery technology, farm size, and production cost." (Holland, 1978, p. 8) California studies were usually based on actual farm interview data solicited by questionnaire. The effort and cost required for studies based on survey data are much greater than for studies based on secondary information (e.g., Cooperative Extension cost budgets for typical farms or census statistics), but survey data probably better reflect actual conditions than do average secondary data. It was suggested, however, by Holland that there may have been a bias built into some of the survey type studies, resulting in an underestimation of large-farm production costs and overestimation

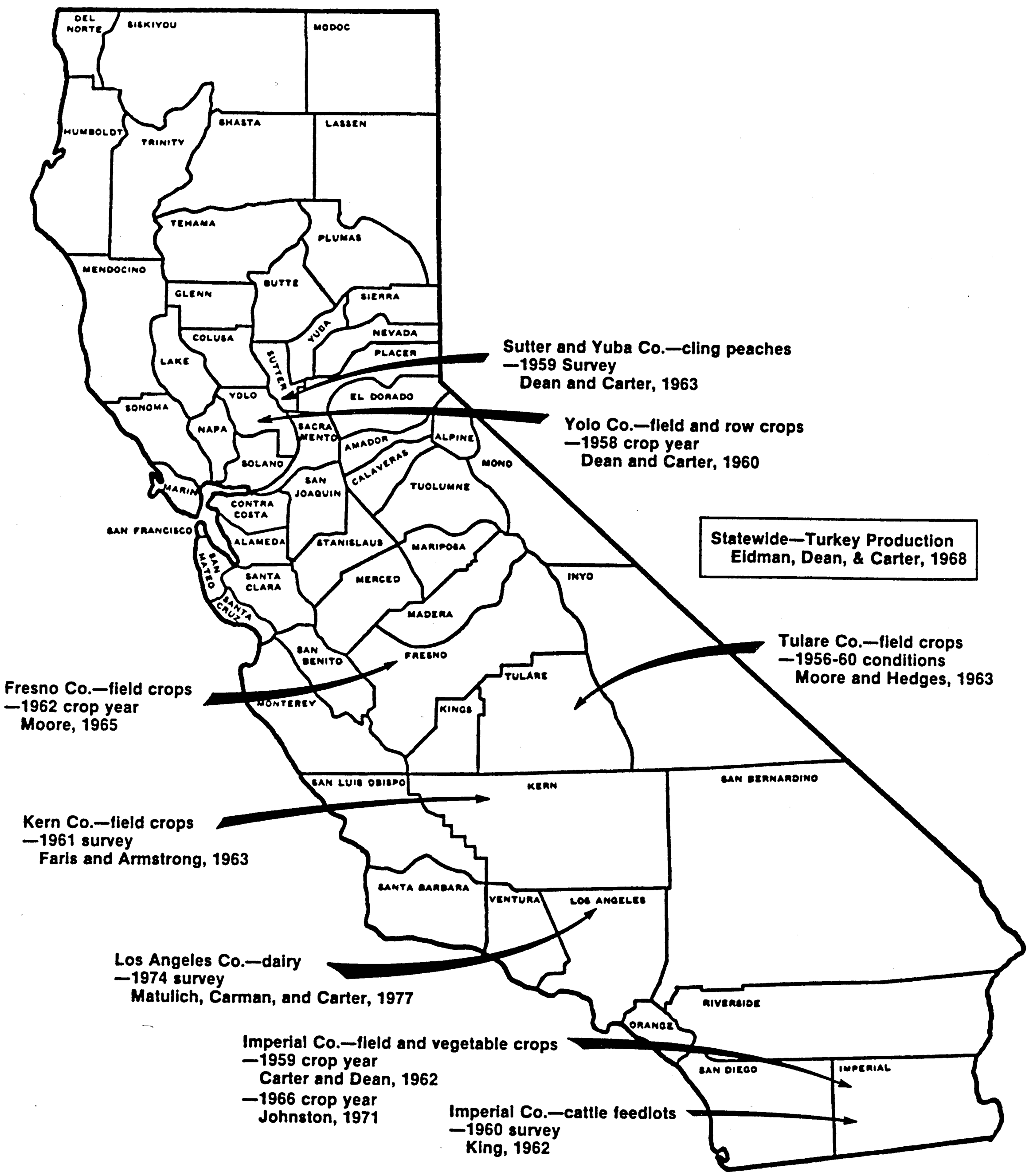



FIGURE 2.1 University of California Economies of Size Studies

of small-farm production costs. Policy issues at the time seemed to revolve around the benefits (cost reductions) attributable to larger sized firms. Small-sized units were not treated with the same emphasis. In several of the studies (Carter and Dean, 1962; and Johnston, 1971) the assumption was that it was probably economically most efficient for the smallest units to custom-hire part or all of the required machinery services. Only a few studies addressed the question of pecuniary economies (diseconomies) of large size units (notably Dean and Carter, 1962; and Faris and Armstrong, 1965).

Most of the California studies used a "synthetic firm" or "economic engineering" approach with the survey data--that is, from a random sample of actual farms, the data were size-stratified and "typical" machinery and equipment combinations were assigned to representative farms in each stratum. Thus, typical machinery combinations were viewed as the resource, limiting the short-run expansion of the farm unit. Budgeting and linear programming were the analytical techniques used. The usual approach generally assumed that the residual claimant to economic returns, in excess of fixed and variable costs, was management (in some cases management and unpaid operator and/or family labor). (For a review of the methodologies used in these studies see Madden, 1967; Carter and Dean, 1961; and Faris, 1961.)

Just as economic conditions differ today from the 1960's, so the interest in farm size has a different emphasis. Welfare and equity considerations have become more important as questions about structure, small farm feasibility, and farm viability, in general, are being asked.

## Empirical Studies of California Crop Farms

Acreage, gross revenue, and the lowest cost-revenue ratio attained for each representative farm size from seven University of California crop production studies are summarized in Table 2.1. In general, significant economies (reductions in cost per dollar of revenue) are reported for "medium-sized" when compared with "small" farms, arising mainly from technical economies associated with typical machinery combinations on the representative farms. Most of the studies also reported that larger sized farms did not enjoy substantially lower unit costs than did medium-sized farms. Thus, cost-revenue ratios generally fall sharply over the first one or two smallest farm sizes and then level off.

Reported results from the same seven studies are summarized diagrammatically in Figure 2.2 which depicts the minimum cost-revenue ratios for each representative farm size <u>relative</u> to the lowest ratio attained in the specific study. (The "relative pct." rows in Table 2.1 are graphed in Figure 2.2.) For example, in the Yolo County field crop study (Carter and Dean, 1961), Size I farms (570 acres) had a 2 percent higher cost-revenue ratio than did Size III farms (2,017 acres). Besides giving a visual presentation of economies of size found in the studies, variation in representative farm sizes and the ranges of sizes studied are also shown in Figure 2.2.

TABLE 2.1

Summary of Economies of Size in California Crop Production for Studies based on mid- to Mid-1960's data

| Location and Study Year | Type of Farm | Author(s) | Rotation[a] | Farm Character-istics | Study Results: Farm Size[b] I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|---|---|---|---|
| Yolo County -1958 crop year | Field crops | Dean and Carter, 1960 | Size-Fixed | Acreage | 570 | 890 | 2,017 | 4,080 | | |
| | | | | Gross Revenue ($000) | 170 | 240 | 428 | 750 | | |
| | | | | Cost/Revenue | .84 | .84 | .82 | .84 | | |
| | | | | (relative pct.) | (102) | (102) | (100) | (102) | | |
| Imperial County -1959 crop year | Field crops | Carter and Dean, 1962 | Fixed | Acreage | < 400[c] | 625 | 1,250 | 2,800 | 4,500 | |
| | | | | Gross Revenue ($000) | 81 | 126 | 253 | 566 | 909 | |
| | | | | Cost/Revenue | .84 | .81 | .78 | .73 | .73 | |
| | | | | (relative pct.)[d] | (115) | (111) | (107) | (100) | (100) | |
| | Field and Vegetable crops | | Fixed | Acreage | < 400[c] | 640 | 1,550 | 2,000 | 3,800 | |
| | | | | Gross Revenue ($000) | 181 | 290 | 700 | 905 | 1,720 | |
| | | | | Cost/Revenue | .84 | .83 | .82 | .82 | .82 | |
| | | | | (relative pct.) | (102) | (101) | (100) | (100) | (100) | |
| Yuba & Sutter County -1959 survey | Cling Peaches | Dean and Carter, 1963 | One-crop non-mech. harvest | Acreage | 24 | 58 | 86 | 229 | 430 | |
| | | | | Gross Revenue ($000) | 17 | 42 | 62 | 164 | 308 | |
| | | | | Cost/Revenue | .96 | .92 | .92 | .92 | .94 | |
| | | | | (relative pct.) | (104) | (100) | (100) | (100) | (102) | |
| | | | One-crop mechanized harvest (15%-green drop) | Acreage | 24 | 58 | 86 | 229 | 430 | |
| | | | | Gross Revenue ($000) | 15 | 37 | 56 | 148 | 278 | |
| | | | | Cost/Revenue | 1.08 | .89 | .87 | .85 | .86 | |
| | | | | (relative pct.) | (127) | (105) | (102) | (100) | (101) | |
| Tulare County -1956-60 conditions | Field crop[h] | Moore and Hedges, 1963 | Variable | Acreage | 80 | 160 | 320 | 640 | 1,280 | |
| | | | | Gross Revenue ($000) | 26 | 54 | 110 | 219 | 439 | |
| | | | | Cost/Revenue | .92 | .87 | .86 | .83 | .81 | |
| | | | | (relative pct.) | (114) | (107) | (106) | (102) | (100) | |
| Kern County -1961 survey | Field crop[e] | Faris and Armstrong, 1963 | Fixed | Acreage | 80 | 160 | 320 | 640 | 1,280 | 3,200 |
| | | | | Gross Revenue ($000) | 19 | 39 | 78 | 155 | 310 | 776 |
| | | | | Cost/Revenue | 1.03 | .95 | .92 | .86 | .85 | .83 |
| | | | | (relative pct.) | (124) | (114) | (111) | (104) | (102) | (100) |
| | | | Size-Fixed | Acreage | 80 | 160 | 320 | 640 | 1,280 | 3,200 |
| | | | | Gross Revenue ($000) | 20 | 40 | 78 | 149 | 283 | 685 |
| | | | | Cost/Revenue | 1.00 | .93 | .91 | .89 | .91 | .92 |
| | | | | (relative pct.) | (112) | (104) | (102) | (100) | (102) | (103) |

Table continued. . .

Table 2.1 continued . . .

| Location and Study Year | Type of Farm | Author(s) | Rotation[a] | Farm Characteristics | Study Results: Farm Size[b] I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|---|---|---|---|
| Fresno County -1962 crop year | Field crop | Moore, 1965 | Variable ..Light soils | Acreage[g] | 193 | 349 | 710 | 1,590 | | |
| | | | | Gross Revenue ($000) | 40 | 65 | 150 | 250 | | |
| | | | | Cost/Revenue | .84 | .85 | .78 | .77 | | |
| | | | | (relative pct.) | (109) | (110) | (101) | (100) | | |
| | | | Variable ..Heavy soils | Acreage[g] | 270 | 629 | 1,134 | 3,305 | | |
| | | | | Gross Revenue ($000) | 70 | 140 | 260 | 480 | | |
| | | | | Cost/Revenue | .92 | .90 | .86 | .93 | | |
| | | | | (relative pct.) | (107) | (105) | (100) | (108) | | |
| Imperial County -1966 crop year | Field and Vegetable crops | Johnston, 1971 | Fixed ..perfect machinery availability[f] | Acreage | 750 | 1,138 | 1,817 | 3,157 | 4,068 | |
| | | | | Gross Revenue ($000) | 146 | 221 | 464 | 806 | 1,040 | |
| | | | | Cost/Revenue | .88 | .86 | .81 | .81 | .82 | |
| | | | | (relative pct.) | (109) | (106) | (100) | (100) | (101) | |
| | | | Fixed ..adjusted machinery availability | Acreage | 750 | 983 | 1,518 | 2,551 | 3,178 | |
| | | | | Gross Revenue ($000) | 146 | 191 | 379 | 652 | 812 | |
| | | | | Cost/Revenue | .88 | .87 | .82 | .81 | .82 | |
| | | | | (relative pct.) | (109) | (107) | (101) | (100) | (101) | |
| | | | Variable ..adjusted machinery availability | Acreage | 500 | 2,018 | 2,021 | 2,500 | 4,063 | |
| | | | | Gross Revenue ($000) | 110 | 527 | 534 | 674 | 1,080 | |
| | | | | Cost/Revenue | .88 | .83 | .81 | .81 | .82 | |
| | | | | (relative pct.) | (109) | (102) | (100) | (100) | (101) | |

a/ Definitions: Fixed: same rotation used for all farm sizes; Size-fixed: rotations differ among farm sizes but constant throughout for the same farm size; Variable: crops selected by linear programming subject to restraints.

b/ Farm size specified as acreage which either exhausts machinery capacity (for fixed and size-fixed rotations), or which results in the minimum cost-revenue ratio for variable rotations.

c/ Cost/Revenue ratio constant from 0 to 400 acres because of contracting of all farming operations by smallest size farms.

d/ Relative percentage is Cost/Revenue ratio for each farm size, relative to the smallest ratio of any farm size investigated in the particular study.

e/ Cotton, alfalfa and double-cropped barley-milo alternative.

f/ Perfect machinery availability does not reflect any adjustment for the spatial distribution of land. Adjusted machinery availability has reduced machinery availabilities to reflect dispersed distribution of parcels in larger farming operations. (See Johnston, 1972.)

g/ Farm sizes reflect number of men (persons) in regular labor supply of 1, 2, 4, and 8, respectively.

h/ Includes all alternative crops, including cantaloupes and sugar beets.

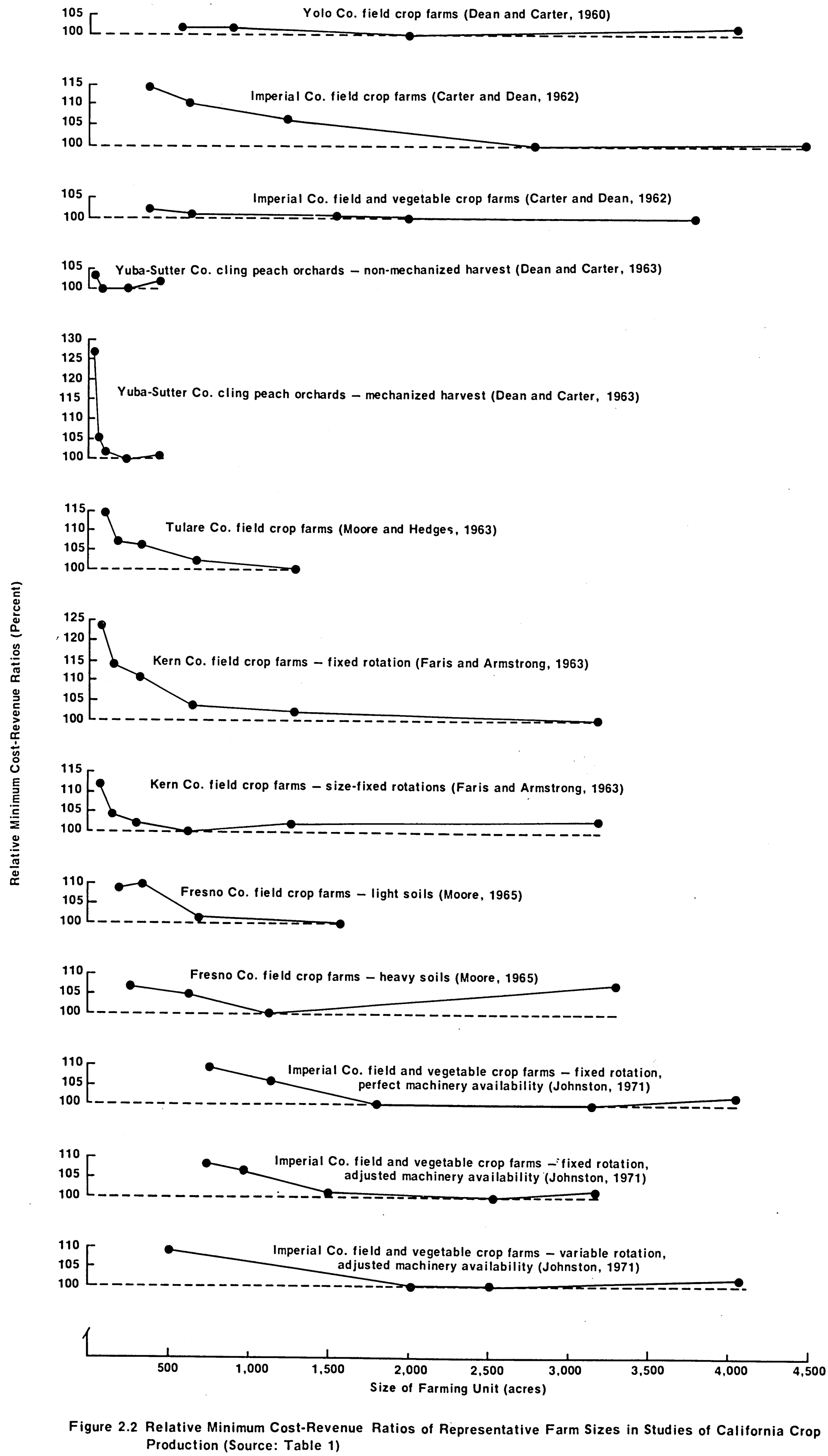



Figure 2.2 Relative Minimum Cost-Revenue Ratios of Representative Farm Sizes in Studies of California Crop Production (Source: Table 1)

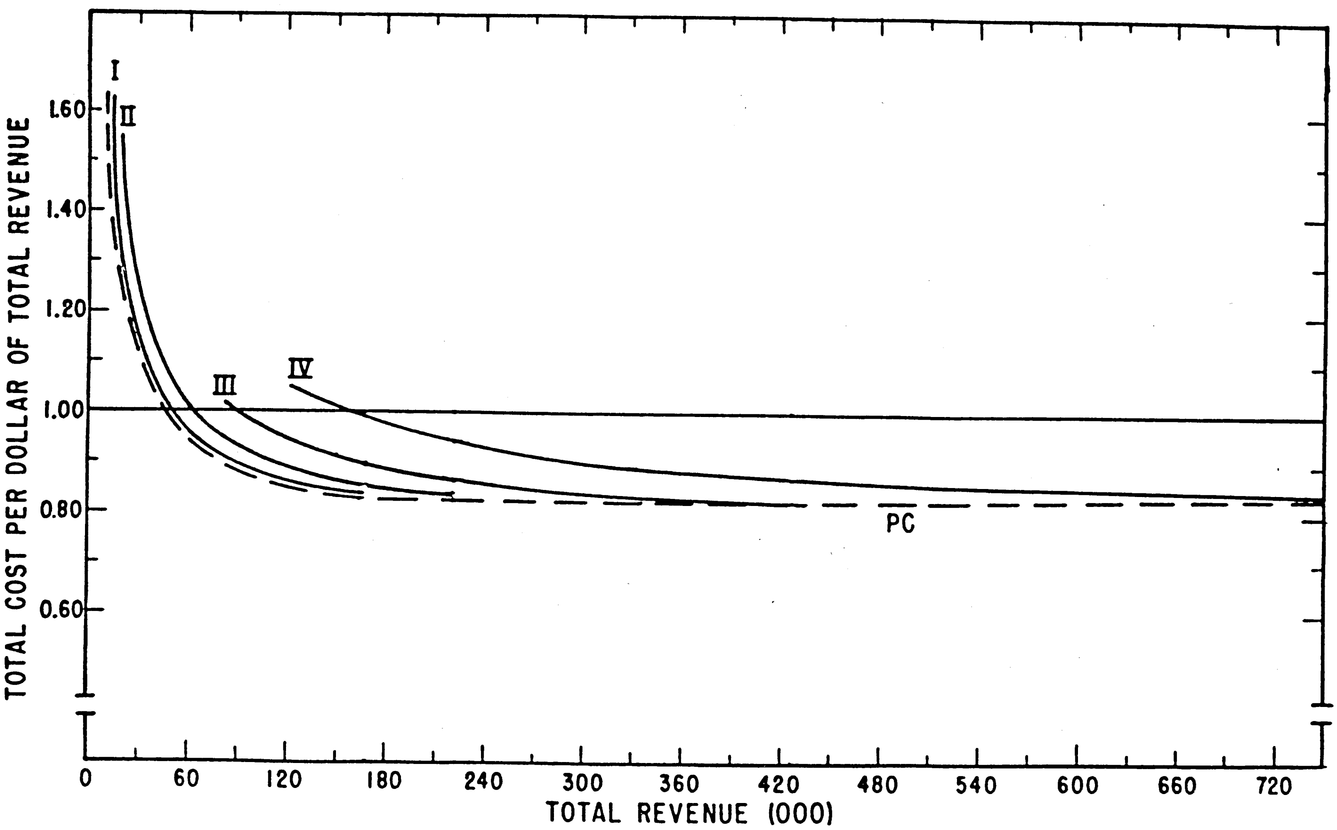
Yolo County Field Crop Farms (1958 Crop Year)

The first in the series of studies of economies of size in Caifornia crop production was the study of irrigated cash crop farms in Yolo County (Dean and Carter, 1960). The study was based on survey information for 37 farms ranging in size from 71 to 4,000 acres, located in a 96 square mile area around Woodland and Davis. Farmers were interviewed during the summer of 1959 to obtain information about farming operations in the 1958 crop year. Four representative farm machinery complements were synthesized from survey information, and the formal analyses included two budgeting alternatives and a linear-programming solution, with comparisons among the alternatives.

The solid-lined short-run curves for each of the four machinery combinations (I-IV) and the dashed-lined envelope or planning curve--the long-run average cost (LRAC) curve are shown in Figure 2.3. The LRAC curve reflects conditions where rotations are fixed for each farm size; rotations were allowed to differ among the four farm sizes affording more intensive farming possibilities for the smaller farms. (Actual cropping patterns in the area showed a tendency to shift toward proportionately more of the lower valued crops as operating units increased in size.) Costs fell quite sharply for both Size I and II farms over farm sizes ranging upwards to about 400 acres ($120,000 total revenue at the rate of nearly $300/acre).

In this case, the LRAC was virtually flat beyond net revenues of $150,000, net revenues increased in a linear fashion with size. While the cost-revenue ratios were uniform for sizes I,

FIGURE 2.3 Average Total Cost Curves for Four Machinery Combinations and Envelope or Planning Curve, Yolo County Cash-Crop Farms (1958 crop year).




Source: Dean and Carter, 1960.

II, and IV (Table 2.1 again), total revenues (and costs) were of course much greater on the larger farming units. Noting the flatness of LRAC, Dean and Carter concluded that (p. 55): ". . . the analysis does not indicate a strong economic incentive for expansion to extremely large size; farms of about 600-800 acres appear able to compete on a unit cost and profit basis with much larger farms. Yet because unit costs are approximately constant over a wide range, a continuation of wide variation in farm sizes can be expected, with little tendency for farm size to concentrate at one 'optimum' size." A 1969 Ph.D. dissertation by Wildermuth contains several alternative, but not substantially different, estimates of the LRAC curve for the same Yolo County crop farms based on 1965 data.

