Changing structure of Iowa farmland ownership

Metin Berk
Iowa State University

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Iowa State University, Ph.D., 1971
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Changing structure of Iowa farmland ownership

by

Metin Berk

A Dissertation Submitted to the
Graduate Faculty in Partial Fulfillment of
The Requirements for the Degree of
DOCTOR OF PHILOSOPHY

Major Subject: Agricultural Economics

Approved:

Signature was redacted for privacy.

In Charge of Major Work

Signature was redacted for privacy.

For the Major Department

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For the Graduate College

Iowa State University
Ames, Iowa

1971
PLEASE NOTE:

Some pages have small and indistinct print. Filmed as received.

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DEDICATED TO

MY MOTHER AND FATHER,
MAKBULE AND DR. MEHMET KAMIL BERK,
WITH LOVE AND AFFECTION.
INTRODUCTION

Owner-operatorship has been the goal of the farm family since the beginning of the settlement of Iowa in the 1830's until the present time. The Jeffersonian dream of owners operating their individual lands and reaping the benefits of their own efforts has always been highly valued and has been regarded as an end to be achieved by society. To this end of owner-operatorship, society has devised legislative as well as technical means to help farm families reach their goals (21, pp. 168-176 and 80, pp. 19-20). Intervening decades have not altered this basic goal which was described by Murray, "The typical Iowa farmer and his family have a strong, continuing desire to own a farm that belongs to them alone. The family-sized farm grew up here, and won its popularity as the most practical unit for this region" (65, p. 1).

Basic goals of society have not altered, but the accelerated rate of technological innovations experienced during the past few decades have transformed the relatively simple business of owning and operating a farm into a complex undertaking. The introduction of technologically superior agricultural inputs—machinery, seeds, pesticides, fertilizers, as well as scientific management techniques—has challenged the basic concept of the economic organization of agriculture in family farm units.

This then is our point of departure. The study is undertaken to identify and isolate the structural changes and adjustments that have taken place in farmland ownership in Iowa due to the impact of technological innovations and other changes experienced in recent decades. It is not intended to isolate specific technological advancements and their
partial effects on farmland ownership. Technological innovations are
taken as given exogeneously, but their total impact on the characteristics
of farmland owners through time is analyzed as far as it relates to their
acquisition and ownership situation. Information gathered will indicate
the trends that are taking place in Iowa farmland ownership. The analysis
of these trends will help formulate policies that create and/or strengthen
existing institutions which promote the goals of the society.

Ownership Norm

In the development of American agriculture, fundamental importance
has been attached to the owner-operatorship norm as is evident in the
following statement:

Rights in land and the ownership thereof have always been
of fundamental importance to the development of American agri­
culture and the welfare of farm people. The nature, transfer,
and valuation of these rights constitute the major institutional
foundations upon which are built American units of agricultural
production--farms, ranches, and plantations. Furthermore, farm
ownership is a basic ideal to which farm people aspire. It is
one which they continually strive to achieve and maintain. Thus
the achievement and maintenance of stable and satisfactory
conditions of farm ownership occupy a pre-eminent role in the
lives of farm people as well as in the nation's agricultural
policies (93, p. 79).

While the norm stresses private ownership of the land by the opera­
tor, in and of itself, it does not imply the organizational form of the
agricultural unit. The specific form of organization is incidental to the
norm of ownership and may exhibit any one of several alternatives in a
given situation.

Family farm, partnership or corporate organizations are some of the
alternative forms in pursuit of the ownership norm. Traditionally,
however, ownership and form of organization have not been considered as
distinct phenomena. Fundamental importance has been attached to a form of
organization centered around the family, as a consumption as well as a
production unit, in discussing the ownership norm of society.

The result of neglecting to consider other forms of organization has
often led to a confusion of ends with the means of attaining these ends.
It has been observed that a specific form of organization has been substi­
tuted as the norm to be achieved in place of the ownership goal (43,
p. 539; 60, p. 310 and 56, p. 1005).

Pursuing a specific form of economic organization as a public policy
goal is disturbing. As Dorner points out, it may eventually become a
defense of inefficient institutions if it is not allowed to compete with
alternative forms:

Our economic institutions always have been subjected to the
competition of alternative forms. The family farm is the dominant
form of economic organization in agriculture because it has given
better performance than other forms . . . the corporate form in
industry evolved to dominate our system, not as a result of public
policy to promote it, but because forms previously existing could
not compete (19, p. 545).

