A PROFILE AND ECONOMIC ANALYSIS OF SMALL FARMS IN MINNESOTA, NORTH DAKOTA AND IOWA: COMPARISONS BETWEEN FARM SIZE AND AMONG PARTICIPATION IN THE U. S. COMMODITY PROGRAMS

A THESIS

SUBMITTED TO THE FACULTY OF THE GRADUATE SCHOOL

OF THE UNIVERSITY OF MINNESOTA

BY

KARIN FRANCES LEONARD

IN PARTIAL FULLFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

MASTER OF SCIENCE

JULY, 1981

ACKNOWLEDGEMENTS

I would like to thank Professor Mary Ryan, who first suggested the idea of studying set-aside participation and Professor Willard Cochrane, my advisor, for seeing the development of that idea through completion. I am also grateful to Professor James Houck for agreeing to assume the duties of chairman of my final oral committee after Professor Cochrane retired. I am indebted to Professor Susan Groshen, who, as my statistical advisor, painstakingly read the entire manuscript and made many valuable suggestions .

Finally, I want to thank my friends and my family for their love and support throughout the past two years.

TABLE OF CONTENTS

Chapter Page

LIST OF TABLES

Table | Page

LIST OF FIGURES

Figure Page

Chapter 1

INTRODUCTION

A comparative profile and analysis of small farmers in the upper midwest will be undertaken with an evaluation of who benefits and to what extent from participation in the set-aside program by different farm sizes.

The results of this thesis should help policy makers understand and appreciate the different economic problems confronting small farmers and the larger commercial farmers and distinguish between need for rural development policies on one hand and commercial agricultural policies on the other.

The following historical background will set the stage for the questions that this thesis will address and the objectives it intends to meet.

HISTORICAL BACKGROUND

Due to the extreme inelasticity of the aggregate demand for and aggregate supply of farm products, any small shift in one of those relations relative to the other gives rise to a dramatic price response. And as T. W. Schultz noted many years ago, instability in the food and agricultural sector is generated by the unequal growth of aggregate demand and aggregate supply.[1/] This price instability has been enhanced in recent years by unpredictable shifts in the foreign demand for American farm products. Thus, modern agriculture

is subject to sharp and unpredictable price swings.

To benefit farmers and consumers alike, it has been the business of the federal government since the 1920's to attempt to stabilize farm price swings and income fluctuations.

Up until the 1920's, the federal government's policy towards intervention in the farm sector was to meddle as little as possible. In 1896, the official opinion regarding the government's guarantee of farm prices was:

> Legislation can neither plow nor plant. The intelligent, practical, and successful farmer needs no aid from the Government. The ignorant, impractical, and indolent farmer deserves none. It is not the business of the Government to legislate in behalf of any class of citizens because they are engaged in any specific calling, no matter how essential the calling may be to the needs and comforts of civilization.2/

By the mid-1920's, however, a prolonged agricultural depression (1873-1897), a period of sustained economic recovery (1897-1910), the Golden Age of Agriculture (1910-1914), accelerated war-time production and war relief efforts (1914-1920), and agricultural depression once again (beginning in 1920) had taken their toll on the farm economy. The economic ups and downs of American agriculture, coupled with the recognition that agriculture was on the verge of a technological revolution, set off rumblings among the agricultural community concerning the need for a national agricultural policy.

In the 1920's, John D. Black, E. G. Nourse, other prominent agricultural economists and Secretary of Agriculture Henry C. Wallace pointed out the need for national direction in American agriculture.

Secretary Wallace, fearful of a decline in agricultural activity, said, " We are approaching that period which comes in the life

of every nation when we must determine whether we shall strive for a well-rounded, self-sustaining national life in which there shall be a fair balance between industry and agriculture or whether, as so many nations in the past, we shall sacrifice our agriculture for the buliding of cities. " 3/

E. G. Nourse cited agricultural policy as a factor of economic stability. In 1924, he explained that " the time has come in the maturing of our national life when it seems desirable to establish and maintain a permanent agriculture in a position of effective coordination to other interests of our national life ... it seems the part of national wisdom to direct our best thought toward efforts designed to minimize the shock of necessary readjustments and to be concerned more with steps necessary to give us the sort of agricultural industry that the nation will need in 1950 or 1975. " 4/

Prior to the 1920's, agricultural policy meant haphazardly instituting a tariff to protect an agricultural commodity from foriegn competition. Apparently no thought was given to the consequences of such legislation. Agricultural colleges, agri-business, and the United States Department of Agriculture (USDA) had been hesitant to consider a future course for U.S. agriculture and get behind specific, thoughtful recommendations to correct the disturbances caused by protective tariffs. As John D. Black remarked in 1925, " It is always easier to sit on the fence and watch." 5/ The farm economics situation by the mid-1920's mandated that everyone involved get off the fence and push for farm relief measures and a national agricultural policy.

But the progress of farm relief was slow and measures taken were generally ineffective. Between 1918, when the first seed loans were made to farmers in the northwest and 1929 when a Federal Farm Board was established by the Agricultural Marketing Act of 1929, the contribution to farm relief amounted mostly to legislative lip service. No measures taken dealt effectively with the major agricultural problem causing the most disturbance. This was over- production.

The federal government seriously attempted to increase agricultural purchasing power (by adjusting production to consumption) only after the economic depression had affected all industries and households of the nation. The Agricultural Adjustment and Relief Act of 1933 (AAA) authorized voluntary acreage reductions and rental, or benefit, payments in connection with reductions as a means to readjust farm production to " establish and maintain such balance between the production and consumption of agricultural commodities." [6] The text of the legislation explained that the " present acute economic emergency " [7] was in part a " consequence of a severe and increasing disparity between the prices of agricultural and other commodities." [8]

Described in the chapter entitled, " What's New in Agriculture " in the 1934 Yearbook of Agriculture, it was " the purpose of the Agricultural Adjustment Act to raise the purchasing power of farm commodities to the pre-war parity. " [9] As serious as they were about intervening in agriculture, the farm policy makers were also realistic about the massive job ahead. The progress toward parity prices, they admitted, " cannot be rapid, for agriculture has tremendous maladjust-

ments to correct, and recovery depends also on factors influencing demand. Nor can we look for uninterrupted progress. Set backs are inevitable. Still less can we expect an unbroken advance, a gain embracing all farm products equally and simultaneously. " 10/

Income support payments authorized by AAA and amounting to over one billion dollars during the years 1934 and 1935 did help many farmers recover from financial straits to some extent. In 1936, however, the AAA was declared unconstitutional and legislation to replace it in 1936 and 1937 was not effective in continuing the farm relief effort.

Then, in February, the Agricultural Adjustment Act of 1938 (AAA of 1938) was approved. This act was designed to support farm prices and income through production control and the " ever-normal granary. " 11/ Income support payments and non-recourse loans were the primary mechanisms for inducing farmers to participate, hold down their production and store their grain. The AAA of 1938 became the organic legislation. Every piece of farm legislation that followed the AAA of 1938 has been an amended version of it.

World War Two made the price and income stabilization features of the AAA of 1938 inoperative. Farm prices rose as demand shifted to high levels of war-time and relief effort consumption. When the farm policy debate for the 1948 legislation began in 1947, price and support measures had been inoperative for the past seven years.

At issue in the 1948 legislation debate was the question as to what extent the government should be involved in supporting farm prices

and income. This issue has been the subject of a continuous struggle throughout each proceeding farm policy debate since 1947.

As time draws near to enact farm policy legislation for 1981, the problems of flucuating farm prices and incomes and the extent to which the federal government should intervene still confront and confound the policy makers. Talk of " tremendous maladjustments to correct " [12/] in 1934 is painfully relevant today. Not only are farm prices and income fluctuations causing problems; today, policy makers and the nation are coming to recognize, more and more, a problem many feel is caused by farm policy legislation. Many knowledgeble observers feel that the distributional impacts of the farm program cause income disparities and are generating a trend towards fewer and fewer, larger and larger farms.

SCOPE OF THE THESIS

An analogy can be made between Arthur Okun's description of the institutions in contemporary American society and the farm commodity programs that portrays a skepticism about the overall social welfare effectiveness of the programs. Okun's " contemporary society is in a sense, a split-level structure. Its political and social institutions provide universally distributed rights and privileges that proclaim the equality of all citizens. But its economic institutions rely on market determined (farm commodity program supported) incomes that generate substantial disparities among citizens in living standards and material welfare. " [13/]

With regard to the farm commodity programs, Congress, in drafting 1981 farm policy, is confronted with " choices that offer somewhat more equality at the expense of efficiency or somewhat more efficiency at the expense of equality. " [14/] Out of farm policy formation a controversy emerges. The controversy stems from two sources:

1) One is the basic question of whether or not farm commodity programs promote efficiency. Are producers who take advantage of the programs being progressive in that participation contributes to the long run growth of the national economy, leads to efficient use of scare resources and facilitates production decisions that are responsive to consumer demands at reasonable prices?

2) Assuming farm commodity programs do promote efficiency, do they generate disparities in income distribution among farms by size differences? In other words, how equitable are the programs in their distribution of income support?

This thesis will explore the second source of controversy. The question as to whether farm commodity programs promote efficiency is left to others to research.

A central issue then, that Congress must not overlook as it debates the 1981 farm legislation is the distributional impact of the current farm commodity programs. Policy makers must ask themselves what contributions the programs make with regard to equity in our agricultural sector and whether income support is necessary.

Former USDA Secretary Robert Bergland questioned whether farm policies are " in whole or part responsible for an unending trend toward larger and larger and fewer and fewer farms. " [15/] In their Status on the Family Farm, USDA acknowledged that " over time, the (commodity) programs probably increase capital requirements and tend to

put renters at a disadvantage and further impede the entry of young farmers. " [16]

This thesis will research the problem by directing attention to the small farmer. Luther Tweeten has argued that a focus on small farms " detracts from attention to serious poverty, underemployment, health, and education problems among farm and rural people. " [17] Tweenten's argument is mainly directed at those persons who advocate a " small is beautiful " [18] Jeffersonian concept of agriculture. Jefferson's dream of a nation of small farmers is appealing, but society did not develop that way and the clock can not be turned back. An objective focus on small farms would inevitably lead to a re-evaluation of rural development problems.

In order to establish what he called a " workable policy on the structure of agriculture ", [19] former USDA Secretary Bergland called for a national dialogue on the future of American agriculture. In a speech to the Farmer's Unions, he asked them " to begin thinking and thinking hard about what kind of agriculture you believe would be in the best interests of the farmers and the nation. " [20]

This thesis is a contribution to that national dialogue. It is hoped that this thesis will serve as a catalyst of change toward a more equitable and more effective national food, fiber and rural development policy.

OBJECTIVES OF THE THESIS

This thesis has two objectives. First, the small farmer will be profiled by comparison with medium and large farmers. Second, through various means of analysis, the hypothesis that commodity programs have provided little or no assistance to the small farmer, in terms of income support, will be examined. Among the possible conclusions that could be reached are:

1) Small farmers participate, but their sales are too small to generate substantial income support from the commodity programs.

2) Small farmers do not participate in the commodity programs.

PLAN OF THE THESIS

Before any study dealing with farm size can be made, definitions of farm size must be established. This will be done. The analysis will then proceed with a discussion about who the small farmers are, what the small farm problem is and whether the small farm is worth saving. Following that discussion, the U.S. agriculture situation leading up to the 1978 crop year will be presented. Benefits and drawbacks of participation in the commodity programs will be evaluated from a national perspective. A profile of the small farm and farmer will be constructed from the survey results. The extent to which small farmers benefit from the commodity programs will be examined.

Ultimately, a conclusion will be reached.

Chapter 2

DEFINITIONS

Farm size in this study will be defined as follows:

1) Small Farms: Those with less than $20,000 per year in sales of farm products. [1]

2) Medium Farms: Those with $20,000 to $100,000 per year in sales of farm products.

3) Large Farms: Those with over $100,000 per year in sales of farm products.

These definitions were chosen primarily because they are the same ones used by the Congress and the USDA, but in terms of the range of gross farm incomes and the distribution of farms over that range, the above definitions appear to be reasonable and relevant. Using a common definition readily facilitates comparison between studies.

It is acknowledged that if farm size was defined differently, the conclusions of this study could be different. For every definition of farm size, the size and composition of the population of small, medium and large farms will vary.

Chapter 3

AN INTRODUCTION TO THE SMALL FARM AND THE SMALL FARMER

This chapter has three objectives; a brief description of the small farmer will be given, the small farm problem will be presented and the question as to whether the small farm is worth saving will be discussed.

WHO ARE THE SMALL FARMERS?

The purpose of this section is to provide the reader with a general overview of who the small farmer is. A more thorough, regionally specific examination of who small farmers are will be presented later. A general overview is given now so that the reader may become familiar with the general characteristics of the small farmer.

According to Luther Tweeten [1/], the small farmer can fall into one or a combination of three broad subclasses. These three small farmer subclasses are:

1) Part-time farmers: These are farmers who do not depend solely upon income from their farm as the only source of income.

2) Aged and/or disabled farmers: Within this category there are various types of small farmers. Some may be retired persons who have worked most or all of their lives in an off-farm job and returned to the land to " gentleman farm". They depend upon a pension or other non-farm income sources to support their retirement on the farm. There also may be aged farm operators who have farmed all their lives, subsist on that income source alone and suffer from chronic low-income problems. Disabled farmers could be aged or young. They suffer from low-income problems because they have neither the resources or the ability to improve their living standards.

3) Full-time abled bodied farmers: Full-time abled bodied farmers may be new entrants into farming, established farm operators, or farmers planning to leave the profession due to their financial situation.

Tweeten believes that the full-time abled bodied farmer can be helped the most by the federal government, agricultural research and extension activities. The part-time farmer will survive because of the nature of their farm operation; farming is not the only income producing source. The aged and/or disabled farmer would benefit the most from welfare programs.

It is the disappearence of the full-time abled bodied farmer that should cause the most worry as far as the structure of agriculture is concerned. Why this is so shall be explained in the next section.

WHAT IS THE SMALL FARM PROBLEM?

Simply stated, the small farm problem is one of self-survival. The capital requirements of agriculture have been raised as technology is substituted for labor. As old farmers retire, their land is bought up and bid up by existing farm operators for expansion purposes. Young people who wish to enter farming are blocked by the high capital barriers. Thus, the number of small and medium sized commercial farms is reduced.

The type of small (and medium) farmer most likely to be affected by the survival problem, in terms of its threat on a potentially viable commercial farm operation, is the full-time abled bodied farm operator.

The survival problem is not unique to the small farmer; the

goal of every business is to stay in business. The small farmer also wants to continue farming because of the lifestyle it affords.

Causes of the survival problem are shared by all sizes of farms, but the smallness of farm size tends to aggravate the consequences of low prices, rising production costs and lack of information about developments in the market and new technologies. New technologies put a low premium on inefficient small-scale operations. They place a high premium on land so that there is tremendous pressure put on small farmers to sell out to larger operators.

The small farm operation is especially hard-pressed by limited access to credit and capital. Small farmers have neither the resources or the collateral of their larger neighbors. Small-scale farm operations also lack the productive capacity to absorb escalating production costs. Their size does not permit them to take advantage of the cost savings larger farms can achieve using new technologies.

Although small farms accounted for only nine percent of the total cash receipts from farming in 1978, their disappearance (and the disappearance of the medium-sized farm) has grave consequences in terms of the effect on the structure of agriculture and the rural community.

Concentration of agriculture's productive resources leaves the supporting rural community and rural town in a surplus condition to present needs. Businesses begin to decline. Schools and churches suffer losses in patronage. The quality of rural town life declines. A few large farms may be prosperous for their operators or investors, but " a prosperous agriculture no longer implies a prosperous rural

community." [2/]

If the disappearence of the small (and medium) farm implies a decline in the quality of life in the rural cummunity, then it becomes the responsibility of public policy to decide what is valued more -- a thriving rural town and farming community mutually dependent on each other for survival or a nation of a few large farms and a decaying rural community. Saving the small farm may be the key to perpetuating a healthy, balanced farm firm - rural town relationship of interdependence. The section that follows will close this chapter on the small farmer and ask more questions than it answers.

IS THE SMALL FARM WORTH SAVING?

A fundamental stumbling block to solving the problem of small farms is the disagreement and confusion over whether the small farm is worth saving in the first place. A value judgement must be passed on the small farm's relative worth to society. If enough people value the small farm as an integral part of the American agricultural institution, a policy will be formulated to deal with the small farm problem.

" Very simply, policies are formulated and pursued to yield results that are highly valued, and to avoid results that are negatively valued. Policies become sharp and clear when human values are internally consistent, firmly held and widely shared." [3/]

Judging from the historical record, Americans have always valued the small farm as an integral and necessary part of American agriculture. Goals set by Thomas Jefferson laid the foundation for farm

size policy. Jefferson's motivation behind championing small farms was political and sociological, not economic.

Thomas Jefferson and John Adams believed that all Englishmen (British and colonists) were endowed with the right to posses land. The two men argued that " the inherent right of the colonies to govern themselves had its close counterpart in the claim of every colonist to possess land in his own right." 4/ A small farm structure in the Colonial era of the United States enabled many men to own property, fulfilling the beliefs of Jefferson and Adams.

Promotion of a small farm structure of agriculture also was a means to " expand the number of responsible citizens with enough property to stand the cost of government." 5/ Jefferson saw small farm living not only as a source of wealth, but also as a source of " human virtues and traits most congenial to popular self-government." 6/

A nation of small farms gave men of the eighteenth century the opportunity to exercise their right to employment, self-reliance and independence.

During the nineteenth century, another argument was added in support of small farms: an agriculture characterized by numerous small farms enabled the competive structure of the economy to contunue. If agriculture could remain competive and open, the monopolies, cartels and concentration plaguing industrialized America at that time could be conveniently overlooked. A competitive agriculture would be " a sufficient reference base to give reality to the myth of a competitive economy." 7/

In the past, America valued the small farm because its existence was " central to three of the functional beliefs on which American society has been erected: self-governing democracy, freedom of occupational choice, and competitive markets as guides to economic behavior." [8]

This committment to historical tradition was upheld most recently in the Secretary of Agriculture's memorandum 1969 of January 3, 1979. The memorandum stated that " it is the policy of this Department to encourage, preserve, and strengthen the small farm as a continuing component of American agriculture... " [9]

In 1937, the Farm Security Administration (FSA) was established with the unofficial goal of mainstreaming small farms back into commercial agriculture. The more realistic goal of the FSA was to help small farmers better their living and financial conditions by improving their tenure status and increasing production. The Farmer's Home Administration (FmHA) continues the work of the now defunct FSA. The Agricultural Credit Act of 1978 revised FmHA's farm loan activities in favor of the more limited resource farmer (the smaller farmer).

One official of the old FSA commented that " FSA was actually a conservation organization seeking to re-establish the rural culture of an earlier era." [10] Conservation of an earlier era is a battle cry for some of today's small farm advocates. They value the small farm because they see it " as a last vestige of Jeffersonian virtues." [11]

Certainly the maintenance of the small farm only for the sake of tradition will not convince everyone that the institution should be

preserved. " It is a cherished American tradition (the small farm), but it is not a well-spring of modern agricultural policy." 12/

Viewed strictly as an economic entity with no social values attached, the full-time small farm could be viewed as an enterprise out of place; the full-time small farm was more appropriate in the earlier periods of U.S. agriculture. It made economic sense when agriculture was the major industry of the nation.

Those who take a narrow view of preservation for historical reasons clash with the small farm advocates. Human values concerning the small farm are not firmly held or widely shared. Therefore, whether small farms are worth saving depends upon the number of people who believe that the consequences of the small farm disappearance are undesirable and the number of people who value the function small farms perform in the structure of agriculture. In short, small farms must be highly valued for policy to reflect the desirability of their continued existence.

The purpose of this paper is only to examine the stated hypothesis and profile the small farmer. No attempt will be made to defend a position on the desirability of saving the small farm. It is hoped that the material presented in this thesis will assist the reader in forming his or her own opinion about the desirability of saving the small farm.

Chapter 4

THE U. S. AGRICULTURAL SITUATION LEADING UP TO THE 1978 CROP YEAR

The survey data used in this thesis covers the 1978 crop year. Therefore, it will be useful and relevant for the purposes of this thesis to describe the U. S. agricultural situation leading up to the 1978 crop year. This will be accomplished through a discussion of the 1978 set-aside program as shaped by the Food and Agricultural Act of 1977 (The 1977 Farm Bill), a review of farm prices and production in 1977 and 1978 and an examination of farmer's expectations for the 1978 crop year as a factor in their decision to participate in the 1978 set-aside program.

THE 1978 SET-ASIDE PROGRAM

Farmer participation in the set-aside program is required (in any year when set-aside is put into effect) in order to receive commodity program benefits. It is therefore relevant for the purposes of this thesis to briefly discuss the set-aside program.

With regard to the set-aside program, the 1977 Farm Bill authorized the concept of a farm's normal crop acreage as a basis for the set-aside. This new idea in farm legislation replaced the previous practice of the set-aside being based on a percentage of historical farm allotments. Allotments were determined from historical planting patterns. A farm's normal crop acreage (NCA) in any crop year is based on a farmer's acreage planted for harvest in the previous

year.

Under the allotment system, diverted and set-aside acres were additions to the farm's soil conserving base. The NCA concept is the inverse of the conserving base requirement. In any crop year when the set-aside requirement is put into effect, the planted acreage of a NCA designated crop plus set-aside acres can not exceed the NCA of each participating farm.

The set-aside concept was first introduced in the Agricultural Act of 1970. Farmers who participate in the set-aside program are required to withhold from production a single parcel of land in order to be eligible for income support payments and low-interest loans. Participation in the set-aside program is strictly voluntary.

The set-aside system eliminated the individual crop-by-crop controls of past farm legislation, thus reducing the efficiency of controlling production. A farmer can grow as much of his most productive crop on his most productive land (land not set-aside). This permits wide swings in production among crop substitutes and contributes to commodity price fluctuations.

To be eligible for wheat payments in 1978, a farmer had to set-aside land equal to twenty percent of his farm's normal wheat acreage. To be eligible for corn payments, a farmer has to set-aside land equal to ten percent of his farm's normal corn acreage.

The following provisions of the set-aside program, authorized by the 1977 Farm Bill are important to understanding the calculations performed in the thesis analysis (these calculations will be described

in the methodology chapter of this thesis):

1) The Allocation Factor: This is a ratio of the national program acreage 1/ to the estimated number of acres actually harvested. " A farmer's acreage eligible for deficiency payments will be determined by multiplying his acreage planted for harvest by the allocation factor." 2/ The allocation factor must not be less than eighty percent nor greater than one hundred percent.

2) Deficiency Payment Provisions: Deficiency payments are made if the national average market price for the first five months of the 1978 marketing year (June through October) is lower than the target price of the NCA designated commodity. The payment rate per bushel will be the difference between the target price and the market price, or the target price and the loan rate, whichever is lower. Payments are limited to $40,000 per person. Payments are computed by multiplying the payment rate per bushel times the number of eligible acres planted for harvest times the farm's established yield per acre.

The Emergency Assistance Act of 1978 altered some of the set-aside provisions authorized by the 1977 Farm Bill. Under the 1978 Act, the Secretary of Agriculture was given discretionary authority to increase target levels for wheat, corn and upland cotton whenever a set-aside was in effect for crops in 1978 through 1981. Under the authority granted by the Emergency Assistance Act of 1978, the target price for wheat was raised and the sign-up period for set-aside participation was extended. The final version of the 1978 set-aside program is outlined in Table 4.1.

Table 4.1. 1978 Set-Aside Program Requirements, Target Prices and Loan Rates

CROP	Set-Aside Requirements	Voluntary Reduction	Target Price	Loan Rate
	- percentages -		- dollars -	
CORN	10	5	2.10	2.00
WHEAT	20	20	3.40	2.25
SORGHUM	10	5	2.28	1.90
BARLEY	10	20	2.25	1.63
OATS	---------No set-aside in effect----------			

FARM PRICES AND PRODUCTION, 1977-1978

In this section, farm prices and production during 1977 and 1978 will be briefly reviewed. An understanding of the farm price and production situation faced by farmers in the year prior to and during the 1978 set-aside program is appropriate to establish a background for the thesis analysis.

Figure 4.1 provides a clear picture of the movement of farm prices in 1977 and 1978.

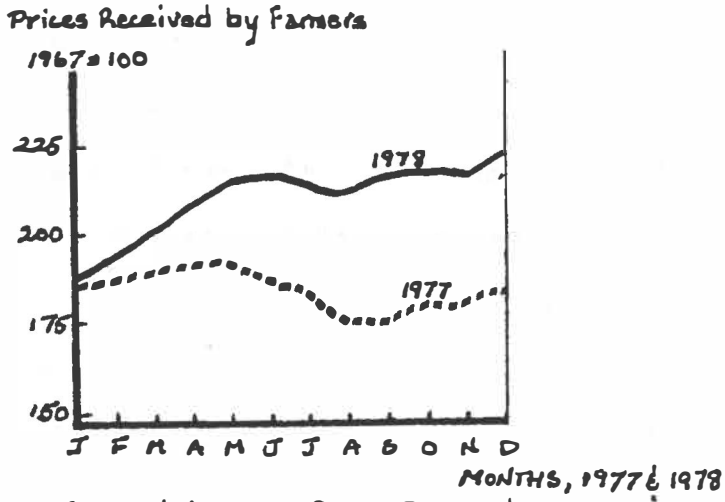

Figure 4.1. Farm Prices Received, 1977, 1978

In 1977, farm prices peaked in May. Prospects of bumper wheat and corn crops contributed to a steady price decline through September of 1977. By Novemeber 1977, the U. S. could look back on three successive years of large crop harvests. Farmers were faced with a slow farm price rally, however. Low farm prices were expected to continue because the large U. S. supply offset strong export demand and

expansion of domestic livestock feeding. Farm income prospects declined under the influence of the weak farm price situation.

As agriculture looked ahead to the 1978 crop year, the major uncertainties centered on the expansion of domestic markets, weather and growing conditions in the U. S. and abroad.

By early 1978 (January and February), the planting intentions of the farm nation indicated another big harvest. At planting time however, corn and wheat plantings were down in response to low prices and strong set-aside participation intentions.

In 1977, there had been heavy participation in the set-aside program that strengthened the farm income situation. Farm prices continued to increase from late 1977 levels (see Fig. 4.1) up until June of 1978 because of the reduction in the amount of readily marketable grain under 1977 and 1978 loan, unfavorable spring planting conditions and a surge in agricultural exports.

Farm prices began a steady, short decline in June of 1978 as shown in Figure 4.1. The price decline ended in August and prices began an increase throughout the rest of the year except for a slight decline in October.

FARMERS' EXPECTATIONS FOR THE 1978 CROP YEAR AS A FACTOR IN THEIR DECISION TO PARTICIPATE IN THE 1978 SET-ASIDE PROGRAM

The purpose of this section is to briefly examine farmer's expectations for the 1978 crop year as a factor in their decision to participate in the 1978 set-aside program. It is relevant to the purposes of this thesis to examine what factors a farmer considers

when deciding to particpate in the set-aside program.

Given the restrictions soil type and climate place on the type of crop that can be feasibly grown, the progressive farmer decides what commodity and how much of it he will produce based on the following factors:

1) Producers' perceptions of what crop and livestock prices will be at harvest and slaughter time.

2) The variability of the weather.

3) Changes in input supplies and prices.

4) Changes and additions in the price and income support programs, i. e. changes in the set-aside provisions, target prices and loan levels.

5) Farm income prospects.

The five factors given above also play a role in the farmer's decision to participate in the set-aside program. Farmers' expectations regarding each factor in relation to set-aside participation will be examined below.

Farm Prices

The weak farm price situation in 1977 would more than likely contribute to intentions of heavy use of the set-aside program in 1978. Faced with the prospect of sluggish farm prices, farmers would insure themselves of income support by participating in the set-aside program.

Weather Variability

During the early months of 1978, wet weather and a delayed spring thaw contributed to a farm price surge. During this time, farmers were making their decisions about set-aside participation. Prices peaked

at the end of the sign-up period (May 31st). High prices and the anticipation of continued high prices more than likely would influence farmers in the short term to not participate in the set-aside program. High prices would encourage farmers to plant all of their crop acreage. In the long run, however, because of the variability of the weather and its effect on production, a farmer would seek to minimize the price risk and participate in the set-aside program.

Changes In Input Supplies and Prices

Production expenses have continued a steady rise since 1939 and there seems to be no change of the trend in sight. Therefore, a farmer seeking to minimize losses and increase his income in light of growing production expenses would more than likely participate in the set-aside program.

Set-Aside Provision Changes

The alterations and newness of the 1978 set-aside program provisions undoubtedly contributed to a delayed reaction on the part of farmers in their decision regarding set-aside participation.

Late changes in March and May of 1978 were designed to take more acres out of production by encouraging set-aside participation through financial incentives.

The Farm Income Situation

1977 farm income figures released in March of 1978 showed that farm income had declined from 1976 levels. 1978 farm income prospects were brighter, but the volatility of the other four factors mentioned above could have made farm income in 1978 unpredictable. Therefore, to

minimize the risk of another decline in farm income, farmers more than likely would participate in the 1978 set-aside program.

With regard to farmer's expectations for the 1978 crop year, a farmer who seeks to minimize the price and income risk of his farm operation would more than likely participate in the set-aside program.

The forthcoming analysis will show the extent to which farmers in 1978 did participate in the set-aside program and the extent to which they benefitted from participation.

Chapter 5

THE BENEFITS AND DRAWBACKS OF PARTICIPATION IN THE 1978 COMMODITY PROGRAMS -- A NATIONAL PERSPECTIVE

The commodity programs attempt to solve the price and income problems of U. S. agriculture in a broad sweeping nature that conceals the vast diversity in farm needs and resources.

The commodity programs (also called the price and income support program) are administered on a macroeconomic scale through the dual system of target prices and non-recourse loans to a microeconomic situation -- the individual farm firm. A policy remedy designed for the nation as a whole may not achieve relief among each individual farm equally. " The fallacy of division warns us that what is true of the whole is not necessarily true of the parts." 1/

Different economic problems confront small farmers and large commercial farmers. Public policy should recognize these differences and distinguish between the need for rural development policies and commercial agriculture policies. The commodity programs are intended for the benefit of commercial agriculture; they don't necessarily benefit small farms nor solve the rural development problems associated with small farms.

Looking with a national perspective, this chapter will explore the distributional impacts of the commodity programs and examine the extent to which small farmers benefit from participation.

In general, large farms do not have persistent low income problems. From time to time, they may experience some lean years, but their farm incomes are substantially higher than small or medium farms. Table 5.1 gives an indication of the difference between the incomes of small, medium and large farms. (Table 5.1 is on the following page.) In 1978, the average farm income per large farm was $52,337 per year compared to $2,708 and $ 17,156 for small and medium farms respectively. Large farms made up only seven percent of the total farm population in 1978 but they accounted for fifty-six percent of the cash receipts from farming in 1978. Large farms are much more vulnerable to price instability and flucuating cash flow problems than small farms. Thus, large farms are not so dependent upon income support from the commodity programs as they are upon the price stabilization and price support features.

Medium farms, which comprised twenty-seven percent of the total farm population, accounted for thirty-five percent of the cash receipts from farming in 1978. Medium farms had the lowest average per farm off-farm income in 1978 (see Table 5.1). Medium farms seem to be in the best position to benefit from the commodity programs because they need both income and price support.

In 1978, small farms accounted for only nine percent of the cash receipts from farming, but they made up the largest percentage of the farm population. Most of their income, on the average, came from off-farm income sources as Table 5.1 indicates. The income and sales figures for small farms presented in Table 5.1 suggest that on average, small farms are not commercially viable operations. The

Table 5.1 Selected Characteristics and Distribution of Farm Size for 1978 U. S. Agriculture

Farm Size	Dist. of Farm Pop.	Average Cash Receipts Per Farm	Dist. of Cash Receipts	Average Farm Income+/	Average Off-Farm Income	Average Def. Pay. Per Farm	Dist. Of Payments	Average Payments Per Farm As A % of Ave. Total Income Per Farm
	-percent-	-dollars-	-percent-	------dollars----------			------percent----------	
SMALL	66.3	5,747	9.0	2,708	15,274	360	21	2
MEDIUM	26.7	56,617	35.0	17,156	7,279	2,443	57	10
LARGE	7.0	348,775	56.3	52,337	10,850	3,476	21	5.5
	100.0		100.0				100	

+/ Includes government payments

Source: "Farm Income Statistics", USDA, ESCS, Stat. Bull. No. 627, October, 1979

USDA classifies farms with less than $2500 in sales of farm products per year as non-commercial farms.[2/] In 1978, forty-four percent of all small farms were non-commercial enterprises by definition.[3/]

Small farms are in a position to be helped the least by the commodity programs because of the very nature of the distribution of program benefits (the size of the payments to each farm varies directly with the farm's volume of production). The average volume of production per small farm (as measured by the cash receipts received from farming) is the lowest among all farm size classes (see Table 5.1).