In a subsequent review article, Carter and Dean (1961, p. 277) noted further that: "In the absence of diseconomies, the primary factors responsible for size differences will probably be managerial ability, capital supply, and risk and uncertainty." Thus, while economies of scale play an important role up to a certain point in the consolidation and expansion of smaller farming units, many other factors have important impacts as well (as is evidenced in the chapters of this report).

<u>Imperial Valley Field and Vegetable Crop Farms (1959 Crop Year)</u>

The second study focused on two types of Imperial Valley farms--(1) farms with revenues from field crops only and (2) farms with both field and vegetable crop production, with vegetable crops accounting for 25-75 percent of total acreage, in most cases (Carter and Dean, 1962). Technical economies of size for each of the two types of farms are shown in Figure 2.4. Since commercial custom operators were generally available in the study area and the survey revealed a lack of certain machinery and equipment on several small farms, the short-run cost curve for Size I was based on custom contracting; whereas, Size II was based on owned equipment. Custom contracting seemed to provide lower costs of production for small farms with a "break-even" point at about 400 acres between contracting and owning equipment and machinery.

For field crop farms (under 1959 conditions), significant cost advantages accrued to operations up to a size of about 1,500-2,000 acres (Figure 2.4a), but the authors also noted that (p. 25): ". . . if farms that are highly mechanized and otherwise set up to operate large acreages under-utilize this capacity, they may have higher unit costs than smaller operations more fully utilizing their fixed resources."

The apparent lack of any economies of size on vegetable crop farms was due to the high proportion of contract harvest costs involved in vegetable crop production. In fact, if adequate custom contracting were always available, there would seem to be little advantage in owning machinery or equipment (Figure 2.4b). In the absence of adequate contract operators, however, when owners must rely on their own machinery and equipment, considerable cost economies occurred up to about 640 acres.

FIGURE 2.4 Imperial County Field and Vegetable Crop Farms (1959 crop year).

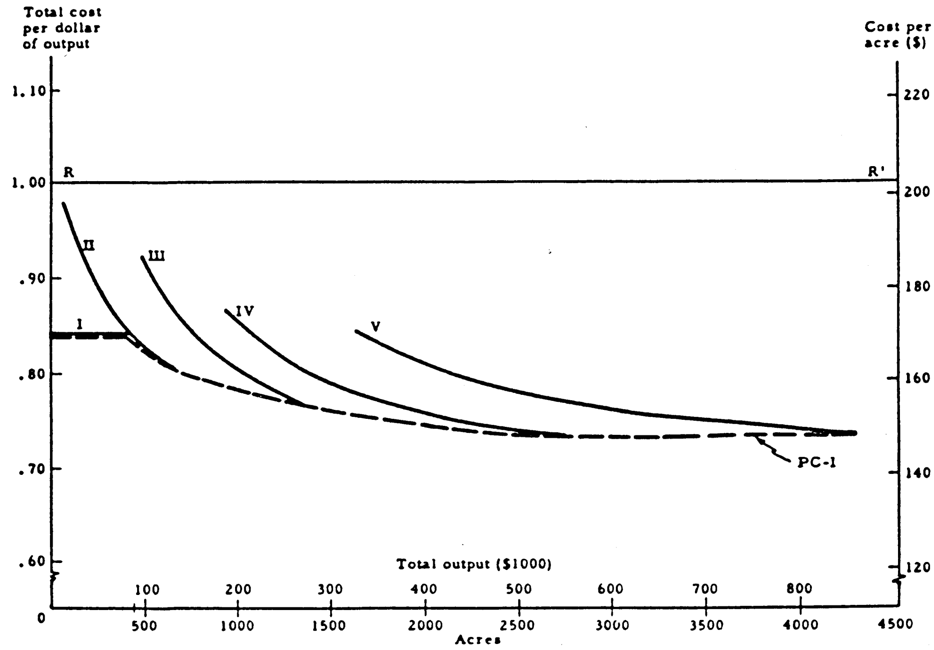



Figure 2.4a. Average total cost curves and envelope or planning curve, field crop farms.

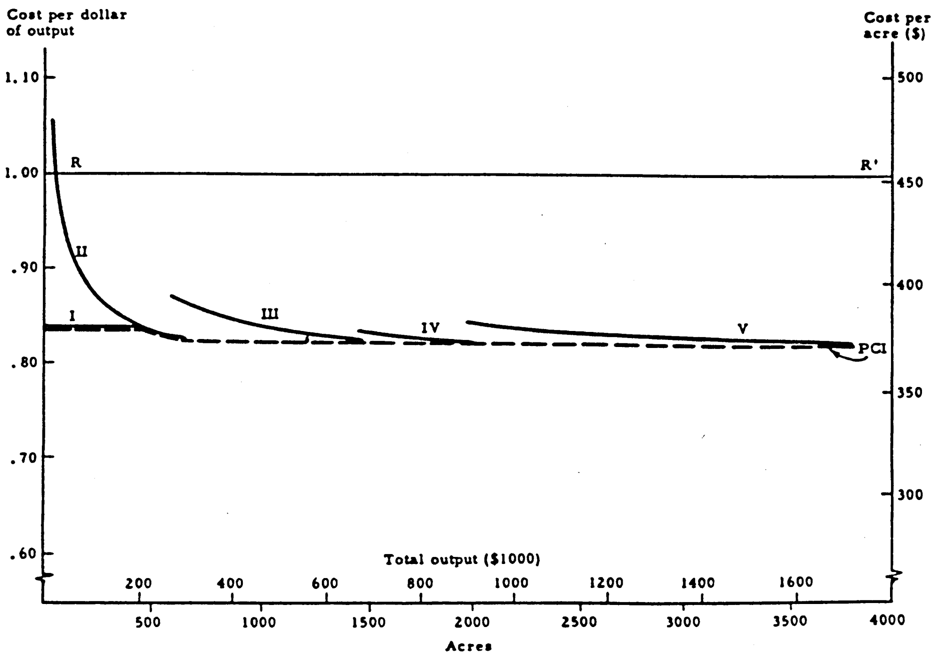



Figure 2.4b. Average total cost curves and envelope or planning curve, vegetable crop farms.

Source: Carter and Dean, 1962.

The study also examined the impact of increasing labor costs on total costs. Because of the higher labor intensity of vegetable crop production, a 50 percent increase in wages was found to increase total costs by 15 percent on vegetable farms; by 10 percent on field crop farms.

A follow-up study on the Imperial Valley data focused on important nontechnial influences on farm size--namely, the many-faceted impact of income taxes on commercial agriculture (Dean and Carter, 1962). The comparison of after-tax profits to the owner-operator as opposed to pretax results to the firm alone, revealed incentives for low-equity (highly-leveraged) firms to expand in size and to make organizational changes, such as incorporation to take advantage of corporate tax rates. Progressive tax structures were identified as a basis for entry of risk capital into agriculture by investors with incentives to seek capital gains rather than ordinary income. Effects of the tax system on the structure of farming are discussed further in Chapter Four.

Yuba and Sutter County Cling Peach Orchards (1959 Survey)

During the late 1950's, because the cling peach industry was under rather severe economic pressure, it was thought that many operations might be too small for profitable management as full-time farming units. In the Yuba City-Marysville area, for example, 44 percent of farmers surveyed, operated orchards of less than 20 acres in 1958 with an additional 26 percent ranging in size from 20 to 40 acres. With a focus on possible adjustments growers could adopt to make their operations more economically rewarding, Dean and Carter (1963) examined economies of size and other matters including "green drop" programs, yields, wages, and the possible mechanization of pruning, thinning, and harvesting operations.

Several families of cost curves for the various alternatives studied are shown in Figure 2.5. On the vertical axis are costs per ton, which can be converted to cost-revenue ratios by using the study's median price of $58 per ton in order to compare the results with those in the other studies. Under "present" production practices in Figure 2.5a, one is led to the conclusion that production from low-yielding and from small-sized, medium-yielding orchards, even with no-green drop, is noneconomic. High-yielding orchards, however, had costs less than $58/ton (and, therefore, cost-revenue ratios less than unity) throughout the range of sizes examined in the study.

Of particular interest in this study is the examination of the effects of mechanization and wage rates on farm size. Under the then "present" production practices, costs per ton declined as farm size expanded to about 60 acres and then was rather constant for larger farms. The prospect of mechanization, however, clearly would require larger farm units, for then per unit costs declined with increased orchard size up to 90-110 acres, after which they were nearly constant. The break-even point (equal costs per ton for mechanization vs. nonmechanization) was about 55 acres--a size larger than 70 percent of the orchards contained in the 1959 survey. Prospective increases in wage rates, however, would increase the relative advantage of mechanized orchards, effectively moving the break-even size towards the

Figure 2.5 Yuba and Sutter County Cling Peach Orchards (1959 Survey)

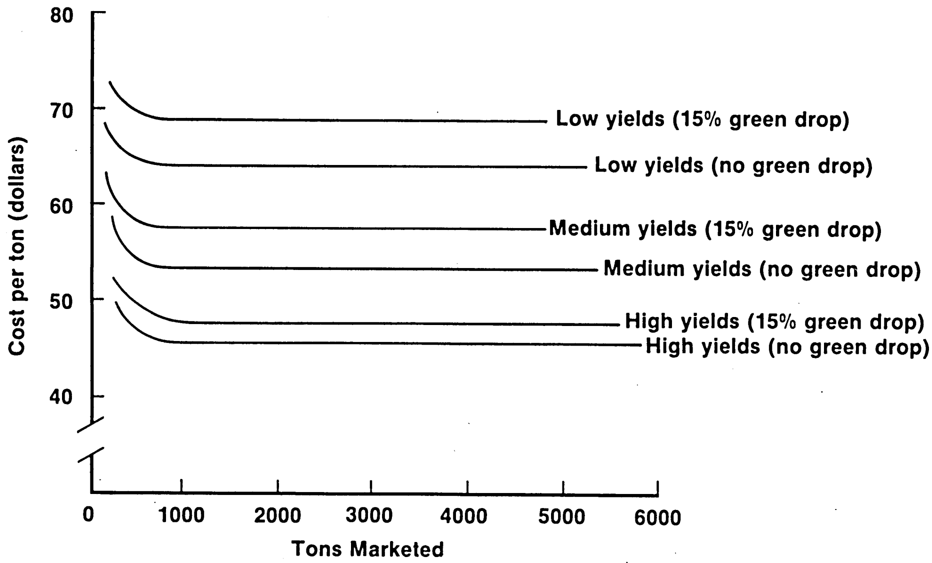



Figure 2.5a Long-run average cost curves for different yield levels, with 15 percent green drop and with no green drop.

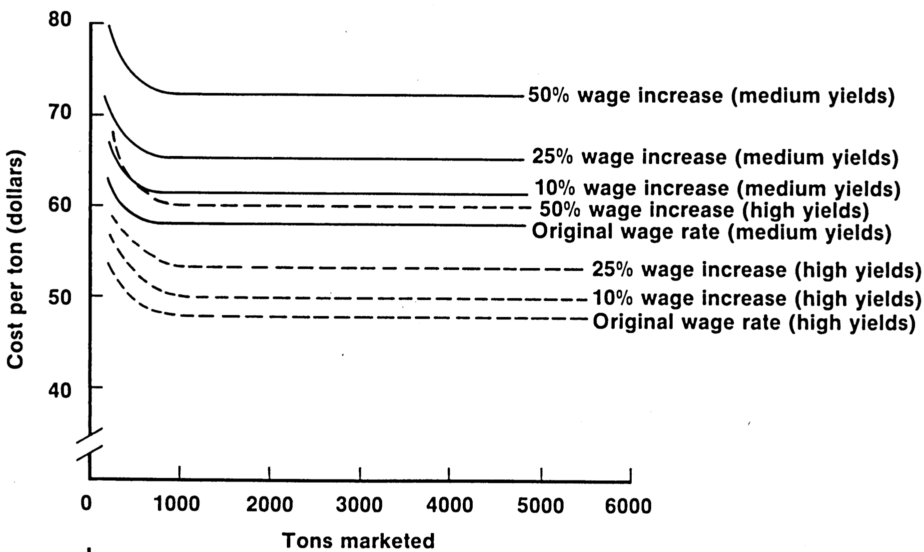



Figure 2.5b Effect of increases in the wage rate on cost curves for cling peach orchards (15 percent green drop).

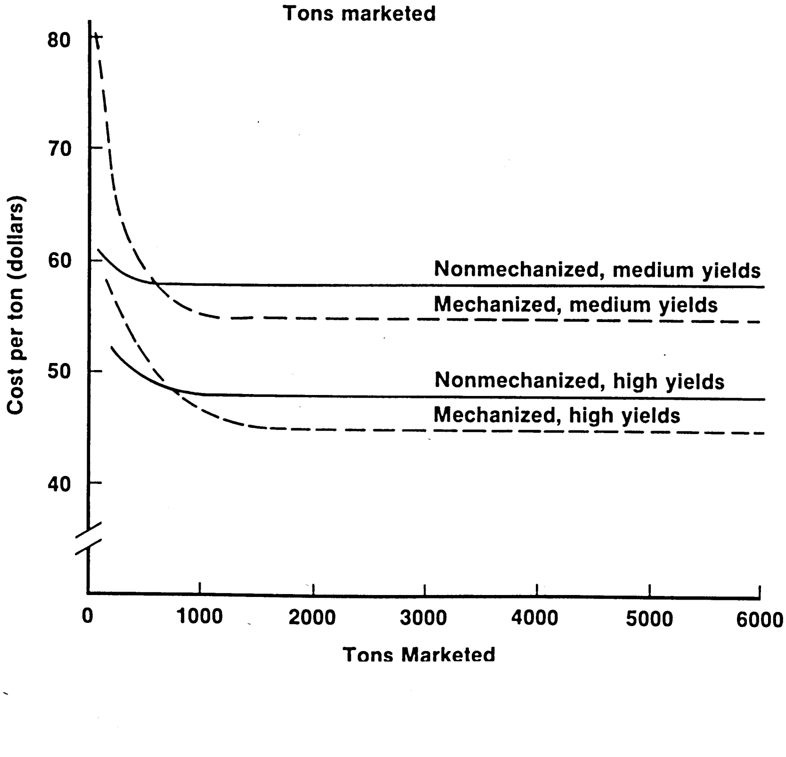



Figure 2.5c Comparison of cost curves for mechanized cling peach orchards (15 percent green drop, 10 percent loss from mechanical harvesting).

Source: Dean and Carter, 1963.

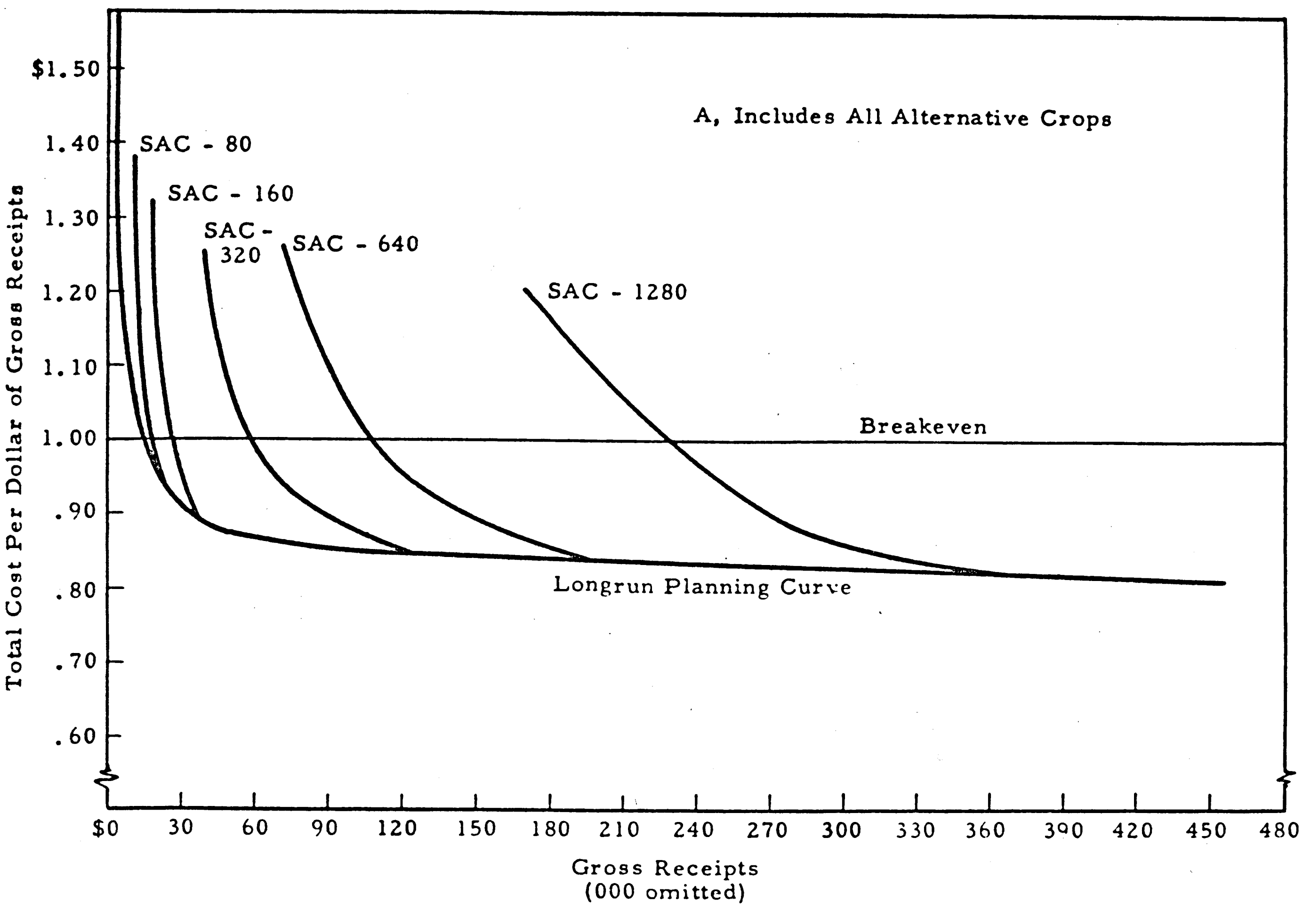
smaller-sized farm units. A 25 percent increase in wages was found to reduce the break-even point to 25-30 acres; a 50 percent wage increase further reduced it to 18-20 acres.

A subsequent, somewhat parallel study by Grise and Johnson (1973), examined costs and revenues of three sizes of Stanislaus County cling peach farms with mechanized and nonmechanized harvests. The authors estimated that by 1970 about 10 percent of production was mechanically harvested and that the break-even point was 37 acres. They also estimated that a 25 percent increase in wages above 1970 rates would lower the equal-cost point to 29 acres.

Tulare County Field Crop Farms (1956-60 Conditions)

An analysis of economies of size due to technical economies was included in a larger study of on-farm irrigation economics for San Joaquin Valley Eastside farms (Moore and Hedges, 1963). Linear programming was used to select crop combinations which maximized net returns for a predetermined size of farm. Crop acreages for each of five specific farm sizes (80, 160, 320, 640, and 1,280 acres farms) were selected from possibilities including alfalfa hay, barley, black-eyed beans, cantaloupes, cotton, grain sorghum, and sugar beets. Rotations were allowed to vary among farm sizes subject to rotational restraints. As can be seen from Figure 2.6, under 1956-1960 conditions, most cost economies were attained as size increased from the 80- to the 640-acre farm. Larger farms had only a minor per unit cost advantage, but they did, of course, enjoy increased gross revenues, due to increased marketings (see Table 2.1).

FIGURE 2.6 Short-run Average Cost Curves and Long-run Planning Curve, Tulare County Field Crop Farms (1956-60 conditions).




Source: Moore and Hedges, 1963.

Kern County Cash-Crop Farms (1961 Survey)

In addition to technical influences on farm size for cash-crop farms in Kern County, Faris (1961) hypothesized pecuniary economies of size in the acquisition of the factors of production--physical inputs, machinery, credit, and/or contract work. Also investigated were possible economies arising from the integration of farm production with marketing or processing activities. Integration was thought to be particularly important for those farm operators who hesitate to expand the size of their operations because of uncertainty, for integration may tend to decrease uncertainty with respect to income. Research results were reported in Faris and Armstrong (1963), and in a journal article (Faris and Armstrong, 1965), conclusions with respect to economies in the acquisition of farm inputs were discussed.

Results for technical economies for Kern County cash-crop farms under two alternative rotations are shown in Table 2.1. Under the fixed rotation (same crop mix used for all farm sizes) assumption, Faris and Armstrong found that the cost-revenue ratios decreased over the whole range of farm sizes from 80 to 3,200 acres in size, although 640 acres had per unit costs similar to those of larger farms. Results for size-fixed rotations (crop mix differs among farm sizes but constant throughout for the same farm size), however, showed increased cost-revenue ratios for farms larger than 640 acres in size (see Table 2.1).

The differing effects of the two assumptions (fixed vs. size-fixed rotations) can be seen further in the average total revenue (ATR) curves shown in Figure 2.7a and 2.7b. ATR was constant (level) for the fixed rotation assumption, but decreased with increasing size under size-fixed rotation. The net effect of ATR, when crop mix was allowed to vary with farm size, in combination with the technical economies costs curve was that the largest net revenue per acre was obtained by 640 acre units (Figure 2.7b). Up to 640 acres, the reduction in costs from technical economies was greater than the reduction in ATR under shifting crop mix.

Allowing crop mix to change with size was taken to be the most realistic assumption reflecting the fact that smaller farms had a much higher proportion of land in cotton than did larger farms. While changes in the percent of cotton to total cropland per farm had little effect on production costs per acre, it did serve to explain the declining ATR as farm size increased.

Research results, reported in another study (1965), based on the 1961 Kern County cash-crop survey, revealed significant economies in the acquisition of factors of production. The per acre difference in acquisition costs for eight inputs (operating capital, fuel and lubricants, fertilizer, insecticides, repair parts, machinery, irrigation equipment, and dusting and spraying) differed by $7.18 per acre between the 80- and the 3,200-acre farm units. Table 2.2 indicates the estimated percentage change in input costs between the 80-acre farm unit and the 640-and 3,200-acre farms, respectively. Whereas technical economies of size under 1961 conditions were found to be negligible for farm units greater than 640 acres in size, significant pecuniary economies

FIGURE 2.7 Kern County Field Crop Farms (1961 survey).