With respect to this study, owner-operatorship is taken to be the
norm the society is striving for but not the specific form of organiza-
tion. In other words, the form of organization is a variable that may
have to adjust to technological changes in the course of achieving the
norm of ownership. Changes and trends in achieving the norm of ownership
in 1970 compared to results of earlier studies in 1946 and 1958 are iden-
tified in this study. Possible reasons for these changes and trends are
proposed in the interest of explaining the processes underway.
Current Situation of Farmland Resources

Recent decades have experienced an accelerated rate of technological innovations in agriculture in the United States. The impact of these changes has been felt in Iowa, as would be expected. Table 1, prepared from census data, indicates the changes in farm size that have been taking place in Iowa since 1930. It can be observed that while percent of land in farms to total land area has been rather stable throughout this period (declining from 96.6 to 94.1 percent), the average size of farm and total number of farms have been changing quite rapidly.

Table 1. Changing characteristics of Iowa land in the period 1930-1964^a

<table>
<thead>
<tr>
<th>Year</th>
<th>Total land area (acres)</th>
<th>Land area in farms (acres)</th>
<th>Land in farms (percent)</th>
<th>Average size of farm (acres)</th>
<th>Total farms (number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1930</td>
<td>35,575,040</td>
<td>34,019,332</td>
<td>95.6</td>
<td>158.3</td>
<td>214,928</td>
</tr>
<tr>
<td>1935</td>
<td>35,575,040</td>
<td>34,359,152</td>
<td>96.6</td>
<td>154.8</td>
<td>221,986</td>
</tr>
<tr>
<td>1940</td>
<td>35,831,040</td>
<td>34,148,673</td>
<td>95.3</td>
<td>160.1</td>
<td>213,318</td>
</tr>
<tr>
<td>1945</td>
<td>35,830,400</td>
<td>34,453,936</td>
<td>96.2</td>
<td>164.9</td>
<td>208,934</td>
</tr>
<tr>
<td>1950</td>
<td>35,868,800</td>
<td>34,264,639</td>
<td>95.5</td>
<td>168.7</td>
<td>203,159</td>
</tr>
<tr>
<td>1954</td>
<td>35,868,800</td>
<td>34,044,533</td>
<td>94.9</td>
<td>176.5</td>
<td>192,933</td>
</tr>
<tr>
<td>1959</td>
<td>35,860,480</td>
<td>33,830,950</td>
<td>94.3</td>
<td>193.6</td>
<td>174,707</td>
</tr>
<tr>
<td>1964</td>
<td>35,860,480</td>
<td>33,758,321</td>
<td>94.1</td>
<td>219.0</td>
<td>154,162</td>
</tr>
</tbody>
</table>

^aSource: (100, p. 7).
In order to observe the changes that have taken place in the character of Iowa farmlands, Figure 1 has been prepared taking the year 1935 as 100 and constructing an index for these three variables mentioned above. It is interesting to note that while percent of land in farms declines at a slow rate from one census to the other, the other two measures, average size of farms and number of farms, exhibit a fast rate of change beginning about 1950. The rate of decline of land in farms is 0.7, 0.7, and 0.3 percent between 1950-1954, 1954-1959, and 1959-1964, respectively. This rate of change can be accounted for by the shift of land resources from agriculture to alternative uses, such as recreation, transportation and urban development. However, for the same period, the rate of growth of farm size and the decrease of farm numbers between censuses exhibit a faster change with the rate of each changing at an increasing pace. The rate of growth for the average farm size has been 4.6, 9.7, and 13.1 percent between 1950-1954, 1954-1959 and 1959-1964, respectively. However for the same periods the rate of decline in farm numbers is 5.1, 9.4, and 11.8 percent respectively.

It is interesting to note that the two rates above have kept pace with each other until 1959. From 1959 to 1964, however, there is a considerable divergence between these two rates. A possible tentative explanation is that the average size of the larger farm units may be increasing faster in size through absorption of smaller units.

Changing characteristics of farm size and numbers are identified in Figure 1 and Table 1. Table 2 presents the existing situation in the seven economic areas of Iowa by 1964. These economic areas have been
Figure 1. Index of land in farms, farm size and farm numbers (Iowa, 1930-1964)
Table 2. Characteristics of Iowa land by economic areas, 1964^a

<table>
<thead>
<tr>
<th>Economic area</th>
<th>Total land area (acres)</th>
<th>Land in farms (percent)</th>
<th>Average size of farm (acres)</th>
<th>Total farms (number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4,117,880</td>
<td>96.8</td>
<td>226.3</td>
<td>17,558</td>
</tr>
<tr>
<td>2</td>
<td>4,218,880</td>
<td>95.5</td>
<td>251.4</td>
<td>16,460</td>
</tr>
<tr>
<td>3</td>
<td>2,463,360</td>
<td>96.5</td>
<td>243.0</td>
<td>9,879</td>
</tr>
<tr>
<td>4</td>
<td>4,812,800</td>
<td>95.0</td>
<td>235.4</td>
<td>20,123</td>
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<tr>
<td>5</td>
<td>6,134,960</td>
<td>92.2</td>
<td>235.2</td>
<td>24,221</td>
</tr>
<tr>
<td>6</td>
<td>5,687,040</td>
<td>94.2</td>
<td>198.6</td>
<td>27,314</td>
</tr>
<tr>
<td>7</td>
<td>8,425,560</td>
<td>92.6</td>
<td>206.0</td>
<td>38,607</td>
</tr>
</tbody>
</table>