The commodity programs are not welfare programs that transfer income to the less fortunate farmer or create a more equal distribution of income. They were not intended to be so. The function of the commodity programs is to stabilize fluctuations in farm prices and support prices above a specific price floor through the non-recourse loan program. The commodity programs also try to stabilize and support farm income through the target price-deficiency payment program.

As the figures in Table 5.1 regarding deficiency payments suggest, the impact of the income support program is incidental in terms of supporting the total income of a farm.

In terms of price stability and price support, the commodity programs are beneficial to large and medium farms more than small farms. This is because large and medium farms, relative to small farms are more vulnerable to price swings because of their larger production volumes.

Just as price instability has a different effect on cash receipts according to the size of the farm, deficiency payments made to a farmer based on his volume of production will vary with farm size. Table 5.1 shows that average payments per farm are almost ten times greater for large farms than for small farms.

Table 5.2 presents a hypothetical wheat farm situation and the different effects a fifty cents per bushel deficiency payment would have as a supplement to farm income and total income.. Figures for acreage and yield were taken from Table 7.1 in chapter seven and represent average wheat acreage and yield for set-aside farms in Minnesota and North Dakota in 1978. Total income is the sum of the farm and off-farm income taken from Table 5.1. Farm income is taken from Table 5.1 also.

Among small farmers, farm income almost doubles with the addition of deficiency payments. The supplement to total income is not so substantial. As a group, in relative terms, small farmers gain the most farm income supplement. In absolute terms, however, the supplement small farmers receive from deficiency payments is not enough to bring their average farm income even up to the level of deficiency payments received by large farmers. With regard to the effect on total income, small farmers gain the smallest supplement relative to medium and large farmers.

In instituting a farm policy to a constituency that is viewed as homogeneous, the federal governemnt has given little attention to the distributional impacts of the farm policy. [4/] The very make-up

Table 5.2 Comparison Between Farm Size of the Effects on Farm and Total Income of Deficiency Payments For A Hypothetical Wheat Farm Situation in 1978.

Farm Size	Acreage	Alloc. Factor	Yield	Def. Pay.	Def. Pay.	Change In Farm Income a/	Change In Total Income b/
	-acres-		bu/ac	per bu.($)		----percent--------	
SMALL	146	1	28	50¢	2044	+87	+12
MEDIUM	258	1	32	50¢	4128	+28	+19
LARGE	484	1	36	50¢	8712	+18	+15

a/ Does not include government payments.
b/ Does not include government payments.

of the commodity programs and the benefits they provide skews the distribution of those payments to the farmers with the largest production volume. Table 5.3 suggests that the farm with the largest volume of production (as measured by the cash receipts from farming) is the large farmer. The largest farms in 1978 received fifty-six percent of the cash receipts from farming, but made up only seven percent of the farm population.

Table 5.3 Distribution of Cash Receipts From Farming in 1939,1964 and 1978

YEAR	Percentage Distribution of Farms by Sales							
	-Smallest----------				-Largest----------			
	10%	20%	33%	50%	33%	20%	10%	1%
	----------percentages----------							
1939	2.5	4.7	7.8	11.9	75.0	62.3	45.2	18.0
1964	1.0	1.8	4.5	12.0	77.0	66.0	50.0	18.0
	Smallest				Largest			
	34.3%	44.7%	55.2%	66.3%	33.7%	21.6%	7.0%	
1978	0.9	2.0	4.2	8.8	91.2	81.3	56.3	

In 1969, James Bonnen computed the distribution of program benefits under the old allotment plan. He found that the highest degree of concentration of program benefits was among the largest farms. As Table 5.4 shows, the largest twenty percent of farms (those with the highest sales per farm) received over fifty percent of the benefits in 1964. The smallest forty percent received less than ten percent of the benefits. The concentration of benefits into the hands of fewer farmers has grown, not unlike the growing concentration of cash receipts among fewer farms.

Table 5.4 Distribution of Deficiency Payments In 1964 and 1978.

YEAR	Percentage Distribution of Farms					
	---Smallest----			----Largest----		
	20%	40%	60%	40%	20%	5%
1964 Wheat Payments	3.3	8.1	20.4	79.6	62.4	30.5
1964 Feed Grain Payments	1.0	4.9	17.3	82.7	56.1	23.9
	----Smallest----------			----Largest------		
	34.3	44.7	55.2	66.3	33.7	21.6	7.0
1978 Payments	2.8	6.5	12.0	21.0	78.8	57.4	21.4

Source: "Farm Income Statistics", USDA, Oct. 1979 and Charles Schultze (page 16).

Refer again to Table 5.3. It presents information that suggests that there has been a growing concentration of farming's resources, as measured by cash receipts received, into the hands of fewer farmers. In 1939 and 1964, the largest thirty-three percent of all farms received seventy-five and seventy-seven percent of the total cash receipts from farming respectively. In 1978, the largest 33.7% of all farms received 91.2% of the total cash receipts from farming.

Because deficiency payments per farm vary directly with the cash receipts received from farming, it comes as no surprise to see that small farms receive a smaller percentage of the payments than in the past. One reason for this is the decline in the number of small farms. Farms with under $20,000 per year in sales of farm products made up 91.4% of the farm population in 1960. In 1978, farms with sales of less than $20,000 per year (the current definition of a small farm) made up only 66.3% of the farm population.

In terms of dollars and cents, small farmers do not receive very much help from the income support program. The average payment per small farm in 1978 was three hundred and sixty dollars. That is only two percent of the average total income of a small farm.

Lorenz curves are a valuable visual aid in presenting income and deficiency payment distributions. In Figure 5.1, the curve is used to show the disparity of income and payment distributions among the farm population in the early 1960's and in 1978.

The farther the respective curves representing income and payment distributions lie to the right and below the diagonal line that

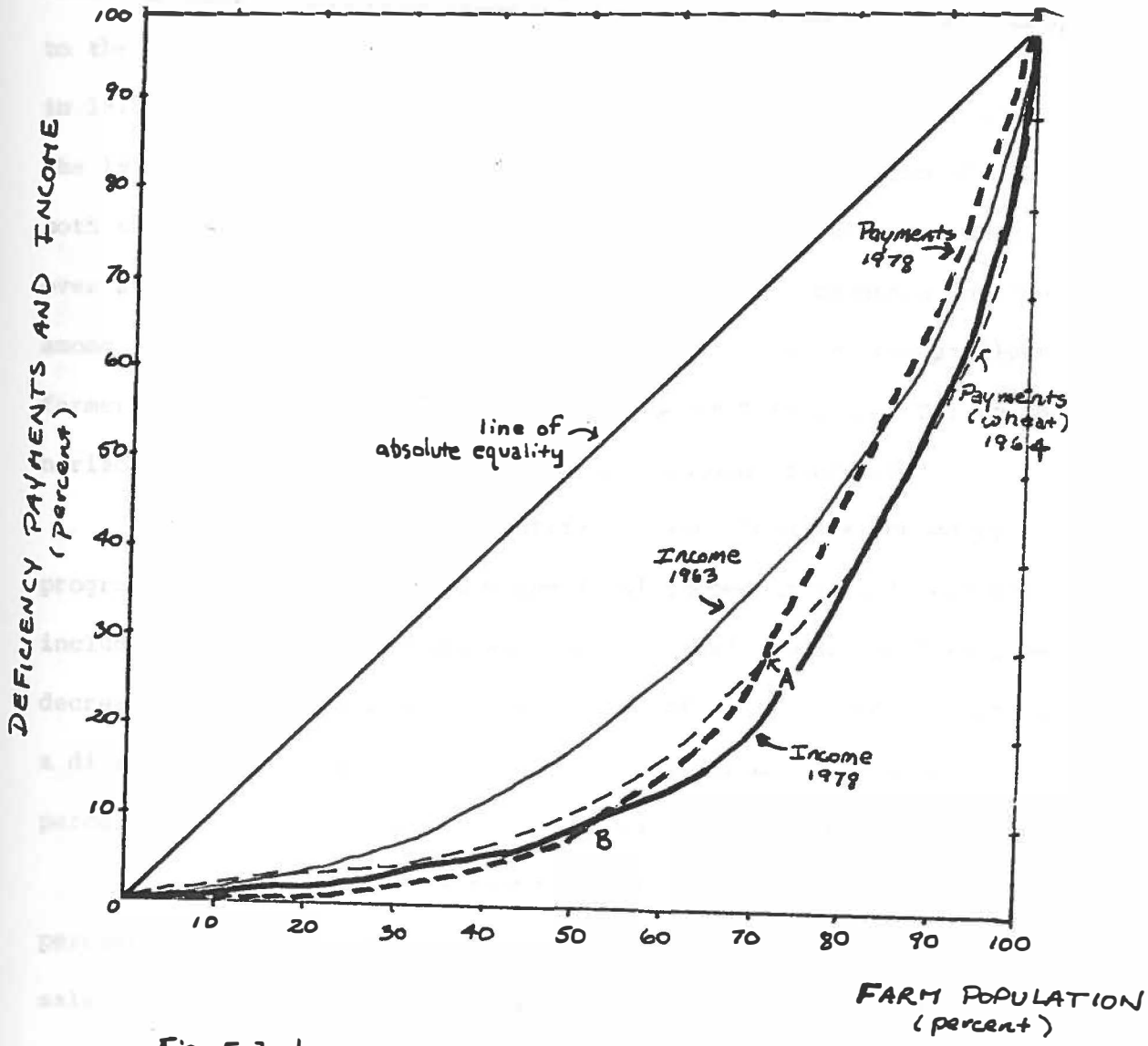

Fig. 5.1. Lorenz curve depicting distribution of deficiency payments and income among farm population in 1963, 1964 and 1978. Source: 5/

bisects the graph into two equal forty-five degree triangles, the more unequal the distribution of income and deficiency payments. According to Figure 5.1, the distribution of income since 1963 has become more unequal; the 1978 income distribution curve is always to the right and below the 1963 curve. The distribution of payments in 1978 is more equal among the largest farmers than it was in 1964; the 1978 distribution of payments curve lies to the left and above both the wheat and feed grain payment curves in 1964 after crossing over at point A in Figure 5.1. The distribution of payments in 1978 among the smallest farmers (approximately 52 percent of the smallest farmers if a straight line is drawn from point B in Figure 5.1 to the horizontal axis) however, has become more unequal since 1964.

Table 5.5 sums up the benfits received from the commodity program as a percentage of farm and total income among all farm sizes, including a more detailed breakdown of the small farm. As farm size decreases, so do benefits as a percentage of total income [6/]. It is a direct relationship. As farm size decreases, benefits as a percentage of farm income increases. This is an inverse relationship.

The exception to the trend in deficiency payments as a percentage of farm income is the small non-commercial farmer. He has sales of farm products that are less than $2500 per year. The characteristics of this smallest farm size: highest off-farm income per farm, highest percentage of the farm population among all of the farm groups depicted in Table 5.5, lowest farm income, all point to the fact that the smallest farm's viability as a potential commercial farm operation is questionable. Their off-farm income supports their

continued existence as a part-time farming operation and therefore, the likelihood of the decline of farms with less than $2,500 in sales of farm products per year is minimal. Small farms with sales in farm products of $2,500 a year and above are more likely to disappear either through expansion into larger size classes, selling out, or moving into a position where the farm operator spends less time farming and more time in an off-farm job.

Table 5.5 Average Deficiency Payments, Farm Income and Total Income Per Farm and Average Deficiency payments Per Farm as a Percentage of Farm and Total Income in 1978 for Different Farm Sizes.

FARM SIZE	Average Deficiency Payments	Farm[a/] Income	Def. Pay. As A Percentage of Farm Inc.	Total[b/] Income	Def. Payments As a Percentage of Total Income
[c/]	-----dollars-------			-dollars-	
IV	92	1,646	5.5	18,851	0.5
III	401	1,504	26.6	17,655	2.3
II	598	2,683	22.3	16,256	3.7
I	926	4,991	18.5	15,059	6.1
MEDIUM	2,443	14,713	16.6	21,992	11.1
LARGE	3,476	48,861	7.1	59,711	5.8

a/ Does not include government payments
b/ Does not include government payments
c/ The Roman numerals distinguish between farm size among the small farm group. I represents all farms with farm sales of $10,000 to $19,999. II represents all farms with farm sales of $5,000 to $9,999. III represents farms with farm sales of $2,500 to $4,999. IV represents all farms with farm sales of less than $2,500.

Why are the small commercial farms (those with sales in farm products between $2500 and $19,999 per year) likely to expand-drop out of farming, or become non-commercial farm operations? The growing concentration of payments among large farmers has been accompanied by a growing concentration of farming's productive resources into the hands of fewer and fewer farmers. Are the two trends connected?

So far the discussion in this chapter has centered on the distribution of actual and tangible benefits of the commodity programs. There are indirect and disconcerting (some may feel) results of the programs. A theory, first espoused by Willard Cochrane in the 1950's,[7] explains why farm numbers have been declining and links this to the commodity programs. A counter-argument, developed by Willis Peterson,[8] will also be mentioned.

Cochrane's theory was first introduced in his book, Farm Prices, Myth and Reality in the chapter entitled, " The Agricultural Treadmill ". The " treadmill theory "[9] takes a microeconomic approach to the problem of industry concentration, recognizing the differences between the effects of farm technological advance and its adoption on the entire agricultural industry and the individual farm firm. Farmers are assumed to operate in a perfectly competitive, free market environment where each farmer is a price taker whose production has no perceptible influence on farm price and output of the whole industry.

The efficient, bright and aggresive farmer perceives that in this perfectly competitve market he cannot increase his returns from

production unless he reduces his per unit cost of production. To achieve the economic profits he would like to make, the farmer takes advantage of capital intensive, cost efficient new technologies that no other farmer has had the foresight to use yet. By adopting new technologies and jumping on the treadmill ahead of his neighbors, the " early-bird " [10/] farmer can lower his farm's cost structure and increase his output per unit of input. Because output per unit of input increases and costs remain constant, cost per unit of output declines and the farmer experiences an economic profit.

This situation is illustrated in Figure 5.2. Initially, the farm firm's average total unit cost curve is $ATUC_1$. The enterprising early-bird farmer who adopts the new technology lowers his average total unit cost (ATUC) from $ATUC_1$ to $ATUC_2$. One farmer among two-million, six-hundred thousand will not influence price in this perfectly competitive situation. The price stays at the level P_1 in Figure 5.2. This enables the early-bird farmer to capture an economic profit of P_1RST. As word spreads about the new technology and the economic profits to be realized with the adoption of new technology, more farmers take advantage of the technolgy and jump on the treadmill. As adoption of the new technology spreads throughout the farming industry, supply expands and price declines to P_2. This causes the economic profit the new technology initially created for the early-bird farmers to be wiped out.

Woe to the farmer unable to get on the treadmill or keep up with it. He may not have been financially able to adopt the new technology or continue using the expensive, capital intensive

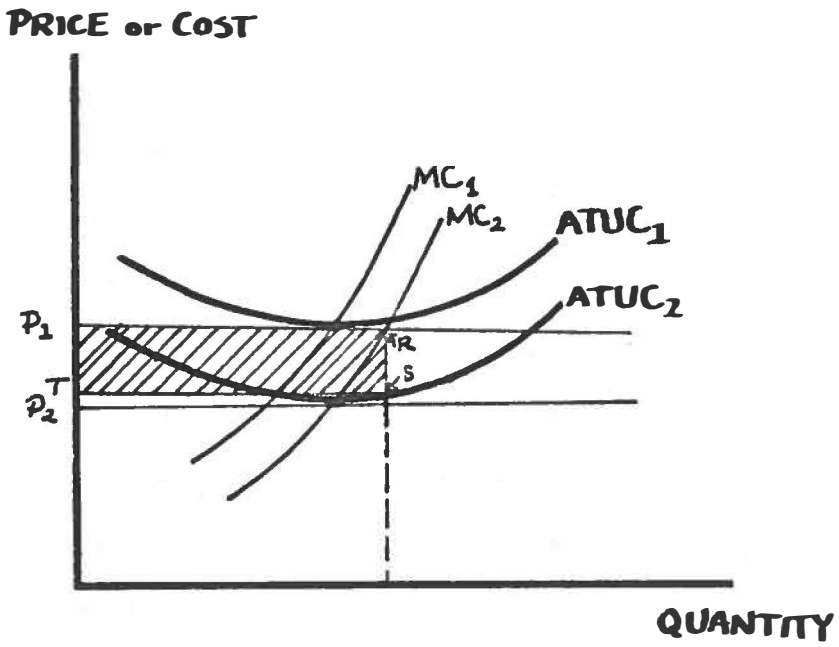

Fig. 5.2. Firm Solution in a free market: the theory of the treadmill, Source: 12/

technology. His operation may have been short in the resources needed to efficiently utilize the capacity of the new technology or the farmer may just have been too lazy to adopt the new technology. For his non-participation on the treadmill, for whatever reason, the laggard farmer is rewarded with lower farm prices. His fate is most likely one of selling out to more aggresive neighbors; he is " cannibalized " [11/] by the farmer fittest to survive.

The treadmill doesn't stop after one technological innovation. Each time a new technology is available, the early-bird farmers will adopt it, make an economic profit and accelerate the treadmill. Just to keep up, other farmers must follow suit or eventually be squeezed out of farming by higher costs. Farm technological advance has created this treadmill. The treadmill is always moving.

The treadmill is always moving. Once a farmer gets on, he must keep pace with his fellow treadmill runners to keep competitive in farming.

Under government intervention (through the commodity programs), the consequences of the treadmill theory become worse (than under free market conditions) for the laggard farmer or those that can't keep up with the treadmill's pace.

Assuming production controls are ineffective and prices are depressed as excess supply gluts the market, the price supporting mechanism of the commodity programs will work to keep prices at level P_1 in Figure 5.3. This means that every farmer who adopts the new technology and moves his cost structure down to $ATUC_2$ in Figure 5.3 will realize an economic profit of P_1RST. This is not a stable

situation however.

The aggressive farmer will strive to achieve an even greater profit. Assuming constant technology at the new technology level, an increase in returns to production can be achieved through expansion of the size of the farm operation (assuming constant returns to size). Expansion of the size of the farm operation is depicted in Figure 5.3 as the farmer moves along the portion of his long run cost surve (LRAC) that exhibits constant returns to size. His ATUC shifts along the LRAC from $ATUC_2$ to $ATUC_3$. This economic manuever expands the aggresive farmer's economic profit to the point where he can realize returns over and above the cost of his farm operation. This shown as the area P_1MNT in Figure 5.3.

In order to expand his farm operation, the aggressive farm operator needed more land. Where did he get it? The aggressive farmer bought out the laggard, inefficient neighbor's productive resources.

As more and more farmers expand their operations, the economics of supply and demand working on a fixed resource base (farm land) dictate that the price of the fixed resource increases. As farmland rises in price, the cost structure of the individual farm firm must also rise (land is a fixed cost in the cost structure of a farm operation). The farmer's ATUC moves upward and to the right as higher land prices are reflected over time in the cost of running a farm. This move is depicted in Figure 5.3 where the ATUC moves from $ATUC_3$ to $ATUC_4$. The farmer, over time, returns to a no-profit, no-loss situation at a higher cost structure.

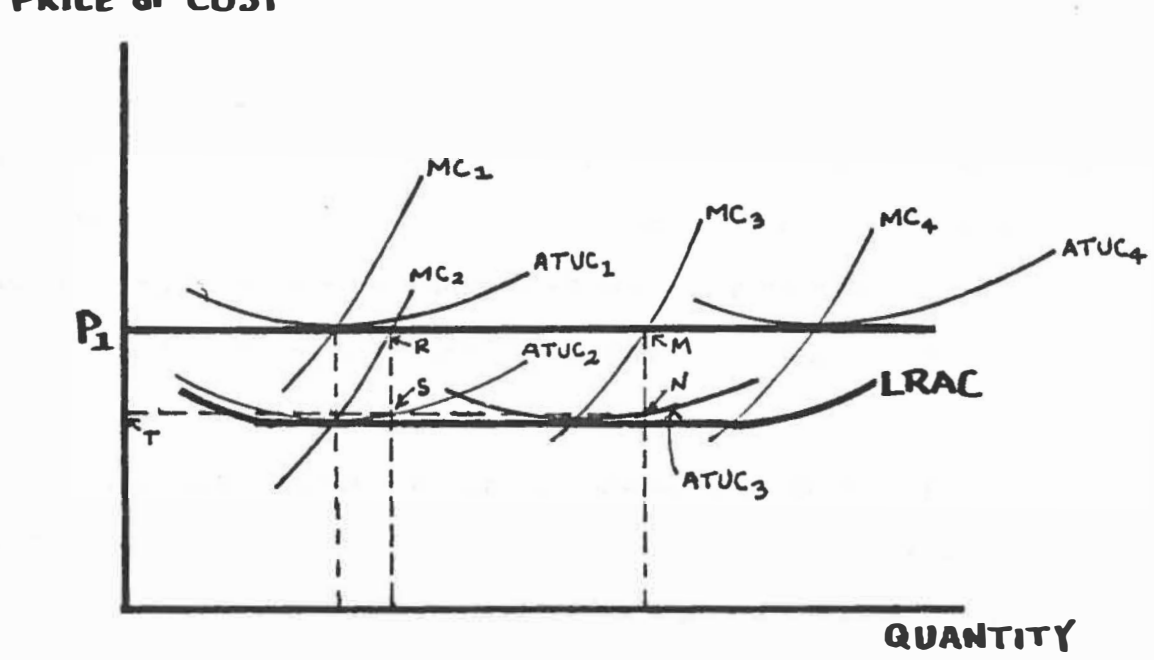

Fig. 5.3. The treadmill theory under government intervention. Source: 13/

In theory, it has been explained why farms are getting larger and small commercial farm numbers are declining as a result of the commodity programs and technological advance. One question remains: Where does the aggressive farmer obtain the capital necessary to purchase additional land for expansion purposes?

The expansion-minded, aggressive farmer uses the income support payments he receives from the commodity programs to purchase additional land. Government farm payments (which include deficiency, disaster, low yield and diversion payments) find their way to being capitalized into the land by farmers who use the income supplement for farm land expansion purposes.

Those who receive the largest amount of payments per farm -- the large farmers -- are able to purchase expansion acreage with their government payments and acquire the productive resources of their smaller, less aggressive neighbors. By bidding up the price of land through expansion purchases, the aggressive, larger farmers are increasing the value of their own wealth. They are also raising the cost structure of the entire farming industry. The higher cost structure means higher farm production costs which tend to wipe out any financial help the government income supplements provide.

The combination of the treadmill and the commodity programs inevitably breeds cannibalism within the farming industry. The victim is the smaller, less-able, less aggressive farmer who either fell off the treadmill or couldn't get on it in the first place. The productive resources of the farmers forced to get out of farming fall into the hands of fewer and fewer, larger and larger farmers.

Willis Peterson, in his paper entitled " The Farm Size Issue: A New Perspective " contends that the growth in farm size is caused by the increase in the urban wage rate and the disparity between it and the farm wage rate. In a later paper, co-authored with Yoav Kislev, Kislev and Peterson explain that " farmers consider the urban wage as the opportunity cost of their own labor." 14/ They describe a model that shows that as the opportunity cost of family labor increases, relative to the cost of capital services, it becomes profitable for full-time family farmers to acquire more machinery and land. 15/ This growth in the size of farms was accomplished because of the farmers who left farming to take advantage of higher non-farm wage rates. Their land was purchased by those farmers who chose to stay in farming but could only do so by expanding their farm's acreage.

Rather than provide alternative reasons for the growth in the average size of farms and an increase in the concentration of farming's productive resources, the two theories described above complement each other. Peterson's theory lacks discussion of the processes at work in the farm sector, but Cochrane's general theory fills in this void. Peterson's theory supplies the reason why farmers who are displaced off of the treadmill (or never get on) are able to leave farming.

The future of the full-time commercial small farmer looks bleak according to the treadmill theory. The treadmill theory also paints no rosy pictures for the medium-sized farmer who can't keep up with new technological adoption. The treadmill theory suggests that the farmer who can work part-time to support the farm operation, either to purchase purchase additional land and/or new technology or to continue a life-

style as a non-commercial farmer, can survive the consequences of the treadmill. This means that the small non-commercial farm will be a part of rural America for a long time to come.

These conclusions are based on a national perspective. Data from the states of Minnesota, North Dakota and Iowa has been studied. Analysis of this data will provide more evidence to make an educated decision concerning the hypothesis posed in Chapter 1 and enable a profile of the small farmer to be constructed.

Chapter 6

SOURCES OF DATA AND METHODOLOGY

The data used in this thesis comes from two sources. The discussion in Chapter 5 was based on data from " Farm Income Statistics", USDA,ESCS, Stat. Bulletin No. 627, October 1979. The results reported in the proceeding chapters are based on data taken from a survey that was completed in 1979 and covered the 1978 crop year. Farms in nine North Central states were included in the survey. Separate samples were taken for corn and wheat farms. The samples were randomly drawn by state crop and livestock reporting services. A mail survey was conducted, farmers were interviewed by telephone and data was collected from the county Agricultural, Stabilization and Conservation offices.

The states used in this thesis had the following sample sizes:

	Actual Usable Returns Sample Size	
State	Corn	Wheat
Minnesota	154	414
North Dakota		461
Iowa	364	
Total	518	875

The purpose of the survey was to gather information for a study to evaluate farmers' " attitudes toward and experience with the grain reserve program." 1/

The survey data was used in this thesis to provide information

about set-aside farmers in order to profile small farms and farmers and to evaluate the extent to which small farmers benefit from the commodity programs (set-aside participation is a prerequisite to receiving commodity program benefits). One question asked farmers was: Did you participate in the 1978 set-aside program? Using this information, farmers were grouped into three categories: (1) set-aside participants; (2) non-set-aside participants and (3) those who answered "I don't know".

Five major crops were included in the survey: wheat, corn, barley, oats and grain sorghum. No sales figures for each crop was reported in the survey. Therefore, for the purposes of the analysis, total sales from each crop were calculated by multiplying state 1978 prices (Minnesota, North Dakota and Iowa where applicable) for the five crops by their respective acreage and yields. Total farm sales per farm was calculated by adding together the separate crop sales. A farmer may not sell all of his crop , however. It was necessary to weight the sales from each crop by the average percentage of each crop sold in the state. The survey data provided this information for wheat and corn farmers in the respective surveys. To establish percentages for the other crops and either wheat or corn, depending on the survey, statewide percentages for the amount of crops actually sold in 1978 were used. These weights (or percentages) were then applied to the crop sales figures for each farm surveyed. Table 6.1 shows the percentages that were used .

Table 6.1 Percentage of Crops Sold in Minnesota, Iowa and North Dakota for the 1978 Crop Year.

CROP	Percentage of Crop Sold in 1978 Minnesota	Iowa	North Dakota
Wheat	97	78	Survey Figures
Corn	57	Survey Figures	65
Barley	86	100	78
Oats	44	31	38
G. Sorghum	+/	44	+/

+/ For the purposes of this thesis and because the grain sorghum harvest averaged 0 and 1 acre per farm respectively in Minn.-Iowa and Minn.-N.D., zero percent was used for Minn. and N.D.

Total farm sales (crop and livestock) was estimated with the help of one survey question that asked farmers to give the percentage of total farm sales realized from the five crops combined. The following formula was used to estimate total farm sales:

$$\text{Total Farm Sales} = \frac{\text{Total Crop Sales (adjusted by statewide \%'s)}}{\text{Total Crop Sales as a Percentage of the Total Farm Sales as Reported in the Survey}}$$

The total deficiency payments received for each crop under normal crop acreage (NCA) designation was calculated using the following formula:

$$\text{Total Deficiency Payments for Specific Crop} = \text{Specific Crop Acreage} \times \text{Allocation Factor} \times \text{Specific Crop Yield} \times \text{Def. Payment Per Bu.}$$

Total deficiency payments received by each farmer eligible to receive payments were calculated by adding up the deficiency payments received for each crop. Underlying all calculations regarding the deficiency payments was the assumption that each set-aside farmer was in total compliance with all of the requirements to receive payments.

Table 6.2 below shows the deficiency payments per bushel and the allocation factors that were applied to the five crops for the 1978 crop year.

Table 6.2 Deficiency Payments and Allocation Factors For Wheat, Corn, Barley, Oats and Grain Sorghum for the 1978 Crop Year.

CROP	Deficiency Payment Per Bushel	Allocation Factor
	-dollars-	
Wheat	.52	1.00
Corn	.03	.971
Barley	.35	.824
Oats	.00--No Set-Aside------	.00
G. Sorghum	.33	.958

The two objectives of this thesis -- to profile the small farmer and the small farm and to examine the stated hypothesis -- will be achieved through several methods of comparative analysis. These are:

1) Calculating mean values and percentage distributions (where the data is conducive to calculations of mean values) of the following characteristic variables of a farm: total farm sales, total deficiency payments, total cropland acreage, total crop acreage (wheat or corn), crop yield (wheat or corn), farmer age, debt to asset ratio, farm tenancy arrangement, livestock and participation in the futures market.

2) Comparing mean values statistically to test for the significance of the difference between the means of selected characteristic varaibles for different farm sizes.

3) Analysis of variance (ANOVA) to test the significance of differences between states as well as farm size in a more sophisticated fashion than in (2) above.

What follows is an explanation of why each of the above methods was used and a description of how the method works.

(1) CALCULATING MEAN VALUES AND PERCENTAGE DISTRIBUTIONS

The STATISTICS command of the Statistical Package for Social Scientists (SPSS) computer program was used to calculate the mean values of the following characteristics variables for wheat and corn farmers in Minnesota and North Dakota and Minnesota and Iowa respectively: total farm sales, total deficiency payments, total cropland acreage, total crop (wheat or corn) acreage, crop yield, farmer age and debt to asset ratios for each farm surveyed. Mean values provide information about the central tendancy of a variable and serve as a simple base from which a small farm and farmer profile

can be constructed. Simple, on-sight comparison of the means of total deficiency payments among the farm groups suggest how the small farmer benefits from the commodity programs.

Percentage distributions of the characteristic variables were calculated using the CROSSTABS command of SPSS. CROSSTABS performed a crosstabulation of the data "which is a joint frequency distribution of cases according to two or more classificatory variables." [2/] The relationship between farm size and each characteristic variable for wheat and corn was tabulated. Distribution tables provide direct observation of how small farms compare to larger farms in order to develop a small farm and farmer profile. Distribution tables involving total deficiency payments suggest the extent to which small farmers benefit from the commodity programs.

(2) COMPARING THE MEANS

The simplest investigation designed to discover and evaluate the differences between farm size was employed to construct a profile of the small farm and farmer. This investigation was also used to determine the extent to which small farmers benefit from the commodity programs. This was the first step in analyzing the data for statistical significance.

The investigation that was conducted tested the differences between the means of two populations. The mean values of six characteristic variables associated with small set-aside farmers were compared to corresponding mean values associated with (1) small non-set-aside farmers, (2) medium set-aside farmers and (3) large set-

aside farmers.

The six characteristic variables were: total deficiency payments per farm, total cropland acreage per farm, total crop acres (wheat or corn) per farm, farmer age and debt to asset ratio. All six variables were used to construct a small farmer and small farm profile. Evaluation of the total deficiency payments per farm was used to determine the extent to which small farmers benefit from the commodity programs.

The samples drawn by the survey were assumed to be independent and normally distributed.

Comparison of the mean values involves stating a statistical hypothesis, testing the hypothesis and deciding whether to accept or or reject the hypothesis.

For each test performed on the six characteristic variables, the hypothesis was stated:

H_O (the null hypothesis) : The mean value of variable A from the small set-aside farm group equals the mean value of variable A from the small non-set-aside participant farm group (or medium set-aside participants or large set-aside participants).

H_A (the alternative hypothesis) : H_O is false; the mean values are not equal.