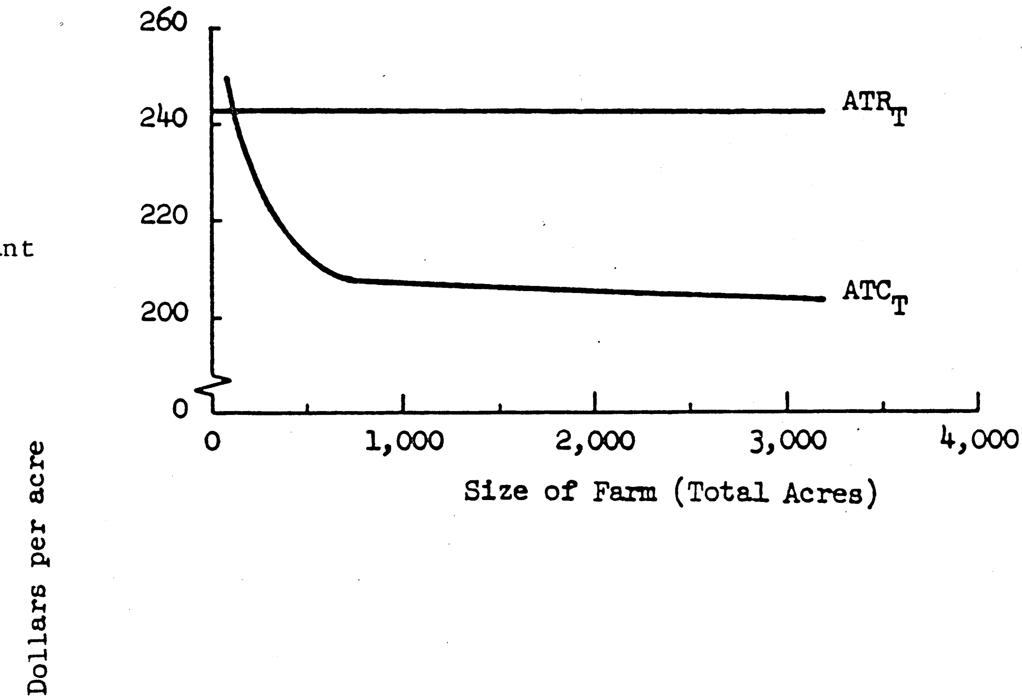



Figure 2.7a. Constant product mix farms.

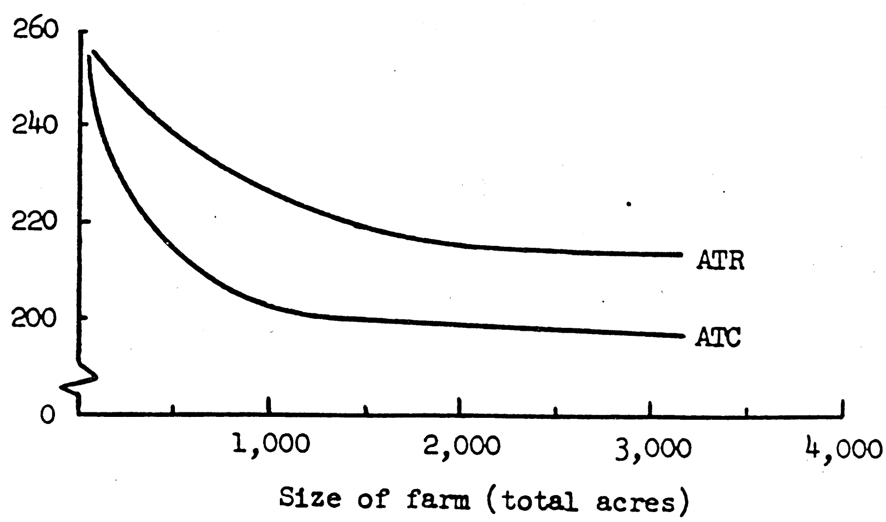



Figure 2.7b. Variable product mix farms.

Source: Faris and Armstrong, 1963.

TABLE 2.2

Economies in the Acquisition of Inputs

| Type of Input | Percent change in input price from price paid by 80-acre farm unit – – for 640-acre farm | – for 3,200-acre farm |
|---|---|---|
| Operating capital | – .41 percent | – .98 percent |
| Fuel and lubricants | 0 | –13 percent |
| Fertilizer | – 4 percent | –10 percent |
| Insecticides | – 5 percent | –14 percent |
| Repair parts | – 1 percent | –15 percent |
| Machinery | 0 | – 4 percent |
| Dusting and Spraying | 0 | –20 percent |

Source: Faris and Armstrong, 1965.

existed for the larger farm units, as indicated in Table 2.2. In fact, the difference between acquisition costs for factors of production between 640-and 3,200-acre farms was $5.35 per acre, or nearly 14 thousand dollars due to pecuniary advantages enjoyed by the larger sized farm unit. Most economies of size studies assume input costs constant, but Faris and Armstrong (1965, p. 70) concluded ". . . that economies in the acquisition of inputs do exist in some farm areas and that they are of sufficient consequence that they should not be ignored in our research efforts."

Fresno County Cotton Farms (1962 Crop Year)

In a 1965 study of cotton farms, Moore sought to determine both the least-cost irrigation distribution systems and machinery combinations for farms on light and heavy soils in central Fresno County. In addition, technical economies of size were examined, as indicated in Table 2.1. Cost-revenue ratios for farms on light soils were found to be generally lower than for those on heavy soils, due in part to the relatively higher cost of drilling additional irrigation wells on heavy-soil farms. Most of the cost economies on light soil units were achieved with a land input of 600-800 acres; whereas, cost savings continued for heavy soil farms up through 1,200-1,400 acres.

Cost-revenue curves for light and heavy soils are shown in Figures 2.8a and 2.8b respectively. The dashed-lines indicate confidence limits about the cost-revenue ratio, expressing variability in product prices and production yields. The increase in

FIGURE 2.8 Fresno County Cotton Farms (1962 crop year).

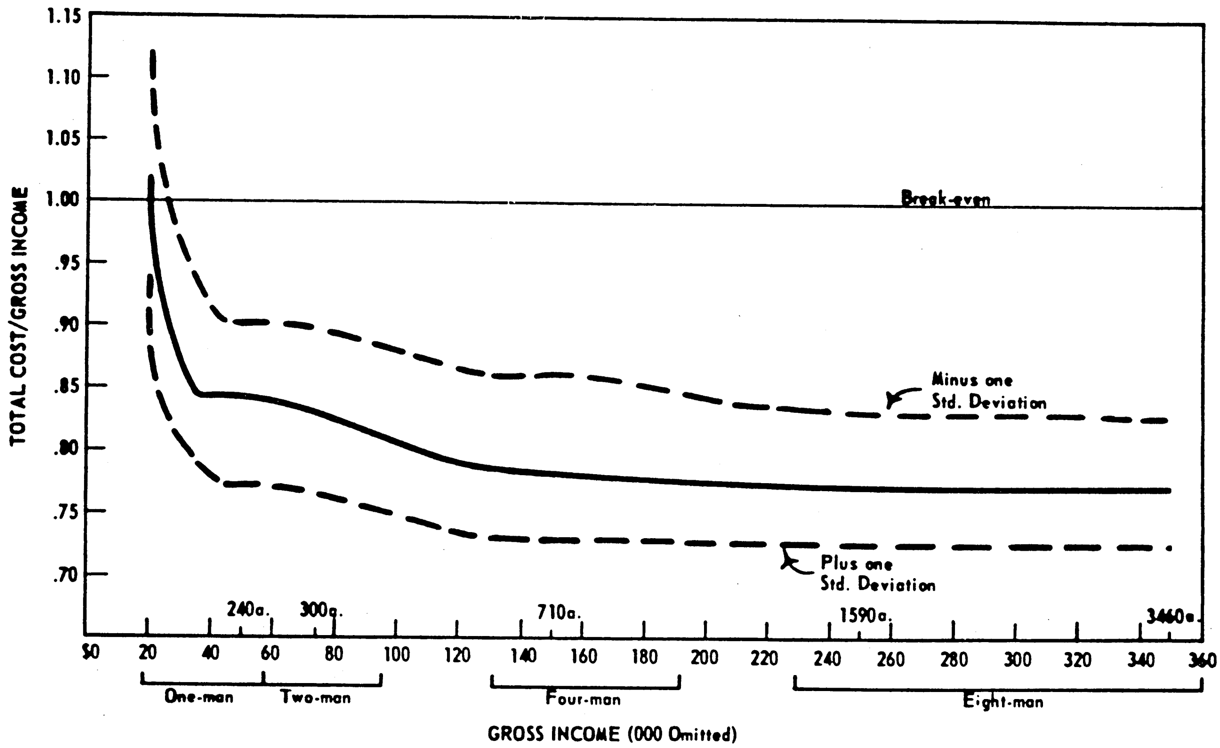



Figure 2.8a. Light Soil Farms

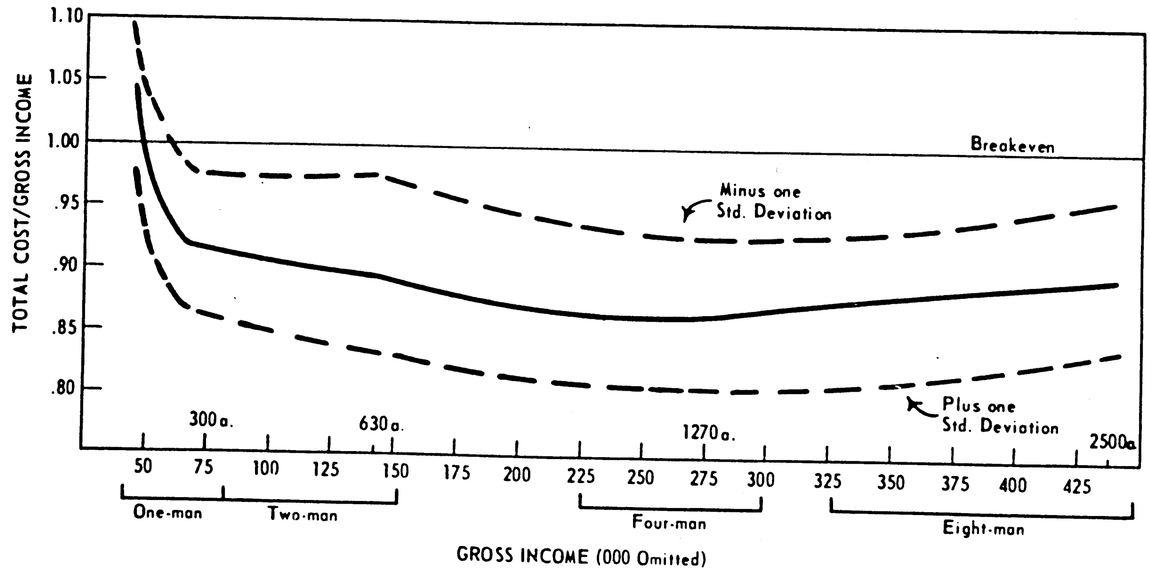



Figure 2.8b. Heavy Soil Farms

Source: Moore, 1965.

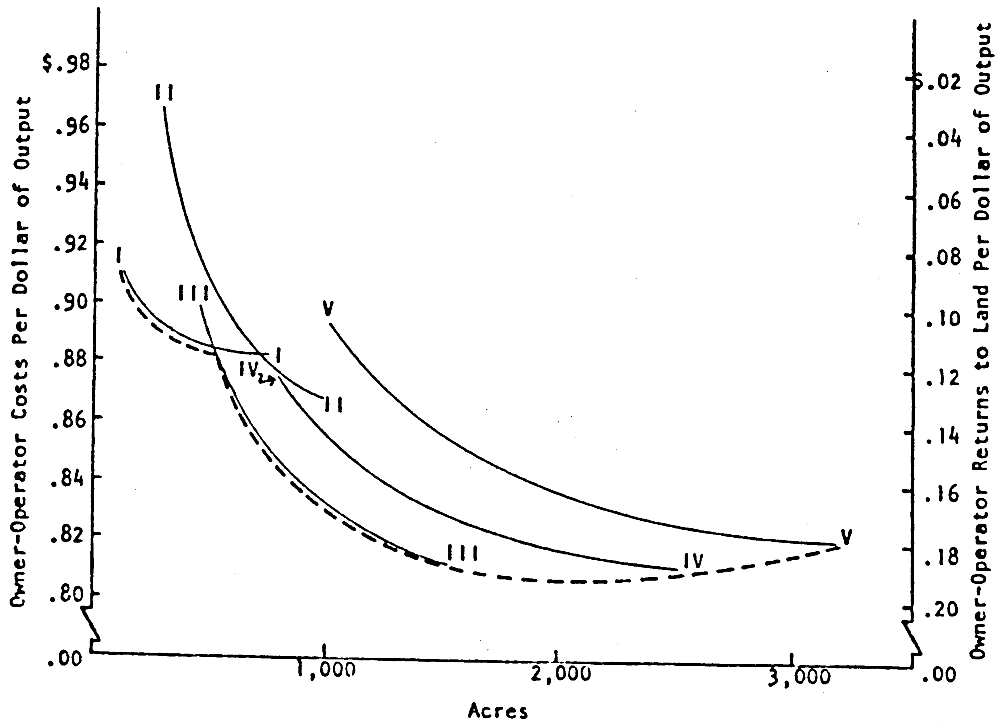
the ratio for heavy soil farms beyond the 1,270 size reflected the fact that as farm size increased the cotton allotment decreased, and heavy soil farms did not have as profitable alternative crop choices as did the light soil farms.

Moore summarized his analysis (p. 42): "Confidence intervals . . . indicated that for the smaller heavy soil units the possibility of negative income was rather high. On the other hand, light soil farm operators would have a stronger possibility of surviving adverse periods and capital accumulation could occur at a more rapid rate."

Imperial Valley Cash-Crop Farms (1966 Crop Year)

Although the primary objective of the final study in the California crop farm series was to determine the value of farmland for typical cash-crop Imperial Valley farms, Johnston (1971) also estimated cost-revenue relationships for owner-operator farms, using survey data from 31 operations. Under several alternative procedures for five farm sizes with different machinery combinations, technical economies of size were estimated to be largely attained on units ranging from 1,500 to 2,000 acres in size (see Table 2.1 and Figure 2.9). Heavy reliance on custom contracting was used to characterize the most efficient means of production on farms less than 500-700 acres in size (Size I). In fact, the survey indicated widespread use of custom services by all farm sizes for certain cultural, harvesting, and hauling operations.

FIGURE 2.9 Imperial Valley Cash-crop Farms (1966 crop year).




Source: Johnston, 1971.

Potential diseconomies of large-sized units due to spatially dispersed farming operations may be an important factor, not considered in the studies reviewed so far. Excess machinery capacities observed in some studies may even be illusory since the spatial distribution of large operations, no doubt influences their machinery and equipment needs. Adjusting machinery availabilities downward from "perfect" to reflect the dispersed distribution of tracts, Johnston found that the maximum size of farm under fixed rotations was reduced from about 4,000 acres to just over 3,000 acres (see Table 2.1). Cost-revenue ratios were not changed for comparable farm size groups (I-V), although, of course, gross revenues were reduced. Thus, when the effects of spatial dispersion on large units were accounted for, physical capacities were reduced about 20 percent on the largest three sizes (III-V). It seems that (p. 656): "diseconomies resulting from the dispersed location of farmed land may warrant explicit consideration as studies of large-size farm units are continued."

<u>Summary of California Crop Farm Studies</u>

The above studies reviewed in their approximate chronological order, reflect a succession of developing methodologies and approaches to the examination of economies of size for California crop farms. Each, based on survey data, attempted to approximate the conditions and factors thought to influence the farming units under study or thought to bear upon possible adjustment processes which might result in the development of more efficient farming units.

The common element among all of these studies is the primary and central importance of technical economies of size emanating from the spreading of fixed machinery and equipment investments over increasingly large-sized farm operations. Although questions of machinery costs, performance rates, and combinations are obviously important to the least-cost operation of farm units, only the Armstrong and Faris (1964) study analyzed these factors in any detail. Furthermore, since farm machinery and equipment have changed substantially over the past two decades, more recent studies would be beneficial. Two recent (1978) research reports from other states may prove useful in subsequent investigations in California: (1) Fulton, Heady, and Ayres in their Iowa State University Study "Farm Machinery Costs and Relation to Machinery and Farm Size" and (2) O'Connell, Rodewald, and Folwell, "The Least-Cost Size of Machinery for Farming Operations in Eastern Washington."

Although technical economies of size were the primary component of most of the above studies, two--Dean and Carter (1962) and Faris and Armstrong (1965)--identified and attempted to measure pecuniary economies. More recently, Krause and Kyle (1970) provided empirical estimates for major input categories on Corn Belt farms. Other studies also added further dimensions as farm size was related to changing economic conditions, variability in yields and prices, and the spatial dispersion of farming operations.

Throughout the above discussion, attention was directed to the common measure of efficiency suggested by cost-revenue ratios. It is clear, however, that small sized farming units might have cost-revenue ratios less than unity but still have inadequate net revenues to repay operator and management at rates equivalent to alternative employment opportunities. Thus, a cost-revenue ratio less than unity for a particular size farm does not ensure the rational existence for all farms of that size.

It has been stressed repeatedly that all of the above studies are now quite dated. Changes that have occurred--increased investment requirements for today's farms, increased costs for factors including the interest cost of capital, and appreciating land values--may be operating to shift the minimum cost-revenue ratios towards larger-sized farms as these larger fixed costs are spread over farming operations. The inclusion of these important changes and the use of more recent methodological developments should be undertaken in any future study of economies of size for today's crop farms in California.

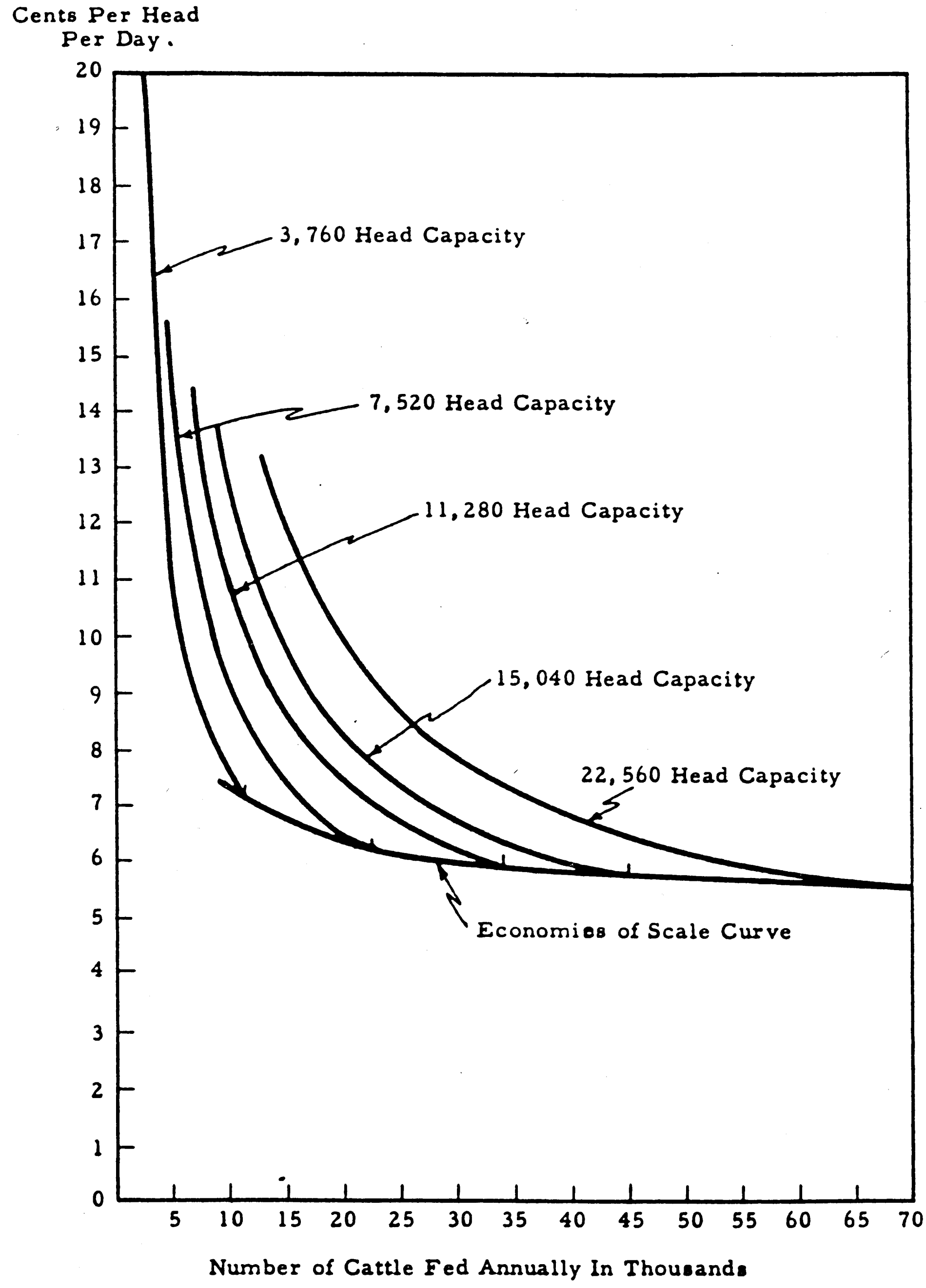
## Empirical Studies of California Animal Production

Just as there are economies of size in crop farming, there are also substantial economies to be realized in livestock operations. Efficiencies in feeding cattle in large feedlots, at least up to the 40,000-head capacity, were attributed in a recent USDA (Sept. 1979) report to technical economies as well as economies in buying inputs, in selling fed cattle, in the acquisition of information and capital, and in developing risk diversion strategies.

The nature of nonfeed costs for cattle feedlots and the effect of feedlot capacity and utilization on daily costs per head were examined by King (1962), using survey information from Imperial Valley feedlots. Short-run cost curves for lots with capacities ranging from 3,760 to 22,560 head are shown in Figure 2.10. If fully utilized for three batches of cattle each year, capacities of each size lot are tripled. Average daily nonfeed costs at maximum output were found to decline from 7.19 cents for the feedlot with a capacity of 3,760 head (11,280 head annually) to a cost of 5.57 cents for the largest feedlot (67,680 head annually). Most of the economies of size were achieved in moving to the feedlot with 7,520-head capacity at a cost of 6.18 cents per day, assuming 100 percent maximum output. The results clearly demonstrated that the level of daily nonfeed costs per head declined, for a given percent of maximum output, as the size of the feedlot increased. The importance of operating feedlots at near maximum output levels was also shown, and benefits of large-scale operation may be offset if facilities are operated at less than full capacity. Using data collected from cattle feedlots throughout the state in 1963, Hopkin and Kramer (1965) provided collaborative evidence on nonfeed and other costs.

Using both primary and secondary data from several sources, turkey production plants each with the optimum combination of inputs for the specified capacities were synthesized by Eidman <u>et</u>

FIGURE 2.10 Economies of Scale Curve for Nonfeed Costs of Operating Feedlots With Cattle Fed 120 Days.




Source: King, 1962.