^Source: (100, pp. 208-217).

drawn to correspond identically with that of the previous ownership studies and are presented in Figure 2. It can be observed from Table 2 that not only has there been a change in land in farms and farm size in Iowa over time, but within the economic areas there is considerable diversity in the same census year. In some economic areas (such as 1 and 3) land resources have still predominantly remained in agriculture, while for others (economic areas 5 and 7) they have declined below the state average. Similarly the average size of farms varies from below 200 acres in the sixth area to over 250 acres in the second area. Comparison of total farms in each economic area is not meaningful since the size of each area is not identical.
Figure 2. Economic areas of Iowa--1958 and 1970
Over time in Iowa and within different economic areas, both land resources in agriculture as well as the number of farms are declining while the average size of a farm is increasing. Tables 1 and 2 and Figure 1 have put this in perspective and indicated the direction of the problem with respect to farmland resources.

Objectives of This Study

Rapid technological innovations in agriculture have placed additional burdens of economic adjustment on farm operators whose goal has been owner-operatorship by the farm family. How far these adjustment pressures and increased requirements for larger land and capital are in conflict with the goal of ownership by the Iowa farmers is the central theme of this study.

The objectives of the study are as follows:

1. Identification and measurement of factors influencing tenure of farmland owners.
2. Determination of the changing characteristics of Iowa farmland owners.
3. Suggestion of possible remedial measures in closing the gap between the norms of the society and the existing situation.

Methods of Survey

Iowa farmland ownership structure has been of interest since the early days of settlement and to this end two previous studies (90, 95) have been conducted. In order to compare the findings of the present study with that of the previous ones, the state is divided into
identically the same economic areas, and the same questionnaires (except with minor modifications) have been utilized. The two kinds of questionnaires mailed, one for individual and one for institutional owners, are presented in Appendix A.

The State of Iowa is divided into seven distinct economic areas which are:

Area 1. Northwest - Livestock
Area 2. Southwest - Livestock
Area 3. Northern - Grain
Area 4. North Central - Grain
Area 5. Southern - Pasture
Area 6. Northeast - Dairy
Area 7. Eastern - Livestock

Figure 2 identifies the boundaries of each economic area and indicates which counties are included in each one.

The sample of farms used in this study was obtained from the United States Department of Agriculture, Agricultural Stabilization and Conservation Service\(^1\) addressograph plates in each county. In each ASCS county office, these plates are kept in files for each farm in a numbered order. From the previous studies, it was expected that about 25 percent of the sample of farmland owners would return the questionnaires. In order to yield the number of desired questionnaires, specific instructions were given to ASCS county officers to pick every 17th addressograph plate starting with a random number.

\(^1\)Hereafter referred to as ASCS.
The questionnaires had been pre-tested in Boone and Story Counties. Some minor modifications of wording and structure had been completed before it was finally printed and mailed to the sampled farmland owners. The results of two mailings provided the desired number of returns to proceed with the study. Table 3 provides the number of questionnaires mailed and the percentage of returns by economic areas. It should be

**Table 3. Number of questionnaires mailed out and proportion of usable ones returned for each area, 1970**

<table>
<thead>
<tr>
<th>Area</th>
<th>Questionnaires mailed out (number)</th>
<th>Questionnaires returned</th>
<th>Returned/mailed (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Used (number)</td>
<td>Discarded (number)</td>
</tr>
<tr>
<td>1</td>
<td>1,418</td>
<td>359</td>
<td>53</td>
</tr>
<tr>
<td>2</td>
<td>1,287</td>
<td>323</td>
<td>41</td>
</tr>
<tr>
<td>3</td>
<td>777</td>
<td>195</td>
<td>22</td>
</tr>
<tr>
<td>4</td>
<td>1,828</td>
<td>447</td>
<td>59</td>
</tr>
<tr>
<td>5</td>
<td>1,843</td>
<td>387</td>
<td>60</td>
</tr>
<tr>
<td>6</td>
<td>1,906</td>
<td>533</td>
<td>67</td>
</tr>
<tr>
<td>7</td>
<td>2,856</td>
<td>695</td>
<td>82</td>
</tr>
<tr>
<td>Individual</td>
<td>11,915</td>
<td>2,939</td>
<td>384</td>
</tr>
<tr>
<td>Institutional</td>
<td>605</td>
<td>277</td>
<td>41</td>
</tr>
<tr>
<td>Iowa, 1970</td>
<td>12,520</td>
<td>3,216</td>
<td>425</td>
</tr>
<tr>
<td>Iowa, 1958</td>
<td>11,002</td>
<td>2,576</td>
<td>--&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup>Information not provided (90, p. 4).
noted that in all areas, except five, returns were in excess of 25 percent. Through careful editing, about 12 percent of the returned questionnaires were found to contain inconsistent or irregular answers. In most cases, these owners have been contacted by telephone to resolve the inconsistencies. In cases where most of the questionnaire was left blank, the respondent had to be discarded from the sample. The result of this cross checking effort has been a larger and more reliable sample size on which to base the findings of the study.