The significance level alpha (α) was set at the five percent level. A five percent significance level means that if the hypothesis was tested one hundred times on one hundred different samples from the same population, five times out of one hundred, the null hypothesis would be erroneously rejected. Stated another way, ninety-five times out of one hundred (or ninety-five percent of the time) the correct

decision will be made regarding the null hypothesis, if the null hypothesis is true. Ninety-five percent is called the confidence level.

If the null hypothesis as stated above is not rejected, it can be said that there exists no statistically significant differences between the two populations. If the null hypothesis in not accepted, it can be said that there exists a statistically significant difference between the two populations.

As an example, suppose farmer age is the variable being tested. If the null hypothesis is not rejected, then it can be said with ninety-five percent confidence that there exists no statistically significant difference in farmer age between the two populations being investigated.

In order to test the hypothesis statistically, the analysis involves (A) pooling the estimated variances of the two populations, (B) calculating a t-statistic and (C) comparing the calculated t-statistic with the critical t-value found in the Student's t-distribution table.[3/] The actual calculations performed in comparing the means analysis can be found in Appendix I.

(A) Pooling the variances

Because the difference between the means of two samples is being tested, the variance of the difference must be estimated in order to compute a t-statistic.

The variance of a difference is the sum of the variance of the individual sample means when the means are independent. The means of

two independent samples are $\bar{X}_1$ and $\bar{X}_2$, respectively. $\bar{X}_1$ and $\bar{X}_2$ are the estimates of their respective population means, u_1 and u_2. It is assumed that $\bar{X}_1$ and $\bar{X}_2$ are normally distributed and independent. By theory then, their difference is also normally distributed.

Usually, the variance of the means is not known and must be estimated. SPSS provides an estimate of the variance of the means when the STATISTICS command of the SPSS program is employed. The estimated variances are called s_1^2 and s_2^2

To obtain a pooled estimate of the variance of the difference, which is called $s^2_{\bar{X}_1 - \bar{X}_2}$, there are two paths to follow. If the variances of the two populations are the same [4/], the formula below is appropriate for pooling the variance:

$$\text{(a)} \quad s^2_{\bar{X}_1 - \bar{X}_2} = \frac{s_1^2 (n_1 - 1) + s_2^2 (n_2 - 1)}{n_1 + n_2}$$

where n_1 = # of cases in sample #1

n_2 = # of cases in sample #2

If the variances of the populations are not equal, s_1^2 and s_2^2 are used, but a different t-statistic than the usual must be calculated. The formula for the different t-statistic will be shown in the next section on estimating a t-statistic.

(B) Calculating the t-statistic

If the variances are equal, then the calculated t-statistic is as follows:

(b) Calculated $t = \dfrac{\bar{X}_1 - \bar{X}_2}{s_{\bar{X}_1 - \bar{X}_2}}$, where $s_{\bar{X}_1 - \bar{X}_2} = s^2_{\bar{X}_1 - \bar{X}_2} \dfrac{n_1 + n_2}{n_1 n_2}$

If the variances are not equal, then the t-statistic must be calculated as follows:

(c) Calculated $t' = \dfrac{\bar{X}_1 - \bar{X}_2}{\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}}$

Because the calculated t' is different than the calculated t, the following conditions apply when the calculated t' is compared to the critical t-value:

Case I : If $n_1 = n_2 = n$, calculated t' = calculated t. The calculated t' can be calculated as in formula (b), but give the t-distribution (n-1) degrees of freedom instead of 2(n-1).

Case II: If $n_1 \neq n_2$, determine the significance levels of t for $(n_1 - 1)$ and $(n_2 - 1)$ degrees of freedom. Call these t_1 and t_2. The significant t (the critical t-value) becomes:

$$(w_1 t_1 + w_2 t_2) / (w_1 + w_2), \text{ where } w_1 = s_1^2 / n_1, \quad w_2 = s_2^2 / n_2$$

(C) Comparing the calculated t-statistic with the critical t-value

In most cases, due to large sample size, the critical t-value used for testing the hypothesis at the five percent level was about 1.98. Refer to Appendix I for the exact values. If the calculated t-value was greater than 1.98, the null hypothesis was rejected at the

five percent significance level. This meant there existed a statistically significant difference between populations.

(3) ANALYSIS OF VARIANCE (ANOVA)

To analyze the data in a more sophisticated fashion[5/], analysis of variance was employed. Analysis of variance (ANOVA) determines the appropriate pooled error variance s^2 in an "elegant and slightly quicker way"[6/] and provides a single test of the null hypothesis that the population means are equal. In using the ANOVA to test the equality of the means, it is assumed that the population variances are equal.

A two-way ANOVA model was used to investigate the survey data. The data was cross-classified by farm size and state. Two-way ANOVA analyzes the two variables (farm size and state) simultaneously; investigation is made into the variations between states as well as variations between farm size. The ANOVA command of the SPSS program performs all of the calculations necessary to produce an ANOVA table. The computer results are found in Appendix II. For a detailed statistical explanation of ANOVA, refer to Statistical Methods by Snedecor and Cochran (pp. 258-298). For the purposes of this thesis it is only necessary to explain the information presented in the ANOVA table.

Table 6.3 will be used as an example to explain how the tables are to be interpreted. In Table 6.3, the wheat acreage per farm in Minnesota and North Dakota is being tested for the significance of the

differences between farm size (small, medium and large) and between the two states.

The F-statistics (circled under the column marked "F") are used to test the hypothesis that mean wheat acreage of the populations (small, medium and large set-aside farms and Minnesota and North Dakota wheat farms) are the same. The F-statistic for testing the significance of the difference in wheat acreage between Minnesota and North Dakota is 48.175; between farm size, 54.490; between states and farm size (called the interaction term), .252.

The F-statistics were calculated by dividing the respective mean square by the residual mean square(the figure that is circled under the mean square column). The residual mean square is the pooled estimate of the variance for all the populations being tested. It is the figure that is circled under the mean square column in Table 6.3.

An F-statistic greater than 2.00 [7/] indicates that there is a significant difference between the states and between farm size. An F-statistic for interaction greater than 2.00 indicates that there exists significant interaction between the states and farm size, i.e. the central tendancy of the variable (farmer age for example) varies between the populations.

FILE WHETSTAT (CREATION DATE = 81/01/27.)

* * * * * * * * A N A L Y S I S O F V A R I A N C E * * * * * * * *

V8 WHEAT ACREAGE
BY V3 STATE
FMSIZE FARM SIZE

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	8961768.228	3	.298E+07	47.998	.001
V3	2998263.242	1	.299E+07	48.175	.001
FMSIZE	6782568.435	2	.339E+07	54.490	.001
2-WAY INTERACTIONS	31356.641	2	15678.320	.252	.777
V3 FMSIZE	31356.641	2	15678.320	.252	.777
EXPLAINED	8993124.868	5	.179E+07	28.899	.001
RESIDUAL	28380239.850	456	62237.368		
TOTAL	37373364.719	461	81070.205		

585 CASES WERE PROCESSED.
123 CASES (21.0 PCT) WERE MISSING.

Table 6.3 ANOVA on Wheat Acreage for Minnesota and North Dakota Wheat Farms Surveyed in 1978.

Chapter 7

A PROFILE OF THE SMALL FARM AND FARMER FROM THE SURVEY RESULTS

The purpose of this chapter is twofold: The first section of this chapter will explain and point out significant relationships revealed through various methods used to analyze the raw survey data. The first section will be divided into three parts by type of analysis used. The first part will cover aggregate statistics and distribution percentages. The second part explains significant findings uncovered by statistically comparing the means between different farm sizes according to certain characteristic variables. The third and final part reports on results from analysis of variance. In the second section, a profile of the small farm and farmer will be constructed from the survey results.

Throughout this chapter and the rest of the thesis, references will be made to four farm groups. For the purposes of this thesis, the four farm groups are: all wheat farms, all wheat set-aside participant farms, all corn farms and all corn set-aside participant farms.

SECTION I: THE SURVEY RESULTS USED TO CONSTRUCT THE PROFILE

The discussion of survey analysis that follows is divided into three parts according to the method of analysis used. The first part describes simple calculation of mean values and distribution percentages.. The second part describes findings uncovered by

comparison of the means analysis. The third part reports on analysis of variance results.

Part A: Aggregate Values and Distribution Percentages

Part A is divided into two sections. The first will present aggregate values of characteristic variables associated with those farms surveyed. The second section presented distribution percentages of the characteristic variables.

Aggregate Values. Average values per farm for total farm sales, total cropland acreage, wheat acreage, wheat yield, farmer age, debt to asset ratio and total deficiency payments for all wheat farms in Minnesota and North Dakota for the 1978 crop year are presented in Table 7.1. Similar information for Minnesota and Iowa corn farms is presented in Table 7.2.

According to Table 7.1, the general trend among wheat farms is for average total farm sales of set-aside farms to increase as farm size increases. Farm sales of all wheat set-aside farms are greater, on the average, than for all non-set-aside wheat farms. Among set-aside farms, average cropland acres increase as farm size increases. Set-aside wheat farms also have larger average cropland acreage than non-set-aside wheat farms. Average wheat acreage displays trends similar to average cropland acreage. Wheat yield increases with farm size. Farmer age decreases as farm size increases. The average debt to asset ratio increases as farm size increases. Average total deficiency payments increase as farm size increases. Average total

deficiency payments for large wheat set-aside farms are almost six times higher than they are for small set-aside wheat farms.

Corn farm figures displayed in Table 7.2 reveal almost exactly the same trends among the characteristic variables as they did for wheat farms in Table 7.1. Corn set-aside farms, however, do not generate higher average total sales in farm products than non-set-aside corn farms.

Tables 7.1 and 7.2 display only mean values. The trends associated with each characteristic have no statistical significance. Following the next section on distribution percentages, the trends associated with certain characteristic variables will be tested for their statistical significance. This will be presented in Parts B and C of this chapter.

Distribution percentages (I). Table 7.3[1/] contains three sets of information related to the distribution of farm size among wheat and corn farms surveyed. The first column presents the distribution of the farm population among all farms and all set-aside farms. Medium-sized farms are the most numerous type of farm enterprise among wheat and corn farms in all four farm groups. Small-sized farms occur with the second most frequency.

When total cash receipts received is used as the criteria for farm size distribution, in each of the four farm groups, the distribution is skewed towards large farms. In almost every one of the four farm groups, large farms received over fifty percent of the total cash receipts in 1978.

Table 7.1. Average Values Per Farm of Total Farm Sales, Total Cropland Acreage, Wheat Acreage, Wheat Yield, Farmer Age, Debt to Asset Ratio and Total Deficiency Payments for All Wheat Farms in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Farms to be Included	Farm Sales Dollars	Cropland Acreage Acres	Wheat Acreage Acres	Wheat Yield bu/ac.	Farmer Age Years	Debt to Asset Percent	Total Def. Payment Dollars
All Wheat	69,147.66	726	240	31	51	20.1	
All Wheat Non-Set-Aside	69,828.98	588	180	32	51	22.03	
All Wheat Set-Aside	73,532.07	771	261	31	50	20.56	5,918.39
Small Wheat Set-Aside	10,185.85	449	146	28	53	16.2	2,375.87
Medium Wheat Set-Aside	47,505.62	768	258	32	49	21.2	5,813.89
Large Wheat Set-Aside	267,316.45	1402	484	36	45	25.3	12,820.66

Table 7.2. Average Values Per Farm of Total Farm Sales, Total Cropland Acreage, Corn Acreage, Corn Yield, Farmer Age, Debt to Asset Ratio and Total Deficiency Payments for all Corn Farms in Minnesota and Iowa Surveyed for the 1978 Crop Year.

Farms to be Included	Farm Sales Dollars	Cropland Acreage Acres	Corn Acreage Acres	Corn Yield bu/ac.	Farmer Age Years	Debt to Asset Percent	Total Def. Payment Dollars
All Corn	58,028.08	362	172	112	48	19.96	
All Corn Non-Set-Aside	70,331.65	346	177	115	48	20.04	
All Corn Set-Aside	54,003.06	394	180	111	47	20.00	754.61
Small Corn Set-Aside	9,041.95	295	122	103	50	13.5	424.72
Medium Corn Set-Aside	48,708.49	390	185	112	46	23.4	835.34
Large Corn Set-Aside	214,031.32	732	343	129	40	28.0	1462.40

The exception was corn set-aside participants. In this case, large farms received 49.5 percent of the total cash receipts. Among all four farm groups, small farms received less than seven percent of the total cash receipts from farming.

The third column depicts the distribution of farm size as a percentage of total deficiency payments received for the 1978 crop year. Among corn set-aside participants, medium farms received slightly over fifty percent of the total deficiency payments. Small and large set-aside corn farmers split the rest more or less evenly.

Small wheat set-aside farmers received only about thirteen percent of the total deficiency payments for the 1978 crop year. Medium-sized wheat farms received 49.5 percent of the payments and large wheat farms, 37.5 percent.

Distribution percentages (II). Two aspects of the raw survey data were revealed through cross-tabulation. They proved useful in constructing a profile of the small farm and the small farmer. They are:

1) For each characteristic variable selected (these include set-aside program participation, total deficiency payments received per farm, total cropland acreage per farm, farmer age, use of the futures market, on-farm grain storage facilities, type of farm tenancy arrangement, debt to asset ratio and livestock on the farm), the distribution of each variable's attributes was calculated for each of the four farm groups where applicable.

2) For each characteristic variable selected (the sames ones mentioned in (1) above), the distribution of farm size was calculated for each of the four farm groups where applicable.

Tables 7.4 and 7.5[2/] indicate that most wheat and corn farmers, grouped by size, are set-aside participants. The only exception occurs

Table 7.3. Distribution of Farm Size Among All Wheat[a/] and Corn[b/] Farms for the 1978 Crop Year as a Percentage of the Farm Population, Total Cash Receipts Received and Total Deficiency Payments Received.

Crop Type	Farm Size	Dist. of Farm Pop. Among -percent-		Total Cash Receipts Received Among -percent-		Total Def. Payments Received Among -percent-
		All Farms	Set-Aside	All Farms	Set-Aside	Set-Aside Participants
Corn	S[c/]	38.1	38.7	5.4	6.5	21.8
	M	47.3	48.7	38.4	43.9	53.9
	L	14.6	12.5	56.0	49.5	24.2
Wheat	S	34.7	32.2	4.8	4.5	12.9
	M	48.9	50.4	33.6	32.6	49.5
	L	16.2	17.3	61.6	62.9	37.5

a/ Minnesota and North Dakota Wheat Farms Surveyed.
b/ Minnesota and Iowa Corn Farms Surveyed.
c/ S, M, and L refer to Small, Medium, and Large Farms respectively.

among large corn farmers, where a slight majority are non-set-aside participants. The greatest frequency of participation occurs among wheat farmers. This makes sense since the differential between the target price and loan rate for wheat was $1.15 per bushel compared to only ten cents per bushel for corn. Wheat farmers had a greater incentive to participate with the potential for a larger deficiency payment than corn farmers did if the price of wheat fell below the target level.

The distribution of farm size among participants and non-participants shown in Tables 7.6 and 7.7 for wheat and corn farms, respectively, slightly favors medium farms as the most common type of wheat farm set-aside enterprise. Small farms are the most common type of corn farm set-aside operation.

Tables 7.8 and 7.9 display the distribution of total deficiency payments received per farm for wheat and corn farms, respectively. Among all small wheat set-aside farmers, the average total deficiency payments per farm occurring with the highest frequency fell into the $1,000 to $2,499 range. Only thirty-three percent of all small farms fell into this range. The rest of the small farm population was spread thinly throughout every other range of total deficiency payments. Among medium set-aside wheat farms, more fell into the $2,500 to $4,999 range than any other category. Large wheat farms concentrated their numbers between the $2,500 to $20,000 plus range.

According to Table 7.9, corn farmers did not receive large total deficiency payments relative to those received by wheat farmers.

Table 7.4. Distribution of Participation and Non-Participation in the Set-Aside Program Among All Small, Medium, and Large Wheat Farms in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Set-Aside Participant?	Small Wheat Farms		Medium Wheat Farms		Large Wheat Farms	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
YES	168	74	233	77.6	76	75
NO	57	25	66	22	25	25
DON'T KNOW	2	1	1	.3	0	0

Table 7.5. Distribution of Participation and Non-Participation in the Set-Aside Program Among all Small, Medium, and Large Corn Farms in Minnesota and Iowa Surveyed for the 1978 Crop Year.

Set-Aside Participant?	Small Corn Farms		Medium Corn Farms		Large Corn Farms	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
YES	86	66	78	62	19	49
NO	43	33	48	38	20	51
DON'T KNOW	1	1	0	0	0	0

Table 7.6. Distribution of Farm Size Among Farms Participating and Not Participating in the Set-Aside Program for All Wheat Farms in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Set-Aside Participant?	All Wheat Farms		
	Small	Medium	Large
	-percentages-		
YES	35	49	16
NO	38	45	17
DON'T* KNOW	67	33	0

*Only 3 Cases fell into this category.

Table 7.7. Distribution of Farm Size Among Farms Participating and Not Participating in the Set-Aside Program For All Corn Farms in Minnesota and Iowa Surveyed for the 1978 Crop Year.

Set-Aside Participant?	All Corn Farms		
	Small	Medium	Large
	-percentages-		
YES	47	43	10
NO	39	43	19
DON'T KNOW	100	--	--

Table 7.8. Distribution of Total Deficiency Payments Received Per Farm Among All Small, Medium, and Large Wheat Farms in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Total Def. Payments Per Farm (Dollars)	Small Wheat Farms		Medium Wheat Farms		Large Wheat Farms	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
0 - 49	7	4	0	0	0	0
50 - 99	2	1	0	0	0	0
100 - 249	8	5	0	0	0	0
250 - 499	13	8	7	3	2	3
500 - 749	14	8	9	4	0	0
750 - 999	9	5	8	3	2	3
1000 - 2499	55	33	35	15	3	4
2500 - 4999	41	24	65	28	10	13
5000 - 7499	11	7	42	18	12	16
7500 - 9999	5	3	32	14	5	7
10000 - 19999	3	2	32	14	28	37
20000 plus	0	0	3	1	13	17

Table 7.9. Distribution of Total Deficiency Payments Received Per Farm Among All Small, Medium, and Large Corn Farms in Minnesota and Iowa Surveyed for the 1978 Crop Year.

Total Def. Payments Per Farm (Dollars)	Small Corn Set-Aside Participants		Medium Corn Set-Aside Participants		Large Corn Set-Aside Participants	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
0 - 49	7	8	0	0	0	0
50 - 99	8	9	1	1	0	0
100 - 249	15	17	9	11	1	5
250 - 499	28	33	22	28	2	11
500 - 749	13	15	21	27	1	5
750 - 999	7	8	9	12	3	16
1000 - 2499	7	8	11	14	9	47
2500 - 4999	1	1	4	5	3	16
7500 - 9999			1	1		

The greatest number of small and medium farms, respectively, fell into the $250 to $499 range. Large corn farms peaked within the $1,000 to $2,499 range. The differences in the amount of the total deficiency payment per bushel received by wheat and corn farmers can account for the differences in the size of the total deficiency payments per farm between crop type. Wheat farmers in Minnesota and North Dakota received fifty cents per bushel in deficiency payments. Corn farmers in Minnesota and Iowa received only three cents per bushel in deficiency payments.

The distribution of farm size within specified amounts of total deficiency payments received per farm is presented for wheat and corn farmers, respectively, in Tables 7.10 and 7.11. Small farms dominate (not surprisingly) farm numbers exclusively within the $0 to $49 range of total deficiency payments per farm among all wheat and corn set-aside farms. The overall trend is for the small farm population to diminish as the level of total deficiency payments per farm increases. Medium wheat farms dominate the range of payments between $2,500 and $10,000. Large wheat farms dominate the $20,000 and over range.

According to Table 7.11, medium corn farms consistently dominate the range of deficiency payments from $500 to $4,999. Large corn farm numbers never dominate any one range of payments, but their numbers increase as the amount of payments per farm goes up.

Tables 7.12a, 7.12b, 7.13a and 7.13b present the distribution of total cropland acreage per farm. Comparison between crop type among all four farm groups reveals that the highest frequency of medium and

Table 7.10. Distribution of Farm Size Within Specified Amounts of Total Deficiency Payments Received Per Farm for All Wheat Set-Aside Participants in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Total Def. Payments Per Farm	Wheat Set-Aside Participants		
	Small	Medium	Large
-dollars-	-percentages-		
0-49	100	0	0
50-99	100	0	0
100-249	89	0	11
250-499	59	32	9
500-749	61	39	0
750-999	47	42	11
1000-2499	59	38	3
2500-4999	35	56	9
5000-7499	17	65	18
7500-9999	12	76	12
10000-19999	15	51	44
20000 plus	0	19	81

Table 7.11. Distribution of Farm Size Within Specified Amounts of Total Deficiency Payments Received Per Farm for All Corn Set-Aside Participants in Minnesota and Iowa Surveyed for the 1978 Crop Year.

Total Def. Payments Per Farm	Corn Set-Aside Participants		
	Small	Medium	Large
-dollars-		-percentages-	
0-49	100	0	0
50-99	89	11	0
100-249	60	36	4
250-499	54	42	4
500-749	37	60	3
750-999	37	47	16
1000-2499	26	41	33
2500-4999	12.5	50	37.5

large wheat farms occur at a larger total cropland acreage interval than do corn farms of similar sales size. Small wheat and corn farms are both the most numerous at the 220 to 499 acreage range of total cropland.

Among all wheat and corn set-aside participants, the same trends occur as described above.

Comparing between farm sizes, medium and large wheat farms are more numerous at higher levels of total cropland acreage than small wheat farms. Among corn farms, large farms achieve higher levels of total cropland acres per farm than medium or small farms.

Tables 7.14 and 7.15 present the distribution of farm size within specified amounts of total cropland acreage per farm. Among all of the four farm groups, small farms achieve their greatest domination of any one range at the 1 to 99 acres interval. Among small farms in each of the four farm groups, this domination is followed by a steady decline in the number of small farms as acreage per farm increases. Exceptions occur among small corn farms and small set-aside corn farms. In these two farm groups, there is a slight increase in small farm numbers beginning at the 1,000 to 1,999 acres range.

Medium farms peaked in numbers within the 500 to 999 acres range in each of the four farm groups. The exception occurred with the all corn farm group. Large farms in each of the four farm groups peaked at the 2,000 acres and over interval.

Table 7.12a. Distribution of Total Cropland Acreage Per Farm Among All Small, Medium, and Large Wheat Set-Aside Participants in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Cropland Acreage Per Farm (Acres)	Small Wheat Set-Aside Participants		Medium Wheat Set-Aside Participants		Large Wheat Set-Aside Participants	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
1-99	12	7	0	0	0	0
100-219	36	22	9	39	1	14
220-499	66	40	62	27	7	10
500-999	37	22	100	43	19	26
1000-1999	14	8	57	25	29	40
2000 plus	1	1	4	17	17	23

Table 7.12b. Distribution of Total Cropland Acreage Per Farm Among All Small, Medium, and Large Wheat Farms in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Cropland Acreage Per Farm (Acres)	Small Wheat Farms		Medium Wheat Farms		Large Wheat Farms	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
1-99	26	10	2	0.5	0	0
100-219	65	25	17	5	2	2
220-499	100	38	99	30	9	9
500-999	48	18	134	40	30	29
1000-1999	21	8	76	23	37	36
2000 plus	3	1	5	1.5	25	24

Table 7.13a. Distribution of Total Cropland Acreage Per Farm Among All Small, Medium, and Large Corn Set-Aside Participants in Minnesota and Iowa Surveyed for the 1978 Crop Year.

Cropland Acreage Per Farm (Acres)	Small Corn Set-Aside Participants		Medium Corn Set-Aside Participants		Large Corn Set-Aside Participants	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
1-99	9	10	2	3	0	0
100-219	26	30	12	16	1	5.5
220-499	38	44	42	55	4	22
500-999	8	9	18	24	9	50
1000-1999	4	5	2	3	3	17
2000 plus	1	1	0	0	1	5.5

Table 7.13b. Distribution of Total Cropland Acreage Per Farm Among All Small, Medium, and Large Corn Farms in Minnesota and Iowa Surveyed for the 1978 Crop Year.

Cropland Acreage Per Farm (Acres)	All Small Farms		All Medium Farms		All Large Farms	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
1-99	26	18	2	2	0	0
100-219	45	32	29	26	1	1
220-499	57	40	55	49	10	13
500-999	9	6	22	20	9	50
1000-1999	4	3	3	3	6	8
2000 plus	1	1	0	0	1	1

Table 7.14. Distribution of Farm Size Within Specified Amounts of Total Cropland Acreage Per Farm for All Wheat Farms and Wheat Set-Aside Participants in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Total Cropland Acreage Per Farm	All Wheat Farms			Wheat Set-Aside Participants		
	Small	Medium	Large	Small	Medium	Large
-acres-	-percentages-			-percentages-		
1-99	93	7	0	100	0	0
100-219	77	20	2	78	20	2
220-499	48	48	4	49	46	5
500-999	23	63	14	24	64	12
1000-1999	16	57	28	14	57	29
2000 plus	9	15	76	5	18	77

Table 7.15. Distribution of Farm Size Within Specified Amounts of Total Cropland Acreage Per Farm for All Corn Farms and Corn Set-Aside Participants in Minnesota and Iowa Surveyed for the 1978 Crop Year.

Total Cropland Acreage Per Farm	All Corn Farms			Corn Set-Aside Participants		
	Small	Medium	Large	Small	Medium	Large
-acres-	-percentages-			-percentages-		
1-99	93	7	0	81	19	0
100-219	60	39	1	66	31	3
220-499	38	55	7	45	50	4
500-999	17	41.5	41.5	23	51	26
1000-1999	31	23	46	44	22	33
2000 plus	50[a/]		50	50[b/]		50

a/ Only two cases occurred in the 2000 acre plus range among all corn farms.

b/ Only two cases occurred in the 2000 acre plus range among all corn set-aside participants.

Tables 7.16a, 7.16b, 7.17a and 7.17b contain the distribution of farm operator age for each of the four farm groups. According the Tables 7.16a and 7.16b, small and medium wheat and wheat set-aside operators most frequently fall into the 55-64 years of age category. Large wheat and wheat set-aside farmers appear to be significantly younger (this statement will be tested later on). The greatest percentage of large wheat and wheat set-aside farmers fall into the 35 to 44 years of age group.

Small and medium corn and corn set-aside farmers, shown in Tables 7.17a and 7.17b, most frequently fall into the 45 to 54 years of age category. Large corn and corn set-aside farms occur with the most frequency within the 25 to 34 years of age group.

The distribution of farm size within farm operator age groups is shown in Tables 7.18 and 7.19 for wheat and corn farmers, respectively. Among all four farm groups, the trend appears to be for age to increase as farm size decreases. Among wheat farmers, this trend begins at ages between 35 and 44. Small wheat and wheat set-aside farmers, however, do dominate the 24 years of age and below group. Among corn and corn set-aside farmers, the number of small farms increases as farmer operator age increases beginning with the youngest age group (except among small set-aside corn farmers, where the steady rise in their numbers begins at the 25 to 34 years of age group).

Table 7.16a. Distribution of Farm Operator Age Among All Small, Medium, and Large Wheat Set-Aside Participants in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Farmer Age (Years)	Small Wheat Set-Aside Participants		Medium Wheat Set-Aside Participants		Large Wheat Set-Aside Participants	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
24 and below	5	3	1	0.4	3	4
25-34	19	12	34	15	11	14
35-44	11	7	43	18	26	34
45-54	34	21	63	27	15	20
55-64	55	34	72	31	17	22
65 and above	39	24	15	6	4	5

Table 7.16b. Distribution of Farm Operator Age Among All Small, Medium, and Large Wheat Farms in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Farmer Age (Years)	Small Wheat Farms		Medium Wheat Farms		Large Wheat Farms	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
24 and below	7	3	3	1	3	3
25-34	27	11	43	13	17	16
35-44	20	8	55	16	30	28
45-54	49	19	96	28	21	20
55-64	93	36	108	32	29	27
65 and above	59	23	23	7	5	5

Table 7.17a. Distribution of Farm Operator Age Among All Small, Medium, and Large Corn Set-Aside Participants in Minnesota and Iowa Surveyed for the 1978 Crop Year.

Farmer Age (Years)	Small Corn Set-Aside Participants		Medium Corn Set-Aside Participants		Large Corn Set-Aside Participants	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
24 and below	1	1	2	3	0	0
25-34	7	8	16	20.5	11	58
35-44	19	22	16	20.5	3	16
45-54	29	34	25	32	4	21
55-64	24	28	17	22	1	5
65 and above	5	6	2	3	0	0

Table 7.17b. Distribution of Farm Operator Age Among All Small, Medium, and Large Corn Farms in Minnesota and Iowa Surveyed for the 1978 Crop Year.

Farmer Age (years)	All Small Farms		All Medium Farms		All Large Farms	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
24 and below	1	1	5	4	0	0
25-34	13	9	25	18	14	34
35-44	24	17	25	18	8	20
45-54	42	30	42	30	12	29
55-64	40	29	33	24	6	15
64 and above	19	14	7	5	1	2

Table 7.18. Distribution of Farm Size Within Farm Operator Age Groups for All Wheat Farms and Wheat Set-Aside Participants in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Farmer Age (years)	All Wheat Farms			Wheat Set-Aside Participants		
	Small	Medium	Large	Small	Medium	Large
	-percentages-			-percentages-		
1-24	54	23	23	56	11	33
25-34	31	49	20	30	53	17
35-44	19	52	29	14	54	32
45-54	29	58	13	30	56	13
55-64	40	47	13	38	50	12
65 plus	68	26	6	67	26	7

Table 7.19. Distribution of Farm Size Within Farm Operator Age Groups for All Corn Farms and Corn Set-Aside Participants in Minnesota and Iowa for the 1978 Crop Year.

Farmer Age (years)	All Wheat Farms			Corn Set-Aside Participants		
	Small	Medium	Large	Small	Medium	Large
1-24	17	83	0	33	67	0
25-34	25	48	27	21	47	32
35-44	42	44	14	50	42	8
45-54	44	44	12	50	43	7
55-64	51	42	7	57	40	2
65 plus	70	26	4	71	29	0

Tables 7.20a, 7.20b, 7.21a and 7.21b indicate that an overwhelming percentage of all farms in each of the four farms groups do not use the futures marekt. Of those who do use the futures market, set-aside participants dominate the numbers. From the information given in the tables below, it is calculated that among those farmers who use the futures market:

1) Within the small wheat farm group, seventy percent were set-aside participants. Among medium wheat farms, seventy-nine percent were set-aside participants. Among large wheat farms, eighty-two percent were set-aside participants.

2) Within the small corn farm group, ninety-four percent of the farmers were set-aside participants. Medium and large corn set-aside farmers made up fifty and thirty-three percent, respectively, among those medium and large corn farmers who used the futures market.

The distribution of farm size according to futures market use is presented in Tables 7.22 and 7.23 for wheat and corn farmers, respectively. Among all wheat and wheat set-aside farms, the figures in Table 7.22 reveal that medium farms are the most common type of wheat enterprise using and not using the futures market. This reflects the distribution of farm size among the entire farm population more than it does the futures market use.

Referring to Table 7.23, it can be seen that among all corn and corn set-aside farmers, the small farmer dominates the distribution of both use and non-use of the futures market.

Table 7.20a. Distribution of Use and Non-Use of the Futures Market Among All Small, Medium, and Large Wheat Set-Aside Participants in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Use the Futures Market?	Small Wheat Participants		Medium Wheat Participants		Large Wheat Participants	
	Number of Farms	% of All Small Participants	Number of Farms	% of All Medium Participants	Number of Farms	% of All Large Participants
YES	7	4.8	11	6	9	13
NO	138	95.1	186	94	61	87

Table 7.20b. Distribution of Use and Non-Use of the Futures Market Among All Small, Medium, and Large Wheat Farms in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Use the Futures Market?	Small Wheat Farms		Medium Wheat Farms		Large Wheat Farms	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
YES	10	4.3	14	4	11	11
NO	221	95.6	374	96	86	89

Table 7.21a. Distribution of Use and Non-Use of the Futures Market Among All Small, Medium, and Large Corn Set-Aside Participants in Minnesota and Iowa Surveyed for the 1978 Crop Year.