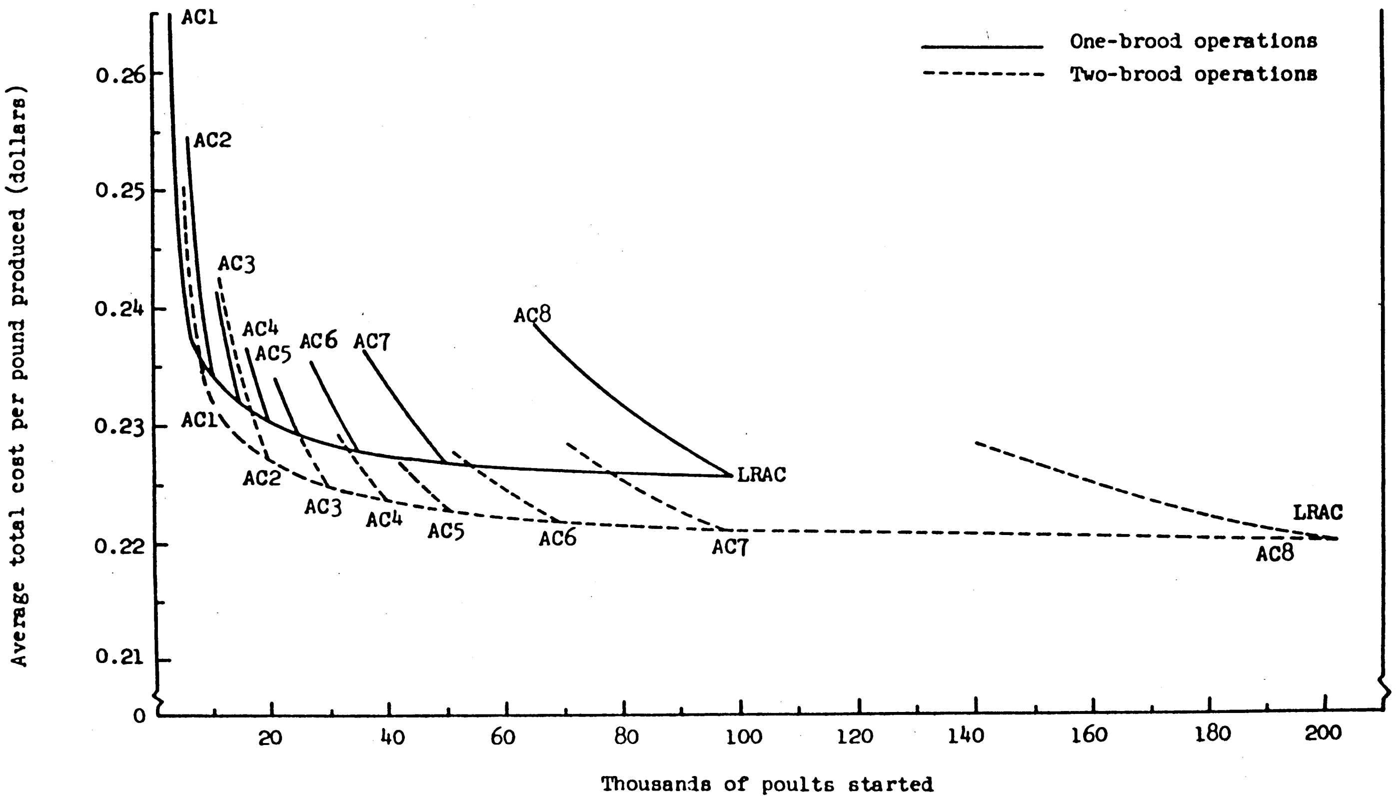
al. (1968). Average cost curves for one-and two-brood operations and the long-run planning curve are shown in Figure 2.11. Increasing the size of the operation from two broods of 5,000 turkeys each to two broods of 100,000, resulted in saving 5 percent of the total production cost, but approximately 4 percent of the decline was already captured by two-brood operations of 20,000 each. Beyond the two-brood operation of 50,000 each, the average total cost of production was relatively constant.

The most recent California economies of size analysis is included as part of a study of large-scale dairies located in the Chino Basin (Matulich et al., 1977 and 1979). The analysis responded to the need to study the impact of waste control structures on the costs and viability of the dairy firms in the area. The authors noted (1977, p. iii) that ". . . separate analysis of dairy and waste disposal costs can lead to a suboptimal decision since the waste disposal method utilized must be compatible with dairy housing." Short-and long-run average cost curves for five combined dairy production and waste management systems are shown in Figure 2.12. Significant economies of size existed in the 375 to 750 cow range, but there were only slight reductions for dairies in excess of 1,200 cows.

## Further Study

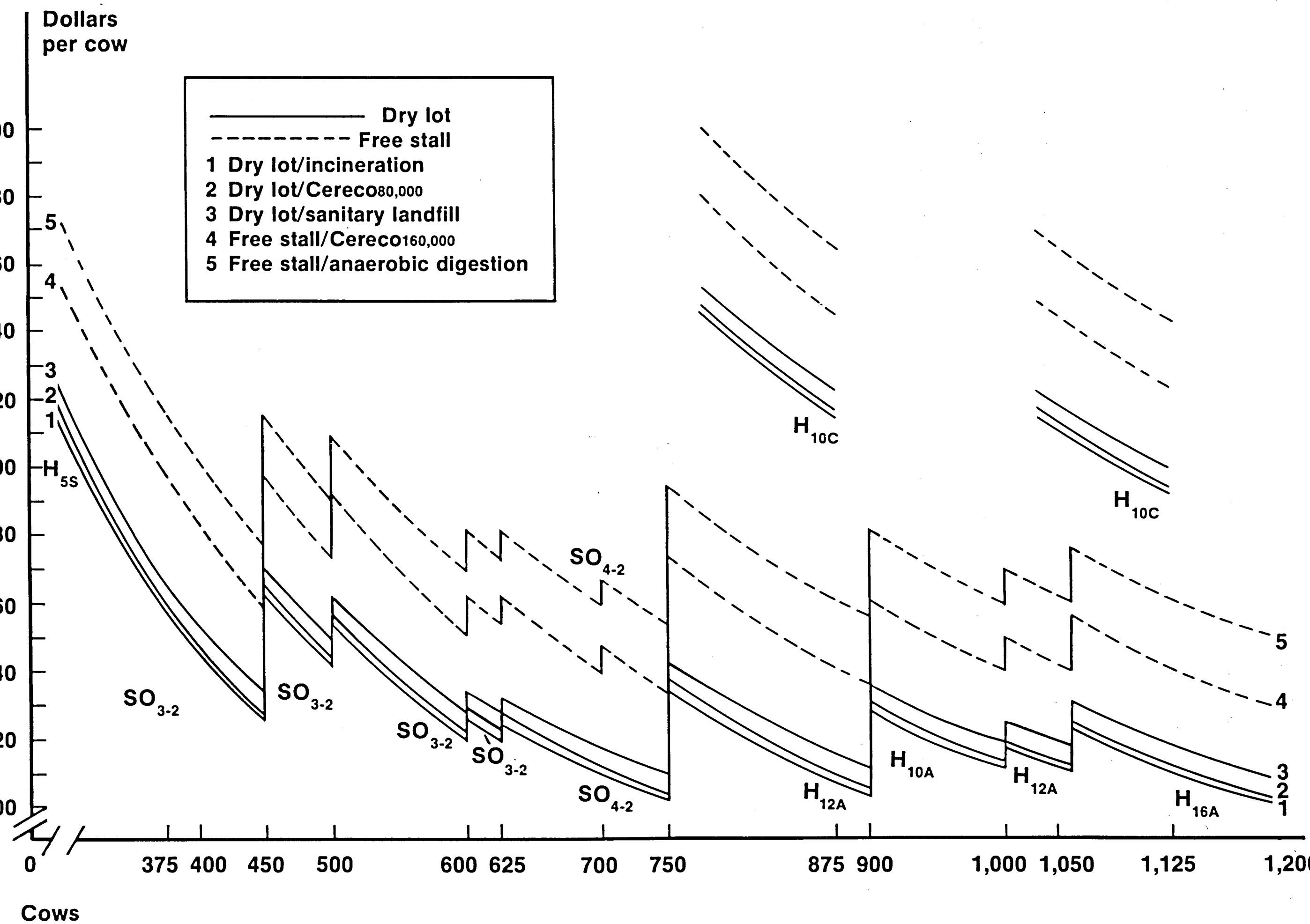
At the outset we noted that the current interest in size relationships in agriculture has a somewhat different motivation than did that for research conducted during the 1960's. Interest

FIGURE 2.11 Average Cost Curves for Eight Sizes of One- and Two-brood Turkey Operations and the Long-run Planning Curve.




Source: Eidman, Dean, and Carter, 1968.

**Figure 2.12 Short- and Long-run Average Cost Curves for Five Combined Dairy Production and Waste Management Systems.**




Source: Matulich, Carman, and Carter.

is now directed more at small farm feasibility and farm viability, in general, but there is only limited evidence for small farm units. Pecuniary economies of size, as best exemplified in the quantity discount, provide definite advantages to larger-scale farms. Whether these advantages in the input supply market are sufficient to be counted among the forces behind the trend toward larger and fewer farms is yet to be determined. In addition, studies in other geographical and commodity settings are needed to provide a more thorough understanding of economies of size in California agriculture.

# CHAPTER III

# THE INFLUENCE OF GOVERNMENT POLICIES ON FARM SIZE

## Introduction

While the roots of government intervention in agriculture extend back to early colonial times, policy emphases have changed through time in response to changes in economic forces and political realities. Some government policies, such as price support programs, are directed specifically to the agricultural sector. Others, such as U.S. monetary and fiscal policy or even foreign policy, are more general and affect agriculture as part of the total economy. Some policies and regulations are initiated at the federal level--for example, import restrictions and tariffs on certain agricultural commodities or OSHA work-safety regulations; others originate at the state level--for example, the provisions of state pesticide regulations or state marketing orders.

Few programs are specifically directed to encourage a particular scale or size of farm, but the net effect of the myriad of influences created by government has probably been to increase farm size. Admittedly, some programs have been slanted toward benefiting small farmers--setting a maximum limit on

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government commodity payments, for example, or the 160 acre limitation policy accompanying federal water projects. Such efforts may partially offset forces operating in the other direction.

The direct benefits or costs of most policies affecting agriculture are generally thought to be distributed in proportion to the output of the farm or to the acreage operated. The direct effects are, therefore, likely to be neutral with respect to scale. It is rather the secondary and often unforeseen impacts that apparently bring about structural change. A cursory review of the literature reveals that in many cases, little is known about the actual effect of a particular policy, program, or regulation on the structure of agriculture, because of the many forces operating simultaneously in the economy. In this chapter, the influence of government policies relating to commodity controls, credit availability, water supply, and environmental regulations is briefly examined. Subsequent chapters also contain elements of governmental impacts as taxation, labor, and marketing of farm commodities are discussed in relationship to farm size.

## Commodity Programs

For over four decades the federal government has attempted to deal with chronic overproduction in agriculture by the use of various commodity programs. Some allege, however, that these programs have had substantial impacts on increased farm size.

In the mid-1960's, Bonnen (1968) examined the distribution of benefits from commodity programs for rice, wheat, feed grains, cotton, peanuts, tobacco, sugar cane, and sugar beets among farms ranked by size of their acreage allotment in the particular commodity. Benefits were more concentrated as allotment size increased. In all cases, except direct payments for feed grain programs, the largest 20 percent of the farmers got over half the benefits, while the smallest 20 percent received less than 5 percent. In cotton, for example, in 1964, the top 20 percent of the farmers received 69.2 percent of the farm program benefits; the lower 20 percent, only 1.8 percent.

In an investigation of the relationship between net farm income and farm program benefits, Leuthold (1969) also concluded that farm programs lead to increased inequality in farm income distribution. The relationship between farm size as measured by value-of-sales class and distribution of commodity program benefits was tested by Schultz (1971) and found to be heavily skewed in favor of larger farms. Other studies by Lidman (1973) and Tweeten (1976) produced similar results.

An equally plausible explanation, however, is that the distribution of sales or net farm income has become more positively skewed due to changing structure resulting from economies of size and other forces. The distribution of benefits which is very closely related to the level of output may also have been affected by the same forces.

Gardner and Hoover (1975) questioned the use of farm sales as a proxy for income. Basing their analysis instead on full income of farm households, they concluded that if the commodity programs of the late 1960's had been eliminated, there would have been a reduction in the inequality of the distribution of farm income.

With a simulation model of farm growth, Boehlje and Griffin (1979) analyzed the impacts of price supports on three different size farms--160, 320, and 640, respectively. They related land values to government programs and found that cost-indexed price supports could rapidly lead to higher land prices. Larger farms would presumably be better able to pay the higher land prices and, therefore, would reap proportionately more program benefits.

For three different sized farms, Sonka (1977) calculated returns to family labor and management with and without price and income support programs. While average returns for each size group were considerably higher with the program, little impact on the relative position of the different groups was discovered. The possible risk-reducing aspects of the program were not included in the analysis.

In an earlier paper surveying empirical studies of the relationships between structure and commodity programs, Sundquist (1971) contended that the stabilizing effects of farm programs on price and income have probably benefited all size farms by reducing risk and improving chances for borrowing capital. Thus, while large farmers have been enabled to enlarge their operations, some smaller farmers have also been able to expand their farms to a viable size. Landowners have gained as program benefits became capitalized into land values, but entry to the owner-operator status has become more difficult. Most farm programs, according to Sundquist, have probably sped the adoption of new technology and the rate of increase in farm size. Sundquist also noted, however, that farm size has increased rapidly in a number of activities for which there have been no direct farm programs, such as livestock and specialty crops. Clearly there is limited empirical evidence on the effect of price supports on farm size, and particularly in California where federal price and income support policies have had less overall impact than in many other states.

## Credit Programs

There are four major types of noncommercial lending activities: Farmers Home Administration, Federal Land Bank, Federal Intermediate Credit Bank, and Bank for Cooperatives.

The Farmers Home Administration (FmHA) assists marginal and beginning farmers who cannot obtain commercial credit. Quance and Tweeten (in Ball and Heady, 1972) pointed out that the net impact of FmHA activity on farm size is unclear, for although FmHA credit assists small producers, it also facilitates the purchase of land and other assets needed for expansion.

The other three programs are generally competitive with commercial banks although as user co-ops their interest rates may be lower. The availability of long, intermediate, and short-term credit from these various institutions has an uncertain effect on farm size. Barriers to entry are reduced so that new farms can be established on easier terms. On the other hand, credit at lower interest rates facilitates farm size expansion (Moore, 1977).

In comparing the historical increase in average farm size and the corresponding increase in farm debt since 1950, Lins (in USDA, Nov. 1979) hypothesized that the number of farms would probably not have decreased as rapidly had credit for the purchase of land been less readily available. A growing proportion of farm real estate purchases are made using borrowed funds. From a survey of the financing needs of small farmers in California (Small Farm Viability Project, 1977), it was found that access to financing was more a function of the experience and financial equity of a farmer than of the size of his farm.

## Water Development and Water-Use Policies

The Department of Interior's 160 acre limitation policy which stems from the Reclamation Act of 1902 provided that no surface water from a federal reclamation project shall be delivered to a land parcel exceeding 160 acres to any one individual landowner (or 320 acres for a farmer and spouse) and no such water shall be delivered unless the farmer is a bonafide resident on the land or a neighboring resident thereof. The law has been variously enforced and administered. Recently, attention has been called to the large discrepancy between the law and its actual implementation. Positions in the debate range from strict enforcement to complete repeal. Congressional hearings have been held, reports given, legislation introduced, and suits filed.

One of the tools of the opponents to strict enforcement has been the various economies of size studies reviewed in Chapter Two. The law, when enforced, established small farms (by today's standards) in the West by means of federally subsidized water. A recent study (USDA, Feb. 1978) estimates changes in returns to management and operator labor in the Westlands and Imperial irrigation districts for different sized farms. Empirical research testing the relationship between water subsidy and farm size is still needed. Another issue that needs research is the distribution of benefits from the water subsidy when land is rented. Land rental is one of the most common ways of expanding farm size, but the benefits of cheap water could be captured by either the landowner or the land renter depending on their respective market power.

## Environmental Regulations

The aroused concern of the American public for care of the environment has resulted in numerous laws affecting agricultural production. Regulations about air pollution, water quality control, soil erosion, animal waste management, and pesticide use have surely added substantially to costs of production. In general, large farming operations should be better able to spread these new costs over more units of production. On the other hand, animal waste management was never an environmental problem on small farms, but rather accompanies the fairly recent practice of confining very large numbers of animals-units in a relatively small area. Research is needed to establish empirically the connection between the various regulations and farm size.

## Conclusion

Government policies and regulations are pervasive in their impact upon farms of all sizes. Apparently, most policies are formulated and implemented with little attention given to their likely effect on various sizes of farms. Moreover, only a limited amount of research has been directed toward answering questions about impacts on changing farm size relationships even after certain policies and regulations have been in effect for considerable time.

# CHAPTER IV

# TAXATION AS A FACTOR IN ECONOMIES OF SIZE

## Introduction

Farmers and other taxpayers respond to taxes and changes in tax provisions as they attempt to maximize after-tax income. It is widely recognized that there are tax provisions unique to agriculture which offer tax planning opportunities. Utilization of these special farm tax provisions in pursuit of individual financial planning objectives may have long-run implications for the structure of agriculture.

Agriculture is subject to a variety of taxes with the most important being the income tax (both indivudal and corporate), property taxes, and estate taxes. These taxes are common to most enterprises but with important differences in applicable provisions. The emphasis here will be on special farm tax provisions and their potential impacts on structural variables such as the number and size of farms, ownership and control of assets, and legal organization.

## Income Taxes

Several aspects of farm income taxation have possible structural implications. The discussion will involve progressive

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income tax rates, deductable versus opportunity costs, and special farm tax provisions giving rise to tax shelter investments including: (1) the use of cash accounting, (2) deductibility of some expenses of a capital nature, and (3) capital gains treatment for assets whose costs may have been deducted as a current expense. Agricultural tax shelter investments are discussed with a summary of evidence on their scope. The chapter is concluded with a comparison of the differential between individual and corporate tax rate schedules.

<u>Progressive Taxes</u>

The impact of progressive income taxes on economies of scale and farm size for large-scale farms, such as are found in California, was analyzed by Dean and Carter (1962). Their theoretical framework and empirical application yielded two useful generalizations: (1) If all economic costs are tax deductible, the inclusion of a progressive income tax does not change optimum output. (2) If economic costs are greater than tax deductible costs (the usual case given opportunity cost interest on equity), then the inclusion of progressive income taxes will reduce the optimum scale of operation. Carman (Aug. 1972) demonstrated that the optimum scale of operation is reduced with increases in tax rates. Thus, the substantial tax rate reductions occurring during 1964-65 and then again in 1969 tended to increase optimum farm size. In 1964-65, the maximum tax rate of 91 percent for income over $400,000 was reduced to a maximum of 70 percent for amounts over $200,000; in 1969, a maximum rate of 50 percent on earned income was imposed.[1] Income variability, such as occurs in agriculture, has significant implications for total tax liability and allocation of costs and income between accounting periods. With progressive income taxes, income tax provisions such as income averaging and loss carry-over have been designed specifically in recognition of inter-year income variability.

An examination of five large California farms in a utility maximizing, risk framework with the entire complex of 1972 tax regulations had interesting before-and after-tax results (Lin _et al_., 1974). The general effect of the complex of income tax provisions was to reduce both the mean and variance of "after-tax" as compared to "before-tax" net income for any given farm crop plan. Because of progressive tax rates and the provisions noted above, the percentage decrease in expected income and risk declines with an increasing rate as net income increases. The response of risk averse farmers to income tax provisions was to significantly increase their level of output, as measured by expected farm income. The increased output (income) involved a shift from a cropping system consisting mainly of low risk field crops to one with substantial acreages of higher risk tree

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[1]The maximum rate of 50 percent was fully effective in 1972. Earned income, now called personal service income, includes wages, salaries, professional fees and compensation for professional service. In a trade or business such as farming, however, in which both capital and personal services are income producing, personal services income is a reasonable allowance for personal services (O'Byrne, 1977).

crops. These results suggest that the general effect of current income tax provisions in agriculture is to induce greater output and risk-taking behavior. These effects would seem to be stronger the greater is the degree of innate risk aversion of the decision maker.

## Special Farm Tax Rules

Special income tax provisions applicable to agriculture have three sources: (1) a 1915 administrative decision permitting farmers a choice between cash and accrual accounting for reporting income, (2) a 1919 Treasury regulation allowing farmers to write off expenditures, normally capitalized in other businesses, incurred in the development of orchards and ranches, and (3) legislative action in 1951 extending capital gains treatment to livestock held for draft, breeding, or dairy purposes (and, in 1969, livestock held for sporting purposes). These provisions form the basis for sheltering ordinary income from taxes via both deferral and conversion to capital gains. A discussion of the use of these provisions to shelter income is contained in Davenport (1969). Farmers and nonfarm investors can utilize these provisions to reduce their tax burden, and in the process, their actions may influence the structure of agriculture.

Cash accounting permits the current deduction of costs which are associated with the production of income in a subsequent tax year. Major agricultural inputs such as feed, seed, fertilizer, labor, and interest can be deducted from income at the time the cost is incurred. The cost of these inputs has been deducted from income even though an inventory existed and, in some cases, where the input was in the nature of a capital expenditure. Since cash accounting ignores inventories, the farmer can control the tax year in which income is realized through storage of crops and timing of sales. The value of the tax deferral obtained depends on the tax bracket of the farmer or investor and the leverage involved.

The differential tax rate for capital gains income provides a very strong incentive for income conversion. Ordinary income can be converted to capital gains when development costs of a capital nature, which add to the value of the asset, are currently deducted from other income (rather than being capitalized) and the costs are subsequently recovered as capital gains upon sale of the asset. Costs of raising breeding livestock are treated as a current deduction and the animals have a zero basis. Thus, all income from the sale of raised breeding animals is capital gains. (Horses and cattle must be held for at least two years to qualify for capital gains treatment.) In the case of orchard development, most costs can be deducted as a current expense even though they add to the value of the asset. Sale of the developed orchard typically results in income conversion since the trees have a near-zero basis. (The costs of developing citrus and almonds for the first four years after planting must be capitalized.)

Because of progressive income taxes, the largest benefits from tax deferral and income conversion accrue to taxpayers in the highest marginal tax brackets, regardless of the source of income. Utilization of farm tax provisions by high income nonfarm investors has received considerable publicity, but farmers and ranchers undoubtedly receive the majority of benefits.

Data on utilization of farm tax provisions are scattered and incomplete. Thus, statements concerning the structural impact of tax provisions are based on theory and circumstantial evidence. The attraction of nonfarm capital into agriculture as tax shelter investments is one aspect of the structure problem which has received attention in the media, but here too, data are limited. Interstate public offerings are registered with the Securities and Exchange Commission (SEC). Public offerings sold only intrastate have no SEC registration requirement but may be registered with a state agency. Neither the SEC nor the comparable state agencies publish data on offerings even when registered. Moreover, private placements and small private offerings have no registration requirements.

The Treasury Department publishes aggregate data on tax returns. Examination of data on individual tax returns reveals that the proportion of returns with farm losses increases with increases in gross income and that taxpayers in the highest income categories have an amazing propensity to lose money farming. While these data have been used to demonstrate that tax loss farming is prevalent, the conclusions that one can draw are necessarily limited. For one such analysis, see Carlin and Woods (1974).