All questionnaires were edited a second time to correct remaining errors and inconsistencies. Items left blank by respondents or in cases where questions were inapplicable to that particular individual, an X and Y were entered respectively and these items were omitted from the tabulations. The answers were then coded and punched on IBM cards. Tabulations were performed by the Iowa State University Computation Center.

Organization of the Study

The study is organized in nine chapters. The first chapter is an introduction and consists of sections which present ownership norm, current situation of farmland resources, objectives of the study, methods of survey and organization of the study.

The hypotheses guiding the study are formulated in the second chapter. After a brief introduction on the role and kind of hypotheses, the ones guiding the study are identified with the procedures for testing. Corrections to obtain a representative sample and a non-respondent bias check is included.

In the third chapter the technique of discriminant analysis is
adapted to farmland ownership problems. After a brief discussion of the background and presentation of the theoretical model, the analysis is applied to a sample of owners in different tenure groups. The objective is to identify the group profiles of each tenure class in accordance with the established norms of the analysis. Since owners in tenure classes are not homogeneous in their characteristics, there exist deviates from their declared tenure classes. These will be called the "response likely" owners. That is, these are the owners most likely to change their tenures within the foreseeable future. Then the analysis is carried to a step of identifying these owners and explaining the reasons for their divergences from their declared tenure classes.

The fourth chapter studies the changes that have been taking place in characteristics of farmland owners. After a brief discussion of organization of agricultural units, the study proceeds to identify the characteristics of farmland owners centered around the family, by acreage, occupation, age and residency. In the final part of the chapter, hypotheses developed earlier with respect to changes in the owners' characteristics are tested.

The fifth chapter is concerned with the changes that have been taking place in the concentration of Iowa farmland ownership. After a discussion of the concept and measurement of concentration, changes in the concentration of ownership acreage and value for each area between 1958 and 1970 are identified. Hypotheses developed with respect to concentration of ownership are tested.

The sixth chapter deals with the tenure experience of farmland
owners. This chapter includes the extent to which the owners used the agricultural ladder in reaching their goal of ownership and their new experiences or modifications with respect to this concept.

Acquisition and transfer methods farmland owners employ are discussed in the seventh and eighth chapters, respectively.

Finally, in the ninth chapter, conclusions and interpretations of findings are summarized.

The study is organized in three parts. The first part is concerned with the first objective and covers the third and fourth chapters. The second part is devoted to the second objective of the study and is treated in the fifth through eighth chapters. The third part concerns the third objective and is presented in the ninth chapter. Hypotheses developed in the second chapter are tested in the relevant sections of these chapters.
PROCEDURES FOR FORMULATING AND TESTING HYPOTHESES

Role of Hypotheses in Inquiry

The nature of scientific inquiry is one of solving experienced problems. The significance of the inquiry largely depends on its contribution to the solution. Salter explains the nature of scientific inquiry when he states:

The function of science is to determine ways of acting that will bring activities to a stated consequence. Science is a continuing process of problem solving in order to give man better control over his experience (78, p. 56).

In order to proceed with the inquiry, the researcher has to formulate the problem and construct the hypotheses to be tested. Recognition and formulation of the problem to be solved is the first task that the researcher has to undertake. While discussing the nature of problems, Timmons states that:

A problem with research potentials arises whenever the consequences or expected consequences fall short of the goal or purpose of achievement. The gap between the consequences and goal is the problematic situation within which the problem for study is delimited (94, p. 9).

This approach to problem formulation looks at the implied or stated goals of the society and determines how far the society has fallen short of achieving its goals. The gap, if it exists, between achievements and goals becomes the problem for study and alternative means to close it become hypotheses for testing and verification.

The hypotheses play a fundamental role in directing a study. It has been pointed out that "... the heart of scientific inquiry is disciplined and directed thought. Hypotheses are the instruments by which the investigator controls and directs his inquiry" (31, p. 41).
Hypotheses can be defined as suppositions which the researcher adopts tentatively in explaining phenomena. In the course of the investigation these tentatively adopted suppositions are put to statistical tests of significance to verify their power of explanation. Statistical tests determine which hypotheses to accept and which to reject. In the former, hypotheses developed are regarded as explaining the observed phenomena under question, while in the latter case revised and modified hypotheses are brought forth to be put to test until a new set of hypotheses that account for all significantly relevant variables are obtained. As Parsons points out, goal of the scientific inquiry is "... formulating a family of hypotheses as alternative explanations and then eliminating those which are less effective" (70, p. 299), in the explanation of observed phenomena.