Use the Futures Market?	Small Corn Participants		Medium Corn Participants		Large Corn Participants	
	Number of Farms	% of All Small Participants	Number of Farms	% of All Medium Participants	Number of Farms	% of All Large Participants
YES	15	19	7	10	3	19
NO	64	81	60	90	13	81

Table 7.21b. Distribution of Use and Non-use of the Futures Market Among All Small, Medium, and Large Corn Farms in Minnesota and Iowa Surveyed for the 1978 Crop Year.

Use the Futures Market?	Small Corn Farms		Medium Corn Farms		Large Corn Farms	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
YES	16	12.5	14	12	9	24
NO	112	87.5	105	88	28	76

Table 7.22. Distribution of Farm Size Among Farm Using and Not Using the Futures Market for All Wheat Farms and Wheat Set-Aside Participants in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Participant in Futures Market	All Wheat Farms			Wheat Set-Aside Participant		
	Small	Medium	Large	Small	Medium	Large
	Percentages					
YES	29	40	31	26	41	33
NO	38	47	15	36	48	16

Table 7.23. Distribution of Farm Size Among Farms Using and Not Using the Futures Market for All Corn Farms and Corn Set-Aside Participants in Minnesota and Iowa Surveyed for the 1978 Crop Year.

Use the Futures Market	All Corn Farms			Corn Set-Aside Participant		
	Small	Medium	Large	Small	Medium	Large
	Percentages					
YES	41	36	23	60	28	12
NO	46	43	11	47	44	9

Tables 7.24a, 7.24b, 7.25a and 7.25b indicate that an overwhelming percentage of all farms in each of the four farm groups have on-farm grain storage facilities. Calculations from the tables also reveal that in most cases, among those farms with on-farm grain storage facilities, the majority are set-aside participating farms.

Using the figures in Tables 7.24a and 7.24b, it can be calculated that among small wheat farms with on-farm grain storage facilities, sixty-two percent were set-aside participating farms. Among large wheat farms with on-farm grain storage facilities, seventy-three percent participated in the set-aside program. Only twenty-four percent of all medium-sized wheat farms, however, had on-farm grain storage facilities and were set-aside participating farms.

Among small corn farms with grain storage facilities, it can be calculated from the figures in Tables 7.25a and 7.25b that sixty-four percent were set-aside participating farms. Fifty-seven and forty-three percent of all medium and large corn farms with grain storage facilities, respectively, were set-aside participating farms.

Table 7.26 indicates that among those wheat farms without grain storage facilities, the majority (among both wheat and wheat set-aside farm groups) are small farms.

The evidence in Table 7.27 suggests that small farms comprise the majority of farm numbers among all corn farms without grain storage facilities.

Among both wheat and corn farms, the majority of farms with on-farm grain storage facilities are medium-sized farms.

Table 7.24a. Distribution of Having and Not Having Farm Grain Storage Facilities Among All Small, Medium, and Large Wheat Set-Aside Participants in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Farm Grain Storage Facilities	Small Wheat Participants		Medium Wheat Participants		Large Wheat Participants	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
HAVE	130	88	69	99	69	99
DON'T HAVE	18	12	1	1	1	1

Table 7.24b. Distribution of Having and Not Having Farm Grain Storage Facilities Among All Small, Medium, and Large Wheat Farms in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Farm Grain Storage Facilities	Small Wheat Farms		Medium Wheat Farms		Large Wheat Farms	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
HAVE	209	89	286	96	95	98
DON'T HAVE	26	11	11	4	2	2

Table 7.25a. Distribution of Having and Not Having Farm Grain Storage Facilities Among Small, Medium, and Large Corn Set-Aside Participants in Minnesota and Iowa Surveyed for the 1978 Crop Year.

Farm Grain Storage Facilities	Small Corn Participants		Medium Corn Participants		Large Corn Participants	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
HAVE	77	97	64	96	16	100
DON'T HAVE	2	3	3	4	0	0

Table 7.25b. Distribution of Having and Not Having Farm Grain Storage Facilities Among Small, Medium, and Large Corn Farms in Minnesota and Iowa Surveyed for the 1978 Crop Year.

Farm Grain Storage Facilities	Small Corn Farms		Medium Corn Farms		Large Corn Farms	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
HAVE	120	93	113	94	37	100
DON'T HAVE	9	7	7	6	0	0

Table 7.26. Distribution of Farm Size Among Farms With and Without Farm Grain Storage Facilities for All Wheat Farms and Wheat Set-Aside Participants in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Farm Grain Storage Facilities	All Wheat Farms			Wheat Set-Aside Participant		
	Small	Medium	Large	Small	Medium	Large
	-percentages-					
HAVE	35	48	16	33	50	17
DON'T HAVE	67	28	5	75	21	4

Table 7.27. Distribution of Farm Size Among Farms With and Without Farm Grain Storage Facilities for All Corn Farms and Corn Set-Aside Participants in Minnesota and Iowa for the 1978 Crop Year.

Farm Grain Storage Facilities	All Corn Farms			All Corn Set-Aside Participant		
	Small	Medium	Large	Small	Medium	Large
	-percentages-					
HAVE	44	42	14	49	41	10
DON'T HAVE	60	40	0	40	60	0

Tables 7.28a, 7.28b, 7.29a and 7.29b indicate that a majority of small farmers own one hundred percent of their farmland. A smaller majority of all medium and medium set-aside farmers also own one hundred percent of their land. Large wheat and corn farms (all farms and all set-aside farms) fall into various farm tenancy arrangements. Using the figures in Tables 7.28a, 7.28b, 7.29a and 7.29b, it can be shown that small wheat and corn set-aside participants comprise over fifty percent of all small corn and wheat farmers, respectively, who own all of their farmland.

Large farms never dominate any one type of farm tenancy arrangement. Tables 7.30 and 7.31 suggest that small farms dominate the farm population among those farmers who own all of their farmland. Medium-sized farms,in each of the four farm groups, vary in their dominance of different farm tenancy arrangements.

Table 7.28a. Distribution of Different Farm Tenancy Arrangements Among All Small, Medium, and Large Wheat Set-Aside Participants in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Farm*/ Tenancy Arrangement	Small Wheat Set-Aside Participants		Medium Wheat Set-Aside Participants		Large Wheat Set-Aside Participants	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
1	92	54.7	71	30	14	18
2	34	20.2	80	34	22	29
4	8	4.7	17	7	7	9
6	11	6.5	42	18	22	29
7	18	10.7	19	8	8	10.5
0	5	2.9	4	2	3	4

*/ Codes for Farm Tenancy Arrangements are:

1 - Own 100%
2 - Own more than rent but not 100%
4 - Own 50% and rent 50%
6 - rent more than own but not 100%
7 - Rent 100%
0 - no answer/none of the above

Table 7.28b. Distribution of Different Farm Tenancy Arrangements Among All Small, Medium, and Large Wheat Farms in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Farm*/ Tenancy Arrangement	Small Wheat Farms		Medium Wheat Farms		Large Wheat Farms	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
1	153	57.5	105	31	19	18
2	45	16.9	109	32	39	37
4	14	5.2	27	8	10	9
6	16	6.0	60	18	25	23.5
7	28	10.5	27	8	8	7.5
0	10	3.7	9	3	5	5

*/ Codes for Farm Tenancy Arrangements are:

1 - own 100%
2 - own more than rent but not 100%
4 - own 50% and rent 50%
6 - rent more than own but not 100%
7 - rent 100%

Table 7.29a. Distribution of Farm Tenancy Arrangements Among All Small, Medium, and Large Corn Set-Aside Participants in Minnesota and Iowa Surveyed for the 1978 Crop Year.

Farm*/ Tenancy Arrangement	Small Corn Set-Aside Participants		Medium Corn Set-Aside Participants		Large Corn Set-Aside Participants	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
1	40	47	24	31	2	11
2	20	23	16	21	5	26
4	5	6	12	15	1	5
6	15	17	15	19	6	32
7	6	7	10	13	5	26
0	0	0	1	1	0	0

*/ Codes for Farm Tenancy Arrangements are:

1 - Own 100%
2 - Own more than rent but not 100%
4 - Own 50% and rent 50%
6 - Rent more than own but not 100%
7 - Rent 100%
0 - No answer/none of the above

Table 7.29b. Distribution of Farm Tenancy Arrangements Amcng All Small, Medium, and Large Corn Farms in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Farm*/ Tenancy Arrangement	All Small Farms		All Medium Farms		All Large Farms	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
1	77	54	44	32	5	12
2	24	17	25	18	12	29
4	8	6	15	11	2	5
6	18	13	28	20	12	29
7	13	9	23	17	10	24
0	2	1	4	3	0	0

*/ Codes for Farm Tenancy Arrangements are:

1 - Own 100%
2 - Own more than rent but not 100%
4 - Own 50% and rent 50%
6 - Rent more than own but not 100%
7 - Rent 100%
0 - No answer/none of the above

Table 7.30. Distribution of Farm Size Among Farms Under Different Farm Tenancy Arrangements for All Wheat Farms and Wheat Set-Aside Participants in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Farm*/ Tenancy Arrangement	All Wheat Farms			Wheat Set-Aside Participants		
	Small	Medium	Large	Small	Medium	Large
			- percentages -			
1	55	38	7	52	40	8
2	23	56	20	25	59	16
4	27	53	20	25	53	22
6	16	59	25	15	56	29
7	44	43	13	40	42	18
0	42	37	21	42	33	25

*/ Codes for Farm Tenancy Arrangements are:

1 - Own 100%
2 - Own more than rent but not 100%
4 - Own 50% and rent 50%
6 - Rent more than own but not 100%
7 - Rent 100%
0 - No answer/none of the above

Table 7.31. Distribution of Farm Size Among Farms Under Different Farm Tenancy Arrangements for All Corn Farms and Corn Set-Aside Participants in Minnesota and Iowa Surveyed for the 1978 Crop Year.

Farm*/ Tenancy Arrangement	All Corn Farms			All Corn Set-Aside Participants		
	Small	Medium	Large	Small	Medium	Large
	-percentages-					
1	61	35	4	61	36	3
2	39	41	20	49	39	12
4	32	60	8	28	67	5
6	31	48	21	42	42	17
7	28	50	22	28	48	24
0	33	67	0	0	100	0[2]

*/ Codes for Farm Tenancy Arrangements are:

1 - Own 100%
2 - Own more than rent but not 100%
4 - Own 50% and rent 50%
6 - Rent more than own but not 100%
7 - Rent 100%
0 - No answer/none of the above

According to Tables 7.32a, 7.32b, 7.33a and 7.33b, a sizable majority of all wheat and corn farms have debt to asset ratios of twenty-five percent and under. Small farms in each of the four farm groups achieve the highest frequency of occurence at the twenty-five percent and under level within the small farm group relative to medium and large farm groups. The underlying trend appears to depict the debt to asset ratio rising as farm size increases. Reasons for this trend can be tied to the higher capital requirements of large farms relative to small ones.

Tables 7.34 and 7.35 present the distribution of farm size according to the debt to asset ratio for wheat and corn farms, respectively. Among wheat farms in Minnesota and North Dakota, medium farms dominate the population at every level of debt to asset ratio.

In Table 7.35, it can be seen that small corn and corn set-aside farms comprised the majority of the farm numbers that had debt to asset ratios twenty-five percent and under. At debt to asset ratios above twenty-five percent, medium corn and corn set-aside farms were the most numerous type of farm enterprise.

Table 7.32a. Distribution of Debt to Asset Ratio Among All Small, Medium, and Large Wheat Set-Aside Participants in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Debt Asset Ratio -percent-	Small Wheat Set-Aside Participants		Medium Wheat Set-Aside Participants		Large Wheat Set-Aside Participants	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
25 and under	141	84	180	77	47	62
26 to 74	22	13	45	19	29	38
75 and above	5	3	8	3	0	0

Table 7.32b. Distribution of Debt to Asset Ratio Among All Small, Medium, and Large Wheat Farms in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Debt Asset Ratio -percent-	Small Wheat Farms		Medium Wheat Farms		Large Wheat Farms	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
25 and under	230	86	262	78	67	63
26 to 74	31	12	63	19	38	36
75 and above	5	19	12	3	1	1

Table 7.33a. Distribution of Debt to Asset Ratio Among All Small, Medium, and Large Corn Set-Aside Participants in Minnesota and Iowa Surveyed for the 1978 Crop Year.

Debt Asset Ratio -percent-	Small Corn Set-Aside Participants		Medium Corn Set-Aside Participants		Large Corn Set-Aside Participants	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
25 and under	73	85	55	70	12	63
26 to 74	13	15	20	26	7	37
75 and above	0	0	3	4	0	0

Table 7.33b. Distribution of Debt to Asset Ratio Among All Small, Medium, and Large Corn Farms in Minnesota and Iowa Surveyed for the 1978 Crop Year.

Debt Asset Ratio -percent-	Small Corn Farms		Medium Corn Farms		Large Corn Farms	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
25 and under	120	84	104	75	27	66
26 to 74	21	15	30	22	13	32
75 and above	1	1	5	3	1	2

Table 7.34. Distribution of Farm Size According to the Debt to Asset Ratio of All Wheat Farms and Wheat Set-Aside Participants in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Debt Asset Ratio -percent-	All Wheat Farms			Wheat Set-Aside Participants		
	Small	Medium	Large	Small	Medium	Large
25 and under	41	47	12	38	49	13
26 to 74	23	48	29	23	47	30
75 and above	28	67	5	38	62	0

Table 7.35. Distribution of Farm Size According to the Debt to Asset Ratio of All Corn Farms and Corn Set-Aside Participants in Minnesota and Iowa Surveyed for the 1978 Crop Year.

Debt Asset Ratio -percent-	All Corn Farms			Corn Set-Aside Participants		
	Small	Medium	Large	Small	Medium	Large
25 and under	48	41	11	52	39	9
26 to 74	33	47	20	33	50	17
75 and above	14	71	14	0	100	0

Tables 7.36a, 7.36b, 7.37a and 7.37b reveal that a majority of all wheat and wheat set-aside farms do not have livestock. A majority of corn and corn set-aside farms, however, do have livestock. This is not a surprising revelation. Many corn farms in Minnesota and Iowa are combination hog-corn or corn-feeder livestock operations. Wheat farms are generally a straight crops-only farm operation. It is interesting to note, however, that the majority of wheat farmers who do have livestock are set-aside participants.

Looking at Tables 7.36a and 7.36b, one can calculate that sixty-eight percent of all small wheat farmers with livestock participated in the set-aside program. Sixty-eight percent of all medium wheat farmers with livestock were set-aside participants. Among large wheat farmers with livestock, seventy-two percent were set-aside participants.

From the information given in Tables 7.37a amd 7.37b, one can calculate that fifty-eight percent of all small corn farmers with livestock were set-aside participants. Among medium-sized corn farmers with livestock, fifty-six percent participated in the set-aside program. Large corn set-aside farmers comprised only forty-three percent of all large corn farms with livestock.

Among all wheat and corn farms with livestock, medium farms were the most numerous, as shown in Tables 7.38 and 7.39. Small farms dominated the farm population among those all corn, all wheat and all corn set-aside farms without livestock. Within the wheat set-aside farm group, medium farms held a slight edge in numbers among those wheat set-aside farms without livestock.

Table 7.36a. Distribution of Farms With and Without Livestock Among All Small, Medium, and Large Wheat Set-Aside Participants in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Livestock	Small Wheat Set-Aside Participants		Medium Wheat Set-Aside Participants		Large Wheat Set-Aside Participants	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
HAVE	63	38	111	48	34	45
DON'T HAVE	103	61	116	50	40	53
NO ANSWER	2	1	6	2	2	2

Table 7.36b. Distribution of Farms With and Without Livestock Among All Small, Medium, and Large Wheat Farms in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Livestock	Small Wheat Farms		Medium Wheat Farms		Large Wheat Farms	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
HAVE	93	35	163	48	47	44
DON'T HAVE	167	63	165	49	57	54
NO ANSWER	6	2	9	3	2	2

Table 7.37a. Distribution of Farms With and Without Livestock Among All Small, Medium, and Large Corn Set-Aside Participants in Minnesota and Iowa Surveyed for the 1978 Crop Year.

Livestock	Small Corn Set-Aside Participants		Medium Corn Set-Aside Participants		Large Corn Set-Aside Participants	
	Number of Farms	% of All	Number of Farms	% of All	Number of Farms	% of All
HAVE	46	53	57	73	13	68
DON'T HAVE	40	47	21	27	61	32
NO ANSWER	--	--	--	--	--	--

Table 7.37b. Distribution of Farms With and Without Livestock Among All Small, Medium, and Large Corn Farms in Minnesota and Iowa Surveyed for the 1978 Crop Year.

Livestock	Small Corn Farms		Medium Corn Farms		Large Corn Farms	
	Number of Farms	% of All	Number of of Farms	% of All	Number of Farms	% of All
HAVE	79	56	101	73	30	73
DON'T HAVE	62	44	37	26	11	27
NO ANSWER	1	--	1	1	0	0

Table 7.38. Distribution of Farm Size Among Farms With and Without Livestock for All Wheat Farms and Wheat Set-Aside Participants in Minnesota and North Dakota Surveyed for the 1978 Crop Year.

Livestock	All Wheat Farms			Wheat Set-Aside Participants		
	Small	Medium	Large	Small	Medium	Large
	-percentages-					
HAVE	31	54	15	30	53	16
DON'T HAVE	43	42	15	40	45	15
NO ANSWER	35	53	12	20	60	20

Table 7.39. Distribution of Farm Size Among Farms With and Without Livestock for All Corn Farms and Corn Set-Aside Participants in Minnesota and Iowa Surveyed for the 1978 Crop Year.

Have Livestock	All Corn Farms			Corn Set-Aside Participants		
	Small	Medium	Large	Small	Medium	Large
	-percentages-					
YES	38	48	14	40	49	11
NO	56	34	10	60	31	9
NO ANSWER	50	50	0	--	--	--

Part B: Comparison of the Mean Values

The results of tests to determine the statistical significance[3/] of any differences between the mean values of characteristic variables for the four types of farm populations are reported in this section.

Mean values of six characteristic variables among small set-aside farms were compared with the mean values of the same six characteristic variables among small non-set-aside participating farms, medium set-aside farms and large set-aside farms. The actual statistical work can be found in Appendix I. Table 7.40 and 7.41 contain the final results of the significance tests that were employed for corn and wheat farms respectively.

Tests comparing the mean values of small participating farms and small non-participating farms revealed no significant differences among most of the characteristic variables. There were two exceptions:

1) Total cropland acreage and corn acreage among small set-aside farms were significantly larger than the total cropland and corn acreage among non-set-aside small corn farms.

2) The test statistic was not conclusive enough to make a decision about the significance of the difference between the population means of total farm sales among small corn set-aside and small corn non-set-aside farms (this test result is not included in Table 7.40, but it is in Appendix I).

The results of the tests performed on the two small farm populations for each crop type (corn and wheat) would lead one to believe that there exist few differences between the populations in terms of the characteristic variables being tested. Thus, the significance tests suggest that small set-aside farmers are not different from small non-set-aside farmers in terms of the physical and

financial attributes of their farms (exceptions previously noted). They also do not differ significantly in age.

Tests conducted to determine the significance of any differences that existed between small and medium set-aside farms revealed the existence of significant differences between the two populations for both crop types. According to Tables 7.40 and 7.41, there is statistical evidence for significant differences for all of the characteristic variables for wheat and corn farms. Exceptions occur among wheat farmers involving the debt to asset ratio and among corn farmers involving total cropland acreage. Between small and medium wheat set-aside farms, no statistically significant differences exist between their debt to asset ratios. The same statement can be said about small and medium corn farms and their total cropland acreage.

Medium set-aside farms received significantly larger total deficiency payments per farm, farmed significantly larger acreages (exception noted above) and specific crop (wheat or corn) acreages, achieved higher yields and experienced higher debt to asset ratios (exception noted above) than small set-aside farms. Medium set-aside farmers were also significantly younger than small set-aside farmers.

The same significant differences were observed between the large set-aside farmers and the small set-aside farmers with no exceptions. Refer to Tables 7.40 and 7.41.

Table 7.40. A Summary of the Results of Tests Performed on the Means of Six Characteristic Variables To Determine Any Statistical Significance of Differences Between Farm Sizes and Differences Between Small Set-Aside Participants and Small Non-Set-Aside Participants, Minnesota-Iowa Corn, 1978.

Small Corn Participants Compared To	CHARACTERISTIC VARIABLES Total Payments	Total Cropland	Total Corn Acres	Total Corn Yield	Farmer Age	Debt to Asset Ratio
Non-Part. Small Farms		Small Participant Farms Have Significant Larger Acreage	Small Participant Farms Have Significant Larger Acreage	No Significant Difference	No Significant Difference	No Significant Difference
Medium Part. Farms	Medium Farms Have Significant Larger Payments	No Significant Difference	Medium Farms Have Significant Larger Acreage	Medium Farms Have Significant Higher Yield	Small Farmers are Significant Older	Medium Farms Have Significant Higher Debt to Asset Ratio
Large Part. Farms	Large Farms Have Significant Larger Payments	Large Farms Have Significant Larger Acreage	Large Farms Have Significant Higher Yield	Large Farms Have Significant Higher Yield	Small Farmers Are Significant Older	Large Farmers Have Significant Higher Debt to Asset Ratio

Table 7.41. A Summary of the Results of Tests Performed on the Means of Six Characteristic Variables to Determine Any Statistical Significance of Difference Between Farm Sizes and Differences Between Small Set-Aside Participants and Small Non-Set-Aside Participants, Minnesota-North Dakota Wheat, 1978.

Small Wheat Participants Compared to	CHARACTERISTIC VARIABLES Total Payments	Total Cropland	Total Wheat Acres	Total Wheat Yield	Farmer Age	Debt to Asset Ratio
Non-Part. Small Farms		No Significant Difference	No Significant Difference	No Significant Difference	No Significant Difference	No Significant Difference
Medium Part. Farms	Medium Farms Have Significant Larger Payments	Medium Farms Have Significant Larger Acreage	Medium Farms Have Significant Larger Acreage	Medium Farmers Have Significant Higher Yield	Small Farmers Are Significant Older	No Significant Difference
Large Part. Farms	Large Farms Have Significant Larger Payments	Large Farms Have Significant Larger Acreage	Large Farms Have Significant Larger Acreage	Large Farms Have Significant Higher Yield	Small Farmers Are Significant Older	Large Farms Have Significant Higher Debt to Asset

Part C: Analysis of Variance (ANOVA)

Figures 7.1a, 7.1b through 7.6a, 7.6b visually express the results of analysis of variance (ANOVA) performed on the Minnesota-North Dakota wheat and Minnesota-Iowa corn survey data. Only set-aside participants were used in this analysis.

ANOVA was the final method of analysis because of the technique's ability to pool the variances of all the data groups (grouped by state) in a more sophisticated fashion than the simpler method of comparing mean values. ANOVA also permitted comparison between states as well as farm size. This adds an extra dimension of contrast to the results, permitting the reader to judge how set-aside farmers vary between states.

The actual ANOVA tables can be found in Appendix II, Section A. The figures presented in this section are referenced to the tables they portray.

In each of the twelve figures, mean values for Minnesota-North Dakota wheat and Minnesota-Iowa corn for each characteristic variable, for each farm size, are graphed and the points connected to form a rough trend line. Each trend line is bordered by two lines which connect the standard error of the mean value associated with each farm size. The standard error was calculated by taking the square root of the residual mean squared of the characteristic variable(taken from the associated ANOVA table) and dividing it by the square root of the number of farms that make up each farm size group. The plotted mean values and their respective standard errors are recorded in Appendix II,

Section B.

By graphing the ANOVA results and combining them with the mean values of each farm size for each characteristic variable, a central tendancy, or trend, emerges that suggests the behavior of each characteristic variable as farm size changes.

Accompanying each figure are F-statistics that indicate the statistical significance of the difference between states, between farm size and a third F-statistic that determines the significance of the interaction between states and among farm size. Directly beside each F-statistic (in parenthesis) is the critical F-statistic associated with it. The absolute value of an F-statistic that is greater than the associated critical F-statistic indicates that there is a statistically significant difference between states and between farm size. A statistically significant interaction F-statistic suggests that the patterns of the state lines in each graph are different (i.e., overall, the trend lines are not parallel to one another). If the interaction F-statistic is not significant, the statistical evidence suggests that differences are consistent between the states (i.e., the trend lines are parallel overall).

In Figures 7.1a and 7.1b, the trend lines suggest that among Minnesota, North Dakota and Iowa farms, total deficiency payments per farm increase as farm size increases. Looking specifically at Figure 7.1a and Minnesota-North Dakota wheat farms, the state F-statistic indicates that there is a significant difference in total deficiency payments per farm between Minnesota and North Dakota. The graph

supports this suggestion. The farm size F-statistic (89.2) strongly suggests that there exists a significant difference between the size of total deficiency payments per farm at different farn size levels. The interaction F-statistic reveals that differences are consistent between the states; the interaction F-statistic is not significant.

The F-statisitics for Minnesota-Iowa corn farmers shown in Figure 7.1b indicate significant differences in the size of the total deficiency payments between the states and between farm size. The interaction F-statistic indicates significant interaction between the states and among different farm sizes; the patterns of the trend lines are different. The shaded portions in Figure 7.1b mark the areas of intersections of the standard error boundaries of the two corn states. The areas of intersection show where along the farm size range there exists doubt as to whether the differences in total deficiency payments per farm between the states and between farm size are significant.

Comparison of Figures 7.1a and 7.1b indicate that the trend in the size of total deficiency payments per farm as farm size increases is very consistent between North Dakota and Minnesota wheat farms but not so for Minnesota and Iowa corn farms. Overall, the trend associated with total deficiency payments per farm is for them to increase as farm size increases, however the course that total deficiency payments take to achieve this trend varies between wheat and corn farmers.

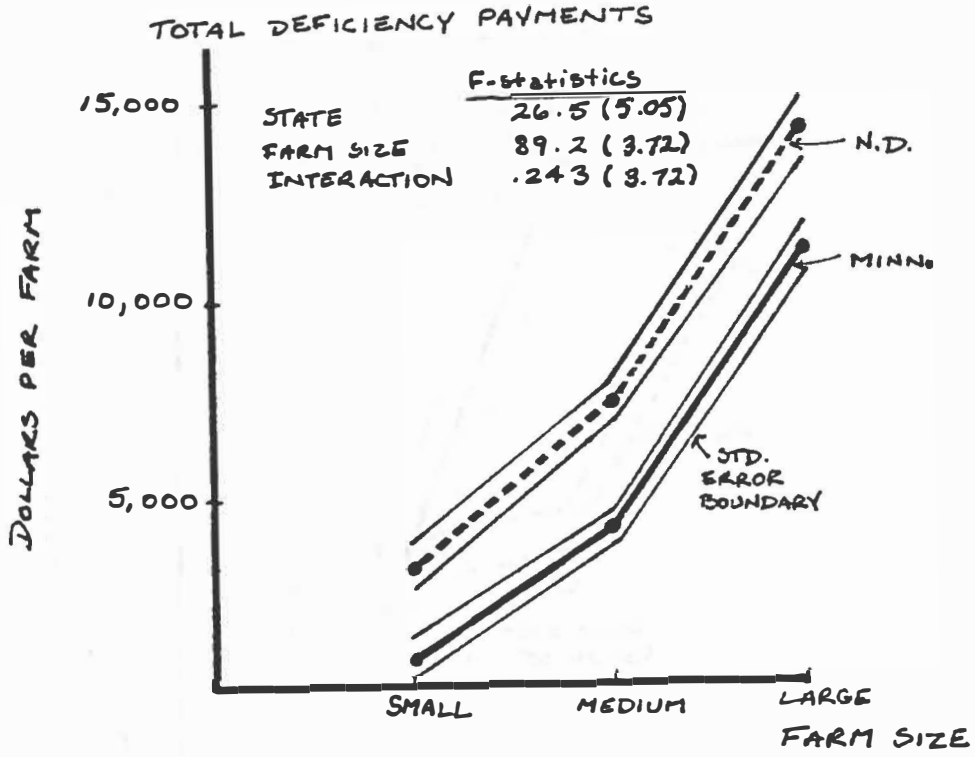

FIGURE 7.12. ANOVA ON TOTAL DEFICIENCY PAYMENTS, MINN.-N.D. WHEAT (ANOVA TABLE A.1, APPENDIX II)

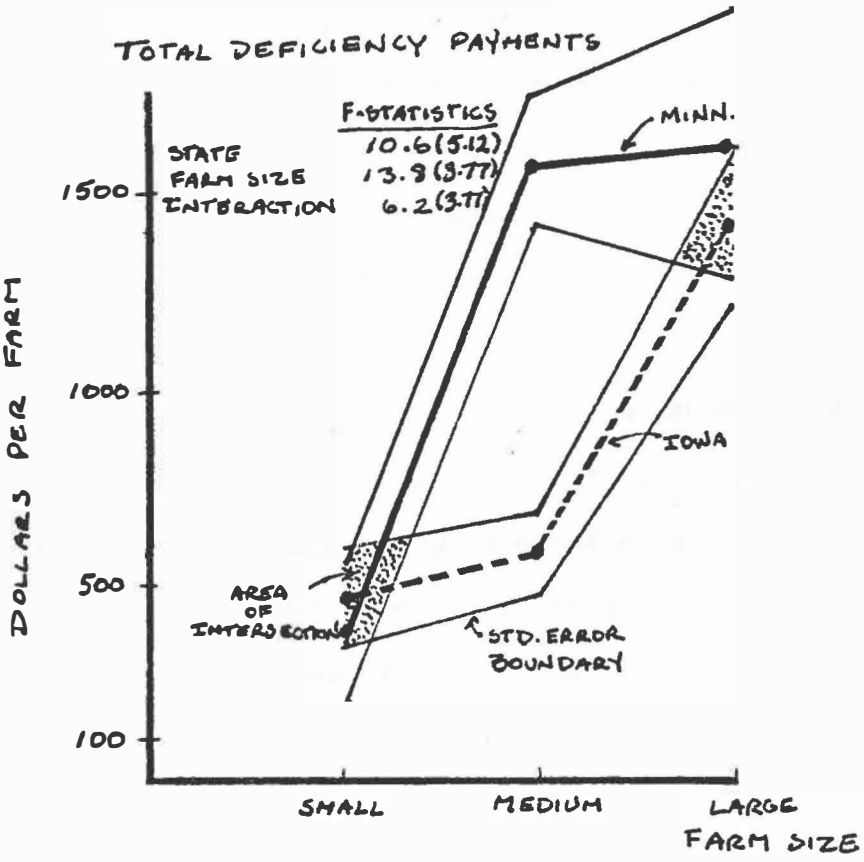

FIGURE 7.1b. ANOVA ON TOTAL DEFICIENCY PAYMENTS, MINN.-IOWA CORN (ANOVA TABLE A.7, APPENDIX II)

Figures 7.2a and 7.2b indicate that among wheat and corn farmers in Minnesota, North Dakota and Iowa, total cropland acreage per farm increases with farm size (as defined in terms of farm sales).

Among wheat farmers, the F-statistics in Figure 7.2a indicate that significant differences in the total cropland acreage per farm exist between Minnesota and North Dakota wheat farms and between farm size. The interaction F-statistic reveals no statistically significant interaction between the states and farm size; the graph supports this conclusion.

Figure 7.2b presents the trend in total cropland acreage per farm for Minnesota and Iowa corn farms. The F-statistic for interaction suggests significant interaction; the patterns in the states lines are not consistent with each other. The F-statistic for farm size indicates statistically significant differences between farm size. According to the F-statistic for state, no significant differences exist between total cropland acreage per farm in Minnesota and Iowa. The two areas of intersection which mark the crossover points probably account for this statistical result of non-significance.

Mean wheat acreage and the trend lines for Minnesota and North Dakota are graphed in Figure 7.3a. The F-statistics indicate significant differences in wheat acreage between states and among farm size. The trend lines are parallel, indicating no significant interaction. The non-significant F-statistic supports this observation.