The staff of the Joint Committee on Internal Revenue Taxation (1975) estimated that tax expenditures related to special farm tax provisions totaled just over $1 billion in fiscal 1976. Of this, $650 million was for expensing capital outlays and $365 million was for capital gains treatment of certain income. The estimated distribution of this subsidy by adjusted gross income class indicates that most (two-thirds to four-fifths) of the benefits probably go to ordinary farmers for whom tax shelter considerations are not the primary incentive.

## Agricultural Tax Shelter Investments

After the Tax Reform Act of 1969, the limited partnership syndicate became the preferred legal form for public offerings of tax shelter investments to nonfarm investors. Large-scale syndicated offerings for cattle feeding, egg production, vineyard and orchard development grew rapidly in numbers and dollar value between 1970 and 1973. At the peak in 1973, there were at least 76 syndicated agricultural offerings with a maximum value of over $389 million (National Association of Securities Dealers, Inc., 1976). The total financial impact was much larger, however, since the capital raised by the funds was leveraged; the general partner typically borrowed $3 to $4 for each dollar furnished by investors. The number and value of offerings decreased in 1974 and 1975 due to severe losses in cattle feeding and reduced prices for grapes and some orchard crops. Following are some rough estimates of the extent of nonfarm tax-motivated investment in the most popular agricultural shelters.

Cattle Feeding. Cattle feeding, which offers tax deferral, has been the most popular agricultural tax shelter in terms of both number of participants and total investment. At the peak in 1973, investor cattle were probably close to one-fifth of all the nation's cattle on feed, according to an estimate by Rhodes (1974). He further estimated that investor cattle constituted one-half or more of the cattle in many of the large, fast-growing lots and that funds channeled something in excess of $300 million into feed lots during the period 1970-73.

Based on the figures in four other studies, however, Rhodes' estimate is probably conservative. (The size of cattle feeding funds varied from less than $1 million to over $45 million with the average around $10 million.) In his survey of SEC approved funds, Scofield (1972) found 14 registrations for cattle feeding in 1970-71. Runner (1971) provided data on 16 funds being offered during 1971. Of these, eight had SEC approval and three were seeking approval; eight of the funds were located in California and five were in Texas. Youde and Carman (1972) estimated that 60 percent of all cattle on feed in California in 1972 were investor-owned with involvement by some 25 cattle funds. Finally, a Texas survey revealed 33 prospectuses for cattle feeding ventures filed with the Texas State Securities Board between 1972 and 1974 (Dietrich et al., 1977). They found that 60 percent of the investors surveyed gave tax deferral as the primary reason for investing in cattle feeding.

Investor actions to utilize (exploit) special farm tax rules through cattle feeding have had both economic and structural impacts. When cattle-feeding syndicates were popular (1970-1973), the traditional late fall decrease in feeder-cattle prices changed to an increase as feedlots attempted to fill their pens at the end of the tax year. Farmer-feeders and feedlots without access to outside capital had difficulty buying feeder cattle during November and December at a price which would yield profits when tax-shelter money was passing into the industry. Matthews and Rhodes (1975) concluded that tax induced investment in cattle feeding through limited partnerships was related to structural changes. They stated that (p. 26):

> The limited partnership has contributed to the formation and growth of larger firms in the cattle feeding industry. Firms utilizing funds have been able to utilize more fully their existing feedlot capacity, to expand existing lots, and to acquire more lots until now the multi-lot cattle feeding firm is becoming common. Capacities of these "super firms" now reach and exceed 100,000 head. Much of this growth activity has occurred simultaneously with the adoption of the limited patnership by these firms. The limited partnership has been seized upon by these entrepreneurs as an opportunity to achieve rapid growth; the results have accentuated the shift in the location of the fed cattle industry from the farmer feedlots of the Midwest to the domain of the super firms with funds in the High Plains and Southwest. As the structure in the cattle feeding industry shifts from one made up of numerous small-to medium-sized feedlots to one made up of fewer firms with much larger feedlot capacities, previously existing market relations begin to break down. Such related industries as slaughter and processing plants, grain suppliers, and trucking services are attracted towards the location of the larger firms.

Breeding Cattle. Tax shelter investments in beef breeding cattle have received considerable publicity and legislative attention. Despite this publicity, available data indicate that tax shelter breeding cattle have been a relatively insignificant proportion of the total beef breeding herd, though, admittedly this conclusion is based on sketchy information.

Oppenheimer Industries, Inc., probably the largest breeding cattle management company, reported that they were managing 148,000 cattle in 1969 and 122,000 in 1970 (Carman, Nov. 1972). Black Watch Farms, a registered Angus operation which gained some notoriety with its bankruptcy, managed some 15,000 cattle for 500 investors in 1970, according to a report by Penn (1975). Scofield's (1972) analysis of SEC registrations revealed a total of 13 offerings for beef breeding herds in 1970-71. The maximum number of cattle offered to investors was 14,500 head and the maximum gross volume of the registration was almost $55 million. A special USDA survey of the ownership of breeding cows found that just over one million head of the January 1, 1974 herd of 53.6 million animals were owned by nonfarm interests (Woods, 1974).

There are no quantitative estimates of the impact of tax provisions on structural aspects of beef breeding cattle, dairy cattle, or hog breeding operations. Cash accounting and capital gains treatment undoubtedly result in larger herds than would otherwise exist and probably lead to lower farm level prices for livestock. It is quite possible that livestock ownership is more dispersed than it would be without the special farm tax provisions.

The impact on individual diary farms of termination of cash accounting and capital gains treatment for breeding animals was examined by Bryant et al. (1973). They found that either change would result in a significant increase in average annual taxes both for farms maintaining a constant herd size and for growing firms. Their results can be generalized to other livestock breeding enterprises.

Orchards and Vineyards. Tax shelter investments in orchard and vineyard development have been concentrated in particular crops. Citrus and almonds were popular during the 1960's, but tax reform terminated their tax shelter advantage. The citrus provision in the Tax Reform Act of 1969 requires that all expenditures for purchase, planting, cultivation, maintenance, or development of any citrus grove be capitalized during the first four years after planting rather than being deducted as a current expense from other income. The capital account is then depreciated over the bearing life of the trees. Note that the present value of depreciation spread over the life of the orchard is substantially less than the present value of the current deduction of development expenses. The rules apply to citrus trees planted after December 31, 1969, and were extended to almond trees planted after December 29, 1970. Investor interest subsequently shifted to other crops, especially wine grapes and there was also significant nonfarm investment in development of walnut and pistachio orchards.

There were eight limited partnerships to establish orchards and vineyards registered with the SEC in 1970-71, according to Scofield (1972). The total acreage to be developed was about 22,000 acres with investor capital of approximately $40 million. Dangerfield (1973) listed a Who's Who of syndicated farming which included offerings for orchard and vineyard development worth almost $53 million and covering 47,000 acres in California. There is undoubtedly some overlap in the syndicates listed by Scofield and Dangerfield. A large number of smaller syndications sold only within California and private placements were not included in either report.

The development of perennial crops is based on expected profits over the life of the asset where after-tax profits depend on both economic conditions and tax provisions. Expected economic conditions, based on recent experience, are probably the most important determinant of new tree plantings. The tax subsidy provided by current deduction of development expenses treated as a reduction in annual costs, can be expected to increase tree plantings and ultimately, total production. Thus, the increase in tree plantings as a result of the subsidy depends on the elasticity of tree plantings and on the tax bracket of the developer. The acreage response to such income tax subsidies was analyzed by Carman and Youde (1973), for the aggregate production of five California orchard crops.

In an examination of five large California farms Lin et al. (1974) found that farmers would reduce acreage of tree crops in response to required capitalization of development costs. In a study of the California-Arizona orange industry, Thor (1980) estimated that annual California orange plantings decreased about 6626 acres as a result of the Tax Reform Act of 1969. None of the above studies, however, explicitly identified tax effects for different sized operations.

## Corporate Farms

The legal organization of the farm firm is an aspect of structure which is heavily dependent on tax laws and provisions. Of the legal forms, single proprietorships accounted for 89.5 percent of farm firms in 1974, followed by partnerships, 8.6 percent, and corporations, 1.7 percent (Census of Agriculture). Farm corporations, while still a small proportion of total farms, are an important economic force. Recent tax rate changes favoring small corporations can be expected to promote further incorporation of farm firms.

Reasons for Incorporation. The corporation is a legal structure with economic motivations and consequences. It offers both a method of resource ownership and a means of allocating risk, control, and returns among parties to the enterprise. The increase in the number of farm corporations is largely the result of careful planning, analysis, and conscious business decisions.

The advantages for incorporation are usually listed under the categories of fringe benefits, limited liability, health and accident insurance for the benefit of the shareholder-employee. Even meals and housing for the shareholder-employees may qualify as tax deductible expenses. In addition to owner participation in tax-privileged employee benefits, the corporate form of busines organization also offers the advantage of limited tort and contractual liability. It should be noted, however, that most financial institutions will require personal guarantees from the owners of small corporations before approving loans. Other reasons for farm incorporation are an extended business life, improvements in estate planning including easier intergeneration transfers of the farm business with savings in estate taxes, achievement of ownership security by younger members of the firm, and maintenance of the resource combinations of a growing farm business. Under gift tax laws an individual may transfer up to $3,000 per year ($6,000 per year for an individual and spouse) to any other indivudal family member free of gift tax. Thus, a couple with two children can make annual tax-free gifts of $12,000. Incorporation facilitates this type of transfer through a gift of shares in the corporation. Several years of this practice can substantially reduce a taxable estate.

The corporate form of organization also has its disadvantages and costs. The organizational, operational, and reporting requirements may involve time, legal and accounting assistance, and other costs not incurred by the sole proprietor or partnership. There may also be a problem of double taxation of income, first as corporate income and then as dividend income to the individual. This problem, however, can be avoided through the subchapter S election or through a growth strategy with retained earnings reinvested in the farm rather than being distributed to the shareholders as salary or dividends.

Income Tax Aspects. Amendments to the Internal Revenue Code (subchapter S) in 1958 stimulated farmers' interest in incorporation. The subchapter S election permits qualifying corporations to shift income or losses directly to the shareholders as is done in partnerships, thus avoiding the double tax at both the corporate and shareholder level. Capital gains are also passed through to the individual shareholder.

Ordinary farm corporations, taxed under the regular provision of subchapter A of the Internal Revenue Code of 1954, can avoid double taxation by using retained earnings to expand. The corporate tax rate, which is less progressive than individual income tax rates, provides a clear incentive for using the corporate business form for expansion purposes.

Tax savings can be maximized by equating the marginal rates on personal and corporate income; savings will increase as total income increases. Retained earnings can also be converted to long-term capital gains.

The recent corporation tax rate changes combined with other corporate advantages will likely lead to a substantial increase in the number of farm corporations in the United States. The prime candidates for incorporation are the largest farms and those interested in growth. The attractiveness of the subchapter A corporation has been enhanced by tax rate changes so that the subchapter A type will probably account for an increased share of farm corporations at the expense of the subchapter S form. Since many corporate farms will be committed to and will have tax savings to finance expansion, a continued movement toward fewer and larger farms is encouraged.

## Estate Taxes

Federal estate taxes are progressive and, thus, they would seem to fall more heavily on large than on small farm estates. It is possible, however, that larger estates have blunted the progressiveness of estate taxes through better planning for the intergenerational transfer of assets. As noted, estate tax planning is often an important consideration in the decision to incorporate a farm. There are no quantitative studies of the impact of estate tax provisions on the structure of agriculture, but it is widely recognized that estate taxes are an important factor in farm planning. There are probably relationships between estate tax provisions and farm structure, even though difficult to isolate, and with recent tax law changes the impacts may become more pronounced.

Prior to 1976, the tax treatment of farm and nonfarm estates was similar. The Tax Reform Act of 1976 introduced important differentials between farm and nonfarm estates with two new provisions: (1) special farm-use valuation, and (2) a 15 year installment payment plan. Sisson (1976) discussed the Act's applicability to agriculture.

## Special Farm Use Valuation

The Tax Reform Act of 1976 enables qualifying farmland to be valued at its "use" rather than "fair market" value for estate tax purposes. Since use values of farmland are typically much lower than market values, estate tax liabilities are reduced for qualifying property. The procedures to be used to determine use value are quite specific. The reduction in the value of a farm estate due to use valuation is limited to $500,000. Boehlje and Harl (1979) outlined two methods for arriving at a use value for farm property and examined the implications of use valuation for farm estates with net worths ranging from $250,000 to $2.5 million. Matthews (1978) and Matthews and Stock (1978) also discussed use valuation of farmland.

Qualifying requirements for use valuation have several possible structural implications. Boehlje and Harl concluded that (p. 111): "with increasing age, eligible persons will be encouraged to move toward a greater investment in land and less investment in nonland assets." In addition, their calculation of the present value of tax benefits from use valuation indicates that (p. 112): "the use valuation legislation could enable older individuals to outbid younger farmers for a particular parcel of land, based strictly on the value of tax benefits each would receive."

Fifteen Year Installment Payment Plan

Estate tax can be paid over a 15-year period with interest amortized at 4 percent. The benefit is limited to the estate tax payable for the first million dollars of farm property. Most estates in which farm property comprises at least 65 percent of the adjusted gross estate will qualify for the installment payment provision.

The value of the installment payment provision depends on investment opportunities. Harl and Boehlje (1978) calculated that savings from a 10 percent net return investment could almost pay the federal estate tax bill over the 15-year installment payment period.

It is likely that these two special farm estate tax provisions will have several effects: (1) an increase in land values as farmers and others attempt to take advantage of tax provisions; (2) a reduced availability of farmland since rules restrict sales of land receiving the valuation to other family members for 15 years (sales outside the family within 15 years results in a recapture of the tax savings); and (3) a tendency to "lock up" land ownership and encourage absentee-ownership of farmland due to the recapture rules.

## Property Taxes

Property taxes are a very important cost to agriculture and with rising land values, their burden has been increasing. Gloudemans (1974) found that farm property taxes had been absorbing some 7 percent of total personal farm income, double the comparable figure for urban dwellers. Tax burdens vary by area and state. In many states, property taxes account for over 10 percent of net farm income. It is not surprising that property taxes on land are generally considered to be regressive in terms of ability to pay the tax from current income. With use-value and preferential assessment legislation now effective in at least 37 states, the distribution of benefits from reduced assessments for farmland has become an important political consideration. Preferential assessment programs are also described by Barlow and Alter (1976).

The per acre market value of a small parcel of land is typically higher than a large parcel of comparable land. Small parcels may be suitable for enlargement of neighboring farms, for rural building sites or part-time farming. Since property taxes are _ad valorem_, the small farm would have higher per acre taxes than the large farm, and thus, property taxes would be a factor in economies of size. Likewise, one would expect use-value assessment to yield the greater per acre tax reductions for small parcels of land.

California's use-value assessment program, the California Land Conservation Act of 1965 (CLCA), has been criticized by a Nader task force (Fellmeth, 1973). The charge was that the program granted millions of dollars of benefits to giant corporate landowners but provided little benefit to small landowners. This type of criticism has been damaging since significant support for enacting the program was from groups interested in providing tax relief to small farmers, particularly those in urban-rural fringe areas.

Empirical research on farm size/property tax relationships is limited. Income distribution impacts of CLCA were analyzed by Hansen and Schwartz (1977) for participants in Sacramento County. They found that the distribution of benefits (in percentage terms) was strongly in favor of the lower income farmers. The largest total benefits, however, went to large landowners--as charged by Fellmeth. Large landowners, obviously, have more acres to subscribe to CLCA in order to receive the reduced assessment than do small landowners, and so receive more total benefits. Also, if small landowners tend to be located nearer urban areas, their opportunities for conversion at a profit may discourage their participation in CLCA. It remains to be seen, however, whether these factors have actually influenced farm size in California. Research is needed in this area.

The impact of alternative tax provisions on the growth of Columbia Basin farms was simulated by Umberger and Whittlesey (1973). Their results suggested that a reduction in the property tax and substitution of an income tax would increase the consolidation of land ownership and control into large farms. This result, however, may be due to the ability of large farms to utilize income tax provisions to their benefit.

## Summary

It is clear from the discussion that taxes influence the decision making and investment behavior of farmers. Information on the relationships between the structure of agriculture and tax provisions, however, tends to be based primarily on budgeted examples and theoretical models rather than on extensive empirical analysis. This shortcoming can be remedied in some areas. It appears that there are sufficient data to obtain quantitative estimates of the impact of changes in some tax provisions, such as citrus and almond orchard capitalization requirements, for example. It should also be possible to examine structural aspects of use-value assessment for property tax purposes. Many areas of taxation and their relationships to structure, however, will probably never be known with any degree of certainty. Data will always be a problem and, even with data, separation of. the effects of tax provisions from other factors may be impossible. Investor motives are important but they cannot be fully known to the researcher. Despite the analytical limitations, the relationship between taxation and the structure of agriculture is important and should be considered in the formation of both tax and agricultural policy.

# CHAPTER V

# THE INFLUENCE OF THE PRODUCT MARKETING SYSTEM ON FARM SIZE

## Introduction

Agricultural marketing has traditionally been defined to include all physical and exchange activities which occur to a product between the farm gate and the final consumer. These activities include marketing functions, institutions, and procedures involved in transforming farm commodities into products available at times, places, and prices desired by final users. The farm gate division between production and marketing has become outmoded, however, with the growing interdependencies between many aspects of farming and marketing systems. The structural characteristics of farming such as location of production, size distribution of farms, technology of production, and patterns of ownership and control of sales may affect the structure of distribution and exchange systems. Conversely, the structural characteristics of marketing firms and institutions may influence the structure and methods of farming. The size, number, and location of marketing facilities may affect farmers' access to markets, thus constraining the products which may be grown economically. Consumer preferences and technical requirements of food

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manufacturers may call for certain specific raw product attributes leading, therefore, to changes in farming methods and practices. Marketing regulations and controls may further constrain farmers' choices as to quantities and qualities of some products which may be sold.

The objective of this chapter is to identify marketing-farming interactions which seem likely to influence the size of farming operations. In the process, some aspects of marketing with minor influence on farm size are identified as well as other aspects where the relationship is unclear. The evidence presented in support of the various hypotheses will be largely qualitative since to this point there is little in the way of empirical measurement of such influences.

## Systems Approach to Marketing Analysis

Among alternative approaches to marketing analysis, the systems approach seems to be the most useful for analyzing impacts of marketing changes on the structure of farming. The systems approach views marketing in terms of several goal-oriented components: (1) the <u>technical system</u> which focuses on productivity and efficiency goals, (2) the <u>power system</u> which determines prices and the division of returns from exchange, (3) the <u>communication system</u> which provides signals coordinating production and marketing decisions, and (4) the <u>adaptive behavior system</u> which generates regulations, controls, and group actions facilitating adjustment to internal and external changes.

Some of the interactions between the marketing and farming systems may be circular--that is, changes in the structure of farming operations may induce changes in the organization and behavior of the marketing system which in turn may affect farming operations. The discussion to follow, however, focuses only on the influence of changes in the marketing system on farm size. The effects of changes in the structure of production agriculture on the marketing system are explored in French and Carman (1979).

## The Technical System

The technical system refers to the methods by which agricultural products are assembled, processed, and distributed to consumers--a system continually altered by the development of new technology and changes in organization. The impacts on farming have been both direct in imposing constraints on farmer production choices and indirect through effects on size and location of marketing firms which in turn influence farming operations.

Direct Impacts. Within the technical system, changes in marketing technology for the physical operations of the assembly, processing, or distribution may each influence farming in different ways. Also, interactions among the various operations may bring about changes in farming methods and practices.

Assembly covers operations associated with transporting farm products to processing and shipping points. The technology of assembly has been altered substantially in recent decades by the development of large-scale bulk handling methods for grains, milk, and many kinds of fruits and vegetables. Such developments, however, would appear to place only the very small farm at a competitive disadvantage and even then probably not at a severe one.

Processing includes such activities as packing fresh produce, canning, freezing, bottling, and drying. Planting schedules, cultural practices, applications of inputs, and harvest schedules may be influenced by processors' desires for certain raw product characteristics consistent with processing technology. Changes in raw product specifications and the use of substitutes may also affect the geographic location of production and possibly the nature of contractual arrangements with growers. Larger growers who are more innovative and better able to assume risks than are small operators, may also be more likely to adapt readily to such changes (Conner, in USDA, Nov. 1979). Extension of this argument would suggest that future developments which require even more exacting raw product specifications may place smaller farms at a further competitive disadvantage. The evidence, however, is not clear, but it seems likely that the advantages of adoption of such changes could be achieved by a relatively modest size farm.

Distribution involves the activities of transporting and selling products beyond the first handler. Most changes in distribution technology have only indirect impacts on farming. They are discussed below.

Indirect Impacts. The observable trend in agricultural processing and marketing toward fewer and larger firms is primarily a result of changes in the technology of transportation, processing, and communication and the interrelated economies of scale in marketing, including financial advantages achieved by mergers. Such changes may lead to further changes in the location of processing and shipping activities. For example, developments such as bulk shipping, improved truck transportation, and piggy-back rail arrangements may alter cost advantages of particular locations. Improvements in storage technology and other processes which deter perishability or extend seasons, may also affect both the size and location of marketing facilities.

Changes in location and size of processing and marketing firms affect farmers primarily by altering their access to markets. Historically, small farm operators have been able to ship products through central markets and to choose among several processors. With the closure of many central markets, increased direct buying by large marketers, and the consolidation of processing facilities, many very small farmers may find it increasingly difficult to obtain access to buyers of their product equal to that enjoyed by large operators.

In fed beef, for example, the development of large-scale feedlots and the construction nearby of large specialized slaughter plants with large-scale breaking operations that minimize the sum of assembly, feeding, processing, and distribution costs, has changed the industry structure substantially (Cothern and Peard, 1978 and Cothern *et al.*, 1978). The number of cattle feeding operations and beef slaughter plants has decreased as their average size has increased. The large-scale packer can realize significant reductions in assembly costs by dealing with only a few large feedlots rather than with numerous, small, scattered feedlots (Moore and Martin, 1978). Rhodes (1972, 1978) has noted that while the big cattle feedlot may have a dozen buyers a week coming by, the farm lot feeder may be lucky to see one buyer occasionally.

Market access is also a serious problem for small fruit and vegetable producers. Large food retailers need large volumes of uniform quality produce to meet their merchandising requirements and so they prefer increasingly to deal directly with large producers or packing firms. Producers not able to meet volume and quality requirements face a residual market involving relatively high marketing costs and correspondingly lower net returns.

## The Power System

The reductions in numbers and the increased size of marketing firms, noted above, have meant increased concentration of buying power in fewer hands, especially for specialty crops and commodities with localized production areas. It is not clear, however, how such power has been exercised and what its impact has been or might be on farm size. Large food manufacturers may prefer to deal with a few large suppliers in order to reduce transaction costs, according to Conner (in USDA, Nov. 1979).

Concentration of marketing functions may increase farmers' vulnerability to shifts in capital investment. High interest rates relative to returns from tomato processing may have caused and may continue to cause some proprietary canners to withdraw from production (Thor, 1979). Growers would then be required to assume ownership in order to maintain sales outlets. Producer purchase of processing facilities would seem to depend on participation by large well-financed growers to succeed.