Kinds of Hypotheses

Hypotheses as the tools guiding inquiry are divided into three kinds by Timmons (94, p. 24): (1) problem delimiting, (2) diagnostic, and (3) remedial.

Problem delimiting hypotheses delimit the specific problem in terms of the gap between goals and achievements of the society. Since most goals of society may be hard to quantify and in many instances in conflict with each other, oftentimes it becomes necessary for the researcher to make judgments about which goals to use in his study and their relative ordering. Within this framework, the researcher can further delimit a segment of a problematic situation so as to enable him to formulate precisely the problem to be studied.

Diagnostic hypotheses follow the problem delimiting phase and
"advance possible reasons and explanations for the development and persistence of the problem previously delimited" (94, p. 26).

Diagnostic hypotheses can be formulated in various forms. They can be in the form of questions, or simple declarations, or in terms of conditional (if such and such, then such and such would follow) statements. The form of hypotheses employed is incidental to the ideas presented.

The third kind of hypotheses are of the remedial type. After the diagnostic hypotheses are developed, tested for their significance and found to be positive, then remedial hypotheses can be brought forth. In other words, remedial hypotheses are "means for ameliorating the problem previously delimited and diagnosed, by bringing about a more complete achievement of a particular end-in-view in the means ends continuum" (94, p. 24).

Formulation and Testing of Hypotheses Guiding This Study

The accelerated rate of technological innovations and changing economic conditions, that have been briefly mentioned in the first chapter, have challenged the farmland owner-operatorship goal of the society. Guided by the objectives of this study, problem delimiting and diagnostic hypotheses are formulated and tested for their statistical significance. For each test, the levels of significance are indicated with the accompanying tables.

The diagnostic hypotheses guiding the study are listed under each delimited phase of the objective of identifying the structural changes in farmland ownership in Iowa.
Identification and measurement of variables influencing tenure of owners

This is the more general and explanatory part of the study. The aim is to group farmland owners according to tenure classes and identify and measure the variables which are conducive to changes in tenure status.

The delimiting phase consists of tenure goals of owners and the extent to which these goals are achieved. The diagnostic hypotheses state that:

1.a Each tenure group consists of a homogeneous class of owners by itself, with similar goals and distinctly different from the rest.
1.b Debt-free full ownership is the goal of all tenure groups rather than operatorship.
1.c Acquisition methods of owned land are the most important factors conducive to changes in tenure status.

The discriminant analysis is utilized in pursuing this objective and findings are presented in the third chapter.

Identification of the characteristics of Iowa farmland owners

2.a Characteristics of Iowa farmland owners are changing.
2.a.1 Distribution of land and value of assets owned are becoming unevenly distributed between owners.
2.a.2 Age distribution of owners are shifting to older groups.
2.a.3 The percentage of out-of-state owners is increasing.
2.a.4 The proportion of farm real estate in acres and value is shifting from farm operators to nonfarm operators.
2.a.5 Nonoperating landlords are in occupations other than farming and their ownership share is increasing.
The above hypotheses are tested and results presented in the fourth chapter.

2.b Concentration of Iowa land ownership is shifting from operators to landlords.

2.b.1 Landlords own larger average sized farms and larger average value of farms than operators.

2.b.2 Landlords have concentrated on high value areas and own a greater number of farms than operators.

2.b.3 Distribution of owned farmland is on a larger acreage for the landlords, as opposed to operators.

2.b.4 Increases in the average number of acres owned have been more rapid for the landlords, as opposed to operators.

2.b.5 Institutional ownership distribution is changing, getting unevenly distributed for acreage as well as value of these resources.

2.b.6 In Iowa the concentration coefficient of land and value of resources owned is increasing.

Hypotheses related to concentration of ownership are tested in the fifth chapter.

Determination of the tenure patterns of farmland owners

Changing technologic conditions in agriculture require larger capital investments which are resulting in modifications of the traditional agricultural ladder concept.

3.a Owners reporting farm experience only are declining while nonoperator landlords with no previous farm experience are
on the rise.

3.b Younger owners are using nonfarm employment as a replacement for the hired hand and tenancy steps in the agricultural ladder.

3.c Basic agricultural ladder is used to a lesser extent than in the past; other patterns are evolving.

3.d Owners with nonbasic agricultural ladder experience own a greater share of the total acreage.

Agricultural ladder and hypotheses related to it are tested in the sixth chapter.

Determination of farmland acquisition methods

4.a Gratuities are important if a farmer is to acquire ownership early in his career.

4.a.1 Family assistance to farmers seeking ownership is on the rise.