Mean corn acreage in Minnesota and Iowa and their respective trend lines are graphed in Figure 7.3b. The F-statistic for state indicates

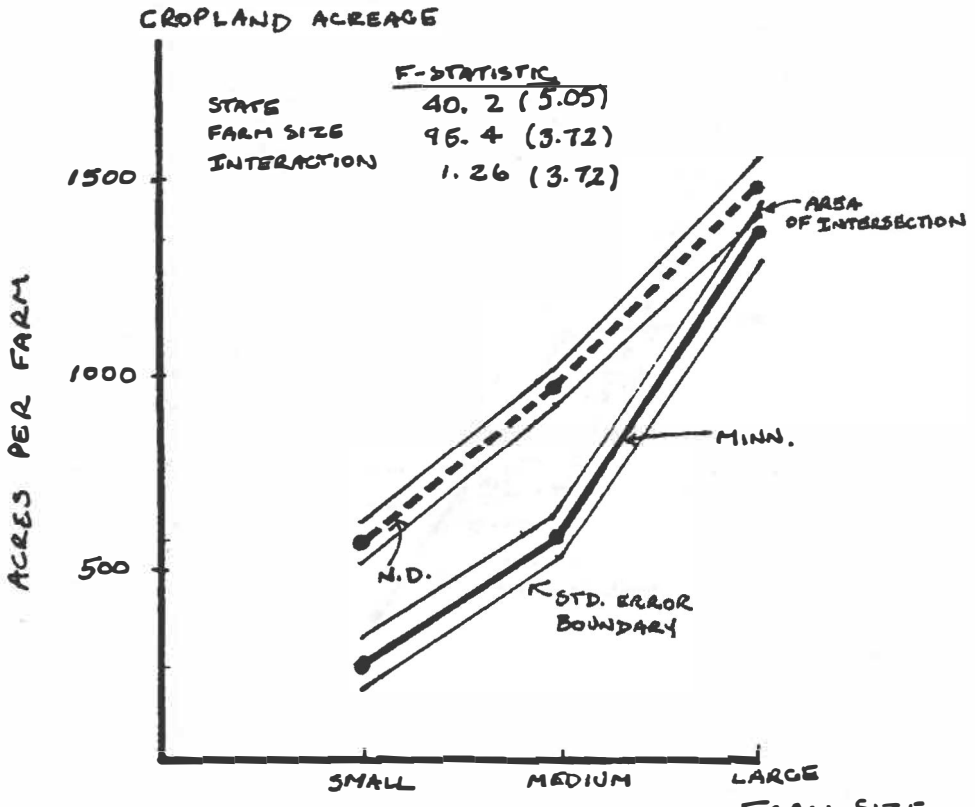

FIGURE 7.2a. ANOVA ON CROPLAND ACREAGE, MINN.-N.D. WHEAT. (ANOVA TABLE A.2, APPENDIX II)

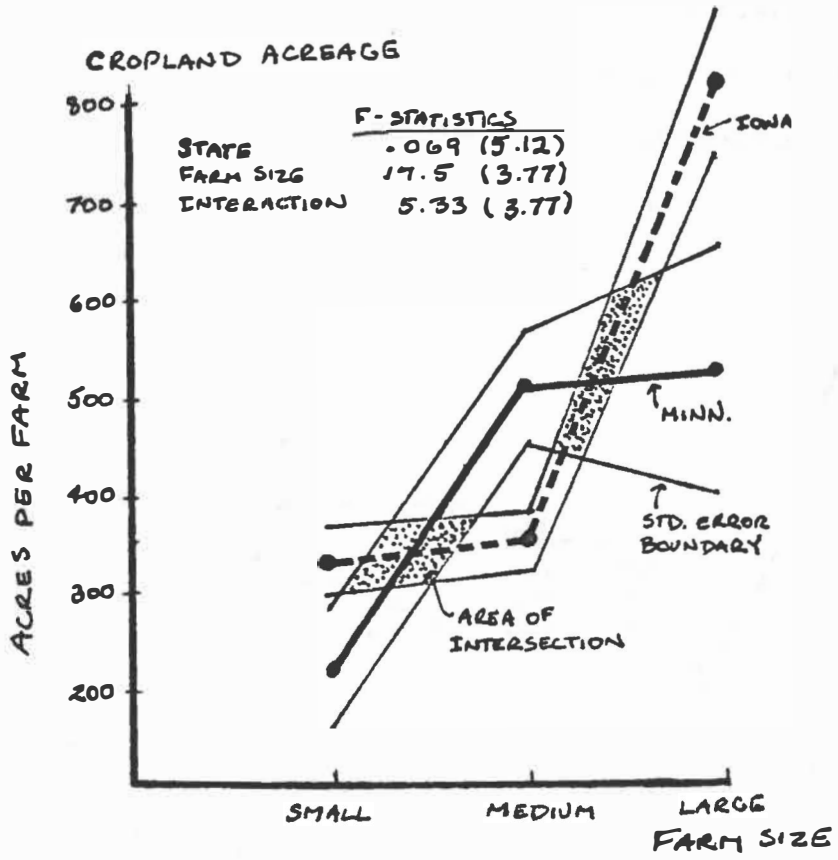

FIGURE 7.2b. ANOVA ON CROPLAND ACREAGE, MINN. - IOWA CORN. (ANOVA TABLE A.8, APPENDIX II)

no overall significant differences in corn acreage between Minnesota and Iowa. Looking at the graph in Figure 7.3b, however, there appears to be differences between small and large farms. Two crossovers in the middle of the graph probably caused the state F-statistic to indicate no significance. The barely significant interaction F-statistic picked up this crossover effect. Significant differences exist between farm sizes, in terms of corn acreage. Both the graph and the farm size F-statistic indicate this to be so.

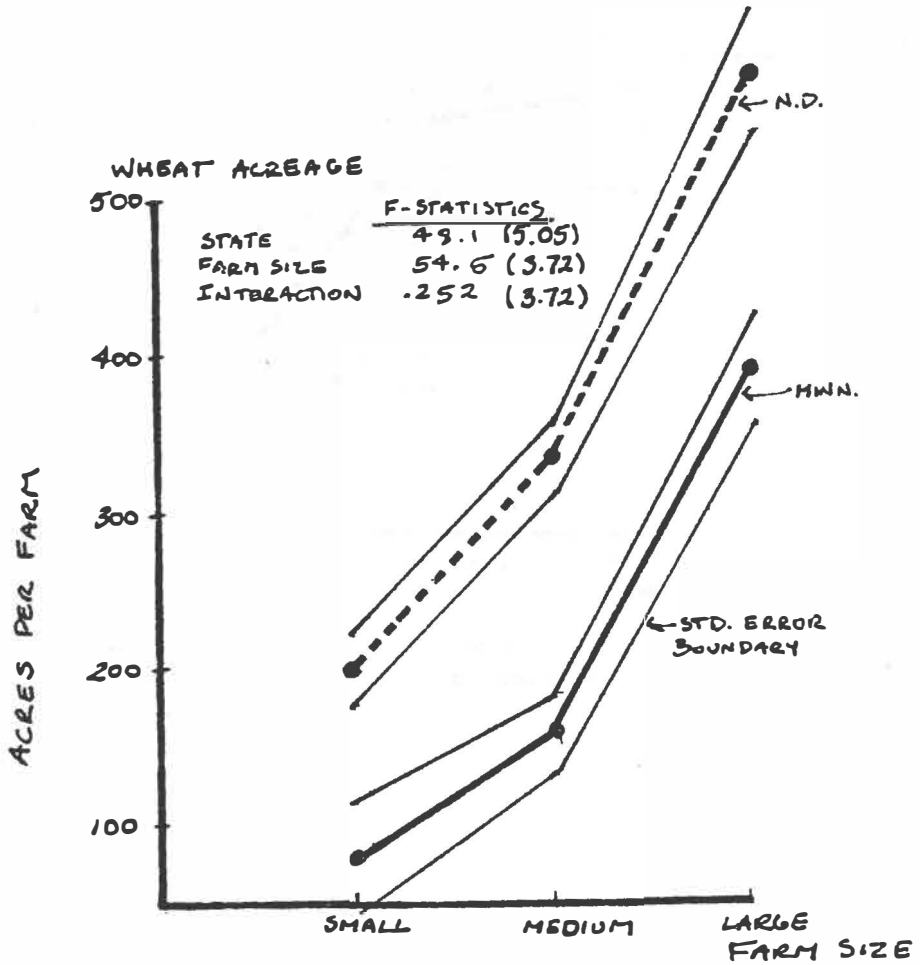

FIGURE 7.3a. ANOVA ON WHEAT ACREAGE, MINN.-N.D. WHEAT (ANOVA TABLE A.3, APPENDIX II)

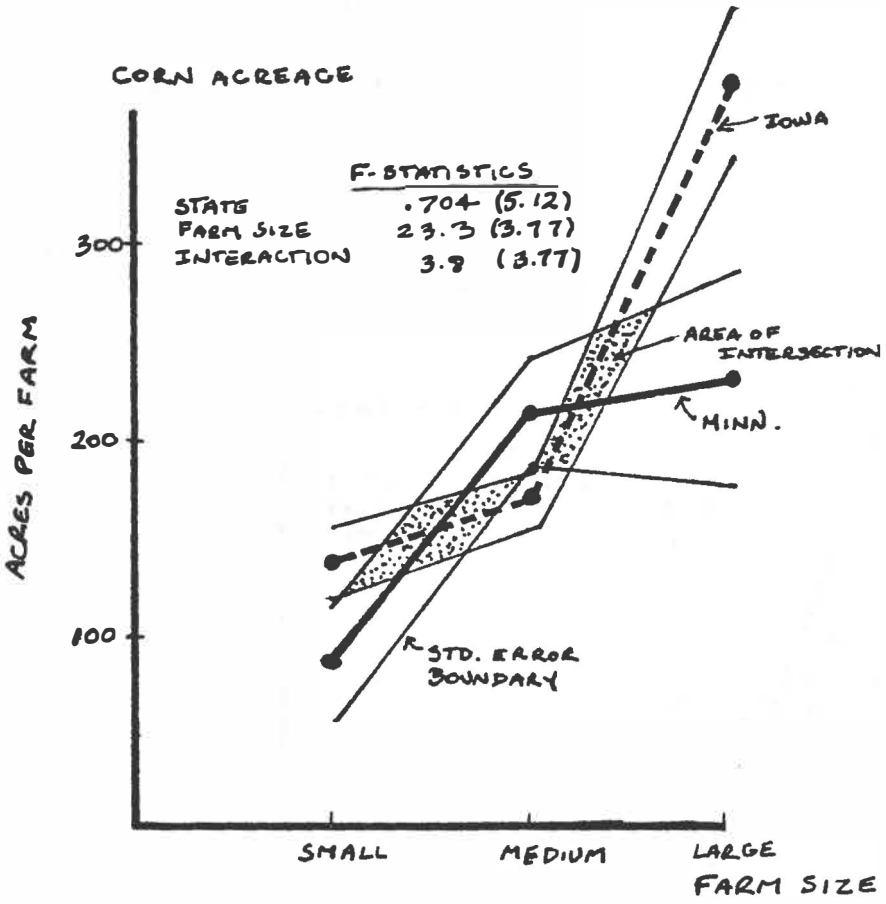

FIGURE 7.3b. ANOVA ON CORN ACREAGE, MINN. - IOWA CORN (ANOVA TABLE A.9, APPENDIX II).

A crossover of trend lines in the Minnesota and North Dakoata wheat yield graph in Figure 7.4a below caused the F-statistic for states to indicate no significant differences in wheat yield between the two states. The interaction F-statistic, however, has failed to pick up the crossover effect (this is probably caused by the fact that, overall, the trend lines are consistent in their directions up and to the right). Overall, the trend is for wheat yield to increase with farm size. The farm size F-statistic is significant, indicating that there are differences in wheat yield as farm size changes.

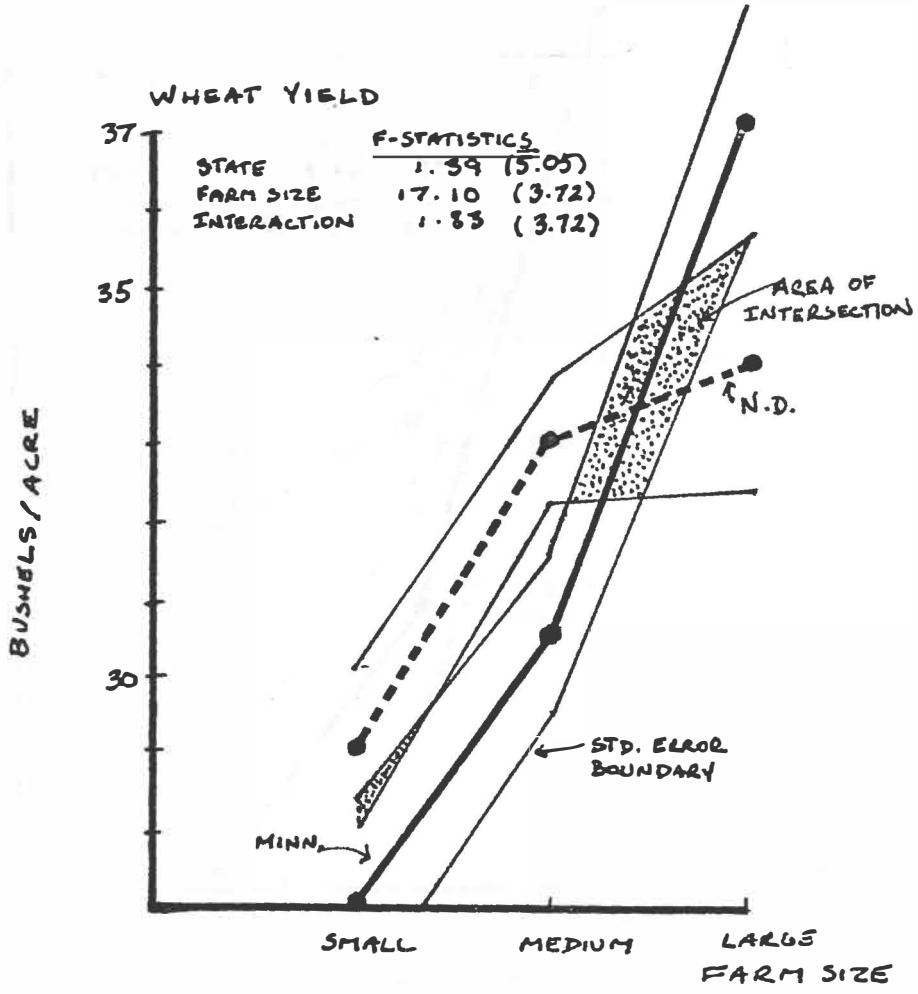

FIGURE 7.4a. ANOVA ON WHEAT YIELD, MINN.-N.D. WHEAT (ANOVA TABLE A.4, APPENDIX II)

The graph in Figure 7.4b and the F-statistics associated with it reveal significant differences between the corn yields of Minnesota and Iowa corn farmers and between farm size. The strength of those differences, particularly at the small farm level, override the effect of the crossover -- enough to cause the interaction F-statistic to indicate no significant interaction. Overall, corn yield increases as farm size increases.

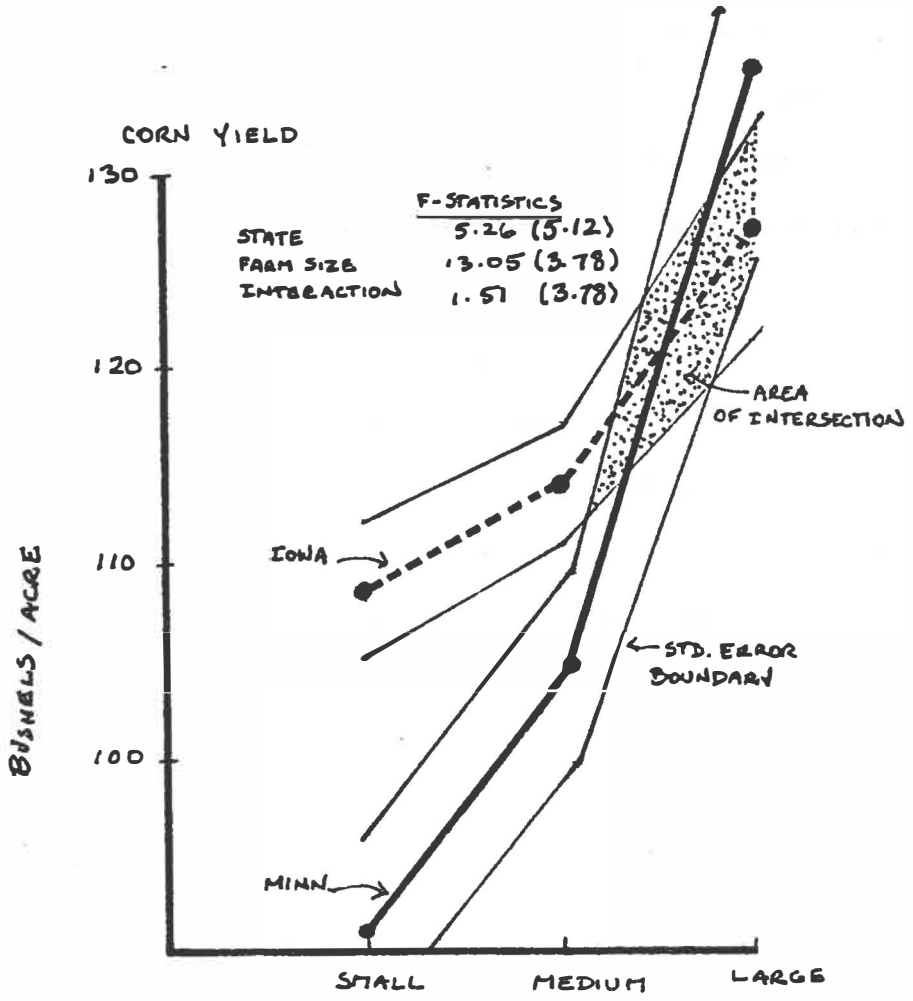

FIGURE 7.4b. ANOVA ON CORN YIELD, MINN.-IOWA CORN (ANOVA TABLE A.10, APPENDIX II)

As farm size increases, farm operator age decreases. This tendancy is illustrated in Figures 7.5a and 7.5b for wheat and corn farms, respectively. Between the states, for both wheat and corn farms, the F-statistics indicate no significant differences in farmer age. Between farm size, for both wheat and corn farms, the F-statistics indicate significant diferences. This statistical evidence is supported by the direction of the trend lines in both Figures 7.5a and 7.5b.

Among wheat farmers, the interaction F-statistic indicates no significant interaction between the states overall and among farm size. Although the trend lines do crossover, the differences between the lines were probably not significant enough to be picked up by the interaction F-statistic. This can be seen for Minnesota and North Dakota wheat farmers in Figure 7.5a.

Among Minnesota and Iowa corn farmers, the F-statistic for interaction in Figure 7.5b indicates no significant interaction. Here again, as in the case of wheat farmers, the overall trend between the lines was not different enough to affect the interaction F-statistic.

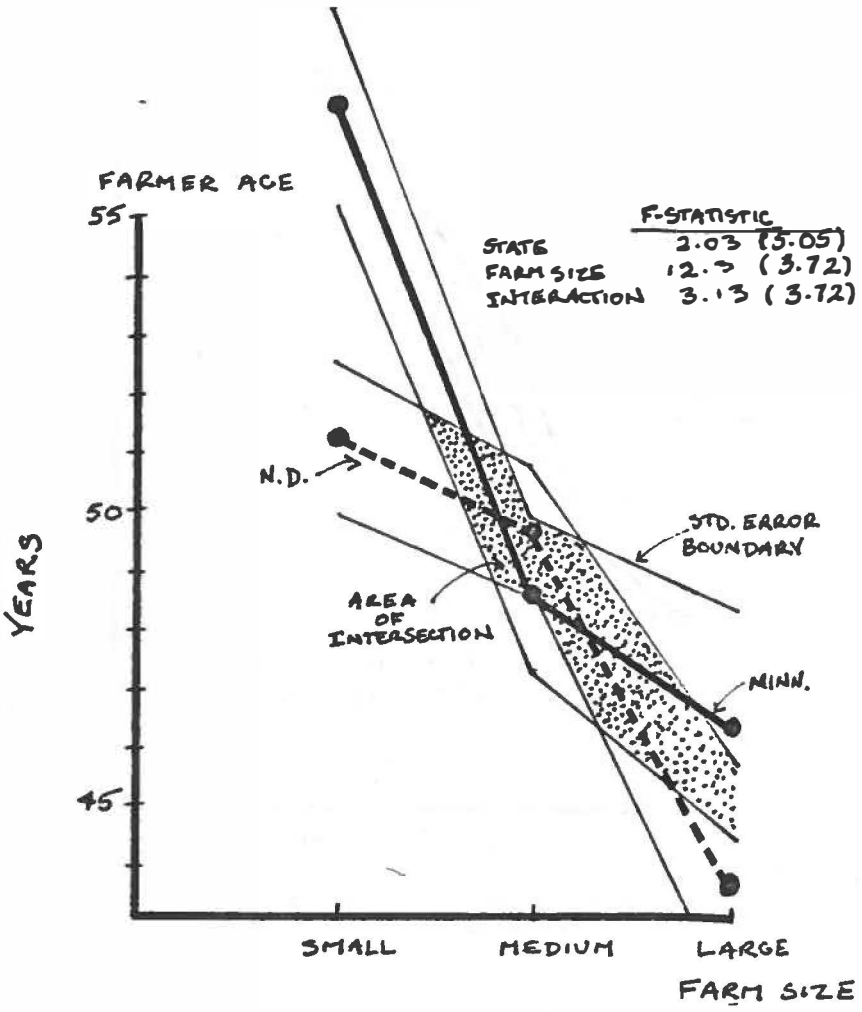

FIGURE 7.5a. ANOVA ON FARMER AGE, MINN. - N.D. WHEAT (ANOVA TABLE A.5, APPENDIX II)

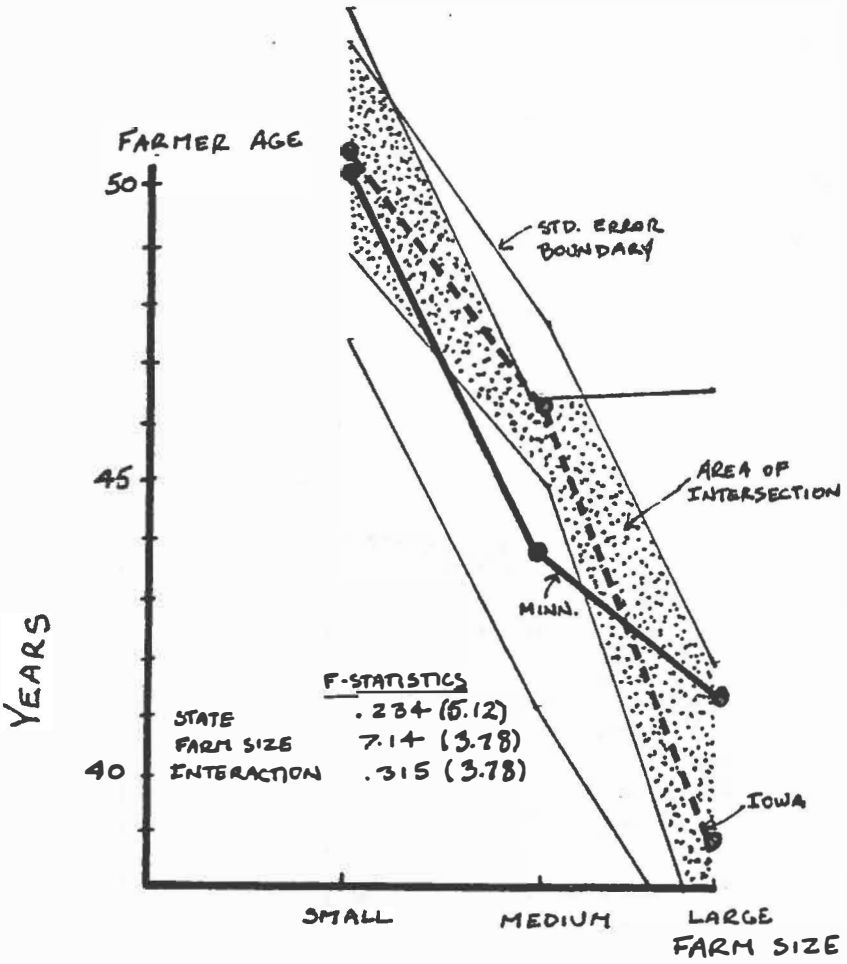

FIGURE 7.5b. ANOVA ON FARMER AGE MINN.-IOWA CORN, (ANOVA TABLE A.11; APPENDIX II).

Overall, the debt to asset ratio does not differ significantly between Minnesota and North Dakota wheat farmers according to the F-statisitic shown in Figure 7.6a below. This is because the overlapping of the standard error boundaries suggest that there is doubt as to the existence of significant differences between the states. The non-significant interaction F-statistic indicates that the patterns between the lines are not different. Overall, the graph indicates that this statement is true. The F-statistic for farm size indicates no significant differences in the debt to asset ratio between farm size overall.

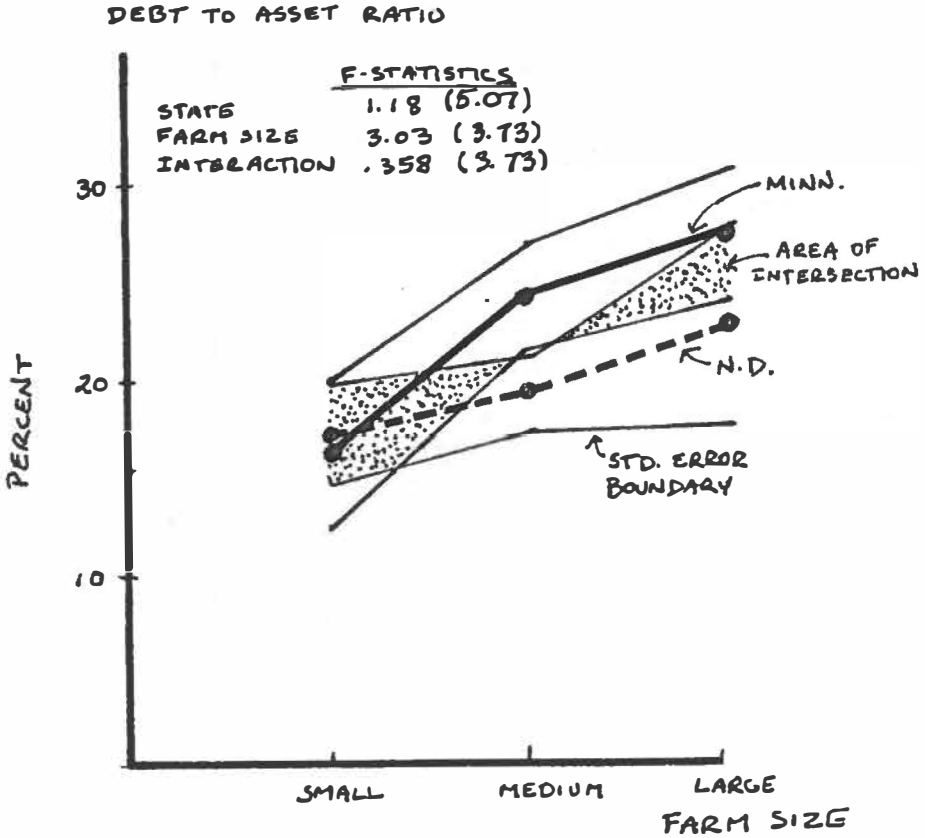

FIGURE 7.6a. ANOVA ON DEBT-TO-ASSET RATIO, MINN. - N.D. WHEAT (ANOVA TABLE A.6, APPENDIX II).

Similar to tendancies in wheat farmers, Minnesota and Iowa corn farmers exhibit no significant differences in their debt to asset ratios. The state F-statistic and the graph in Figure 7.6b , below, support this observation. The interaction F-statistic indicates no significant interaction; overall, the patterns between the two trend lines are similar.

The farm size F-statistic for corn, unlike that for wheat, indicates that the debt to asset ratio is significantly different between farm size. The debt to asset ratio exhibits a tendancy to increase as farm size increases among Minnesota and Iowa corn farms.

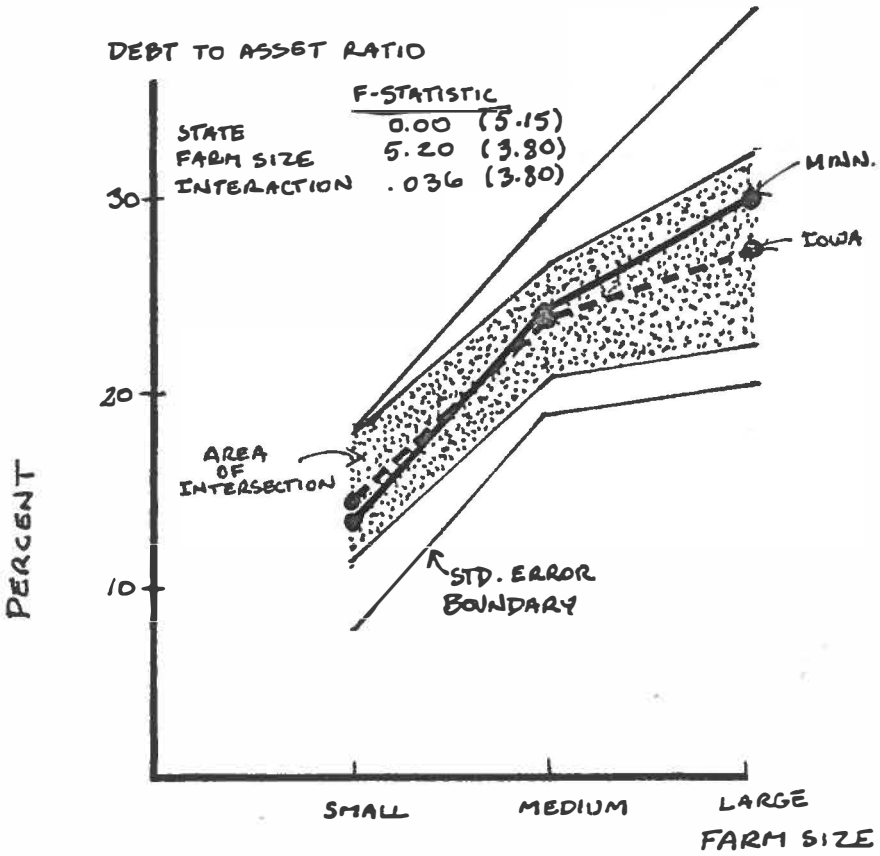

FIGURE 7.6 b. ANOVA ON DEBT-TO-ASSET RATIO, MINN-IOWA CORN (ANOVA TABLE A.12, APPENDIX II).

It is clear from the ANOVA results just presented that differences exist between the states being compared and combined in this analysis. The main purpose of using ANOVA was to fulfill the objectives of this thesis, but the method also provided a test for determining whether it was correct to combine data from different states. If significant differences do exist between the states, then careful thought should be given to combining the data in order to avoid wide variations and deviations from mean values.

Since the results of this thesis are taken from combined data groups, the validity of the results will have to be judged on the relevance of combining data by states. Although differences in mean values existed for some of the characteristic variables between states, overall the trends of the characteristic variables between the states were consistent.

SECTION II: THE CONSTRUCTED PROFILE OF THE SMALL FARM AND SMALL FARMER

Twelve characteristic variables served to develop a profile of the small farm and the small farmer in a comparative setting with medium and large farms. To summarize the results given in the preceding section, a synopsis of the knowledge known about each characteristic variable, derived from the survey results as related to the small farm, is given below:

1) Total Farm Sales Per Farm: This variable was used to group the wheat and corn farms into three size groups, small, medium and large. Contrary to national figures cited in Chapter 5, small farms in Minnesota-North Dakota and Minnesota-Iowa do not comprise a majority of the farm population. Medium farms do.

2) Set-Aside Participation: Overall, a majority of all farms among both wheat and corn farms within each size class are set-aside participants. Participation among small farms is roughly equivalent and in some cases greater than participation among medium and large farms.

3) Total Deficiency Payments: Small wheat and corn farmers receive significantly smaller total payments per farm. The trend was for total deficiency payments per farm to increase with farm size.

4) Farmer Operator Age: Small wheat and corn farmers are significantly older than their medium and large farmer neighbors. The overall trend is for farmer age to decrease as farm size increases.

5) Total Cropland Acreage Per Farm: The overall trend for this variable is for total cropland acreage to increase with farm size. Significant differences exist between small and medium and large farms.

6) Total Wheat and Corn Acreage Per Farm: The overall trend among wheat and corn farms is for wheat and corn acreage , respectively, to increase with farm size. Significant differences exist between small and medium and large farms.

7) Wheat and Corn Yield: On the average, small farmers achieve significantly lower yields than either medium or large farmers. The overall trend was for crop yield to increase with farm size.