The problem of maintenance of sales outlets, of course, is neither new nor restricted to California tomato growers. Producers have formed cooperatives to purchase and operate processing operations with varying degrees of success. Large well-publicized acquisitions by grower cooperatives include the Welch Grape Juice Company and American Crystal Sugar Company (see, Goldberg, 1972, and Volkin and Bradford, 1975, respectively). Such acquisitions require producers initially to commit large amounts of capital to processing facilities, and then continued investment is usually needed. To purchase the American Crystal Sugar Company, for example, growers had to invest an amount equal to $100 per acre of beets to be delivered in 1973. A similar attempt by Washington sugar beet producers to purchase two U and I, Inc. factories threatened with closure, failed when growers could not commit the necessary capital.

The product differentiation and diversification strategies of large food manufacturers may have further impacts on farmers.

Standardization may impose restrictive contractual specifications. Changes in product mix and ingredient substitutions can affect the location of production and farm enterprise combinations. These shifts may tend to result in consolidation towards larger farming operations (Conner, in USDA, Nov. 1979).

Another related issue affecting farm-size structure occurs when a region specializes in the production of a particular commodity. Input suppliers and marketing services serving producers of that commodity "agglomerate" in that area, and industry economies are then realized by producers there, which are unattainable by those who attempt to grow the crop elsewhere. One example is vegetable production in the Salinas Valley. On the input side, seed specialists, plant nutritionists, soil testing services, box manufacturers, and others, all offer specialized services for the large industry giving the area a cost advantage over other areas. Also, the assembly component of the product marketing sector is an integral part of the system with specialized packing houses and refrigerated transportation speeding highly perishable commodities to market. Even bankers of the area specialize in knowing the ins and outs of vegetable production. The economics achievable by "agglomeration" of an industry may create a barrier to entry in other areas.

<u>The Communication System</u>

Under a free and open market system, agricultural producers make their production decisions based on price information received via the marketing process. They decide what to produce, how much to produce, and when to produce it in accordance with their expected profit maximizing calculations, with assurance of a market for whatever is produced. The free market system still prevails for commodities such as wheat and feed grains, except for government-imposed restrictions. For many other commodities, however, free market conditions have been replaced or supplemented by various contractural arrangements or by integration through common ownership of production and marketing facilities. A review of coordination and exchange mechanisms in U.S. agriculture is given in North Central Regional Research (1976). Vertical arrangements have generally been developed in an effort to reduce uncertainty and to provide closer coordination between the input requirements of marketing and processing firms and the output decisions of producers. They may also provide some cost efficiencies in the reduction of acquisition costs (French and Carman, 1979; USDA, Sept. 1979).

Economists who have examined the issue of the impact of vertical structures on farm size (Rhodes, 1972; Knutson et al., 1978; Moore and Martin, 1978; Tomek and Paul, in USDA Nov. 1979) have suggested two kinds of influences. First, as closed-market arrangements increase, the market access problem discussed previously is exacerbated. Farmers without such vertical ties may find it difficult to survive (or at least to produce the particular commodities affected) unless they are of a size to provide their own marketing services and to take advantage of facilitating institutions such as hedging in futures markets. Second, the integrative process may favor larger-scale farming operations. Although backward integration by marketing firms through ownership of farming enterprises is not widespread, those firms that do so, tend to establish large farm units. More commonly, farm production and marketing-processing activities are coordinated by some type of contractual arrangement rather than ownership. Farms using sales contracts have much larger volumes than others, according to USDA (Sept. 1979). The cause and effect relationship, however, is not entirely clear, for there is some question as to whether contracting tends to result in larger farm size or large farms result in contracting. It seems likely that the influence goes both ways.

The Adaptive Behavior System

Farmer efforts to adapt to changing external economic conditions have resulted in three main developments: (1) cooperative organizations to perform processing and marketing operations, (2) the so-called "self-help" market control programs, and (3) bargaining agencies.

Cooperative Organizations. In 1976, there were approximately 4,800 cooperatives in the United States accounting for nearly 30 percent of the cash receipts from farm marketings, an increase from about 20 percent in 1950. Cooperatives help solve the problem of access to markets for both small and large farmers. The costs of serving small and large farmers, however, are different (Dunn et al., in USDA, Nov. 1979). Large volume transactions with large farms may cost less per unit so that if all costs are pooled and assigned to members equally, larger farmers may find themselves subsidizing smaller farmers. Pooling systems which better reflect these cost differences may help maintain the efficiency of the cooperative, but might also further increase the advantage of larger farms, thus promoting farm size expansion.

It is difficult to obtain other information on the magnitude of difference in per unit costs of serving large and small farmer cooperative members. It is suspected that in most cases it is not very significant. Overall, while cooperatives probably have not been of much help in preserving very small farms, they appear to have been and likely may continue to be a major force in permitting farms of modest size to survive.

Market Control Programs. State and federal marketing order programs have provided mechanisms whereby farmers have been able to achieve greater industry-wide control of the quantity, quality, product characteristics, and rate-of-flow of products to markets. (For information on the nature, use and importance of marketing order programs see Garoyan and Youde, 1975; French *et al.*, 1978; North Central Regional Research, 1978; and Babb and Bohall, in USDA, Nov. 1979.) Such programs have been applied mainly to milk, and fruits and vegetables. Milk orders have operated through control of pricing mechanisms, whereas fruit and vegetable orders have provided shipping standards for grade, size, and maturity, total supply management, allocation among market outlets, and control of intraseasonal flows. Also included have been generic advertising and promotion programs aimed at enhancing the demand for the product.

Marketing orders have probably not affected industry concentration greatly for either dairy farmers or fruit and vegetable growers, according to Babb and Bohall (in USDA, Nov. 1979). They point out, however, that orders may induce expansion of farm size because they stabilize prices and reduce risk. On the other hand, to the extent that orders enhance prices, they may permit less efficient farmers to survive. The net impact of marketing orders on the entry of new firms remains uncertain, for higher prices and reduced risk may encourage entry while quota requirements discourage it.

Bargaining. Another means by which farmers have attempted to attain greater control has been through group efforts to bargain with buyers over terms of sale for their products. The most common approach has been to form cooperative associations which bargain with processor buyers only for those farmers who are members of the association. (The nature and extent of cooperative bargaining are described in French and Carman, 1979; Lang, 1978; Rhodes, 1978; and Torgerson, 1976.) A second approach is through exclusive agency cooperatives such as provided for by the Michigan Agricultural Bargaining Act of 1973 (Shaffer and Hamm, in North Central Regional Research, 1976). Exclusive agency bargaining combines elements of marketing order programs and cooperative bargaining associations, since the agency bargains not only for its own members but for all farmers designated to fall within the defined bargaining unit.

It seems likely that the impact on farm size of the more common cooperative bargaining association would be similar to that of other cooperatives, discussed above. The exclusive agency cooperative, on the other hand, may have impacts more like those of marketing order programs. The price-enhancement and risk-reducing effects of successful bargaining may encourage farm size expansion, aid in the survival of less efficient firms, and encourage the entry of new producers. The net impact of such offsetting forces is uncertain.

## Areas for Further Research

The major changes in the marketing system in recent years have been: (1) increased purchases by processors directly from farmers, (2) greater use of contractual arrangements, and (3) the associated decline of terminal markets. These changes have influenced farm size mainly by affecting the access of smaller farms to markets and by making it more difficult for them to interact in an increasingly complex coordinating structure.

While much as been written about the problem of market access and vertical coordination (see especially Rhodes, 1972 and USDA, Sept. 1979) it is very difficult to evaluate the full implications of policies when little quantitative information is available concerning the cost and profit aspects of such influences. The challenge facing researchers is to isolate such costs (and returns) and relate them to factors such as farm volume, assembly distance, alternative sales outlets, and the structural and institutional characteristics of markets. Costs will vary by commodity and region. Data could be obtained from surveys of farmers and marketing firms, with marketing cost functions then developed by a combination of cost synthesis and statistical analysis. Such quantification would provide important information needed to evaluate the social gains and tradeoffs of alternative policies and programs.

# CHAPTER VI

# RISK AND FARM SIZE

## Introduction

Farming activities are fraught with risk and uncertainty. Input-output relationships vary with the weather. Technological change in inputs makes the relationship to output even more unsure. Input costs and supplies can be causes of considerable concern, e.g., sources and prices of energy, labor, irrigation water, etc. Output prices are another obvious uncertainty, as is access to markets. Obtaining adequate credit and having good cash-flow repayment capacities are by no means assured. Given the propensity of government for making changes, price, income, regulation, trade, and other policies do not always provide the security intended. Long-term investments in perennial crops, machinery and equipment, or even in farmland must be made in the face of these tremendous uncertainties.

## Defining Risk

Risk is not easily quantified or even defined. Probably the most common measure is variability about the mean, with greater variance implying greater risk. Besides the mean-variance

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measurement, comparisons of mean absolute deviations, coefficients of variation (standard deviation/mean), semi-variances, and ranges are also used. More recently, economists have made other attempts at defining risk. For example, if a policy or action alters the distribution of returns, then incomes under that policy or action are less risky only if everyone prefers the policy (Rothschild and Stiglitz, 1970). Another measure is simply the probability of falling below some established minimum--e.g., bankruptcy or ruin (Moscardi and de Janvry, 1977). In summary, it is apparent from the various attempts to define risk that there is no generally accepted practical approach to measure risk. Lacking a precise definition of risk, the task of describing the relationship between risk and farm size is very difficult. Using either the mean-variance or the Rothschild-Stiglitz approach, the judgment that larger farms are more risky than smaller ones cannot be made a priori, since both mean and variability of net farm income increase with farm size. Hence, some risk averters would prefer the lower mean with less variability; others, the higher mean with greater variability.

## Changing Size Distribution of Farms

The hypothesis that needs to be explored is that changes in risk have altered optimum farm size. There are five reasons commonly given for increasing farm size. Since each reason has a close tie-in with risk, each is discussed briefly:

1. Government policies that reduce risk lead to the adoption of decreasing cost technologies.

2. Government policies that reduce risk, lead to increased output.

3. Government policies (price supports, acreage restrictions, subsidies, quotas, etc.) that reduce risk to producers, also reduce risk to factor owners (in particular, capital owners) and thereby reduce prices and increase supplies of inputs.

4. Technological change is risk reducing and output increasing.

5. Institutions such as futures markets, contractual arrangements, and vertical integration that reduce risk encourage increased size.

1. Government policies that reduce risk lead to the adoption of cost-decreasing technologies. It has been argued by a number of researchers that price support policies have speeded the adoption of new technologies in agriculture (Gray *et al*., 1954; Hathaway, 1955; Tyner and Tweeten, 1968; Gardner and Pope, 1978) with the resultant shift in the supply curve to the right. It is unclear, however, whether this impact is primarily due to increased prices (or expected prices) or to more general risk considerations. It seems intuitively likely that stabilized prices enhance the investment in new technologies as well as in land. Further research is needed to determine if and how such reduced risk leads to the adoption of new technology. Investment in new technology may lead to further reduction in risk and to

increased farm size, but the reduced risk from government policies may in and of itself stimulate investment in adding more land to the farm.

2. Government policies that reduce risk lead to increased output. Policies that reduce risk result in a movement along the supply curve--that is, commodity output is enhanced by a reduction of risk. Whether or not this leads to changes in farm size, however, has not been tested empirically. For example, in a multicrop situation, if risk in one crop falls resulting in the increased output of that crop, it doesn't necessarily follow that the scale of the total operation will be increased. The historic relationship between government risk-reducing, output-increasing policies and farm size has yet to be determined by researchers.

3. Government policies that reduce risk to producers also reduce risk to factor owners. It has been shown that a reduction in output price uncertainty (while holding the mean price constant) will theoretically lead to increased factor usage (Batra and Ullah, 1974). Pope and Kramer (1979) showed that a reduction in yield uncertainty (holding the mean yield constant) will lead to increased factor usage if factors marginally increase risk, but will lead to a reduction in factor usage if factors marginally reduce risk.

Government policies which reduce risk to producers probably have the effect of reducing risk to lenders of capital. Where reduced risk increases agricultural capital, the wherewithal to expand farming operations is enhanced. The relationship between risk-reduction and increased capital to agriculture is complicated and the relationships are so intertwined that it has been extremely difficult for researchers to separate out empirically the precise effects of risk-reducing government policies on producers and on factor suppliers. Thus, the subequent impacts on farm size of reduced factor prices and increased factor supplies have not yet been isolated.

4. Technological change is in general risk reducing and output increasing in the short run and probably has gradually led to increased farm size. There are two types of technological change.. The first can be called factor neutral. Some genetic improvements, for example, lead to increased yields and a reduced variance in yields, resulting in increased output, lower marginal costs, and reduced risk. Some genotypes, however, may have had increased average yields but produced a greater variability of yields over time. Risk averters may choose not to adopt these. Thus, the impact of this sort of technological change on the total output of the commodity is not clear.

A second type of technological change can be called factor augmenting. Labor-saving, capital-using technological changes such as in new types of machinery, appear to be risk reducing in decreasing the variability of production. It is likely that increasing capital-labor ratios are in fact risk reducing, because harvest vulnerability to adverse weather conditions is diminshed (Just and Pope, 1979). A reduction in risk increases the incentives for adoption of new technology and perhaps leads to a complementary increase in farm size. Neither theory (Silberberg, 1974) nor empirical analyses have determined the long-run implications of technological change on the structure of agriculture where the long run is determined by adjustments in prices, entry, and exit such that equilibrium is attained.

5. Institutions that reduce risk provide the impetus for increased farm size. Three such examples are: forward contracting, land leasing, and the futures market.

Evidence indicates that forward contracting is dramatically increasing (Jesse, 1974). It may be, as is sometimes alleged, that this increase represents a growth in buyers' monopsonistic power as they seek assurance of quality and a reduced variation in supply. If, on the other hand, contracts are negotiated on a competitive basis, then both buyers' and sellers' wishes are represented in equilibrium contracts and both benefit from the contract (Blaich, 1959). To the extent that such contracts reduce risks to farmers, an inducement to farm size expansion may be present. Although several studies of contracts and risk sharing have been made (e.g., Buccola and French, 1979; Moore and Synder, 1969), little attention has been directed to the tradeoff between the assured forward price of the contracts and implicit prices of risk reduction to the farmer.

Another type of contracting which also reduces risk is that provided by the land rental market. There has been an increase in farmland rentals. There are some theoretical arguments (e.g., Bell and Zusman, 1976; Cheung, 1969), that suggest that share rents reduce risk to the operator by sharing risks with the landowner. Renting may reduce the risk of cash flow shortfalls for expanding firms.

In theory, the emergence of the futures markets for many commodities should lead to reduced price risk for farmers (Holthausen, 1979; Danthine, 1978; Feder et al., 1977; Pope and Kramer, 1978). Empirical evidence seems to indicate that farmers' use of the futures market is limited mainly to large producers (Paul et al., 1976). Presumably, transaction costs, production uncertainty, and basis risk are inhibiting factors to the participation of many farmers.

## Static Relationships Between Farm Size and Risk

Now that the five causes of risk reduction and their possible impacts on farm size have been at least touched upon, the focus can now be narrowed down to the direct question of whether risk itself is positively or negatively correlated with the scale of agriculture. Smaller farms are allegedly less vulnerable to risk, because the small farmer has proprotionately lower cash expenses, proportionately larger fixed commitments, and, therefore, takes a lower inputed return to his own labor, management, and capital in adverse income years (LeVeen, 1973). This has been called the small farmers' "staying power," providing an important buffer for the nation's food and fiber supplies in hard times.

In a study of the Australian sheep industry, Anderson (1972) found that net farm income increased at a diminishing rate with increasing size of firm while the standard deviation of net income increased at a constant rate. Thus, the largest firms had fairly high probabilities of achieving negative incomes of considerable magnitudes but also the opportunity to experience very high levels of income. In a synthetic cost study of Fresno County farms, Moore (1965) found that standard deviations about net income increased with farm size (measured in terms of gross income), replicating Anderson's results.

If, in fact, these larger standard deviations associated with larger farms do indicate an increased riskiness for some farmers, it would seem that diversification could offset some of this risk. Diversification, however, may mean that the farmer must forego economies of size in a particular crop, thereby losing some of the advantages of larger size. The relevant empirical question would be to determine the nature of changes in the production possibility curve as growth occurs. If large-scale economies are associated with increased production of a single crop, then risk-specialization tradeoffs are of special importance.

Using broad census classifications, White and Irwin (in Ball and Heady, 1972) found some support for the prevailing notion that large farms in the U.S. are becoming more specialized. In California, however, it appears that larger crop farms are more diversified than smaller ones (Pope, 1976). Assuming that a minimum size of each activity must be maintained in order to be viable, then larger acreage operations are able to diversify by taking on several of these activities. It may be, at least in California, that economies of size for a particular crop are not sufficient to warrant an emphasis on narrow specialization on large farms. Thus, the incentives may be for larger farms to self-ensure against risk through diversification.

## Needed Research

The subject of risk is particularly formidable. Several questions have been raised; few (if any) have been adequately answered. The first key question is: Do risk-reducing factors give an impetus toward increased farm size? Most studies reviewed here dealt with one specific factor to determine whether or not it was, in fact, risk-reducing but not with the general matter of the relationship between reduced risk and farm size. This latter relationship remains unresolved. The second main question, yet unanswered, is: Are small farms riskier than large farms? Or is the risk environment such that smaller farms inevitably will expand or not survive?

Before such central questions can be addressed, more background research is needed. For example, the linkage between various public policies and risk needs to be better understood. Although difficulties in defining risk and limited available data have so far inhibited empirical investigation of the real-world connection between risk and farm size, it seems imperative to move in this direction with research efforts.

# CHAPTER VII

# THE RELATION OF LABOR COSTS TO FARM SIZE

## The Importance of Labor Costs

Most farms in the United States have neither year-round nor seasonal employees. Only 13 percent of farms with sales above $2,500 reported having at least one paid employee who worked at least 150 days on the farm during 1974, and only 41 percent reported having at least one paid employee who worked any length of time on the farm during the year. The comparable proportions for California are 31 percent and 61 percent, respectively (Census of Agriculture).

Even among farms that have employees, the average number of people employed is not large. Farms that employed at least one person for 150 or more days averaged 3.2 such employees, and farms that employed at least one person for any length of time averaged 7.4 employees. For California, the corresponding averages are 8.6 and 27.6 employees per farm--and turnover among a farm's seasonal workers accounts for perhaps one-third of the latter figure.

Labor costs are, nevertheless, an important expense. The principal components are wages and bonuses, Social Security and unemployment insurance taxes, workers' compensation insurance,

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and the value of housing, meals, insurance, transportation, and other perquisites. In 1977 these items constituted 8.4 percent of total production expenses (other than the value of owners' labor or interest on owners' investment) and 12.2 percent of current operating expenses for U.S. farms. For farms in California the percentages were 23.4 percent and 29.3 percent, respectively (USDA, Oct. 1979, Jan. 1980).

In this chapter, the way labor costs change with the scale of farming is examined. Costs investigated include those of managerial, supervisory, skilled, and unskilled labor. Nine factors which may alter unit labor costs as farm size increases are identified: (1) the proportion of operator time used for management, (2) supervisory time per hour of supervised time, (3) quality of supervisorial and other complementary employees, (4) time spent on various tasks, managerial and physical, (5) the proportion of skilled workers' time used for unskilled work, (6) wage rates, (7) recruiting and managing seasonal workers, (8) legal requirements with respect to hired farm labor, and (9) unionization. Each of these influences on costs is discussed in relationship to farm size, and findings are summarized in a final table.

## The Effect of Scale on the Use of Operators' Time

The way that farm operators allocate their time between managerial and other activities varies with the size of their farms. After studying the allocation of operators' time on 44

New York dairy farms with from 30 to 340 milk cows, Hughes and Stanton (1965, p. 8) reported: "As the size of herd increases, the operator devotes a lesser, but still important, amount of regular day time to regular labor activities, more to entrepreneurial activities, possibly more to farm-related activities, and about the same to nonfarm activities." Presumably the larger operators devoted more time to managerial tasks because the magnitude of those tasks increased with the size of the herd, it was less expensive and less risky to delegate nonmanagerial than managerial tasks, and the managerial tasks were less unpleasant and more prestigious. Not even the largest operator in the study was, however, a full-time manager.

It has not been established that greater concentration on managerial tasks by larger operators produces economies of scale. Rodefeld observed (in Rodefeld _et al._, 1978) that farmers believe that they gain major efficiencies from separating manager and labor status roles. On the other hand, MacGillivray and Stevens (1964) pointed out that specialization increases repetition, repetition is boring, boredom produces fatigue, and fatigue reduces productivity.

If the advantages and disadvantages of specialization happen to offset each other, greater concentration on managerial tasks by larger operators will not produce economies of scale. If farms of different sizes use the same amount of every input per unit of output and pay the same prices for purchased inputs, and if each use of operator time is valued at the wage rate prevailing for that kind of work, expenses per unit of output would be independent of farm size. A larger operator would have an advantage, but it would be measured by the larger total value assigned to his time rather than by lower expenses per unit of output.

## The Effect of Scale on the Amount of Supervision

Does an increase in farm size tend to change the amount of supervisory time that an operator must use per hour of supervised time in order to obtain a given level of performance from typical workers at a given wage rate? Three pairs of investigators have studied this question.

Hughes and Stanton (1965) found neither economies nor diseconomies of scale in supervision when they studied New York dairy farms having from zero to 9.0 man-equivalents of hired labor.

On the other hand, Johnson and Hvinden (1977) found evidence of diseconomies of scale in supervision when they studied 97 grain farms in North Dakota having from zero to four hired workers.

Similarly, Krause and Kyle (1971) found evidence of diseconomies of scale in supervision when they interviewed the managers or owner-operators of 48 midwestern corn farms during 1969. The investigators reported that, because workers' motivation deteriorated as the size of the farm increased, larger farms used more supervision per unit of output. As a result, hired labor and management cost a farm $13.73 per acre annually if it cultivated 2,000 acres, but $15.19 per acre if it cultivated 5,000 acres.

There are several reasons why workers' attitude toward their work or their employer may deterioriate as the size of the employer's operation increases. First, the apparent difference between the employer's wealth and the worker's wealth grows. Second, interaction between owners and workers becomes less personal. Third, workers worry less about the employer and more about their co-workers. These factors may be the underlying cause of diseconomies of scale in supervision--if the latter exist.

## The Effect of Scale on the Optimal Quality of Complementary Employees

Some people are better supervisors than other people. As a result, a farm's cost of supervised labor may decrease, and its yields and prices received may increase, by a larger proportion if the farm employs one person as a supervisor than if it employs another. On the other hand, if the farm pays a higher salary in order to attract, retain, or develop a more effective supervisor, its total expenses per unit of output may increase. If so, the size of the farm will determine whether it would be of benefit to employ the more effective supervisor.

Similarly, the size of a farm may determine whether it would be profitable to employ a more effective but more expensive manager, broker, irrigator, duster, or other person whose activities provide benefits that are proportional to the scale of the farm.