4.a.2 Nonoperator landlords receive their ownership of land mainly by gift and/or inheritance.

4.a.3 Young owners are increasingly utilizing combinations of gifts and inheritances in acquiring ownership of farmland.

4.a.4 Operators, as opposed to landlords, and farmers, as opposed to nonfarmers, use inheritances other than land for land ownership purposes.

4.a.5 Operators, as opposed to landlords, receive a higher value of nonland inheritance.

4.b Farmers are increasingly utilizing purchase contracts and using part ownership as a means of acquisition of new farmland.
4.b.1 The use of purchase contracts is increasing in all areas and for all owners.

4.b.2 Part-owner operators, as opposed to other tenure groups, are increasingly using purchase contracts and mortgage-for-deed.

4.b.3 Farmers, more than nonfarmers, young owners, as opposed to older owners, are utilizing purchase contracts.

4.b.4 Larger amounts of value of the outstanding debt is on the operator class of owners.

4.b.5 Farmlands of institutional owners, compared to individual owners, are increasingly being held free of debt.

Problems related to acquisition methods delimited in 4.a and 4.b above are tested in the seventh chapter.

Identification of farmland transfer methods between generations

5.a Individual transfer plans are on the rise.

5.a.1 Landlords rent their lands to their immediate family members so as to acquaint them with farming and eventually help in transfer of farmland to the next generation.

5.a.2 All owners are making greater use of individual transfer plans, both inter-vivos transfers and wills.

5.a.3 Younger owners are preparing wills more frequently than in the past.

5.a.4 Farmers, as opposed to nonfarmers, make greater use of transfer plans.

5.b Social security payments to farmers are encouraging receivers to
retire earlier, providing opportunities for transfer of land ownership to younger generations.

5.b.1 Receipt of social security payments by farmers encourage retirement by age 65.

5.b.2 Owners who receive social security payments are increasingly transferring farmlands to the next generation.

5.b.3 Farmers receiving social security payments are adopting inter-vivos transfers more often than those who do not receive social security payments.

Transfer objectives of owners and related diagnostic hypotheses from 5.a.1 - 5.b.3 above are tested and presented in the eighth chapter.

Procedures Used in Testing Hypotheses

In all studies it is required that we should have a test to determine the significance of our findings. Throughout this study, except in the third chapter, findings are expressed in terms of percentages. In order to test for a significant difference between two percentage figures, a set of nomograms has been used, constructed for the 95 percent and the 90 percent confidence levels. These nomograms have been adapted from Strand (88) by Scott Krane on an idea of H. O. Hartley and have already been used in earlier land ownership studies (89, 91). Similarly, our tests of significance is based on these sets of nomograms. A detailed explanation of construction and use of the nomograms is provided in Appendix C.

Differences between percentages were tested first at the 95 percent confidence level. When very significant differences were found, they were identified by two stars (**) . Differences between percentages that were
not significant at the 95 percent level have been put to test at the 90 percent confidence level. If they were found to be significant at the 90 percent level, they were identified with one star (*). For percentages with no significant difference at the 90 percent level, it was assumed that the difference arose due to sampling variation or non-sampling errors.

In cases where data was subdivided into sample sizes of less than 100 units, the tests of significance between two independent samples were not used. The reason for not testing in such cases is the fact that sampling variation, as well as non-sampling errors, which exist in small groups is too large to obtain reliable comparisons.

Probability Corrections of the Sample

According to ASCS record files in each county, each farm is given a specific number. The sample of farms that were drawn into the study consisted of the 17th random farm number in each county. However, farmland owners possessing more than one farm had varying chances of being selected because they appeared in the records as many times as they had separate farm numbers. In addition, in cases where farm lands were owned in partnership or in other forms of joint ownership (other than husband and wife), each individual owner listed has been sent a separate questionnaire to respond to.

To reflect in the estimates the different chances owners had of entering the sample, each questionnaire returned has been adjusted by two weights: (1) a weight based on the number of times each individual owner would have been expected to appear on the records of ASCS and (2) a weight
based on his owned land acreage together with his share of jointly owned land corrected for his chance of appearance in the sample.

Since not all farmland owners drawn into the sample returned the questionnaires and the ones that were incompletely returned had to be discarded, a correction factor (adjustment in sampling fraction for non-response) had to be incorporated into the estimates.

In all economic areas, the original sampling rate for ASCS farms was 1/17. The probability of any particular owner being drawn in the sample depended on the number of ASCS farms he owned (either solely or in partnership). Thus if the $i^{th}$ owner in the $j^{th}$ economic area (stratum) was listed on $t_{ij}$ ASCS farms, then the probability that he would be selected in the sample was

$$ p_{ij} = \frac{t_{ij}}{17} \quad (i = 1, 2, \ldots, n_j') \quad (j = 1, 2, \ldots, 7) $$

Since usable questionnaires were not obtained for every owner drawn into the sample, it was necessary to make an adjustment for non-response as follows:

Let

- $n_j$ = number of ASCS farms selected from ASCS county lists in the $j^{th}$ economic area, and
- $n_j'$ = number of usable responses returned in the $j^{th}$ economic area.