8) Futures Market Use: A majority of small farmers (as well as medium and large farmers) do not use the futures market. Among those small farmers who do use the futures market, an overwhelming majority were set-aside participants.

9) Ownership of On-Farm Storage Facilities: A majority of all farmers, both wheat and corn, own on-farm grain storage facilities. Of those without storage facilities, however, small farms comprised the majority. Among those small wheat and corn farmers with grain storage facilities, a majority were set-aside participants.

10) Farm Tenancy Arrangements: Small farmers tend to own all of their land and they are among the majority who do so.

11) Debt to Asset Ratio: Small farmers have significantly lower debt to asset ratios than medium or large farms (except for wheat farms, according to the ANOVA results). The trend is for the debt to asset ratio to increase with farm size.

12) Ownership of Livestock on the Farm: A majority of wheat farmers do not have livestock on their farm. A majority of corn farmers do. Among small wheat farmers with livestock, a majority were set-aside participants. A majority of small corn farmers with livestock also were set-aside participants.

To construct a small farm and small farmer profile for Minnesota, North Dakota and Iowa, the twelve characteristic variables were fitted into six categories relating to the business characteristics of the farm firm. These are: Sales and Income, Assets, Productivity, Net Worth, Subsidies and Methods to Minimize Risk. The following profile of the small farm and small farmer emerges as suggested by the national farm data and analysis on the survey data:

Sales and Income: The small farm generates significantly smaller farm sales than medium or large farms. This is obvious by virtue of the definition chosen for farm size. Small off-farm income is greater than medium or large farms' off-farm income.

Assets: The small farmer operates on significantly smaller acreages than medium or large farmers do. The small farm livestock situation is relatively equivalent to medium and large farms. Small farmers comprise the majority of farms without on-farm grain storage facilities. The small farmer has lower debt to asset ratios than medium or large farmers.

Productivity: Assuming that lower crop yields reflect lower productivity and older farmers are less productive than younger farmers in terms of labor output per man-hour, small farmers experience lower productivity than medium or large farmers. This is because small farmers' crop yields are significantly lower and their age is significantly older than medium or large farmers.

Net Worth: Small farmers own more of their farmland than medium or large farmers. Therefore, in terms of relative net worth, small farmers are better off than their larger neighbors. In absolute terms, however, because they farm significantly smaller acreage, small farmers' real net worth is probably lower than medium or large farmers. Small farmers have significantly lower debt to asset ratios (in most instances) than medium or large farmers. This reflects less capital investment and less loan activity on the part of small farmers. Therefore, the larger farmers may have more debts to assets than the small farmer.

Subsidies: Small farmers participate in the set-aside program at rates relatively equal and in some cases greater than medium or large farmers. This makes a large percentage of small farmers eligible to receive deficiency payments (subsidies). Small farmers, however, receive significantly smaller total deficiency payments per farm than medium or large farmers do. The size of the payment varies directly with the farm's volume of production and, therefore, the sales of the farm. Small farmers, by the very nature of their size definition, will receive less than larger farms.

Methods to Minimize Risk: To avoid the risk of a price decline, small farmers, (1) participate in the farm set-aside program and (2) use the futures market. Most of the small farmers who use the futures market also participate in the set-aside program.

Chapter 8

THE EXTENT TO WHICH SMALL FARMERS BENEFIT FROM PARTICIPATION IN THE COMMODITY PROGRAMS

Financial and physical characteristics of the small farm and farmer were examined for the differences between farm size in Chapter Seven in order to construct a profile of the small farm and farmer. This chapter will reexamine the characteristics that directly relate to the determination of the extent to which small farmers benefit from participation in the commodity programs. This will be done to fulfill the second objective of this thesis.

This chapter will be divided into two sections. The first section will present the differences between farm size in relation to the benefits farmers receive from the commodity programs. The second section will discuss the extent to which small farmers benefit from participation in the commodity programs.

SECTION I: THE SURVEY RESULTS USED TO DETERMINE THE DIFFERENCES BETWEEN FARM SIZE

Tables 7.1, 7.2, 7.3, 7.8, 7.9, 7.10 and 7.11, in Chapter Seven, contain information directly related to the distribution and amount of total deficiency payments received by farmers surveyed in Minnesota, North Dakota and Iowa.

Small farms received the lowest average deficiency payments per farm (refer to Tables 7.1 and 7.2). As a group, small farms received

the smallest percentage of the total deficiency payments distributed among those farms surveyed (refer to Table 7.3). Small farms heavily dominated the population of farms receiving the smallest amounts of total deficiency payments, while large farms overwhelmingly dominated the population of farms receiving the largest deficiency payments per farm (refer to Tables 7.8, 7.9, 7.10 and 7.11).

The comparison of the means analysis presented in Section I, Part B of Chapter Seven (on page 111), revealed that medium and large set-aside farmers received significantly larger total deficiency payments per farm than small set-aside farmers.

The ANOVA results on total deficiency payments, graphically depicted in Figures 7.1a and 7.1b (pages 118 and 119), strongly suggest that total deficiency payments per farm increase with farm size.

From the statistics presented in Tables 7.4 and 7.5 (page 70), it is clear that a majority of small farmers participate in the set-aside program and receive program benefits in the form of deficiency payments. As the discussion above makes clear, however, there are differences in the financial rewards of set-aside participation among different farm sizes. The distribution of commodity program benefits is not equal. The following Lorenz curve analysis presents the extent of the unequal distribution.

Lorenz Curve Analysis

Figures 8.1 and 8.2 graphically present Minnesota and North Dakota wheat and Minnesota and Iowa corn total deficiency payment distributions, respectively. The 1978 survey data is compared with

1978 national figures and 1964 wheat and feed grain payments distributions. The farm population distribution (smallest to largest farms going left to right) is located along the horizontal axis. Total deficiency payments distribution in located along the vertical axis.

The curve representing absolute equality of distribution is the diagonal line that bisects the graph into two identical forty-five degree triangles. Absolute equality of distribution means that any given percentage of payments is received by the same percentage of the farm population.

In Figure 8.1, the area between the actual distribution curves and the absolute equality line represents deviation from absolute equality of distribution. It is clear that among Minnesota and North Dakota set-aside participants the distribution of payments was not equal for the 1978 crop year. For example, at point A in Figure 8.1 on the 1978 Minnesota-North Dakota curve, thirty percent of the farm population of set-aside participants received only twelve percent of the total deficiency payments distributed. The 1978 national distribution is more unequal than the survey distribution. In 1978, thirty percent of the national set-aside participant population received only three percent of the payments. In 1964, four percent of the wheat payments went to the smallest thirty percent of the farms.

Small wheat farmers made up thirty-two percent of the wheat set-aside participants in Minnesota and North Dakota. They received only thirteen percent of the total deficiency payments. This means that each small wheat farmer received, on the average, four-tenths of

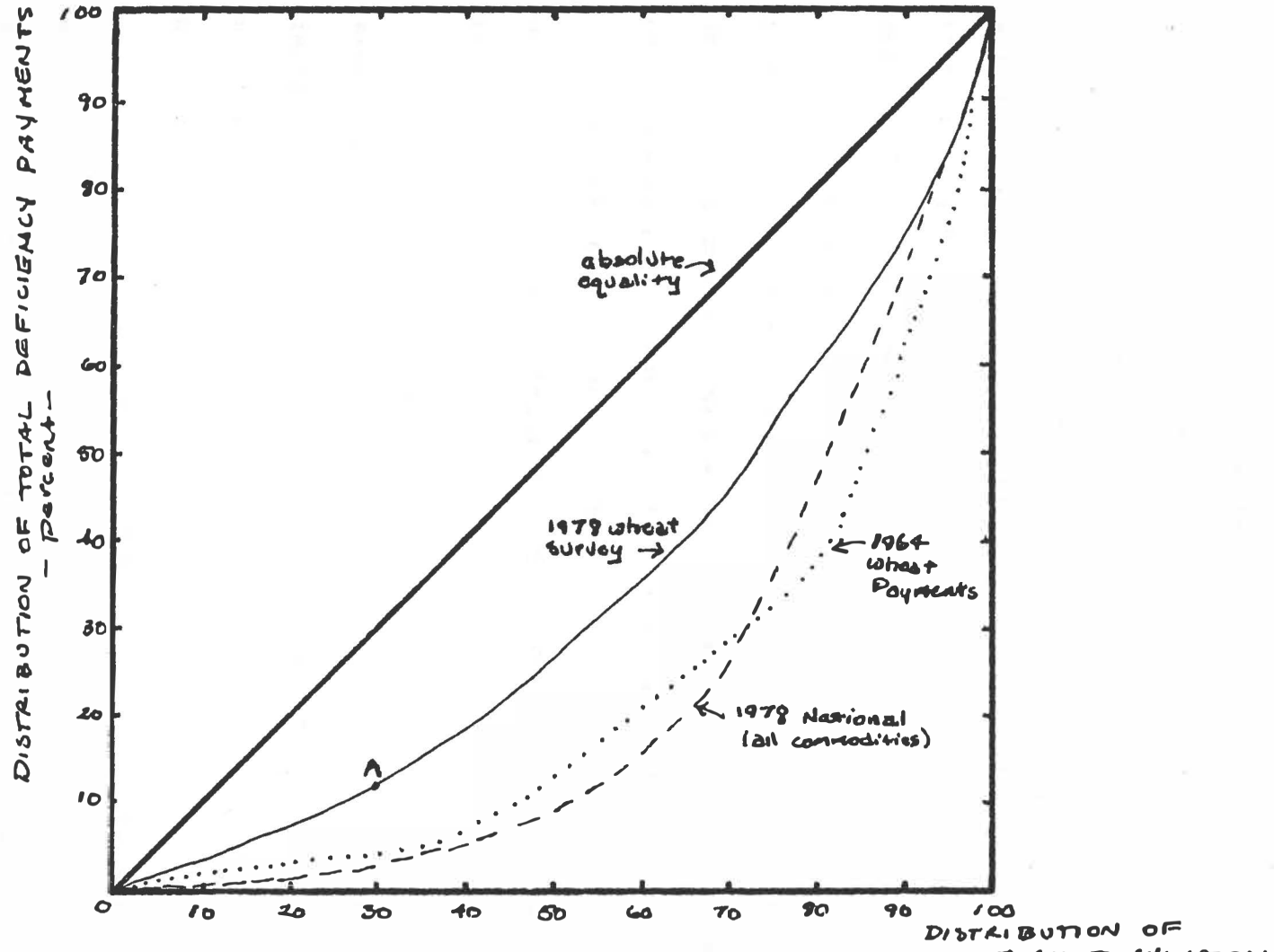

Figure 8.1: LORENZ CURVE FOR TOTAL DEF. PAYMENTS (WHEAT). MINN.-NORTH DAKOTA.

a percent of the total deficiency payments distributed among those Minnesota and North Dakota wheat farmers who were surveyed.

Small corn farmers made up thirty-eight percent of the Minnesota-Iowa survey population. As a group, according to Figure 8.2, they received almost twenty-two percent of the deficiency payments that were distributed among those corn farmers surveyed. This means that each small corn farmer received, on the average, six-tenths of a percent of all the payments distributed.

In relative terms (comparing percentages), small corn farmers received more deficiency payments per farm than small wheat farmers. In real terms, however, small wheat farmers received larger payments, on the average, per farm. Using the figures in Tables 7.1 and 7.2 (pages 65 and 66), one can calculate that four-tenths of a percent and six-tenths of a percent translate into $2,375.87 and $424.72, received by wheat and corn farmers respectively.

According to the distributions presented in Figure 8.2, Minnesota and Iowa corn farmers surveyed for the 1978 crop year received a more equal distribution of payments than either the 1978 national farm population or those farmers who received feed grain payments in 1964.

Comparison of Figures 8.1 and 8.2 reveal that the Minnesota and Iowa corn farmers received a more equal distribution of total deficiency payments than Minnesota and North Dakota wheat farmers. If one could superimpose Figure 8.1 onto Figure 8.2, it could be shown that the corn farmers receive a more equal distribution (closer to absolute equality) of total deficiency payments at every point along

the 1978 Minnesota-Iowa curve of actual distribution. The 1978 corn curve would always lie above and to the left of the 1978 wheat curve.

Clearly, for both wheat and corn farms in Minnesota-North Dakota and Minnesota-Iowa, respectively, the distribution of payments has improved since 1964. On these combined states level, the distribution of payments is also more equal than on the national level. The more unequal distribution of payments at the national level is probably caused by aggregation of more crop payments on the national level than at the state level.

Although there is some discrepancy between state and national levels, it still remains clear that deviation from absolute equality of distribution of deficiency payments exists among wheat and corn farmers.

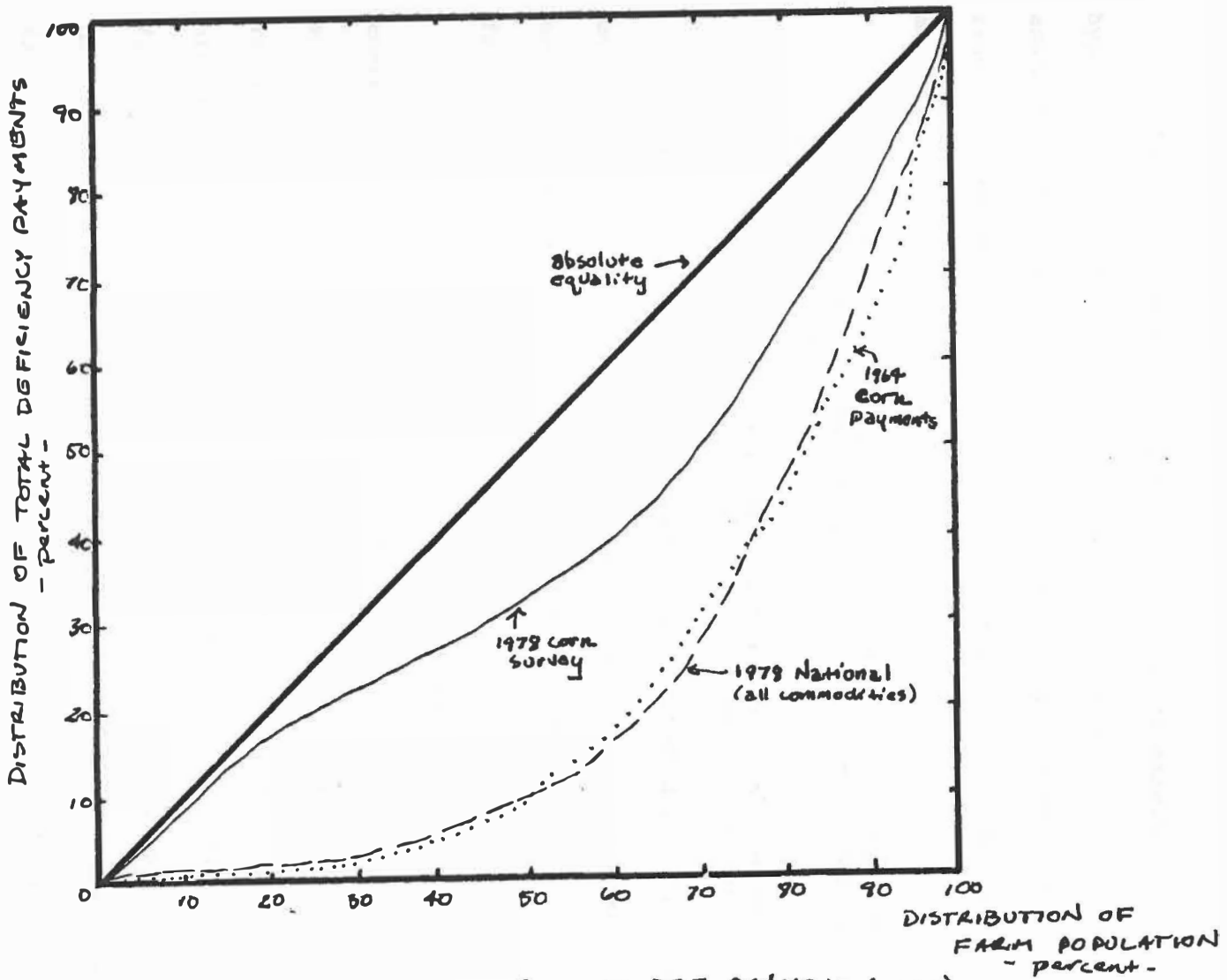

Figure 8.2. Lorenz Curve for TOTAL DEF. PAYMENTS (CORN) MINN.-IOWA CORN.

SECTION II: THE EXTENT TO WHICH SMALL FARMERS BENEFIT FROM PARTICIPATION IN THE COMMODITY PROGRAMS

The second objective of this thesis was to examine the hypothesis that the commodity programs have provided little or no assistance in terms of income support to the small farmer. As a result of the analysis performed, the following conclusions can be made regarding the hypothesis:

1) Small farmers participate in the commodity programs, but their sales are too small to generate substantial income support from the commodity programs.

2) The set-aside program tends to attract the small farmer who is a better manager than others within the small farm group.

The first conclusion was made as a result of direct observation on total farm sales per farm, total deficiency payments per farm, farm set-aside particiaption and national values of average farm income per farm.

The majority of small farmers were set-aside participants, thereby eligible for deficiency payments. Small wheat farms averaged approximately ten thousand dollars in sales of farm products per farm in 1978, among those surveyed; corn farmers managed to bring in about nine thousand dollars per farm for the 1978 crop year. These sales figures generated approximately $2,400 and $400 in total deficiency payments per wheat and corn farm, respectively. Clearly, these federal farm subsidies were not enough to raise small farmers into higher farm size classes, but what did the subsidies do for the small farm income situation?

Recall that the average income per small farm in 1978 (nationally) was $2,708. Small wheat and corn farmers, on the average, raised their farm incomes by eighty-eight and sixteen percent, respectively, by participating in the set-aside program and receiving payments. These percentages were arrived at by using the average deficiency payments for wheat and corn farmers mentioned above.

If substantial is defined as meaning of real worth, value or effect, small farmers (particularly small wheat farmers) received substantial income support from the commodity programs. The small farmer's farm income was raised substantially by the addition of deficiency payments, but that farm income figure was not substantial in the first place. Also, because this is a comparative study, substantial must be defined in relative terms. The relative worth, value or effect of the small farmer participating in the commodity programs is such that his or her farm income stays the same or declines.

Figures 8.3 and 8.4 present the average farm sales, income and added-on total deficiency payments per farm for small, medium and large farms among those surveyed in Minnesota-North Dakota and Minnesota-Iowa. As one can see from the graphs, the farm income situation of the small farmer improves with the addition of deficiency payments, but so does the income situation of the medium and large farmer. In fact, the income situation of the medium and large farmer improves to a greater extent than the small farmer. This is most obvious in the Minnesota-North Dakota wheat situation in Figure 8.3.

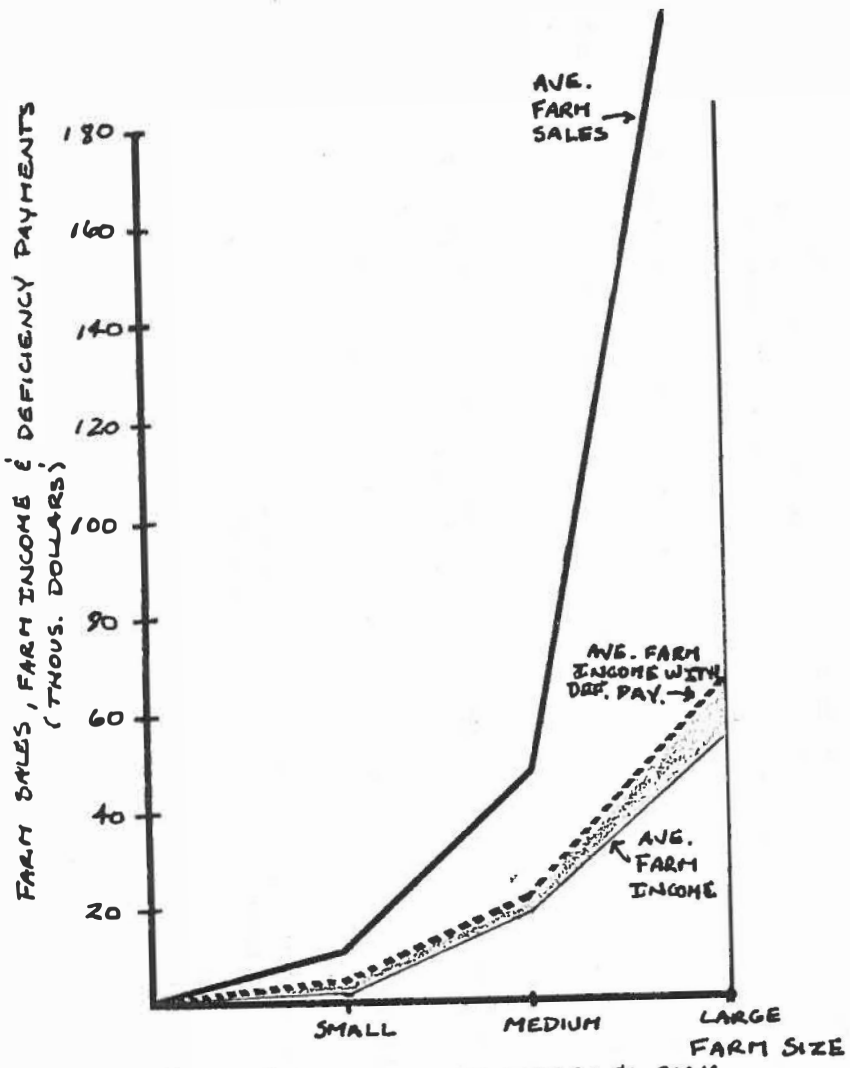

Fig. 8.3. AVERAGE PER FARM, FARM SALES, FARM INCOME AND DEFICIENCY PAYMENT FOR MINN & N.D. WHEAT FARMS IN 1978.

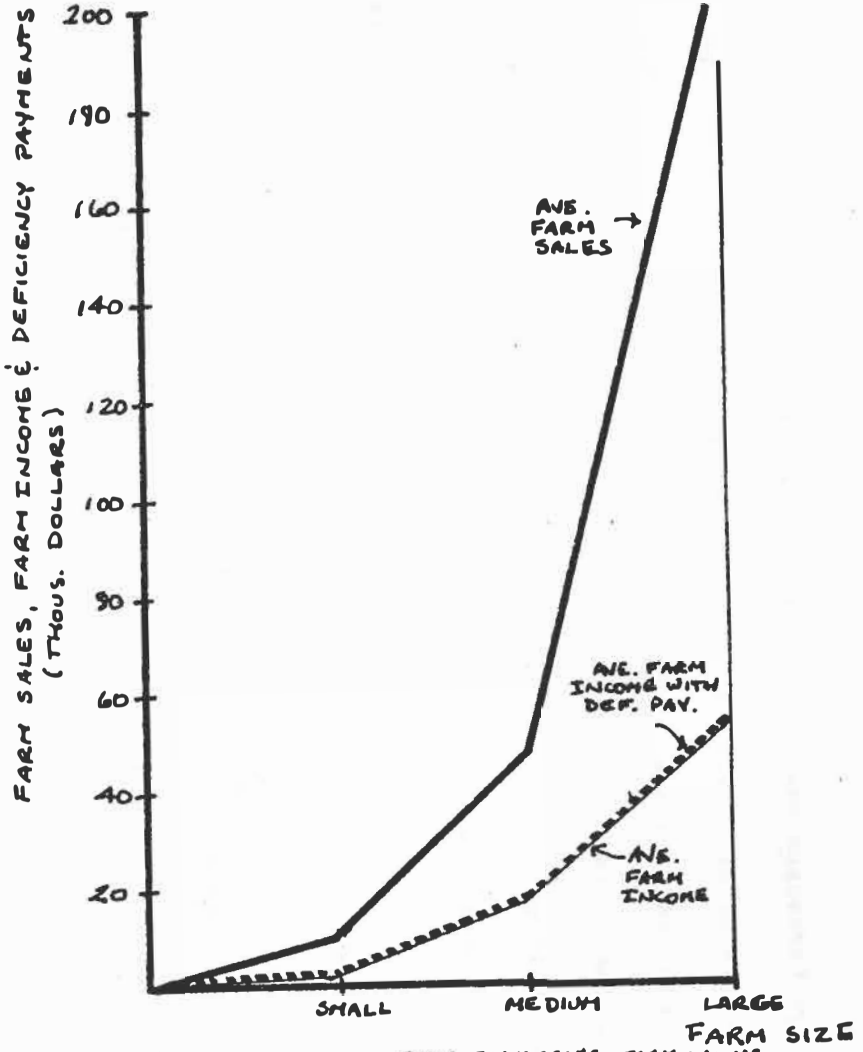

Fig. 8.4. AVERAGE PER FARM, FARM SALES, FARM INCOME, AND DEFICIENCY PAYMENT FOR MINN. AND IOWA CORN FARMS IN 1978.

The second conclusion was based on what was suggested by several characteristic variables and their relationship to set-aside program participation. The evidence is not substantial and deserves further study, but the percentages imply that small set-aside farmers are better managers than small non-set-aside farmers. Better managers is defined to mean farmers who are progressive and who seek to minimize the risk in their farm operation.

Small set-aside farmers are progressive because they:

1) Participate in a federal government program. This implys that they are also aware of the agricultural extension service, the Farmer's Home Administration, federal loan programs, production credit associations and programs of the Agriculture, Stabilization and Conservation Service (which administers the set-aside program). This means that they are probably aware of the latest technical and financial information and technology affecting the farm and they probably desire to be informed.

2) Comprise the majority of small farmers who own livestock and on-farm grain storage facilities. This implies diversification of the farm enterprise and control of farm production from planting to delivery.

Small set-aside farmers are more likely to avoid risk in their farm operation than small non-set-aside farmers because they minimize the risk of price flucuations by:

1) Participating in the set-aside program which guarantees a minimum price for their farm product.

2) Using the futures market to hedge againist a price decline in a farm commodity.

3) Having on-farm grain storage facilities to hold their grain until a favourable price develops for their commodity.

Chapter 9

IMPLICATION OF THE SURVEY RESULTS

In the preceding analysis of the survey data, the small farm and the small farmer were profiled and the extent to which the small farmer benefits from participation in the commodity programs was examined.

To conclude this thesis, the implications of the survey results vis-à-vis the national perspective will be discussed. The discussion will be divided into two parts: the first part will deal with the small farm and farmer profile; the second part will discuss commodity program benefits received by the small farmer. Following the implications discussion will be a brief final note.

THE SURVEY RESULTS VIS-À-VIS THE NATIONAL PERSPECTIVE

Nationwide, small farmers can fall into one or a combination of the following three categories: (1) part-time farmers, (2) aged and/or disabled and (3) full-time abled bodied farmers. The survey data contained no information that would suggest the working and physical status of small farmers that were surveyed. The national figures for off-farm income, cited in Chapter Five, however, clearly indicate that a majority of small farmers depend on an outside-the-farm

income source to supplement the income they generate from their farm operation. The tendency for off-farm income to increase as farm size decreased within the small farm group (refer to Table 5.6) is clearly evident from national farm and total income figures.

Analysis of the survey data on farmer age significantly showed that small farmers were older than larger farmers. This suggests that small farmers in the survey are, more than likely, older farmers. This supports a national characteristic that is common among small farmers.

Nationwide, small farmers averaged less in total sales per farm than small farms surveyed in Minnesota, North Dakota, and Iowa. This is not surprising considering the larger variation in total sales encountered nationally. Minnesota, North Dakota and Iowa also are among the most productive farming states in the nation. They tend to generate higher farm sales than the national average, which includes the more depressed farming areas of the nation in its calculation.

Small farmers in the survey made up only 34 to 38 percent (variations among wheat and corn farms) of the total farm population surveyed compared to a national figure of sixty-six percent of the farm population. This fact can help account for the difference in average farm sales between the national and survey figures.

Nationally, small farms are plagued by lack of capital, resources and under capacity to use large farm machinery. Small farms in the survey were no exception. Among all farms with grain storage facilities, livestock and large acreages, small farms were consistently in the

minority. Among all small farms, however, small set-aside farmers, more than likely, had grain storage facilities, livestock and in the case of corn farms only, larger acreages.

In terms of absolute benefits from the commodity programs, small farmers surveyed averaged greater deficiency payments per farm than small farmers nationally. The differential between wheat farms and the national average was very large -- $2100 -- compared to a smaller differential of eighty dollars for corn farmers. The national figure takes into account all of the variations among many commodities; this serves as an explanation for the magnitude of the differential between national and survey figures.

The distribution of payments among small farms surveyed was more equal than the distribution of payments among small farmers nationwide. In addition, for both corn and wheat farmers surveyed, the distribution of payments has become more equal since 1964, but absolute equality of distribution has not been achieved.

The full-time small farms, nationwide and those in the survey, are prime candidates for extinction through the mechanism of the treadmill. The deficiency payments small farmers receive do not help them expand their operations. In many states, the average small farm deficiency payment would not buy one acre of farm land. Part-time farmers, who earn enough off-farm income to enable them to continue a farm-rural lifestyle will, more than likely, avoid the cannibalistic effects of the treadmill.

THE FINAL NOTE

The two objectives of this thesis have been met: to profile the small farm and the small farmer and to examine the hypothesis that the commodity programs have provided little or no assistance to the small farmer in terms of income support.

Small farmers do participate in the commodity programs, but their sales do not generate substantial income support from the programs. This conclusion is not surprising, considering the benefits from the commodity programs vary directly with a farm's volume of production. This thesis, however, serves as a new source of documentation which provides more evidence that the commodity programs do not benefit the majority of farmers they were intended to serve in the first place.

Although a majority of small farmers do participate in the commodity programs, the small farmer who needs the most assistance is less likely to participate. This small non-participant is, more than likely, a prime candidate for rural development assistance programs, rather than commercial agricultural assistance programs (which are the commodity programs). In administrating more effective public policy in agriculture today, the need for rural development policies should be distinguished from the need for commercial agricultural policies.

The problems of the small farmer are not being ignored. The Agricultural Credit Act of 1978 expanded services of the Farmer's Home Administration specifically for the use of limited resource farmers. Under the Carter administration, the USDA, the Community Services

Administration and ACTION sponsored joint projects to coordinate the attack on the problems facing the small farmer and the rural community.

Hammering out agricultural policy for rural development and commercial agriculture to answer the question, "What do we propose to do with agriculture?"[1/] is not an easy job. "The issues that develop will obviously not be capable of scientific solution...inescapably the analysis must be as largely in terms of politics as of economics."[2/]

BIBLIOGRAPHY

Ball, A. Gordon and Earl O. Heady. Editors, Size, Structure and Future of Farms. Ames Iowa: Iowa State University Press, 1972.

Benedict, Murray R. The Farm Problem - An Analysis of Federal Aid To Agriculture. The Twentieth Century Fund, 1955.

Bergland, Robert. "National Dialogue on the Future of American Agriculture," Address to the National Farmer's Union Convention, Kansas City, Missouri, March 12, 1979.

Berry, Wendell. The Unsettling of America: Culture and Agriculture. New York: Avon, 1977.

Black, John D. "The Progress of Farm Relief," American Economic Review, Vol. XVIII (June, 1928).

_____. "The Role of Public Agencies in the Internal Readjustments of the Farm," Journal of Farm Economics, Vol. VII. (April, 1925).

_____. Introduction to Economics For Agriculture. New York: The Macmillan Co., 1953.

_____. Economics for Agriculture, Selected Writings of John D. Black. Cambridge, Mass.: Harvard Univ. Press, 1959.

Bonnen, James. "The Absence of Knowledge of Distributional Impacts: An Obstacle to Effective Public Program Analysis and Decisions," Contribution to A Compendium of Papers Submitted to the Sub-Committee On Economy in Government of the Joint Economic Committee, U.S. Congress, 1969. pp. 419-449.

Breimyer, Harold F. "Can the Family Farm Survive? - The Problem and the Issue," Univ. of Missouri Special Report 219, 1978.

Brewster, David. "Federal Policy and the Small Farm, A Historical View," Contribution to "Toward a Federal Small Farms Policy, Phase I., Washington, D. C.: National Rural Center, Nov. 1978.

Carlin, Thomas A. and John Crecink. "Small Farm Definition and Public Policy," American Journal of Agricultural Economics, (Dec. 1979).