Some farmers interviewed by Krause and Kyle during 1969 apparently were of too small a scale to justify employing top-quality personnel. The farms involved had from 1,000 to 8,600 acres in row crops (primarily corn) and were scattered throughout the five corn-belt states. Krause and Kyle reported (p. 14):

> The largest units controlled more dollars of assets and thus could pay higher rates for labor, supervision, and management. These rates . . . enabled the large units to employ higher quality workers. Wide variation exists in the quality of labor employed. Some people classified as foremen were actually assuming many overall management responsibilities.

Other writers seem to have ignored the possibility that the optimal quality of complementary employees may change if the scale of the employer changes.

## The Effect of Scale on the Cost and Profitability of Tasks with Fixed Time

The relation between the size of a farm and the amount of time that its owners or employees use to accomplish a task is different for different tasks. Two teams of investigators have studied the relation for managerial tasks, and two have done so for physical tasks.

Hughes and Stanton (1965) examined the amount of time that 44 New York dairy farmers used to obtain information during 1964. They reported (p. 10): "The amount of time spent collecting information is essentially constant among all the size groups."

As a result, total time used to gather information per unit of output decreased, though at an ever slower rate, as output increased.

For other managerial tasks, Hughes and Stanton found variable time as well as fixed time. For buying and selling and for miscellaneous tasks (credit management, business planning, physical inspection, and professional consultation), variable time increased with farm size at either a decreasing or constant rate. Hence total time used to accomplish these tasks per unit of output decreased as size increased, though at a decreasing rate. For record-keeping, on the other hand, variable time increased with farm size at an increasing rate. Hence total time used for this task per unit of output decreased until a particular size was reached and thereafter increased. The diseconomies of scale in record-keeping offset economies of scale in the other tasks and made the total time used for all managerial tasks per unit of output independent of size.

Johnson and Hvinden (1977) studied a different type of farming and reached a different conclusion. After analyzing the amount of time that 97 North Dakota grain farmers said they used in various managerial activities during 1975, Johnson and Hvinden reported that time used to purchase inputs, market products, keep records, plan, and gather information per dollar of gross sales declined with farm size. That is, there were inexhaustible, but progressively smaller, economies of scale in accomplishing managerial tasks.

The amount of time used to accomplish physical tasks was studied by Erickson, Johnson, and Nodland (1958). In particular, they analyzed the number of hours spent caring for 67 lots of feeder cattle on 59 farms in southern Minnesota during 1956-1957, the lots ranging in size from 16 to 240 calves. The investigators reported (p. 25): "There was significantly less time used per 100 pounds gain for those lots with 50 head or more as compared to those below 50 head. This is due to economies of large scale operation obtained by spreading the fixed time in doing a task over a greater number of animals . . .." After studying data for 488 beef-cattle farms in Kansas, Knight and Bortfeld (1958) found evidence of economies of scale in accomplishing physical tasks over an even wider interval.

The four studies summarized above may have uncovered only part of the relation between farm size and the amount of time or money used to accomplish various tasks. Jumps in the amount of time used to accomplish a task may occur not merely when scale increases from zero to a positive figure, but at every scale where the number of people accomplishing the task--and therefore total startup and windup time--increases. If so, there may be a minimum optimal scale both for each task and for all profitable tasks combined, instead of inexhaustible economies or diseconomies of scale. This question needs further research.

## The Effect of Scale on Specialization by Employees

If a part-time milker, bookkeeper, etc., is not available, a farm operator's best alternative may be to hire someone full-time and use part of the person's time in work that ordinarily carries a lower salary. The farm's labor cost per dollar of sales then would decrease with scale.

To illustrate, suppose that each of four contiguous farms has an employee who spends 60 percent of every workday doing skilled work and 40 percent doing unskilled work--and receives a skilled worker's salary for all of his time. During every workday, the farms obtain 2.4 human-days of skilled labor and 1.6 human-days of unskilled labor from the four workers--and overpay for the latter. In contrast, a consolidated operation presumably could obtain the 2.4 human-days of skilled labor from three skilled workers, add one unskilled worker, and overpay for only .6 of a human-day of unskilled labor per work day. If workers who specialize perform better, the consolidated farm also would obtain better results per hour worked.

It is possible, however, that the example is unrealistic. Labor may be available in relatively small increments, and employees may receive salaries that reflect all of their activities, not just their most expensive activity. Indeed, employers may give existing employees progressively more demanding assignments without corresponding increases in pay. Unfortunately, no evidence is available on the question.

## The Effect of Scale on Wage Rates

In nonfarm employment, larger workplaces tend to pay higher wages than smaller ones (Reynolds, 1978). Bigness seems to make a difference even when one allows for the effect of unionization, industrial concentration, type of product, region, size of city, race, sex, schooling, fringe benefits, hours worked per year, overtime pay, and other explanatory variables.

Why size matters is unclear. One of many possible explanations is that larger establishments use more capital-intensive techniques, have lower ratios of employee compensation to total expenses, and have higher ratios of net income to sales. If so, they could "afford" to pay higher wages.

Krause and Kyle (1971) discerned a relation between pay and bigness for corn farms in the midwest. They reported that wage rates for labor, supervision, and management increased with size. On the other hand, they also indicated that differences in farm size explained less of the variance in wage rates than did differences in tasks performed or perquisites received.

Other things being equal, higher wage rates produce higher expenses per unit of output--but other things may not be equal. Paying higher wage rates may enable a grower to attract better workers, obtain better performance from a given set of workers, reduce quitting, and increase the proportion of seasonal workers who return the following year. Higher wages also may shock a grower into adopting more economical methods of production. Nevertheless, there is an untested presumption that paying higher wage rates increases unit costs.

## The Effect of Scale on Recruitment and Management of Seasonal Workers

Farms obtain seasonal workers in a variety of ways: operators place signs by the road; post notices at stores, taverns, and labor camps; ask their children to recruit schoolmates; ask acquaintances to refer workers; list openings with the state employment service; advertise in newspapers and by radio; ask year-round employees to recruit seasonal workers; hire people who can recruit and communicate with residents of nearly communities; invite workers to return next year; transport crews between units in different districts; bring contract workers from Puerto Rico, Jamaica, Canada, or Mexico; pay a custom operator to harvest the crop; or pay a handler, processor, cooperative farm labor association, or farm labor contractor to find and screen workers (Sosnick, 1978). Farm labor contractors, in turn, recruit workers primarily by personal contact in low-income areas and at day-haul pickup points.

Labor contractors usually do more for growers than merely find and screen workers. Contractors often arrange and pay for liability insurance; furnish long-haul, day-haul, and field transportation; provide food, housing, water, and latrines; schedule work and assign workers to tasks; instruct and supervise workers; calculate, record, and pay earnings and payroll taxes; calculate and deduct charges for food, housing, and other items; extend credit to workers and help them with personal problems; and continually replace workers who quit. For these services, contractors commonly charge growers 12-15 percent of the workers' earnings or an equivalent amount per hour worked, row hoed, or pound harvested.

Does farm size affect the cost of recruiting and managing seasonal workers per hour of labor obtained? One can obtain some indirect evidence by learning which farms use a labor contractor. If farms below some size do so while comparable larger farms do not, it can be inferred that the cost of recruiting and managing seasonal workers per hour of labor obtained is greater for the smaller farms than for the larger farms and that the difference would be even greater if the smaller farms did not use a labor contractor.

It is not clear whether use of a labor contractor changes with farm size. Scheuring (1978) interviewed 55 farmers who grew processing tomatoes in California's Central Valley during 1977. The present writer later divided the respondents into two groups--42 growers with 600 or fewer acres of tomatoes and 13 growers with 700 or more acres--and found that 52 percent of the smaller growers used a labor contractor while only 23 percent of the larger growers did so. Chance alone, however, would produce that large a difference in 17 out of 100 samples taken. Furthermore, it is possible that the reason why relatively few of the large farms used a labor contractor was not that the unit cost of recruiting and managing seasonal workers without help from a contractor was lower for the large farms, but that contractors able to serve the large farms charged them more per hour of labor provided.

Unfortunately, no other data seem to be available. The Census of Agriculture reports the number of farms in an area that obtained workers from a labor contractor but does not classify the farms by size. Information about the prices that contractors and other suppliers of seasonal workers charge farms of different sizes is also lacking. Nevertheless, it seems likely that obtaining seasonal workers from intermediaries reduces whatever disadvantage relatively small farms may have in recruiting and managing the workers.

Ihnen and Heady (1964) reached a stronger conclusion about another form of contracting--custom harvesting. Their calculations indicated that total expenses per dollar of hay, oats, soybeans, and corn produced could be as low for a one-man, one-tractor farm with merely 240 acres of average land in crops as for larger farms, provided the farmer arranged for custom baling, combining, and shelling (and obtained the services on schedule). Custom harvesting lowered expenses per dollar of product for a hypothetical 240-acre farm in southern Iowa from 1.02 to .91 and completely eliminated the disadvantage that the farm otherwise had compared to farms with at least 320 acres in crops.

Some questionable assumptions, however, were made by Ihnen and Heady. For one thing, they assumed that custom operators charge all farms the same price per unit of service. If so, the cost of accomplishing the tasks involved would be the same per unit of output for any farm that is too small to reduce expenses by doing the work itself. Further, they assumed that custom operators' prices are at least as low as a large farm's cost of doing the work itself. If so, the cost of accomplishing the tasks would be the same per unit of output for any farm, regardless of size. Although the conclusion of Ihnen and Heady may therefore be too strong, it is evident that competent and timely performance by custom operators greatly reduces the disadvantage of small farms.

## The Effect of Scale on Legal Requirements

Some legal requirements create economies of scale. For example, Cal/OSHA requires that both a farm with one man and one woman at work and a farm with 15 men and 15 women at work have two toilets immediately available to the workers. If both farms were to comply, the smaller employer would have higher expenses per worker.

On the other hand, farms with sufficiently small payrolls are exempt from a variety of other regulations intended to protect employees from mistreatment. Because the threshold varies from statute to statute, a farm becomes subject to an increasing variety of requirements as its payroll increases. In California, the sequence is as follows:

1. <u>Reporting pay</u>. Under an order of the California Industrial Welfare Commission, a farm employing five or more persons at any one time during a calendar year must pay a full-day employee for four hours' work during any day of the year

that the employee reports as required and does not receive work for reasons within the employer's control. Since rain, equipment failure, and cannery quotas are beyond an employer's control, the requirement is inconsequential.

2. Discrimination. Under the California Labor Code, an employer of five or more persons may not discriminate in hiring, assigning, compensating, promoting, or discharging employees on account of race, color, ancestry, religion, national origin, physical handicaps, sex, pregnancy, or being 40 to 64 years of age. The federal Civil Rights Act has similar provisions, but it exempts employers of less than 15 (or, for age, 20) people and allows employers of less than 100 people not to file an annual report of employment practices with the U.S. Equal Employment Opportunity Commission. The rules are seldom enforced.

3. Pesticides. Under regulations of the California Department of Food and Agriculture, an employer may not send five or more employees into a field treated with pesticides without first giving a county official written evidence that medical care is available. The burden is negligible.

4. Housing. Under the California Labor Code, an employer providing housing for five or more employees must pay for inspection and obtain certification that the housing meets minimum standards. Because compliance involves costly construction and maintenance, there is a large increase in expenses per bed at five beds.

5. Transportation. Under the California Vehicle and Administrative codes, a vehicle may not be used to transport

seven or more farm employees unless the Highway Patrol has approved its condition and equipment within the last year, the driver has passed a physical examination within the last two years and had ten hours of classroom instruction, and every passenger has a seat at least 16 inches wide. Hence, expenses per worker carried jump at seven workers.

6. Accidents. According to Cal/OSHA, if a farm employs eight or more persons simultaneously, it must record occupational injuries and illnesses suffered by its employees during the following year and retain the record for five years. The burden is negligible.

7. Minimum wages. Under the federal Fair Labor Standards Act, an employer using more than 500 human-days of farm labor during a calendar quarter may not pay less than the federal minimum wage during the following calendar year (nor employ people under 12 years of age other than the operator's children). A farm would qualify if seven employees worked at least one hour during 72 days of the quarter. The California Industrial Welfare Commission also sets a minimum wage. For 1980, it was the same as the federal minimum ($3.10 per hour for an experienced adult), and small employers were not exempt. Nevertheless, exemption from the federal minimum was helpful until July 1, 1980, when a court order restraining enforcement of the state minimum was removed. In most other states, being exempt remains helpful. About 40 states have no minimum wage for farm work; and during July of 1980, because of the exemption (plus noncompliance),

average farm wage rates were less than $3.10 per hour in 14 states (USDA, Aug. 1980, p. 12).

8. Unemployment insurance. According to a 1976 amendment to the federal Social Security Act, a farm that pays cash wages of $20,000 or more during a calendar quarter or employs ten or more farm workers during at least one day of 20 different weeks of a calendar year must pay unemployment insurance taxes during that and the next year. Being exempt, however, is not helpful to a farm in California, for under the California Unemployment Insurance Code an employer paying anyone more than $100 of wages in cash or kind during the calendar quarter must pay unemployment insurance taxes during that and the next year. Depending on the benefits received by former employees during the previous year (which can be reduced by hiring students), a California farm's UI tax will be from 1.4 to 4.9 percent of the first $6,000 of each employee's annual wages (California Farm Bureau Federation, 1979, Sec. 12, p. 3). In most other states, a farm keeping its third-quarter payroll below $20,000 avoids this expense.

## The Effect of Scale on Unionization

Unionization is either an accomplished fact or is likely to become so on farms in five different states. Many dairy farms in California have had contracts with either the International Brotherhood of Teamsters (IBT) or the Christian Labor Association since the 1930s. Sugarcane and pineapple plantations in Hawaii have had contracts with the International Longshoremen's and

Warehousemen's Union since 1946. Since 1966, over 100 vegetable and fruit farms in California and Arizona, along with the Minute Maid citrus groves in Florida, have signed contracts with Cesar Chavez's United Farm Workers of America, AFL-CIO (UFW). About 20 other vegetable growers in California deal with the IBT, the International Union of Agricultural Workers, or the Independent Union of Agricultural Workers. In addition, the Texas Farm Workers Union is actively seeking contracts in Texas.

Signing with a union usually entails four kinds of costs: higher wages, increased fringe benefits, time spent interacting with the union, and loss of managerial prerogatives. Each is discussed below.

Various studies indicate that a unionized establishment outside of agriculture tends to have higher hourly earnings (that is, higher base rates, larger night-shift premiums, extra pay for overtime work, more bonuses, and/or higher piece rates) than the same establishment would have had if it were not unionized or threatened with unionization. The increase in hourly earnings from unionization is much larger for blue-collar workers than clerical workers and for black workers than white workers and, in the case of black blue-collar workers, reaches 25 to 35 percent (see, for example, Shapiro, 1978, pp. 200-202, and Parsley, 1980, pp. 5-9). While these studies pertain to nonagricultural employment, Wyeth (1974, pp. 177-181) noted that wage rates for seasonal farm work rose similar proportions (20 to 33 percent) in parts of California where the UFW sought recognition as workers' bargaining agent.

In nonagricultural industries, unionization tends to increase fringe benefits as well as hourly earnings (Rice, 1966, p. 587), and the potential cost to farmers of additional fringe benefits is large. In a sample of 474,000 people employed on relatively large farms in the 48 mainland states during May of 1971, the U.S. Department of Labor (1972) found that only 27 percent were receiving any perquisites. Similarly, Hayes (1978) found that only 36 percent of 322 agricultural employers in 21 California counties provided year-round workers with health insurance during 1976 and that less than 1 percent provided it to seasonal workers. In 1970, transportation, housing, food, health insurance, life insurance, retirement benefits, pay for time not worked (vacations, holidays, rest periods, standby time, disabilities, bereavements, jury duty, witness time, union time, and make-work), and other fringe benefits not required by law cost U.S. farmers 5.9 percent of cash wages, compared to 26.1 percent for American manufacturers, even though the manufacturers' average hourly pay was about twice as high (Sosnick, 1978).

Unionization also creates costs of dealing with the union. An employer spends time negotiating agreements, providing employment data, resolving grievances, discussing safety, debating innovations, handling dues, etc. Because the UFW entrusts union business to workers and volunteers, interacting with that union has been especially trying for growers.

In addition, by lessening an employer's prerogatives, unionization affects operating costs indirectly. The employer becomes less able to select, discharge, discipline, or even direct his employees; and the union may force him to dismiss people for strikebreaking, failing to participate in demonstrations, or other manifestations of disloyalty. For example, the UFW usually has insisted that growers obtain field workers from a UFW hiring hall, a process that forces growers to hire whomever the dispatcher sends, obstructs rehiring former employees, shifts workers' loyalties, and occasionally leaves a grower shorthanded. The UFW also has vetoed new equipment, banned organophosphorous pesticides, and decided when workers may re-enter a sprayed field.

Larger farms are more tempting targets for a union. The per-worker cost of a given type of organizing campaign decreases as the number of workers increases, as does the per-worker cost of servicing the union's standard collective bargaining agreement. In addition, a larger farm may be more vulnerable to a boycott and to criticism for overt antiunion activity.

How the size of farm affects worker response is less clear. Referring to nonagricultural employment, Reynolds (1978) observed that workers in large establishments are likely to be more alienated from management and therefore more willing to support a union. On the other hand, when Segur and Fuller analyzed the first flurry of farm-worker elections in California (1976), they found evidence of a more complicated relation. Unions did receive a larger proportion of the votes in relatively large bargaining units than in medium-sized units, but unions also received a larger proportion in relatively small units than in medium-sized units. In a later paper, Fuller and Mamer (1978) speculated that two-thirds of California farms with payrolls above $20,000 per year ultimately would sign with a union, while only one-third of those with payrolls between $10,000 and $20,000 would do so.

## Conclusion

Most studies of economies of scale in farming assume that labor costs per unit of output do not change as scale increases unless techniques of production change. In fact, even if techniques do not change with scale, there are at least nine reasons why labor costs per unit may change as scale increases. As a farm grows, five of these nine factors tend to reduce expenses per unit, while four tend to do the opposite. The span and magnitude of these effects, and even their direction, however, remains uncertain. Some tentative findings about the nine factors are summarized in Table 7.1, and some questions that need further study are identified.

Table 7.1

The Effect of Farm Size on Nine Variables that Affect Labor Costs

| Variable | If a farm grows, the variable tends to | Until | Because | Hence, expenses per unit of output tend to | Unless | Researchers should study |
|---|---|---|---|---|---|---|
| The proportion of operator time used for management | Rise | The operator is a full-time executive | Owners want control | Fall | Fatigue offsets greater effectiveness | Effect of specialization |
| Supervisory time per hour of supervised time | Rise | ? | Workers' fidelity falls | Rise | Specialists supervise better or supervision has fixed time | Motivation of employees |
| Optimal quality of complementary employees | Rise | It pays to have only top-quality personnel | Benefits are proportional to size | Fall | Higher salaries offset greater effectiveness | Which effect is stronger |
| Time spent on profitable tasks per unit of output | Fall | More than one person performs each profitable task | Each person has startup and windup time | Fall | Variable time per unit rises or optimal intensity of tasks falls | Effect of scale on optimal intensity |
| The proportion of skilled workers' time used for unskilled work | Fall | No employee does work that others would do for less pay | More skilled work is done | Fall | Skilled workers work part time or receive reduced pay | Relation of salaries to work done |
| Average hourly earnings of employees | Rise | ? | Wages rise with ability to pay | Rise | Higher wages elicit better performance | Effect of wage rates on performance and turnover |
| Expenses of recruiting and managing seasonal workers | Fall | ? | Labor contractors or custom operators achieve economies of scale | Fall | Those specialists have a single fee and no farm could do the job itself at lower cost without being punished for mistreating workers | Specialists' fees and treatment of workers |
| Legal requirements | Rise | Cash wages reach $20,000 per quarter | Exemptions are lost | Rise | The farm violates the law | Compliance with the law |
| The probability that a union will seek recognition | Rise | ? | Per-member organizing and service costs fall | Rise | The farm is isolated or employs people very briefly | Unions' organizing strategies |

# CHAPTER VIII

# ENERGY USE, MECHANIZATION, AND ECONOMIES OF SIZE

## Introduction

Production agriculture in the United States and in California has become progressively more energy intensive through the use of increased amounts of fertilizers, pesticides, irrigation water, and machinery. The substitution of fossil fuel based inputs for human and animal energy has been partly in response to relatively cheap fossil fuel supplies, abundant land, and relatively high cost labor. The substitution of energy-intensive inputs for land has probably been speeded up by government programs which restricted the use of land in order to control the supply of certain commodities.

This chapter outlines what we know about the relationship between energy use in agriculture and the scale of farming operations. Information about energy use patterns associated with various farm size groups would be helpful to decision makers in considering the differential impacts of increased energy prices or reduced energy supplies on agricultural producers.

Studies of energy use or mechanization in agriculture have essentially followed one of two different approaches: (1) analyzing energy or machinery use in a given nation, state, or

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region with a given level of agricutural development or (2) making comparisons among countries of differing levels of development, with differing technological systems.

## Analysis of Energy Use and Mechanization in Agriculture in the U.S. and in California

### Energy Use

Although there is little in the literature investigating the relationship between energy use *per se* and farm size, the economies of scale effect from mechanization (machinery use) has been relatively well analyzed. Many of the studies use "energy accounting" to give a picture of energy requirements in agriculture. In most of these studies the implicit assumption is that scale economies are constant.

Energy accounting is sometimes broad enough to consider "embodied" energy requirements including the food consumed by farm workers, the energy needed to manufacture farm machinery and agricultural chemicals, and the energy used in bringing the product to its final consumption-ready form. More frequently, however, studies account only for direct energy inputs used in production agriculture. For example, the costs of direct energy used in 1970 and in 1974 to produce 14 California field crops in 29 different production situations were compared by Commoner *et al.* (1974). Direct energy studies are useful for analyzing short-term crop adjustments to rising energy costs or to decreased energy supplies.

Another type of study dealing with direct energy use in production agriculture is a California study by Williams and Chancellor (1974). The effect of the availablity of five energy-related inputs on the production of nine crops in five subregions was examined. The energy-related inputs (or processes) were: tillage and planting horsepower, harvest capacity, production energy (diesel fuel, gasoline, etc.), fertilizer application, and irrigation water. Output was simulated assuming different availability levels for the inputs. The study used a commodity approach without consideration of scale or farm size differences.

The impact of increased price and/or reduced availabilities of fuel and fertilizer on California irrigated farms was analyzed by Johnston _et_ _al_. (1978). An increase in energy costs was found to increase production of field crops and decrease that of vegetables. Reduced fuel and fertilizer availability, however, tended to reduce the production of field crops to a greater extent than that of vegetables. In examining the welfare effects, it was concluded that producer profits were more sensitive to energy availability levels, whereas consumer benefits were more affected by energy cost adjustments.

Extending energy accounting beyond the production agriculture stage are several studies of interest. Per unit energy values for California crop products were established and _constant unit_ requirements assumed in order to estimate the total direct energy consumption for each product (Cervinka et al., 1974). Energy inputs, including natural gas, electricity, diesel fuel, gasoline, LP-gas, propane, butane, and aviation fuel, were estimated for each stage from initial planting to the finished product. Similar energy accounting methods for estimating energy requirements for wheat (from seed to household toast) were used by Avalani and Chancellor (1975) and for sugar beets from production to consumption by Avalani et al. (1976).