Then

$$ \frac{n_j'}{n_j} = \text{adjustment in sampling fraction for non-response.} $$
Combining the probability of selection, $P_{ij}$, with the adjustment for non-response, we get the corrected sampling rate:

$$
\left( \frac{t_{ij}}{17} \right) \left( \frac{n_j}{n_i} \right).
$$

The reciprocal of this is

$$S_{ij} = \left( \frac{17}{t_{ij}} \right) \left( \frac{n_i}{n_j} \right)
$$

which is the appropriate weight to use for the $i^{th}$ respondent in the $j^{th}$ economic area (stratum) when estimates are being made.

The second weight, assigned to acreage owned, is formulated differently. This is because each owner had to report all the land he owned (individually or in partnership with others) rather than his personal share or of the farm number that brought him into the sample.

So, if we let

- $Z_{ij} = \text{acres of land solely (husband and/or wife) owned by the } i^{th} \text{ respondent in the } j^{th} \text{ stratum},$
- $W_{ij} = \text{acres of land owned in partnership with others (other than husband and wife) by the } i^{th} \text{ respondent in the } j^{th} \text{ stratum, and}$
- $y_{ij} = \text{i}^{th} \text{ respondent's share of the land owned in partnership (or in any other form of joint ownership) in the } j^{th} \text{ stratum},$

then the weight assigned to $i^{th}$ respondent's farm acreage in the $j^{th}$ economic area (stratum) is
Estimates of number of owners and farmland acreage has been made for each economic area (7 in total) and then summed over areas to get the state estimates.

Formulation of estimates for areas and state totals are:

1. Estimate of total number of farmland owners in the $j^{\text{th}}$ area:
   \[
   \hat{N}_j = \sum_{i=1}^{n'_j} S_{ij}
   \]

2. Estimate of total number of farmland owners in the state:
   \[
   \hat{N} = \sum_{j=1}^{7} \sum_{i=1}^{n'_j} S_{ij}
   \]

3. Estimate of total acres of land owned in farms in the $j^{\text{th}}$ area:
   \[
   \hat{U}_j = \sum_{i=1}^{n'_j} K_{ij}
   \]

4. Estimate of total acres of land owned in farms in the state:
   \[
   \hat{U} = \sum_{j=1}^{7} \sum_{i=1}^{n'_j} K_{ij}
   \]

The estimated mean of acres of land owned in farms in each economic area and the state mean can be represented as:
(1) Estimated mean of acres of land owned in farms in an economic area:

\[
\bar{U}_j = \frac{U_j}{N_j} \quad (j = 1, 2, \ldots, 7)
\]

(2) Estimated mean of acres of land owned in farms in the state:

\[
\bar{U} = \frac{\bar{U}}{N}
\]

It should be noted that findings reported in the tables have all been corrected by the above weights appropriately. The only exceptions are the "number reporting" figures in each table which indicate the uncorrected number of people responding to that particular item.

Nonrespondent Bias Check

In mail surveys, it is expected that a large percentage of those who were mailed questionnaires would not respond. This observation came true in this survey as well. As can be seen in Table 3, about 75 percent of the questionnaires were not returned. Since our final analysis rests on the data provided from the returned questionnaires, it is important to check the characteristics of the nonrespondents and compare them with our findings.

In order to observe the characteristics of the nonrespondents, a bias check was made on a random sample of nonrespondents in the North Central area (economic region 4). 124 farmland owners representing 115 ASCS farms were sampled for the interview. Telephone interviews have been obtained from 99 farmland owners (18 owners have refused, 7 sold the farm, died or
presented other reasons) and the data thus obtained were tabulated for nonrespondents. Comparisons between the respondents and nonrespondents have been made for the same economic area on important characteristics of the owners. The table of comparisons is presented in Appendix B, Table 1, with significant differences noted whenever found.

The differences between the two estimates came to be insignificant, which has increased the confidence attached to our findings. The two significant differences observed have been the percentage of owners reporting wills and the average value of land per owner. It is indicated that more than 95 percent of the nonrespondents, as opposed to almost 78 percent of respondents, had wills. This is a significant finding and further supports the increasing use of planned transfer methods. Average value of land per owner reported by the nonrespondents have resulted unusually low ($19,134) compared to respondents ($103,823). A possible reason for such a low estimate for the former may be due to underreporting by the nonrespondents.