Cochrane, Willard W. "Beliefs and Values Underlying Agricultural Policies and Programs," Contribution to Farm Goals in Conflict. Ames, Iowa: Iowa State Univ. Press, 1963. pp. 50-63.

_____. "Farm Price Gyrations - An Aggregative Hypothesis," Journal of Farm Economics, Vol. XXIX (May, 1947).

_____. Farm Prices, Myth and Reality. Minneapolis: Univ. of Minn. Press, 1958.

_____. The Development of American Agriculture, A Historical Analysis. Minneapolis: Univ. of Minn. Press, 1979.

_____ and Mary E. Ryan. American Farm Policy, 1948-1973. Minneapolis: Univ. of Minn. Press, 1976.

Finney, D.J. Probit Analysis. England: Cambridge Univ., 1971.

Freund, Rudolf. "John Adams and Thomas Jefferson on the Nature of Landholding in America, " Land Economics, Vol. XXIV (May, 1948).

Gardner, Bruce. "Public Policy and the Control of Agricultural Production, " American Journal of Agricultural Economics, (Dec., 1978).

_____. "How is Scale and Structure Determined in Agriculture?" American Journal of Agricultural Economics, 60(1978),p. 295.

Horner, J. F. "The U. S. Governmental Activities in the Field of Agricultural Economics Prior to 1913," Journal of Farm Economics, Vol. X (October 1928).

Jeffords, Edd, ed. Uncertain Harvest - The Family Farm in Arkansas. Eureka Springs, Ark.: Ozark Institute, 1980.

Kislev, Yoav and Willis Peterson. "Relative Prices, Technology and Farm Size," A Univ. of Minn. Dept. of Ag. and Applied Economics Staff Paper No. P-80-11, May, 1980.

Larson, Donald and James Lewis. "Small Farms Profile," Washington, D. C. : Economic Dev. and Natural Resources Econ. Div., ESCS, USDA, Mimeo, 1978.

Lewis, Elmer. Farm Relief and Agricultural Adjustment Acts. Washington D. C. : U.S. Gov't. Printing office, 1954.

Madden, J. Patrick and Heather Tischbein. "Toward an Agenda for Small Farm Research," American Journal of Agricultural Economics, Vol. 61, No. 5, 1979.

Minnesota Agricultural Statistics, 1979.

National Advisory Commission on Food and Fiber, Food and Fiber for the Future. Washington, D. C. : U.S. Gov't. Printing Office, 1964.

Nelson, Frederick J. and Willard W. Cochrane. " Economic Consequences of Federal Farm Commodity Programs, 1953-1972," Agricultural Economic Research, Vol. 28 (April, 1976).

Nie, Norman H. C., Hadlai Hull, Jean G. Jenkins, Karin Steinbrenner and Dale H. Bent. Statistical Package for the Social Sciences, SPSS. New York: McGraw-Hill Book Co., 1975.

Nourse, E.G. " Some Economic factors in An American Agricultural Policy," Journal of Farm Economics, Vol. VII (Jan., 1925).

Okun, Arthur. Equality and Efficiency, The Big Tradeoff. Washington, D. C.: The Brookings Institution, 1975.

Paarlberg, Don. Farm and Food Policy, Issues of the 1980's. Lincoln, Neb. : Univ. of Neb. Press, 1980.

Penn, J. B. "Commodity Programs and Inflation," American Journal of Agricultural Economics," Vol. 61, No. 5, 1979.

Raup, Philip. "Some Questions of Value and Scale in American Agriculture," American Journal of Agricultural Economics, Vol. 60, (May, 1978).

_____. "Societal Goals in Farm Size," Contribution to Size, Structure and Future of Farms. Ball and Heady, eds., Ames, Iowa: Iowa State Univ. Press, 1972. pp. 3-19.

Rausser, Gordon C., David Zilberman and Richard E. Just. "Governmental Intervention in Competitive Markets: The Case of U. S. Agricultural Policy," Working Paper No. 80, Calif. Ag. Experiment Stat.,May May, 1980.

Ruttan, Vernon. "Agricultural Policy in An Affluent Society," Journal of Farm Economics, Vol. 48 (Dec., 1966).

Saupe, William E. "Information Needs Relating to Small-Farm Programs and Policies," Wash. D. C.: ESCS, USDA Staff Report, July, 1980.

Schultz, T.W. Redirecting Farm Policy. New York: The Macmillan Co., 1943.

_____. Agriculture in an Unstable Economy. New York: McGraw-Hill Book Co., 1945.

_____. "How Efficient is American Agriculture?" Journal of Farm Economics, Vol. 29, (1947).

Schultze, Charles L. The Distribution of Farm Subsidies: Who Gets the Benefits?. Wash., D. C.: The Brookings Institution, 1971.

Schumacher, E. F. Small is Beautiful: Economics As If People Mattered. New York: Harper and Row, 1973.

Schuh, G. Edward. "U.S. Agriculture in an Interdependent World Economy," Paper presented at the American Enterprise Inst. Conference of Food and Agricultural Policy, Oct. 2-3, Wash., D. C., 1980.

Snecdecor, George W. and W. G. Cochran. Statistical Methods. Ames, Iowa: The Iowa State Univ. Press, 1978.

Spencer, Milton H. Contemporary Economics. Worth Publishers, Inc., 1974.

Stanton, B. F. "Some Political Arithmetic of Large and Small," Cornell Agricultural Economics Staff Paper.

_____. "Perspective on Farm Size," American Journal of Agricultural Economics, (Dec., 1978).

Stigler, George.

Tweeten, Luther and Isaac Popoola. "Typology and Policy for Small Farms: Agricultural Economist Versus Alternative Culturist," Journal Article of the Oklahoma Ag. Experiment Station.

U. S. Congress. Senate, Subcommittee on Rural Development of the Committee on Agriculture, Nutrition and Forestry. Rural Development Oversight. Hearing, 96th Congress., 1st Session, April 2, 1979.

U. S. Congress. Senate. Committee on Agriculture, Nutrition and Forestry. The State of American Agriculture. Hearing, 96th Cong., 1st Session, January 24, 1979.

U. S. Congressional Budget Office. Public Policy and the Changing Structure of American Agriculture. Wash., D. C.: U. S. Gov't Printing Office, Sept., 1978.

U.S. Dept. of Agriculture. Structure Issues of American Agriculture. ESCS, Ag. Econ. Report 438.

U.S. Dept. of Agriculture. Status of the Family Farm - Second Annual Report to the Congress.

U. S. Dept. of Ag. "Feed Situation", Fds-266 through Fds-272.

U. S. Dept. of Ag. "Wheat Situation", WS-244 through WS-246.

U. S. Dept. of Ag. "Agricultural Outlook," AO-25 through AO-38.

U. S. Dept. of Agriculture. "Bibliography of Research Relating to Small Farms, 1970-1977," by Ann Ingerson, NED, ESCS Working Paper, Sept., 1977.

U. S. General Accounting Office. "Changing Character and Structure of American Agriculture; An Overview," Wash., D. C.: U.S. Gov't. Printing Office, 1978.

Valdes, Alberto, ed. Economics and Design of Small Farmer Technology. Ames, Iowa: The Iowa State Univ. Press, 1979.

Wallace, Henry C. " A National Agricultural Program - A Farm Management Problem," Journal of Farm Economics, Vol. VI (Jan., 1924).

Wehrwein, George. "Which Does Agriculture Need - Readjustment or Legislation? The Case for Legislation," Journal of Farm Economics, Vol. X (Jan., 1928).

Wilcox, Walter W. "State Distribution of Farms With Sales of $2,500 to $39,999 and less than $1,000 Off-farm Income," Wash., D. C.: Congressional Research Service, Mimeo, 1979.

_____. "Large Farm Program Payments and Implications of Proposals For Limitations," Wash., D. C.: Library of Congress Legislative Reference Service, 1969.

_____. "Economic Aspects of Farm Program Payment Limitations," Washington, D. C.: Library of Congress Leg. Ref. Service, 1969.

_____ and Willard W. Cochrane. Economics of American Agriculture. New Jersey: Prentice-Hall, 1974.

Wonnacott, Thomas H. and R.J. Wonnacott. Introductory Statistics. New York: John Wiley and Sons, 1972.

Yearbook of Agriculture. U. S. Dept. of Ag. , 1934.

APPENDIX I

COMPARISON OF THE MEANS ANALYSIS

MINN. - IOWA CORN

H_0: MEAN FARM SALES DO NOT DIFFER BETWEEN SMALL SET-ASIDE AND SMALL NON-SET-ASIDE FARMS

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

$$\frac{3.65 \times 10^7_{61}}{3.63 \times 10^7_{37}} = 1.005$$

SIGN. $F_{61,37} = 1.84$

(B) TEST HYPOTHESIS

$$\text{POOLED } S^2 = \frac{3.65 \times 10^7(61) + 3.63 \times 10^7(37)}{62 + 38} = 3.569 \times 10^7$$

$$S_{\bar{X}SS - \bar{X}SNS} = \sqrt{3.569 \times 10^7 \left(\frac{62+38}{(62)(38)}\right)} = 1.23 \times 10^3$$

$$\text{Est. } t = (9041.95 - 6596.61) / 1.23 \times 10^3 = 1.98$$

Sign. $t = 1.98$ Est. t = Sign. t

MINN. - IOWA CORN

H_0: MEAN CROPLAND ACREAGE DOES NOT DIFFER BETWEEN SMALL SET-ASIDE AND SMALL NON-SET-ASIDE FARMS

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

$$\frac{96855.75_{61}}{13176.90_{37}} = 7.35$$

SIGN. F = 1.84 $\quad$ $7.35 > 1.84$ VARIANCES DIFFER

(B) TEST HYPOTHESIS, employ special t-test

$$\text{Est. } t' = (295 - 183) / \sqrt{96855.75/62 + 13176.90/37}$$

$$= 2.557$$

SIGN $t' \cong 2.00$

Est. $t' >$ SIGN. t' $\quad$ REJECT THE NULL HYPOTHESIS

SMALL SET-ASIDE FARMERS HAVE GREATER ACREAGE

MINN. - IOWA CORN

H_0: MEAN CORN ACREAGE DOES NOT DIFFER BETWEEN SMALL SET-ASIDE AND SMALL NON-SET-ASIDE FARMS

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

$$\frac{9904_{61}}{2601.08_{37}} = 3.8077$$

$\text{SIGN.}F_{61,37} = 1.84$ $\quad 3.8077 > 1.84$ VARIANCES DIFFER

(B) TEST HYPOTHESIS, employ special t-test

$$\text{Est. } t' = (122 - 79) / \sqrt{9904/62 + 2601.08/37}$$

$$= 2.84$$

$$\text{Sign } t' \cong 2.00$$

Est. t' > SIGN. t' REJECT THE NULL HYPOTHESIS, SMALL SET-ASIDE FARMERS FARM MORE CORN ACREAGE

MINN. - IOWA CORN

H_0: MEAN CORN YIELD DOES NOT DIFFER BETWEEN SMALL SET-ASIDE AND SMALL NON-SET-ASIDE FARMS.

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

$$\frac{745.56_{61}}{717.72_{37}} = 1.038$$

SIGN. F. = 1.84 $\quad$ $1.038 < 1.84$ $\quad$ VARIANCES ARE EQUAL

(B) TEST HYPOTHESIS

$$\text{POOLED } S^2 = \frac{745.56(61) + 717.72(37)}{62 + 38} = 720.35$$

$$S_{\bar{X}_{SS} - \bar{X}_{SNS}} = \sqrt{720.35\left(\frac{62+38}{(62)(38)}\right)} = 5.529$$

$$\text{Est. } t = (107 - 103)/5.529 = .723$$

SIGN. $t < .723$ $\quad$ DO NOT REJECT THE NULL HYPOTHESIS

MINN.-IOWA CORN

H_0: MEAN FARMER AGE DOES NOT DIFFER BETWEEN SMALL SET-ASIDE AND SMALL NON-SET-ASIDE FARMERS.

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

$$\frac{186.96_{35}}{126.41_{60}} = 1.478$$

SIGN. $F_{35,60} = 1.85$ $\quad 1.478 < 1.85$ VARIANCES ARE EQUAL

(B) TEST HYPOTHESIS

$$\text{POOLED } S^2 = \frac{186.96(35) + 126.41(60)}{36 + 61} = 145.65$$

$$S_{\bar{X}_{SS} - \bar{X}_{SNS}} = \sqrt{145.65\left(\frac{36+61}{(36)(61)}\right)} = 2.536$$

$$\text{est. } t = (53-50)/2.536 = 1.18$$

SIGN. $t = 1.98$

est. t < SIGN. t. DO NOT REJECT THE NULL HYPOTHESIS

MINN. – IOWA CORN

H_0: MEAN DEBT TO ASSET RATIO DOES NOT DIFFER BETWEEN SMALL SET-ASIDE FARMS AND SMALL NON-SET-ASIDE FARMS.

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

$$\frac{659.91}{248.97}\begin{matrix}27\\50\end{matrix} = 2.65$$

SIGN. $F_{27,50}$ 1.91 2.65 > 1.91 VARIANCES DIFFER

(B) TEST HYPOTHESIS, employ special t-test

$$\text{Est. } t' = (16.1 - 13.5) \Big/ \sqrt{659.91/(28) + 248.97/(51)}$$

$$= .487$$

SIGN. t' 7 .487 = Est. t' DO NOT REJECT THE NULL HYPOTHESIS

MINN. - IOWA CORN

H_0: MEAN TOTAL PAYMENTS DO NOT DIFFER BETWEEN SMALL AND MEDIUM FARMERS OF THOSE WHO PARTICIPATE IN THE COMMODITY PROGRAMS

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

$$\frac{\text{MED } 1.10 \times 10^6 \text{ 77 d.f.}}{\text{SMALL } 1.51 \times 10^5 \text{ 61 d.f.}} = 7.28$$

SIGN. $F_{77,61,\alpha=.05} = 1.64$ $\quad 7.28 > 1.64$ VARIANCES DIFFER

(B) TEST HYPOTHESIS, employ special t-test

$$\text{Est. } t' = (835.34 - 424.72) / \sqrt{(1.51 \times 10^5)/62 + (1.10 \times 10^6)/78}$$

$$= 3.19$$

$t_{.05,61} = 2.00$

$t_{.05,77} = 1.99$

$$\text{SIGN. } t' = \left[5.89 \times 10^5 (2.00) + 1.41 \times 10^4 (1.99)\right] / 6.03 \times 10^5$$

$$= 2.00$$

Est. t' > SIGN t', REJECT THE NULL HYPOTHESIS

MINN. - IOWA CORN

H_0 : MEAN TOTAL CROPLAND ACREAGE DOES NOT DIFFER BETWEEN SMALL AND MEDIUM SET-ASIDE FARMS

H_A : H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

SMALL / MED $\quad \frac{96855.75_{61\ d.f.}}{53444.19_{75\ d.f.}} = 1.81$

SIGN. $F_{61,75} = 1.66$ $\qquad$ $1.81 > 1.66$ $\qquad$ VARIANCES DIFFER

(B) TEST HYPOTHESIS, employ special t-test

$$\text{EST. } t' = (390 - 295) / \sqrt{96855.75/62 + 53444.19/76}$$

$$= 1.995$$

$t_{.05,61} = 2.00$

$t_{.05,75} = 1.99$

SIGN. $t' = 2.00$

EST $t' <$ SIGN t' $\qquad$ DO NOT REJECT THE NULL HYPOTHESIS

MINN. - IOWA CORN

H_0: MEAN CORN ACREAGE DOES NOT DIFFER BETWEEN SMALL AND MEDIUM SET-ASIDE FARMS

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

$$\text{MED} \quad \frac{1.21 \times 10^4}{\text{SMALL} \quad 9904} \quad \begin{matrix} 77 \\ 61 \end{matrix} = 1.22$$

$\text{SIGN. } F_{77,61} = 1.64 \qquad 1.22 < 1.64$ VARIANCES ARE EQUAL

(B) TEST HYPOTHESIS, employ regular t-test

$$\text{POOLED } S^2 = \frac{1.21 \times 10^4 (77) + 9904(61)}{78 + 62} = 1.097 \times 10^4$$

$$S_{\bar{X}_M - \bar{X}_S} = \sqrt{1.097 \times 10^4 \left(\frac{78+62}{(78)(62)}\right)} = 1.78 \times 10^1$$

$$\text{Est. } t = (185 - 122) / 1.78 \times 10^1 = 3.54$$

$\text{SIGN. } t_{138} = 1.98 \qquad \text{Est. } t > \text{SIGN. } t$

REJECT THE NULL HYPOTHESIS

MINN. - IOWA CORN

Ho: MEAN CORN YIELD DOES NOT DIFFER BETWEEN SMALL AND MEDIUM SET-ASIDE FARMS

HA: Ho IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

$$\text{SMALL} \quad \frac{745.56_{61}}{\text{MED} \quad 455.73_{77}} = 1.64$$

SIGN. $F_{61,77} = 1.66$ $\quad 1.64 < 1.66$ VARIANCES ARE EQUAL

(B) TEST HYPOTHESIS

$$\text{POOLED } s^2 = \frac{745.56(61) + 455.73(77)}{62 + 78} = 575.5$$

$$S_{\bar{X}_M - \bar{X}_S} = \sqrt{575.5\left(\frac{62+78}{(62)(78)}\right)} = 4.08$$

$$\text{Est. } t = (112 - 103)/4.08 = 2.206$$

SIGN. $t_{138} = 1.98$ $\quad$ Est. $t >$ SIGN t.

REJECT THE NULL HYPOTHESIS

MINN-IOWA CORN

H_0: MEAN FARMER AGE DOES NOT DIFFER BETWEEN SMALL AND MEDIUM SET-ASIDE FARMERS

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

$$\text{MED } \frac{150.95_{77}}{126.41_{60}} = 1.19$$

SIGN. $F_{77,60} = 1.64$ $\quad 1.19 < 1.64$ VARIANCES ARE EQUAL

(B) TEST HYPOTHESIS

$$\text{POOLED } s^2 = \frac{150.95(77) + 126.41(60)}{78 + 61} = 138.185$$

$$s_{\bar{x}_s - \bar{x}_m} = \sqrt{138.185\left(\frac{78+61}{(78)(61)}\right)} = 2.01$$

$$\text{Est. } t = (50-46)/2.01 = 1.99$$

SIGN. $t_{137} = 1.98$ $\quad$ Est. $t >$ SIGN. t, REJECT THE NULL HYPOTHESIS

MINN. - IOWA CORN

H_0: MEAN DEBT TO ASSET RATIO DOES NOT DIFFER BETWEEN SMALL AND MEDIUM SET-ASIDE FARMS

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

$$\text{MED } \frac{489.55_{60}}{\text{SMALL } 248.97_{50}} = 1.97$$

SIGN. $F_{60,50} = 1.735$ $\quad 1.97 > 1.735$ VARIANCES DIFFER

(B) TEST HYPOTHESIS, employ special t-test

$$\text{Est. } t' = (23.4 - 13.5) / \sqrt{489.55/61 + 248.97/51}$$
$$= 2.755$$

$t_{\alpha=.05, 60} = 2.00$

$t_{\alpha=.05, 50} = 2.008$

$$\text{SIGN. } t' = [8.03(2) + 4.88(2.008)] / 8.03 + 4.88$$
$$= 2.003$$

Est. t' > SIGN. t' REJECT THE NULL HYPOTHESIS

IN ALL THREE CATEGORIES, MEAN TOTAL PAYMENTS, TOTAL CROPLAND ACREAGE AND CORN ACREAGE, IT WAS OBVIOUS FROM THE SIGNIFICANCE TESTS THAT LARGE CORN SET-ASIDE FARMERS RECEIVE LARGER TOTAL DEFICIENCY PAYMENTS AND FARM GREATER ACREAGES THAN SMALL CORN SET-ASIDE FARMS.

MINN. - IOWA CORN

H_0: MEAN CORN YIELD DOES NOT DIFFER BETWEEN SMALL AND LARGE SET-ASIDE FARMS.

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

SMALL / LARGE $\quad \frac{745.56_{61}}{286.13_{19}} = 2.61$

SIGN. $F_{61,19} = 2.27 \qquad 2.61 > 2.27 \qquad$ VARIANCES DIFFER

(B) TEST HYPOTHESIS: EMPLOY SPECIAL t-TEST

$$\text{Est. } t' = (129 - 103) / \sqrt{745.56/61 + 286.13/20} = 5.07$$

$t_{61} = 2.00$

$t_{19} = 2.093$ Est. t is clearly larger than pooled sign. t would be.

REJECT THE NULL HYPOTHESIS

MINN-IOWA CORN

H_0: MEAN FARMER AGE DOES NOT DIFFER BETWEEN SMALL AND LARGE SET-ASIDE FARMERS

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

SMALL / LARGE $\quad \frac{126.41_{60}}{102.37_{19}} = 1.23$

SIGN. $F_{60,19} = 2.27 \qquad 1.23 < 2.27$ VARIANCES ARE EQUAL

(B) TEST HYPOTHESIS:

$$\text{POOLED } S^2 = \frac{126.41(60) + 102.37(19)}{61 + 20} = 117.6$$

$$S_{\bar{X}_S - \bar{X}_L} = \sqrt{117.6\left(\frac{61+20}{(61)(20)}\right)} = 2.79$$

$$\text{Est. } t = (50-40)/2.79 = 3.58$$

$\text{SIGN. } t_{79} = 1.989 \qquad \text{Est. } t > \text{SIGN. } t$, REJECT THE NULL HYPOTHESIS

MINN. - IOWA CORN

H_0: MEAN DEBT-TO-ASSET RATIO DOES NOT DIFFER BETWEEN SMALL AND LARGE SET-ASIDE FARMS.

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

SMALL 248.97_{50}

LARGE 170.57_{14}

$$\frac{248.97_{50}}{170.57_{14}} = 1.46$$

SIGN. $F_{50,14} = 2.64$ $\quad 1.46 > 2.64$ VARIANCES ARE EQUAL

(B) TEST HYPOTHESIS

$$\text{POOLED } s^2 = \frac{248.97(50) + 170.57(14)}{51 + 15} = 224.80$$

$$s_{\bar{X}_L - \bar{X}_S} = \sqrt{224.80\left(\frac{51+15}{(51)(15)}\right)} = 4.40$$

$$\text{Est. } t = (28 - 13.5) / 4.40 = 3.295$$

SIGN. $t = 2.00$ $\quad$ Est. $t >$ SIGN. t

REJECT THE NULL HYPOTHESIS

MINN. - N.D. WHEAT

H_0: MEAN FARM SALES DO NOT DIFFER BETWEEN SMALL SET-ASIDE AND SMALL NON-SET-ASIDE FARMS

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

$$\frac{3.655 \times 10^7 \text{ 52 d.f.}}{2.96 \times 10^7 \text{ 148 d.f.}} \quad 1.23$$

SIGN $F_{52,148 \text{ d.f.}} = 1.622$ $\quad 1.23 < 1.622$

VARIANCES ARE EQUAL

(B) TEST HYPOTHESIS

$$\text{POOLED } S^2 = \frac{3.655 \times 10^7(52) + 2.96 \times 10^7(148)}{53 + 149}$$

$$= 3.1096 \times 10^7$$

$$S_{\bar{X}_{SS} - \bar{X}_{SNS}} = \sqrt{3.1096 \times 10^7 \left(\frac{53+149}{(53)(149)}\right)} = 8.9186 \times 10^2$$

$$\text{Est. } t = (10185.85 - 8657.81) / 8.9186 \times 10^2 = 1.71$$

Sign. $t = 1.98$ $\quad$ Est. $t <$ Sign. t, DO NOT REJECT THE NULL HYPOTHESIS

MINN. -N.D. WHEAT

H_0: MEAN TOTAL CROPLAND ACREAGE DOES NOT DIFFER BETWEEN SMALL SET-ASIDE AND SMALL NON-SET ASIDE FARMS.

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

$$\frac{178490.32_{52}}{154288.55_{146}} = 1.156$$

SIGN. $F_{52,146} = 1.62$ $\quad 1.156 < 1.62$ VARIANCES ARE EQUAL

(B) TEST HYPOTHESIS

$$\text{POOLED } S^2 = \frac{178490.32(52) + 154288.55(146)}{53 + 147}$$

$$= 159038.12$$

$$S_{\bar{X}_{SS} - \bar{X}_{SNS}} = \sqrt{159038.12\left(\frac{53+147}{(53)(147)}\right)} = 63.89$$

Est. $t = (449 - 365) / 63.89 = 1.31$

Sign. $t_{199} = 1.98$

Est. $t <$ Sign. t DO NOT REJECT THE NULL HYPOTHESIS

MINN. - N.D. WHEAT

H_0: MEAN WHEAT ACREAGE DOES NOT DIFFER BETWEEN SMALL SET-ASIDE AND SMALL NON-SET-ASIDE FARMS

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

$$\frac{65007.44}{22124.13}\ {}^{52}_{148} = 2.93$$

SIGN. $F_{52, 148} = 1.622$ $\quad 2.93 > 1.622$ VARIANCES DIFFER

(B) TEST HYPOTHESIS, employ special t-test

$$\text{Est. } t' = (146 - 131) / \sqrt{65007.44/53 + 22124.13/149}$$

$$= .404$$

SIGN. $t' > .404$ DO NOT REJECT THE NULL HYPOTHESIS

H_0: MEAN WHEAT YIELD DOES NOT DIFFER BETWEEN SMALL SET-ASIDE AND SMALL NON-SET-ASIDE FARMS

H_A: H_0 IS FALSE

THE MEAN WHEAT YIELD FOR EACH POPULATION IS THE SAME EXACTLY.

MINN. - N.D. WHEAT

H_0: MEAN FARMER AGE DOES NOT DIFFER BETWEEN SMALL SET-ASIDE AND SMALL NON-SET-ASIDE FARMERS.

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

$$\frac{202.25_{145}}{190.23_{50}} = 1.06$$

SIGN. $F_{145,50} = 1.65$ $\quad 1.06 < 1.65$ VARIANCES ARE EQUAL

(B) TEST HYPOTHESIS

$$\text{POOLED } S^2 = \frac{202.25(145) + 190.23(50)}{146 + 51} = 197.145$$

$$S_{\bar{X}_{SS} - \bar{X}_{SNS}} = \sqrt{197.145\left(\frac{146+51}{(146)(51)}\right)} = 2.28$$

$$\text{Est. } t = (54 - 53)/2.28 = .439$$

SIGN. t < Est. t. DO NOT REJECT THE NULL HYPOTHESIS

H_0: MEAN DEBT TO ASSET RATIO DOES NOT DIFFER BETWEEN SMALL SET-ASIDE AND SMALL NON-SET-ASIDE FARMS

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

$$\frac{568.01}{293.36}\begin{matrix}100\\36\end{matrix} = 1.936$$

SIGN. $F_{100,36} = 1.80$ $\quad$ $1.936 > 1.80$ $\quad$ VARIANCES DIFFER

(B) TEST HYPOTHESIS, employ special t-test

$$\text{Est. } t' = (16.2 - 12.8) / \sqrt{568.01/101 + 293.36/37}$$

$$= .92$$

SIGN $t' > .92$ $\quad$ DO NOT REJECT THE NULL HYPOTHESIS

MINN. – N.D. WHEAT

H_0: MEAN TOTAL PAYMENTS DO NOT DIFFER BETWEEN SMALL AND MEDIUM SET-ASIDE FARMS.

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

$$\text{MED.} \quad \frac{2.36 \times 10^7 \,/\, 232}{5.69 \times 10^6 \,/\, 148} = 4.15$$

SIGN. $F_{232,\,148} \leq 1.43 \qquad 4.15 > 1.43$ VARIANCES DIFFER

(B) TEST HYPOTHESIS, EMPLOY SPECIAL t-TEST

$$\text{Est. } t' = (5813.89 - 2375.87) \Big/ \sqrt{2.36 \times 10^7/233 + 5.69 \times 10^6/149}$$

$$= 9.21$$

$t_{232} = 1.98$
$t_{148} = 1.98$
} SIGN $t' = 1.98$

Est. $t' >$ SIGN t' REJECT THE NULL HYPOTHESIS

MINN.- N.D. WHEAT

H_0: MEAN TOTAL CROPLAND ACREAGE DOES NOT DIFFER BETWEEN SMALL AND MEDIUM SET-ASIDE FARMS

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

MED. $\frac{1.91 \times 10^5}{\text{SMALL } 154288.55} \begin{matrix} 231 \\ 146 \end{matrix} = 1.24$

SIGN $F_{231,146} = 1.43$ $\quad 1.24 < 1.43$ VARIANCES ARE EQUAL

(B) TEST HYPOTHESIS

$$\text{POOLED } s^2 = \frac{1.91 \times 10^5 (231) + 154288.55 (146)}{232 + 147}$$

$$= 1.76 \times 10^5$$

$$s_{\bar{x}_m - \bar{x}_s} = \sqrt{1.76 \times 10^5 \left(\frac{232 + 147}{(232)(147)} \right)} = 4.42 \times 10^1$$

$$\text{Est. } t = (768 - 449) / 4.42 \times 10^1 = 7.22$$

SIGN. $t_{377} = 1.98$ $\quad$ Est. $t >$ SIGN t.

REJECT THE NULL HYPOTHESIS

MINN. - N.D. WHEAT

H_0: MEAN WHEAT ACREAGE DOES NOT DIFFER BETWEEN SMALL AND MEDIUM SET-ASIDE FARMS

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

$$\frac{\text{MED.}\quad 421\,86.8_{232}}{\text{SMALL}\quad 221\,24.13_{148}} = 1.91$$

SIGN. $F_{232,148} \leq 1.43$ $\quad 1.91 > 1.43$ VARIANCES DIFFER

(B) TEST HYPOTHESIS, EMPLOY SPECIAL t-test

$$\text{Est. } t' = (258 - 146) / \sqrt{42186.8/233 + 22124.13/149}$$

$$= 6.17$$

SIGN $t' = 1.98$

Est. t' > SIGN t' REJECT THE NULL HYPOTHESIS

MINN. - N.D. WHEAT

H_0: MEAN WHEAT YIELD DOES NOT DIFFER BETWEEN SMALL AND MEDIUM SET-ASIDE FARMS.

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

$$\text{MED.} \quad \frac{102.39_{232}}{87.02_{148}} = 1.176$$

SIGN. $F_{232,148} = 1.43$ $\quad 1.176 < 1.43$ VARIANCES ARE EQUAL

(B) TEST HYPOTHESIS

$$\text{POOLED } s^2 = \frac{102.39(232) + 87.02(148)}{233 + 149} = 95.9$$

$$s_{\bar{x}_M - \bar{x}_S} = \sqrt{95.9\left(\frac{233 + 149}{(233)(149)}\right)} = 1.03$$

$$\text{Est. } t = (32 - 29)/1.03 = 3.88$$

$$\text{SIGN. } t_{380} = 1.98$$

Est. t > SIGN. t REJECT THE NULL HYPOTHESIS

MINN. - N.D. WHEAT

H_0: MEAN FARMER AGE DOES NOT DIFFER BETWEEN SMALL AND MEDIUM SET-ASIDE FARMS.

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

SMALL $\frac{202.25}{145}$ = 1.43

MED. 141.19 227

SIGN. $F_{145, 227} \leq 1.43$ VARIANCES DIFFER

(B) TEST HYPOTHESIS, EMPLOY SPECIAL t-test

Est. $t' = (53-49) / \sqrt{202.25/146 + 141.19/228} = 2.83$

Sign. $t' = 1.98$

Est. t' > Sign. t' REJECT THE NULL HYPOTHESIS

MINN.-N.D. WHEAT

H_0: MEAN DEBT TO ASSET RATIO DOES NOT DIFFER BETWEEN SMALL AND MEDIUM SET-ASIDE FARMS

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

SMALL $\frac{568.01_{100}}{528.33_{166}} = 1.08$

MED

SIGN. $F_{100,166} = 1.31$ $\quad 1.08 < 1.31$ VARIANCE ARE EQUAL

(B) TEST HYPOTHESIS

$$\text{POOLED } s^2 = \frac{568.01(100) + 528.33(166)}{101 + 166} = 541.21$$

$$s_{\bar{X}_M - \bar{X}_S} = \sqrt{541.21\left(\frac{101+166}{(101)(166)}\right)} = 2.94$$

$$\text{Est. } t = (21.2 - 16.2) / 2.94 = 1.70$$

$$\text{SIGN. } t_{266} = 1.98$$

Est. t < SIGN. t DO NOT REJECT THE NULL HYPOTHESIS

MINN. - N.D. WHEAT

IN ALL THREE CATEGORIES, MEAN TOTAL PAYMENTS, CROPLAND ACREAGE, AND WHEAT ACREAGE, IT WAS OBVIOUS FROM THE SIGNIFICANCE TESTS THE LARGE SET-ASIDE FARMS RECEIVED LARGER TOTAL PAYMENTS AND FARMED GREATER ACREAGE THAN SMALL SET-ASIDE FARMS

MINN. - N. D. WHEAT

H_0: MEAN WHEAT YIELD DOES NOT DIFFER BETWEEN SMALL AND LARGE SET-ASIDE FARMS.