Substantial indirect energy requirements associated with manufacturing machinery and with producing agricultural chemicals should be (but seldom are) taken into account in studies of energy use in agriculture. Only a few studies considered indirect energy use. For example, a large energy accounting model for U.S. agriculture estimated that the energy required to produce fertilizers and pesticides amounted to 36 percent of the total energy used in agriculture (USDA, 1976).

To our knowledge only one agricultural energy use study attempted to relate energy use patterns to size of operation in California. In analyzing the energy costs of intensifying beef production, Hughes and Williams (1974) used nine different production levels (350 head to 750 head in 50 head steps).

Energy use "accounting" studies provide an important first step in understanding the energy needs of agriculture. There is, however, a serious deficiency of investigations relating energy use to the size of farming operations. It is in this area that research is needed in order to understand the overall impacts on American and California agriculture from the changing energy scene.

## Mechanization and Size Effects

By contrast, most economies of size studies (reviewed in Chapter II) included explicitly, or more often implicitly, machinery and equipment use as one of the most important factors in achieving economies. In most studies, economies of size in machinery use were not the primary objective of the analysis, but rather the interest was in overall economies in a given type of agricultural production.

A few studies concentrated specifically on size economies of machinery use. The best example for California is Armstrong and Faris (1964). They argued that a considerable portion of the observed decrease in unit costs as farm size increases can be attributed to changes in the use, type, or size of farm machinery. The point at which the larger and more expensive pieces of machinery are fully utilized can usually be attained by the "medium size" farm (Faris, 1961). The movitation for farms to grow larger appears to be associated with advantages other than technical economies of scale.

## Energy Use and Mechanization Comparisons Among Countries

The energy accounting studies discussed in the previous section concentrated on energy use within the nation, the state, or a particular region where the level of technological development could be assumed relatively constant. After the 1974 energy crisis some studies appeared which compared energy efficiency between agricultural production based on U.S. technology and that based on Asian technology. It has been suggested that these studies provide a new method of analyzing size economies in energy use since they provide information on production processes and firm size not directly observable in the United States. It should be noted, however, that some researchers when making comparisons of energy efficiency between U.S. mechanized and the traditional Asian type of agricultural production have come up with diverse and even contradictory results. For example, Perelman (1977) concluded that Chinese rice production is about 300 times more energy efficient than is rice production in the U.S. By contrast, Makhijani's research (1975) determined that energy requirements per unit of product are much lower for U.S. farmers than for their counterparts in less developed countries.

There are several reasons for such conflicting conclusions--the primary one being differences in what is being counted as energy-inputs to agricultural output. If the comparison of energy efficiency is made on the basis of commercial (primarily fossil fuel) energy, then substantially more energy is used per unit output in developed countries than, say, in Tanzania where human labor provides the entire energy input for corn production (Makhijani, 1975). If the comparison is based on total direct energy including human and animal labor as well as commerical energy, then there is surprisingly little difference in the total energy input per hectare. Perelman's conclusion about the greater efficiency of Chinese rice production was based on a comparison of farm-level energy use in China (where most of what is produced is consumed on the farm) with the entire U.S. food system which includes energy use in processing, packaging, and transportation.

It is difficult to analyze size effects of energy use with comparisons between developed and developing countries, since the physical scale of production and cultural practices are so vastly different. Some tentative conclusions, however, can be drawn about rice and corn production based on Makhijani's (1975) research. Considerable economies in total energy use are achieved in the move from small-scale production based on human and animal labor to the introduction of mechanization. It is clear, however, that if the scale of production is defined as the volume of output from a constant acreage, then energy efficiency declines quite rapidly as more and more energy-intensive methods are introduced.

The selective introduction of energy-intensive methods in developing countries can lead to substantial increases in energy efficiency. According to Makhijani, relatively small investments in irrigation and fertilizers in India would result in increased labor productivity, employment, and energy efficiency due to increased yields and the possibility of multiple cropping. If yields are already high and if irrigation requires substantial pumping, then increases in yield are associated with a loss in energy efficiency. For example, average U.S. corn yields increased 138 percent from about 34 bushels per acre in 1945 to 81 bushels in 1970, but the energy efficiency ratio (kcal return/input kcal) declined from 3.70 to 2.82 over the period (Pimentel _et al_., 1973).

According to the induced investment theory (Binswanger and Ruttan, 1978), relative prices of the factors of production determine the direction of development. In America, where land has been abundant, energy resources cheap, and labor relatively expensive, agriculture has developed in a labor-saving, land-using direction. The result is that most American farm machinery is designed for use on large-or medium-sized farms. Machinery costs are, therefore, understandably high for small farms owning relative "large" machines. Machinery tailored to very small-scale farming heretofore, has not generally been readily available. One solution for the small operator has been to custom hire some of the machine work, and as a practice many economies of scale studies have assumed that machinery operations were contracted on small sized farms.

Because of the lack of information about machinery use on small farms in the U.S., the research gap may be filled by turning to areas of the world where resource endowments are quite different from the U.S.--that is, where labor has been relatively cheap and land, scarce. Japan provides an excellent example of land-saving, labor-using development, but other East Asian countries where mechanization is at stages different from Japan are also of interest.

In order to promote mechanization on small farms and the greater agricultural productivity that it usually entails, several countries have offered various types of subsidization programs to help with the high cost (Kim, in Southworth, 1972; and Wu, also in Southworth). Another method enabling farmers to proceed with mechanization is to form some type of cooperative. A farmer may own a machine and rent it to others, or farmers may own it as a group. Custom hire systems also work well. Several sharing arrangements are discussed by Kanazawa (in Southworth, 1972). Economies of size have been analyzed in a few of the studies of Asian agriculture (Kudo, and Jegatheesan, in Southworth, 1972).

## Concluding Comments

In response to spiraling energy costs and erratic energy supplies, several studies have examined energy requirements for an array of crops grown under different cultural systems and in different geographical regions. Individual studies vary in detail from accounting only for direct fossil fuel requirements in production to a total energy use including "embodied" energy for major inputs like machinery. Few studies, however, have examined carefully the relationship of farm size and energy efficiency. Such analysis is necessary for assessing possible adjustments to changing energy price and supply relations by individual farms as well as understanding likely structural changes in agriculture in the years to come.

# CHAPTER IX

# FARM SIZE AND THE RURAL COMMUNITY

## Introduction

All of the other chapters in this report investigate the forces internal and external to agriculture that may be directly or indirectly behind the trend of increasing farm size and decreasing farm numbers. In this chapter attention is focused in the reverse direction: toward impacts of farm size on rural communities. Indeed, some attribute a direct causal connection from large scale agriculture to the deterioration of the communities in its midst.

Before addressing this issue, it is essential to establish what type of rural community we are talking about. Rodefeld (1974) defined a rural community as a trade center, relatively densely settled by nonfarm people, surrounded by a hinterland of farm people. There really is no typical rural community in California, however. Central Valley agricultural towns are as different from North Coast communities as they are from Sierra towns or desert towns. Obviously, the issue under discussion applies only to towns in which agriculture is an important part

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of the economy. Such agriculturally-dependent towns vary in size from Fresno, 194,800 people in 1978--a veritable hub of agricultural activity--to Imperial, 3,240 inhabitants, a place nearly 100 percent dependent on agriculture. Although agriculture is very important in the area surrounding certain places such as San Diego or Santa Barbara, it is unlikely that structural changes taking place in farming have much of an impact on the quality of life there. Other communities, however, might literally disappear without agriculture.

A second matter that is germane to this discussion is how quality of life in a community is defined or measured. Common attributes that are associated with "quality" include health and education facilities, recreational outlets such as playgrounds and parks, and cultural attractions such as theaters, restaurants, and museums. The availability of churches, service clubs, senior citizen organizations, etc., are also considered positive factors that enhance the quality of life in a community. Individuals, however, vary greatly in how they value these services and differ in the form they consider most desirable. Herein lies the problem for researchers attempting to relate the "immeasurable" quality of community life with a factor like scale or size of farms in the area. Indeed, even our perception of quality is constantly changing in response to a variety of external influences and constraints.

Included in the number of questions often raised regarding the impact of increasing farm size on rural communities, are the following (see, for example, Raup, 1972):

1. Do large scale farms, more than small farms, pass on certain costs for which rural communities pay?

2. Does the replacement of small farms by large farm firms actually result in the deterioration of rural social structures, place added burdens on rural public services, and impair the tax base of rural communities?

3. Do large scale farms alter the occupational composition of the work force resulting in a dual labor market characterized by an elite strata of managers and supervisors, and lesser paid workers in field and unskilled jobs?

## Previous Studies Relating Farm Size to Rural Communities

Two agriculturally-dependent rural communities in California, Arvin in Kern County and Dinuba in Tulare County, were selected over 35 years ago as empirical sites to use in testing the relationship between the quality of life in a rural community and the size of surrounding farms. The 1944 study has recently been reprinted (Goldschmidt, 1978).

The two towns were approximately the same size, were equally dependent on agriculture, had been in existence enough years for the development of social institutions, but were surrounded by agricultural operations distinctly different in scale. Although both places had small and large farms, the average farm size in

Arvin (497 acres) was nine times larger than that in Dinuba (57 acres). Approximately the same dollar volume of agricultural production was brought to market in both places but in the Dinuba area it was divided among nearly five times as many farms. An analysis of economic and social conditions in the two places revealed that:

1. The small farm community (Dinuba) supported twice as many local businesses as did the large farm community.

2. The volume of retail trade was 61 percent greater in Dinuba than in Arvin.

3. The expenditure for household supplies and building equipment was over three times as great in Dinuba.

4. The small farm community (Dinuba) supported 20 percent more people per dollar volume of agricultural sales and these people had a better average standard of living than in the large farm community.

5. In Arvin, nearly two-thirds of all people gainfully employed were agricultural wage laborers; in Dinuba, less than one-third. Over one-half of those employed in Dinuba were businessmen, white collar workers, or farm operators; in Arvin, less than one-fifth.

6. Public services such as paved streets, sidewalks, garbage and sewage disposal were far greater in Dinuba than in Arvin.

7. There were more schools, parks, churches, organizations for civic improvement, public recreation centers, Boy Scout troups, newspapers (two in Dinuba, one in Arvin) in the small farm community than in its large farm counterpart.

8. In Arvin, decisions on community welfare were largely in the hands of county officials, whereas in Dinuba decisions were more frequently made by local popular elections.

Goldschmidt admitted that factors other than the scale of the surrounding agriculture could have had some bearing on the striking differences in the quality of life of the two places. Upon examination of some of these, however, the conclusion was reached that (p. 28): "the primary, and by all odds the factor of greatest weight in producing the essential differences in these two communities was the characteristic difference in the scale of farming--large or small--upon which each was founded. There is every reason to believe that the results obtained by this study are generally applicable wherever like economic conditions prevail."

Arvin and Dinuba were revisited in 1977 to update the several findings of Goldschmidt listed above. Since the two communities had grown in quite different ways since 1946, Goldschmidt's methodology could not be used but rather the historic growth patterns of the two places were analyzed (Small Farm Viability Project, 1977). It was found that Dinuba still supported twice as many businesses as Arvin and had improved the volume of retail trade advantage to 70 percent, up from 61 percent in 1946. Similarly, Dinuba still had more public services, schools, churches, parks, etc., than Arvin. In contrast to Goldschmidt's conclusion generalizing the applicability of his results, however, the report concluded that a study of two communities cannot provide sufficient information from which to draw general conclusions about the effects of farm size on local community life.

An ongoing project, directed by Dean MacCannell of the Department of Behavioral Sciences, University of California, Davis, is attempting to test the applicability of Goldschmidt's generalized findings with current and much more extensive data. Communities in the Central Valley were selected that were small enough so that factors other than agriculture would have only minor effects. A series of indicators of quality of community life were amassed for each town. A series of hypotheses is currently being tested--correlations between concentration of land ownership and various quality of life variables and between the amount of landowner absenteeism and the same community variables.

In a 36-town pretest, many of the relationships tested were strong and statistically significant. Although much more work needs to be done on the project, the tentative conclusion is that the Goldschmidt hypothesis may be applicable--and in places other than Arvin and Dinuba. Another study, reported in the Small Farm Viability Project report (1977), also attempted to find the link between the size of farm operations surrounding a town and the quality of life by examining information about 130 communities of the San Joaquin Valley.

Whereas the above studies suggest a high negative correlation between the quality of life in rural communities and the scale of surrounding agriculture, it is difficult to verify a causal relationship beween the two. The two phenomena may develop independently from various other underlying common or historical factors. Important factors at least in California are the source and availability of water, and the diversity of the tax base of the community. For example, Dinuba flourished on the banks of the Kings River, while Arvin and surrounding agriculture had to draw deeply from groundwater aquifers. Groundwater pumping requires high capital investment; herein may lie an important basic cause of the difference in the two communities and in their surrounding agriculture. Also, if a town is wholly dependent on agriculture, property taxes on agricultural land go into county coffers, whereas if a town, for whatever reasons, has been able to attract factories and commercial activities, it will have the financial means to provide more services for its residents. The factors attracting such tax-producing activities are surely far more complex than the simple linkage of economic vitality to the scale of agricultural production that happens to have developed in the surrounding area.

Several empirical studies have examined economic relationships resulting from alternative farm size distributions.

In comparing two distinct sets of census tracts in Fresno County, both with a high degree of agricultural activity, LeVeen (1979) found that the median income was 27 percent higher, the proportion of families with incomes of $10,000 or more was 59 percent greater, and the proportion of families with incomes less than $5,000 was 25 percent smaller in the "larger-than-family-farm" tracts than in the industrial farm tracts. (Note that "larger-than-family-farm" was used rather than "family farm" for the smaller units because cropping patterns in the study area require more hired labor than is used where the USDA definition of "family farm" applies more closely.) LeVeen concluded that (p. 677): "a more strict enforcement of the Reclamation Act would have important beneficial consequences for a portion of individuals in the rural economy." Since both types of farms, however, employ considerable seasonal labor (p. 685), "it is unlikely that breaking up the land will do much to eliminate the principal source of rural poverty."

Sonka and Heady (1974) analyzed the number of farms, total income of the farm sector, net income per farm, cost of food to consumers, and employment and income generated in rural communities under four alternative farm size constraints: small (under $10,000 sales), medium ($10,000 to $39,999 sales), large (over $40,000), and a mixture of the three. The study showed that (p. 70): "larger farms are associated with lower consumer food costs, less labor and capital required in agriculture, and higher income per commercial farm . . . that smaller farms are associated with higher total income for the farm sector, greater farm employment, greater total purchase of inputs by farms, and greater off-farm generation of employment and income."

A study of a small Idaho town, revealed similar tradeoffs between small-farm (less than 120 acres) and large-farm impacts. Using an input-output analysis based on data obtained by a mail survey of farms in the area, Michaels and Marousek (1978) found that (p. 13): "replacing small farms with large farms results in greater regional income while increasing the number of small farms yields greater regional employment."

## Conclusion

Thus, Goldschmidt's classic study provided a fertile source of hypotheses that have yet to be settled by researchers. Further, times have changed since the 1944 study. Improvements in transportation and communication have probably had just as much effect on the redistribution of population and the demise of rural villages as have changes in the structure of agriculture. Rural people now have a wider choice of where to shop for goods and services and the nearest small town may not offer satisfaction for their specialized and more sophisticated demands. Intermediate-sized regional trade centers have emerged as providers of specialized economic services to the rural population, only 15 percent of which are farm people (Brown, in USDA, Nov. 1979). These larger rural centers, an intermediate link between the metropolis and the countryside, also furnish input-supply and product-marketing services for the area's farmers. Meanwhile as services in some of the nation's villages decline, some of these same towns are experiencing unprecedented residential growth as former city dwellers seek the amenities of a rural setting. Thus, changes in rural America and California and in the structure of agriculture comprise an ongoing dynamic process brought about by many interrelated forces.

Two specific research endeavors could be initiated with direct bearing on the farm size--quality of community life connection. First, an analysis of the proportion of a community's tax revenues derived from farms of various sizes might be a manageable, yet revealing project. Another would be a comparison of labor market stability in large-farm and small-farm communities. It has been alleged that communities in the midst of large-scale agriculture are plagued with flows of migrant labor, considerable underemployment and poverty, and seasonal demand for labor causing abrupt peaks and troughs in the employment picture. It could well be, however, that such measures of community ill health are more a function of the type of crop grown in the area than of size of the farms.

A more comprehensive framework for analysis of change in rural America is identified in Rodefeld _et al_. (1978). The selected readings focus on changes in six areas: agricultural technology, farm organizational and occupational structure, transportation, communication, urban population distribution, and the rural economic base. Interrelationships among the six areas are stressed, number of hypotheses are advanced about possible social and economic causes of change, including examination of the link between farm size and the quality of community life. In order to determine empirically the actual link, however, between farm size and such an allusive unquantifiable variable as quality of community life, a cooperative research effort among economists and sociologists would be warranted. Such a joint effort is perhaps long overdue.

# CHAPTER X

## SUMMARY AND CONCLUSIONS

This report has examined diverse forces influencing farm size with particular reference to California. An overview was given in Chapter I with a comparison of statistics about agriculture in the state and nation, drawing heavily on the 1974 Census of Agriculture. The picture that emerged was that farming in California is quite different from that of the nation as a whole--larger farms in terms of acreage and sales--but it was also shown that aggregate census data have serious limitations for revealing meaningful structural changes in farm size, or other characteristics.

Previous empirical California economies of size studies were reviewed in Chapter II, the majority of which were done in the 1960's. For a specified state of technology, most studies showed average production costs declining, rapidly at first, and then leveling out for medium-sized farming units. The exact size varied according to the geographic and commodity characteristics of the farm being studied. Further expansion of farm size beyond the minimum-cost point was generally not to decrease per unit costs, but to increase income. Research is needed to determine the minimum-cost size of farms under current conditions as well as to determine whether or not these general findings still hold true in the 1980's.

The possible impacts of various government policies on farm size were explored in Chapter III. It is frequently asserted that large farmers capture more of the benefits of price and income support policies than do small farmers since payments are based on volume of production. It is as yet unanswered, however, whether large farms benefit more on a per acre basis unintentionally encouraging farm-size expansion. Other policies were discussed in Chapter III; for most, if there is an impact on the structure of agriculture at all, it is indirect.

Taxation has had an important, and often unintended, impact on the structure of agriculture. Research related to these impacts is examined in Chapter IV. Progressive income taxes, capital gains taxation at favorable rates, cash accounting, and current deduction of certain expenses of a capital nature affect farm investment decisions and have attracted capital from nonfarm investors. Income and estate taxes are central in the decision to incorporate the farm firm. Recent corporate tax rate reductions will probably encourage more farms to incorporate. There is little empirical research exploring the relationship between farm size and various tax provisions because of lack of data available to researchers.

Impacts that the product marketing system have on farm size were explored in Chapter V. It was noted that changes in marketing technology may affect farm operations by influencing product specifications and methods of handling and transporting farm products, by affecting the location and scale of processing facilities and shipping activities, and by changing marketing channels. Such developments may alter farmer access to markets in a way that places smaller farms at a competitive disadvantage and forces them to incur higher per unit marketing costs.

Concentration of buying power into fewer hands may also affect farm returns, but the impact on farm size, other than in terms of market access, is not clear. Changes in communication systems and vertical coordination may further exacerbate the problem of market access for small farmers. Farmers without vertical ties through contracts or cooperatives may find survival increasingly difficult unless they are of a size to provide their own marketing services. In order to evaluate the potential benefits of alternative policies aimed at enhancing the position of smaller farmers, more needs to be known about how marketing costs and returns are affected by factors such as farm volume, assembly distance, alternative sales outlets, and the institutional and structural characteristics of markets. The research challenge is to isolate these factors and develop marketing cost functions through a combination of cost synthesis and statistical analysis.

The possible relationships between risk bearing in the traditionally risky business of farming and farm-size were explored in Chapter VI. Many factors such as various government policies and technological changes can affect the risk-level in farming, but not necessarily in the same way for each size of farm. Empirical research in this important area is only in beginning stages although there have been many important insights gained in recent years at the theoretical and conceptual levels.

The question of unit labor costs and the scale of the farming operations, was explored in Chapter VII. An array of economic, legal, and qualitative factors was examined to determine their impact on the cost structure of farms of different sizes. Of the nine factors examined, five were thought to lead to decreased labor costs as farm size increases, while four tended toward higher labor costs. In most cases the surmised relationships, so far, are based more on intuition and judgment rather than on firm empirical data for California farms.

Chapter VIII identitied some of the farm-size issues concerning energy use and mechanization. American agriculture has tended to develop in an energy-using, land-using, labor-saving direction because, historically, energy was cheap, land was abundant, and labor was relatively expensive. The question is what farm-size adjustments will be wrought by the escalation of energy prices and possible curtailment of energy supplies? The research need is to examine the response of different sizes and types of farming units to these changing energy scenarios.

While most chapters in the report examined the various forces behind the trend toward larger farms, Chapter IX, turned the question around by asking what impact the scale of farming operations has on rural communities. Goldschmidt's 1944 case study suggested that many small farming units surrounding a community created a vital economic and social structure and that a community in the midst of large scale agriculture tended to be less diverse and viable. Studies are needed to retest Goldschmidt's findings with recent and much more extensive data.

One may conclude from this review that there is no single, simple explanation for the trend toward ever-larger farms. While considerable evidence exists that there is a significant technical basis for economies of scale in farming (see Chapter II), cost-savings tend to level off at a "medium size" unit, with the least-cost point varying widely for different type farms. Explanations of expansion beyond this point involve the many influences examined in Chapters III through VIII: government policies, the tax structure, the product marketing system, the risk environment, changes in labor costs and in energy costs and availability.

The difficulty for researchers as well as policy makers is that the various influences are so intertwined and confounded that singling out any one factor as the cause would be hazardous indeed. Nevertheless, since the issue of farm size is one of considerable concern, it behooves university researchers to sort among the hypotheses reviewed here and attempt to establish empirically which are true connections; which are spurious correlations.

There is considerable difference of opinion about the effects of concentration of American agriculture in fewer hands. Increased efficiency on farms has freed all but three percent of our population from growing food and fiber. Yet, if most cost economies can be achieved, say, on farms with gross sales of $75,000 to $100,000, why should there be farms with sales of

$500,000 or more? Is the rural community worse off when surrounded by a few large farms rather than many smaller ones? Agricultural economists, rural sociologists, and policy makers continue to wrestle with this question.

Another concern is that increased concentration may ultimately lead to increased market power, resulting in higher food and fiber prices. Under the more competitive conditions, generally associated with agricultural production, the benefits of new technology are mostly passed along to consumers.

Because of these concerns there has been discussion and some political support for governmental intervention to maintain an agriculture of predominantly family farms. Our review of the impact of post programs suggests that caution must be exercised, however, in such interventions to insure that the benefits of policies are actually received by the intended target group.

Further research is needed to carefully discern the underlying causes of the farm size expansion phenomenon before any policy prescriptions can be taken, if deemed desirable. This report represents an effort in this direction. Future research agendas will hopefully be designed to reveal more clearly the key influences, and the magnitudes of those influences, on changes in the size of farms in some of California's diverse geographical and commodity settings.

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