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

$$\frac{\text{LARGE}}{\text{SMALL}} \quad \frac{125.67_{79}}{87.02_{148}} = 1.44$$

SIGN. $F_{79,148} = 1.57$ $\quad 1.44 < 1.57$ VARIANCES ARE EQUAL

(B) TEST HYPOTHESIS

$$\text{POOLED } S^2 = \frac{125.67(79) + 87.02(148)}{80 + 149} = 99.59$$

$$S_{\bar{X}_L - \bar{X}_S} = \sqrt{99.59\left(\frac{80+149}{(80)(149)}\right)} = 1.38$$

$$\text{Est. } t = (36 - 29) / 1.38 = 5.797$$

$$\text{Sign. } t = 1.98$$

Est. t > Sign. t REJECT THE NULL HYPOTHESIS

MINN. - N.D. WHEAT

H_0: MEAN FARMER AGE DOES NOT DIFFER BETWEEN SMALL AND LARGE SET-ASIDE FARMERS.

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

$$\begin{matrix}\text{SMALL} \\ \text{LARGE}\end{matrix} \quad \frac{202.25_{145}}{149.33_{79}} = 1.35$$

SIGN. $F_{145,79} = 1.53$ $\quad 1.35 < 1.53$ VARIANCES ARE EQUAL

(B) TEST HYPOTHESIS

$$\text{POOLED } S^2 = \frac{202.25(145) + 149.33(79)}{146 + 80} = 181.96$$

$$S_{\bar{X}_S - \bar{X}_L} = \sqrt{181.96\left(\frac{146+80}{(146)(80)}\right)} = 1.876$$

$$\text{EST. } t = (53-45)/1.876 = 4.26$$

SIGN. $t = 1.98$

EST. $t >$ SIGN. t REJECT THE NULL HYPOTHESIS

MINN. – N.D. WHEAT

H_0: MEAN DEBT TO ASSET RATIO DOES NOT DIFFER BETWEEN SMALL AND LARGE SET-ASIDE FARMERS

H_A: H_0 IS FALSE

(A) TEST HOMOGENEITY OF VARIANCES

$$\frac{\text{SMALL}}{\text{LARGE}} \quad \frac{568.01_{100}}{353.27_{68}} = 1.61$$

SIGN. $F_{100,68} = 1.596$ $\qquad 1.61 > 1.596$ $\qquad$ VARIANCES DIFFER

(B) TEST HYPOTHESIS, employ special t-test

$$\text{Est. } t' = (25.3 - 16.2) / \sqrt{568.01/101 + 353.27/69}$$

$$= 2.776$$

$$\text{Sign. } t' \cong 1.98$$

Est. $t' >$ Sign. t' $\qquad$ REJECT THE NULL HYPOTHESIS

APPENDIX II
SECTION A

ANALYSIS OF VARIANCE TABLES

MINN-NORTH DAKOTA WHEAT STATISTICS

FILE WHEISTAT (CREATION DATE = [illegible].)

* * * * * * * * * A N A L Y S I S O F V A R I A N C E * * * * * * * *

TOTPAY TOTAL DEFICIENCY PAYMENTS
BY VS STATE
FMSIZE FARM SIZE

* *

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	[illegible]	3	.219E+10	64.332	.001
VS	[illegible]	1	.904E+09	26.493	.001
FMSIZE	[illegible]	2	.304E+10	89.207	.001
2-WAY INTERACTIONS	16590075.152	2	.829E+07	.243	.784
VS FMSIZE	16590075.152	2	.829E+07	.243	.784
EXPLAINED	[illegible]	5	.132E+10	39.696	.001
RESIDUAL	.1555E+11	456	.341E+08		
TOTAL	.2217E+11	461	.480E+08		

585 CASES WERE PROCESSED.
123 CASES (21.0 PCT) WERE MISSING.

TABLE A.1. ANOVA on Total Deficiency Payments, Minnesota and North Dakota Wheat, 1978 Survey Data.

MINN-NORTH DAKOTA WHEAT STATISTICS

FILE WHEISTAT (CREATION DATE = 11/01/80.)

* * * * * * * * ANALYSIS OF VARIANCE * * * * * * * *

BY V7 CROPLAND ACREAGE
V8 STATE
FARM-SIZE

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	5596557.27	3	.186E+08	72.012	.001
V3	1042363.917	1	.104E+08	40.256	.001
FMSIZE	4942529.127	2	.247E+08	95.395	.001
2-WAY INTERACTIONS	652060.194	2	326030.097	1.259	.285
V3 FMSIZE	652060.194	2	326030.097	1.259	.285
EXPLAINED	56617997.321	5	.113E+08	43.711	.001
RESIDUAL	.111731E+09	431	259096.414		
TOTAL	.172935E+09	436	396412.527		

580 CASES WERE PROCESSED.
130 CASES (22.2 PCT) WERE MISSING.

TABLE A.2. ANOVA on Cropland Acreage, Minnesota and North Dakota Wheat, 1978 Survey Data.

MINN-NORTH DAKOTA WHEAT STATISTICS

FILE WHEISTAT (CREATION DATE = 81/01/27.)

* * * * * * * * A N A L Y S I S O F V A R I A N C E * * * * * * * *

V8 WHEAT ACREAGE
BY V3 STATE
FMSIZE FARM SIZE

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	8981760.228	3	.298E+07	47.998	.001
V3	2998263.242	1	.299E+07	48.175	.001
FMSIZE	6782568.435	2	.339E+07	54.490	.001
2-WAY INTERACTIONS	31356.041	2	15678.320	.252	.777
V3 FMSIZE	31356.041	2	15678.320	.252	.777
EXPLAINED	8993124.868	5	.179E+07	28.899	.001
RESIDUAL	28380239.850	456	62237.368		
TOTAL	37373364.719	461	81070.205		

585 CASES WERE PROCESSED.
123 CASES (21.0 PCT) WERE MISSING.

TABLE A.3. ANOVA on Wheat Acreage, Minnesota and North Dakota Wheat, 1978 Survey Data.

DAKOTA WHEAT STATISTICS

FILE WHEISTAT (CREATION DATE = 01/01/27.)

* * * * * * * * ANALYSIS OF VARIANCE * * * * * * * *

V13 WHEAT YIELD

BY V3 STATE

FMSIZE FARM SIZE

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F.
MAIN EFFECTS	3516.624	3	1172.208	11.569	.001
V3	140.645	1	140.645	1.388	.239
FMSIZE	3461.937	2	1730.969	17.083	.001
2-WAY INTERACTIONS	371.308	2	185.654	1.832	.161
V3 FMSIZE	371.308	2	185.654	1.832	.161
EXPLAINED	3887.933	5	777.587	7.674	.001
RESIDUAL	44988.512	444	101.325		
TOTAL	48876.444	449	108.856		

450 CASES WERE PROCESSED.

0 CASES (0 PCT) WERE MISSING.

TABLE A.4. ANOVA on Wheat Yield, Minnesota and North Dakota Wheat, 1978 Survey Data.

MINN=NORTH DAKOTA WHEAT STATISTICS

FILE MNRSTAT (CREATION DATE = 01/01/80.)

* * * * * * * * A N A L Y S I S O F V A R I A N C E * * * * * * * *

V82 FARMER AGE
BY V3 STATE
EMSIZE FARM SIZE

* *

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	4079.174	3	1359.725	8.472	.001
V3	326.575	1	326.575	2.036	.154
EMSIZE	3947.451	2	1973.926	12.309	.001
2-WAY INTERACTIONS	1004.134	2	502.067	3.131	.045
V3 EMSIZE	1004.134	2	502.067	3.131	.045
EXPLAINED	5083.308	5	1016.662	6.340	.001
RESIDUAL	71042.622	443	160.362		
TOTAL	76125.930	448	169.813		

585 CASES ARE PROCESSED.
131 CASES (22.4 PCT) WERE MISSING.

TABLE A.5. ANOVA on Farmer Age, Minnesota and North Dakota Wheat, 1978 Survey Data.

MINN-NORTH DAKOTA WHEAT STATISTICS

FILE WHEATSTAT (CREATION DATE = 01/21/20.)

* * * * * * * * A N A L Y S I S O F V A R I A N C E * * * * * * * *

DEBT TO ASSET RATIO

BY V3 STATE

EMSIZE FARM SIZE

* *

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	4135.199	3	1377.733	2.722	.044
V3	599.452	1	599.452	1.184	.277
EMSIZE	3969.679	2	1984.840	3.922	.020
2-WAY INTERACTIONS	362.951	2	181.475	.359	.699
V3 EMSIZE	362.951	2	181.475	.359	.699
EXPLAINED	4498.150	5	899.630	1.776	.117
RESIDUAL	167562.853	331	506.232		
TOTAL	172059.003	336	512.080		

586 CASES WERE PROCESSED.
248 CASES (42.4 PCT) WERE MISSING.

TABLE A.6. ANOVA on Debt to Asset Ratio, Minnesota and North Dakota Wheat, 1978 Survey Data.

MINN-IOWA CORN STATISTICS

FILE CORNSTAT (CREATION DATE = 01/01/80.)

* * * * * * * * * * A N A L Y S I S O F V A R I A N C E * * * * * * * * * *

TOTPAY TOTAL DEFICIENCY PAYMENTS

BY V3 STATE

EMSIZE FARM SIZE

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	2[illegible]7530.[illegible]	3	.801E+07	12.519	.001
V3	[illegible]234.405	1	.670E+07	10.583	.001
EMSIZE	17[illegible].479	2	.[illegible]+07	13.909	.001
2-WAY INTERACTIONS	7[illegible].12	2	.399E+07	6.239	.002
V3 EMSIZE	[illegible].812	2	.399E+07	6.239	.002
EXPLAINED	3[illegible]71.480	5	.641E+07	10.008	.001
RESIDUAL	9[illegible]74.750	1546[illegible]1.265			
TOTAL	.13[illegible]109	1[illegible]4.190			

660 CASES WERE PROCESSED.
105 CASES (15.9 PCT) WERE MISSING.

TABLE A.7. ANOVA on Total Deficiency Payments, Minnesota and Iowa Corn, 1978 Survey Data.

MINN-IOWA CORN STATISTICS

FILE CORNSTAT (CREATION DATE = [illegible])

* * * * * * * * * A N A L Y S I S O F V A R I A N C E * * * * * * * * *

V7 CROPLAND ACREAGE
BY V3 STATE
FMSIZE FARM SIZE

* *

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	[illegible]	[illegible]	39[illegible]977.742	11.728	.001
V3	5473.[illegible]	1	5473.566	.069	.793
FMSIZE	2779507.[illegible]	2	.138E+07	17.546	.001
2-WAY INTERACTIONS	844[illegible].707	[illegible]	2422240.353	5.331	.006
V3 FMSIZE	844[illegible].707	[illegible]	2422240.353	5.331	.006
EXPLAINED	[illegible]	[illegible]	57[illegible]2.787	9.169	.001
RESIDUAL	1195[illegible]97.658	151	7[illegible]01.971		
TOTAL	1559[illegible]	156	9[illegible]39.818		

263 CASES WERE PROCESSED.
106 CASES (40.3 PCT) WERE MISSING.

TABLE A.8. ANOVA on Cropland Acreage, Minnesota and Iowa Corn, 1978 Survey Data.

MINN-IOWA CORN STATISTICS

FILE CORNSTAT (CREATION DATE = 81/01/27.)

* * * * * * * * ANALYSIS OF VARIANCE * * * * * * * *

V9 CORN ACREAGE
BY V3 STATE
FMSIZE FARM SIZE

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	754777.524	3	251592.508	15.826	.001
V3	11189.184	1	11189.184	.704	.403
FMSIZE	740126.516	2	370063.158	23.278	.001
2-WAY INTERACTIONS	121507.733	2	60653.867	3.815	.024
V3 FMSIZE	121507.733	2	60653.867	3.815	.024
EXPLAINED	876285.258		5175217.052	11.022	.001
RESIDUAL	2446212.936	154	15897.487		
TOTAL	3324298.194	159	20907.536		

263 CASES WERE PROCESSED.
103 CASES (39.2 PCT) WERE MISSING.

TABLE A.9. ANOVA on Corn Acreage, Minnesota and Iowa Corn, 1978 Survey Data.

...N-IOWA CORN STATISTICS

FILE CORNSTAT (CREATION DATE = 01/01/27.)

* * * * * * * * A N A L Y S I S O F V A R I A N C E * * * * * * * *

V14 CORN YIELD
BY V3 STATE
FMSIZE FARM SIZE

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF- OF F
MAIN EFFECTS	15469.055	3	5156.352	10.776	.001
V3	2514.459	1	2514.459	5.255	.023
FMSIZE	12480.052	2	6243.426	13.047	.001
2-WAY INTERACTIONS	1445.619	2	722.909	1.511	.224
V3 FMSIZE	1445.619	2	722.909	1.511	.224
EXPLAINED	16914.674	5	3382.975	7.070	.001
RESIDUAL	71299.546	149	478.519		
TOTAL	88214.219	154	572.820		

155 CASES WERE PROCESSED.
0 CASES (0 PCT) WERE MISSING.

TABLE A.10. ANOVA on Corn Yield, Minnesota and Iowa Corn, 1978 Survey Data.

MINN-IOWA CORN STATISTICS

FILE CORNSTAT (CREATION DATE = 01/01/80.)

* * * * * * * * * A N A L Y S I S O F V A R I A N C E * * * * * * * * *

V02 FARMER AGE
BY V3 STATE
FMSIZE FARM SIZE

* *

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	1993.389	3	664.463	4.911	.003
V3	32.173	1	32.173	.234	.629
FMSIZE	1963.209	2	981.604	7.140	.001
2-WAY INTERACTIONS	86.723	2	43.361	.315	.730
V3 FMSIZE	86.723	2	43.361	.315	.730
EXPLAINED	2071.112	5	414.222	3.013	.013
RESIDUAL	21033.995	153	137.477		
TOTAL	23105.107	158	146.235		

263 CASES WERE PROCESSED.
104 CASES (39.5 PCT) WERE MISSING.

TABLE A.11. ANOVA on Farmer Age, Minnesota and Iowa Corn, 1978 Survey Data.

MINN-IOWA CORN STATISTICS

FILE CORNSTAT (CREATION DATE = 03/03/20.)

* * * * * * * * * * A N A L Y S I S O F V A R I A N C E * * * * * * * * * *

DEBT TO ASSET RATIO

BY VS STATE FARM-SIZE

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	3702.233	3	1234.078	3.252	.024
VS	.174	1	.174	.000	.983
FMSIZE	3702.059	2	1851.029	4.878	.009
2-WAY INTERACTIONS	26.807	2	13.403	.035	.965
VS FMSIZE	26.807	2	13.403	.035	.965
EXPLAINED	3729.040	5	745.808	1.965	.087
RESIDUAL	46252.960	122	379.204		
TOTAL	49982.000	127	393.559		

203 CASES WERE PROCESSED.
136 CASES (51.7 PCT) WERE MISSING.

TABLE A.12. ANOVA on Debt to Asset Ratio, Minnesota and Iowa Corn, 1978 Survey Data.

APPENDIX II
SECTION B

TABLES OF MEAN VALUES AND STANDARD ERRORS

Table A.13 Mean Values and Standard Errors For Characteristic Variables, Minnesota and North Dakota Wheat Farms, 1978 Survey Data.

Characteristic Variable	Cross Reference	Farm Size	State			
			Minnesota		North Dakota	
			Mean	Std. Error	Mean	Std. Error
Total Deficiency Payments	Fig. 7.1a Tab. A.1	Small	$959.8	780.3	$3228.5	605.5
		Medium	$4054.4	581.0	$7160.16	508.3
		Large	$11358.1	901.1	$14437.09	947.0
Cropland Acreage	Fig. 7.2a Tab. A.2	Small	247.0 acres	68	572.7 acres	53
		Medium	569.3	51	920.0	44
		Large	1335.7	79	1475.7	83
Wheat Acreage	Fig. 7.3a Tab. A.3	Small	57.8 acres	33	198.8 acres	26
		Medium	162.1	25	330.9	22
		Large	394.0	39	583.0	42
Wheat Yield	Fig. 7.4a Tab. A.4	Small	27.0 bu/ac	1.3	29.0 bu/ac	1.0
		Medium	30.5	1.0	33.0	0.9
		Large	37.1	1.5	34.0	1.6
Farmer Age	Fig. 7.5a	Small	56.9 years	1.72	51.2 years	1.32
		Medium	48.5	1.27	49.6	1.11
		Large	46.2	1.95	43.6	2.05
Debt to Asset	Fig. 7.6a Tab. A.6	Small	15.9 %	3.65	16.4	2.83
		Medium	23.2	2.55	19.5	1.96
		Large	27.3	3.56	22.5	5.38

Table A.14 Mean Values and Standard Errors For Characteristic Variables, Minnesota and Iowa Corn Farms, 1978 Survey Data.

Characteristic Variable	Cross Reference	Farm Size	State			
			Minnesota		Iowa	
			Mean	Std. Error	Mean	Std. Error
Total Deficiency Payments	Fig. 7.1b Tab. A.7	Small	$370.9	194.1	$445.0	119.3
		Medium	$1571.8	179.0	$581.3	105.1
		Large	$1597.4	358.0	$1417.3	206.7
Cropland Acreage	Fig. 7.2b Tab. A.8	Small	207.6 ac.	68.25	328.0 ac.	41.95
		Medium	505.5	62.92	351.9	37.27
		Large	510.0	125.85	811.5	75.21
Corn Acreage	Fig. 7.3b Tab. A.9	Small	89.0 ac.	30.58	134.4	18.79
		Medium	211.8	28.92	175.2	16.55
		Large	229.0	56.38	381.4	32.55
Corn Yield	Fig. 7.4b. Tab. A.10	Small	90.3 bu/ac	5.30	108.1 ac/bu	3.26
		Medium	104.6	4.90	113.9	2.87
		Large	135.4	9.78	127.0	5.64
Farmer Age	Fig. 7.5b. Tab. A.11	Small	50.2 years	2.84	50.5 years	1.76
		Medium	43.8	2.62	46.3	1.53
		Large	41.4	5.24	38.9	3.03
Debt to Asset	Fig. 7.6b. Tab. A.12	Small	13.0 %	5.51	13.72 %	3.05
		Medium	23.47	4.93	23.41	2.81
		Large	30.0	9.55	27.27	5.76

NOTES

CHAPTER ONE

[1]T.W. Schultz, Agriculture in an Unstable Economy, (New York: McGraw-Hill Book Co. Inc., 1945).

[2]J. F. Horner, "The U. S. Governmental Activities in the Field of Agricultural Economics Prior to 1913," Journal of Farm Economics, Vol. X, No. 4, Oct., 1928, p. 455. The quote was originally from a statement made by the Secretary of Agriculture in 1896, from the Yearbook of Agriculture(1896). The quote continues: Lawmakers cannot erase natural laws nor restrict or efface the operation of economic laws. It is a beneficient arrangement of the order of things and the conditions of human life that legislators are not permitted to repeal, amend, or revise the laws of production and distribution.

[3]John D. Black, "National Agricultural Policy," American Economic Review, Vol XVI, No. 1, Supplement, March 1926, p. 134, quoting Henry C. Wallace.

[4]Edwin G. Nourse, "Some Economic Factors in an American Agricultural Policy," Journal of Farm Economics, Vol. VII, No. 1, Jan., 1925, p. 18.

[5]John D. Black, "The Role of Public Agencies in the Internal Readjustments of the Farm," Journal of Farm Economics, April, 1925, Vol. VII, No. 2, p. 174.

[6]Elmer A. Lewis, Farm Relief and Agricultural Adjustment Acts, (Washington, D. C.: U.S. Gov't Printing office, 1954), p. 20.

[7]Ibid.

[8]Ibid.

[9]U. S. Dept. of Agriculture, 1934 Yearbook of Agriculture,p.101.

[10]Ibid.

[11]The Ever-Normal Granary was a term used in the 1938 Ag. Adj. Act to designate a reserve of farm commodities that would help support prices and maintain a stock of grain for the nation's use.

[12]U. S. Dept. of Ag., p. 101.

[13]Arthur Okun, Equality and Efficiency, The Big Tradeoff, Wash., D. C.:The Brookings Institution, 1975), p. vii.

[14]Ibid.

[15]Robert Bergland, "National Dialogue on the Future of American Agriculture," A Speech presented to the National Farmer's Union Convention, Kansas City, Missouri, March 12, 1979.

[16]U. S. Congress,"Status of the Family Farm," (Washington, D. C.: U. S. Gov't Printing Office, 1979), p. 25.

[17]Luther Tweeten and Isaac Popoola, "Typology and Policy for Small Farms: Agricultural Economist Versus Alternative Culturalist," Journal Article of the Okla. Ag. Experiment Station, p.4.

[18]E. F. Schumacher wrote a book entitled, Small Is Beautiful: Economics As If People Mattered. (New York: Harper and Row, 1973) which advocates small-scale lifestyle, technology, agriculture, health and education.

[19]Bergland, Farmer's Union Speech.

[20]Ibid.

CHAPTER TWO

[1]Small farms can also be divided into two groups: commercial and non-commmercial farms. USDA's definition of a commercial farm includes all farms with sales from farm products that are $2,500 or greater per year. Non-commercial farms have sales of less than $2,500 per year from farm products.

CHAPTER THREE

[1]Luther Tweeten and Isaac Popoola, "Typology and Policy for Small Farms: Agricultural Economist Versus Alternative Culturalist, p.p. 9-13.

[2]Vernon Ruttan, "Agricultural Policy in an Affluent Society," Journal of Farm Economics, Vol. 48, No. 5, Dec. 1966, p. 1116.

[3]Willard W. Cochrane, Farm Prices, Myth and Reality, (Minnesota: Univ. of Minn. Press, 1958), p.111.

[4]Rudolf Freund, "John Adams and Thomas Jefferson on the Nature of Landholding in America," Land Economics, May, 1948, Vol. XXIV., No.2.

[5]David Brewster, "Federal Policy and the Small Farm, A Historical View," A paper presented for the Small Farm Policy Workshop, Winrock, Arkansas 1977. Published in Toward a Federal Small Farms Policy, Phase I, (Wash., D. C.: The Nat'l Rural Center, 1978), p. 26.

[6]Philip Raup, "societal Goals and Farm Size," a chapter from Size, Structure and Future of Farms, Ball and Heady, Eds.,Iowa State Univ. Press, 1972, quoting from A. Whitney Griswold, Farming and Democracy, (New York: Harcourt Brace, 1948, pp. 26-31), p.5.

[7]Raup, p.5.

[8]Raup, p.6.

[9]William Saupe, "Information Needs Relating to Small Farms Programs and Policies," USDA, ESCS Staff Report, July, 1980, p. 22.

[10]Brewster, p. 35.

[11]Tweeten and Popoola, p. 13.

[12]Brewster, p. 48.

CHAPTER FOUR

[1]National program acreages (NPA's) are determined by the Secretary of Agriculture and represent the estimated acreage needed to meet the domestic and export, plus carry-over stocks, demand of individual commodities. NPA's serve as a guideline to designate the normal crop acreage (NCA) for each farm within a county.

[2]Page iv, "Commodity Provisions Under the Food and Agriculture Act of 1977," Ag. Econ. Report No. 389, ERS, USDA, October , 1977.

CHAPTER FIVE

[1]Contemporary Economics, by Milton Spencer, 2nd Ed., Worth Publishers, Inc., 1974, p. 11.

[2]This definition for non-commercial farms is given on page 26 of Farm Structure, A Historical Perspective on Changes in the Number and Size of Farms, A Committee Print, U. S. Senate Committee on Ag., Nutrition and Forestry, April, 1980.

[3]Calculated from figures available in "Farm Income Statistics," USDA, ESCS, Stat. Bulletin No. 627, October, 1979, p. 52.

[4]For an informative discussion of the distributional impact of government programs that raises major questions about equity, refer to James T. Bonnen's "The Absence of Knowledge of Distributional Impacts: An Obstacle to Effective Public Program Analysis and Decisions." The article is part of "A Compendium of Papers Submitted to the Subcommittee on Economy in Government of the Joint Economic Committee," 91st Congress, 1st Session, 1969, p. 419-449.

[5]Bonnen, p. 440 and "Farm Income Statistics", USDA, pp. 56&60.

[6]The trend actually begins with medium farms whose average deficiency payments per farm as a percentage of total income are 11.1%.

[7]This theory, called the treadmill theory, was first described by Willard W. Cochrane in his book, Farm Prices, Myth and Reality (Univ. of Minn. Press, 1958), in the chapter entitled, "The Agricultural Treadmill". Cochrane also devotes a chapter of a more recent work, The Development of American Agriculture: A Historical Analysis, to a discussion of the treadmill theory, pp. 378-395.

[8]Peterson's theory is described in "The Farm Size Issue: A New Perspective" (Univ. of Minn., Dept. of Ag. and Applied Econ. Staff Paper No. P-80-6, Feb. 1980) pp. 4-7. It is also described in a later paper authored by Yoav Kislev and Willis Peterson: "Relative Prices, Technology and Farm Size" (Univ. of Minn., Dept. of Ag. and Applied Econ. Staff Paper, May 1980), pp. 5-9.

[9]The treadmill theory was first given this name in Cochrane's Farm Prices, Myth and Reality. See footnote (7) above.

[10]A term used by Willard Cochrane to describe a farmer who is the first to take advantage of new technologies.

[11]A term used by Willard Cochrane to describe the way is which smaller farms are bought up and added to existing farms by aggresive larger farmers.

[12]Cochrane, The Development of American Agriculture: A Historical Analysis, Figure 19.3A, p. 389.

[13]Ibid. Adapted from Figure 19.4, p. 391.

[14]Kislev and Peterson, p.8.

[15]The model is described on pages 5-9 in "Relative Prices, Technology and Farm SIze", Kislev and Peterson.

CHAPTER SIX

[1]Mary E. Ryan, "Manual For Users of Data Tape From the Grain-Reserve Farmer Survey NC-152, Subproject 4", (St. Paul, Minn.: Dept. of Ag. and Applied Econ., Jan., 1980), p.1. The manual was prepared for users of the data tape. The project is now headed by Prof. William Myers at Iowa State Univ., Ames, Iowa. There is a data tape in storage at the Univ. of Minn. in the computer office at 125 Classroom Office Bldg., 1994 Buford Ave., St. Paul, Minn. 55108.

[2]Norman H. Nie et al, Statistical Package for the Social Sciences, (New York: McGraw-Hill Book Company, 1975). p. 218.

[3]Most statistical textbooks have a Student's t-distribution table in the appendix. This thesis used the resources provided in Statistical Methods, by Snedecor and Cochran, Iowa State Univ. Press, 1978. p. 549.

[4]An F-test must be employed to test the equality of the variances between two populations in order to pool the variances for the t-test. A hypothesis is set up as follows:

$H_0: \sigma_1^2 = \sigma_1^2$, where σ_1^2 and σ_1^2 are the two population variances, respectively.

H_A: H_0 is false.

An estimates F-statistic is calculated by dividing the sample variance, s^2, of population 1 by the sample variance of population 2 or vice versa, depending upon which sample variance is larger. The largest s^2 is always the numerator of the F-statistic quotient. If the estimated F is greater than the significant F at the five percent level of significance, the null hypothesis is rejected (Using a two-tailed F-test). Significance tables for the F-distribution begin on page 560 of Statistical Methods by Snedecor and Cochran.

[5]Regression analysis, the next step toward sophisticated analysis after ANOVA, was attempted as a means to predict farm size ((i. e. to profile characteristics of the small farmer). It was not included in the text of the study because the percent of variation in the dependent variable explained by the regression equation was less than twenty-five percent in all of the best regressions.

The forward inclusion method of determining the best linear regression was employed in the analysis. This means that variables were entered only if they met a pre-established criterion. The order of inclusion was determined by the respective contribution of each variable to the explained variance.

Although the R-square (the percent of variation in the dependent variable explained by the regression equation) of each regression was not significant, the results are nonetheless interesting.

The best regression, using wheat farm survey data (1978) was:

Log to the base 10 of farm sales = 4.46 - .35(Farmer Owns 100% of farm land- a dummy variable) (31.7) (7.0) + .015(Wheat Yield, in bu/ac) (6.81) - .066(No livestock- a dummy var.) (2.75) - .32(Farmer rents 100% of farmland- a dummy var.) (3.62) + .002(Debt to Ratio,%) (2.36) - .004(Farmer Age, years) (2.08) + Error term

R-square=.24532 $F_{1, 476} = 5.02$ The estimated F-statistics for the regression coefficients are beneath them in parentheses to show the significance.

The trend for farm size among wheat farms in Minnesota and North Dakota, as measured by the $\log_{10}$ of farm sales, was for farm size to decrease if the farmer owned all of their farmland; for farm size to increase as wheat yield increases; for farm size to decrease if there is no livestock of the farm; for farm size to decrease if the farmer rents all of his land; for farm size to increase, slightly, as the debt to asset ratio rises; and for farm size to decrease as the farmer's age increases. Only two regression coefficients were significant (Farmer owns 100% of land - a dummy variable and wheat yield).

The best regression, using corn farm survey data (1978) was:

Log to the base 10 of farm sales = 3.959 (414.96) + .0046(Corn Yield, in bu/ac) (8.036) - .239(Farmer Owns 100% of farm land- a dummy var.) (7.36) + .269(Farmer Uses the Futures Market- a dummy var.) (4.19) - .0738(No Livestock- a dummy var.) (2.43) + Error Term

R-square = .0988 $F_{1, 217} = 5.02$

The trend for farm size, as measured by the $\log_{10}$ of farm sales, among corn farms in Minnesota and Iowa was for farm size to increase with corn yield; for farm size to decrease if the farmer owned all of his farmland; for farm size to increase if the farmer used the futures market; for farm size to decrease if there was no livestock on the farm. All of the regression coefficients were significant with the exception of the livestock dummy variable.

The probit regression technique (refer to Probit Analysis by D. F. Finney, Cambridge Univ., 1971, 3rd ed. for a thorough explanation of the technique) was experimented with in the early stages of the thesis work to determine the probability that a farmer with certain characteristics would chose to participate in the set-aside program. This was done to see if a relationship existed between farm size and set-aside participation. The results were not included in this thesis, because the regression coefficients were not statisically significant.

[6]George W. Snedecor et al., Statistical Methods, (Iowa State: Univ. Press, 1978), p. 259.

[7]Because sample sizes were over 200, a conservative significance value of the F-statistic was chosen as the test statistic. The F-value at the five percent significance level for samples over 120 is 1.00.

CHAPTER SEVEN

[1]In tables 7.3,7.4, 7.5, 7.8, 7.9, 7.12a, 7.12b, 7.13a, 7.13b, 7.16a, 7.16b, 7.17a, 7.17b, 7.20a & b, 7.21a & b, 7.24a & b, 7.25a & b, 7.28a & b, 7.29a & b, 7.32a & b, 7.33a & b, 7.36a & b, and 7.37a & b, the percentages sum to 100 horizontally. In tables 7.6, 7.7, 7.10, 7.11, 7.14, 7.15, 7.18, 7.19, 7.22, 7.23, 7.26, 7.27, 7.30, 7.31, 7.34, 7.35, 7.38, and 7.39 the percentages sum to 100 vertically.

[2]Ibid. A reminder.

[3]The use of the word significance will always refer to statistical significance throughout the remainder of this thesis.

CHAPTER NINE

[1]Remarks made by Edwin G. Nourse in his presidential address to the Farm Economics Assoc. in 1924 are not unlike Robert Bergland's (cited in the thesis introduction). Edwin G. Nourse, "Some Economic Factors in an American Agricultural Policy," Journal of Farm Economics, Vol. VII, No. 1, Jan., 1925, p.1.

[2]John D. Black, "The Progress of Farm Relief," American Econ. Review, Vol. XVIII, No. 2, June 1928,p. 252.