Tests of the hypotheses are further developed and applied in the remaining chapters of the study.
Scientific inquiry proceeds after items under study are classified into homogeneous groups according to some characteristic, such as sex, age or some other qualitative or quantitative measure. However, in some research situations the grouping of items under study according to one characteristic alone may not reflect adequately the "true" portrait of the group. In situations where there are many variables influencing the item, it may be more useful if we could go one step further and reduce all influencing variables into an index so as to differentiate between the groups. In multivariate populations, the problem of distinguishing between groups is best done by performing discriminant analysis so as to reduce the variates into a single variate.

As far as this study is concerned, farmland owners are grouped into homogeneous a priori groups by one of their characteristics -- tenure. For our purposes, farmland owners belong to one of the four tenure groups. If they operate only the land they own, they are called full owner operators (FOO). If they own and operate their land but rent additional land, they become part owner operators (POO). If they own and operate part of their land and rent out the remainder, they are operating landlords (OL); and when they rent all of the land they own, they become non-operating landlords (NOL).

The shortcomings of the above classification are evident since it does not take into account either the absolute size of the rented land or any of the many other influencing variables in determining who falls into
which class. It is very likely to find a heterogeneous group of farmland owners put together according only to the manner in which they utilize their land. Also from the above classification scheme, it is not possible to identify the "response-likely" landowner, i.e. the landowner who is on the margin of categories. Thus it is not possible to predict who is most likely to change tenure status and which variables influence this shift in the absence of discriminant analysis.

For the reasons mentioned above, and due to the exploratory nature of the first part of this study, it was decided to apply discriminant analysis techniques to the study of farmland ownership.

The objective of the discriminant analysis can be summarized as finding "rules of behavior in the assignment of individuals to predetermined classes with optimal properties" (57, p. 144).

Background of Discriminant Analysis

The idea of discriminating between multivariate populations is not novel and could probably be traced far back in history. Scientifically, however, the subject is regarded to have begun with the work of Karl Pearson around 1920 (57, p. 111). The original developments in the field were mainly concerned in seeking a coefficient which would "measure the distance" between two populations. Pearson's $C^2$ (his coefficient of racial likeness) was first applied on anthropometric data, on Burmese skulls by Miss Tildesley (92).

About this time, Mahalanobis was interested in the subject and came to the conclusion that Pearson's $C^2$ had not achieved its
purpose. Therefore, Mahalanobis worked out a new coefficient which he called $D^2$ and used this measure on racial mixture of Bengal in 1925. Hotelling's contribution to the analysis came during the 1930's when he generalized "Student's" $t$. Hotelling's $T^2$ was, in fact, equivalent to Mahalanobis' $D^2$, but it was some time before this fact was realized (57).

Fisher's contribution into the analysis begins with the publication of his paper on classifying plant specimens in the biological sciences in 1936 (32). The most important difference between Fisher and Mahalanobis was that while the latter was measuring the distance between the two populations, the former was only dividing the sample space into two regions, allocating an item to one of the populations according to the region it fell into. As can be observed, the two approaches are quite similar. In this study, we utilize both approaches for constructing the critical regions by which the items (in our case, farmland owners) will have to be separated into distinct populations of tenure classes.

Further theoretical developments in discriminant analysis are largely attributed to Rao (73, 74, 75 and 76). Meanwhile, quite a few scientists were concerned with the practical problems of application (7, 14, 15, 71, 84 and 101). As early as 1941, economists had realized the potentials of the techniques of discriminant functions in application to practical economic problems. Durand (20) has adapted the technique and applied it successfully in determining good and bad car loans. Tintner (96) utilized

\[ 2nC^2 \] varied very much with the sample number and, although it provided a test of significance, it did not measure the magnitude of the difference between two populations" (57, p. 112).
it in order to construct an "index" which best discriminates between consumers' goods and producers' goods on the basis of cyclical behavior of relevant prices. More recently, a similar approach is followed by Higgins (49) to discriminate between employment in defense and nondefense industries.³

Application of linear discriminant analysis in agricultural economics has been of more recent origin. Blood and Baker (12) have utilized the technique to delineate production situations in Northern Great Plains which favor wheat or range forage production. While recently Ladd (58) has used the technique in his analysis of ranking of dairy bargaining cooperative objectives. The most recent application of the discriminant analysis in agricultural economics is reported (62) on farm size and efficiency problems in Yugoslavia.

The Analytic Technique of Discriminant Analysis

The characteristic of this technique is that it allows various variables common to the two classes to be examined but collapsed into one coefficient to be tested. In other words, the principal feature of the technique is to find the linear combination of various variables that best discriminate between two classes with the use of the coefficients of the discriminant function. These coefficients (let us say represented by $Z$ or Mahalonobis' $D^2$), one for each item (in our case farmland owner) will cluster around their a priori class. They have the optimum property of

³A very interesting application of discriminant analysis has recently been made by Adelman and Morris (2) for evaluating economic development potentials of underdeveloped countries.
being the maximum distance apart between the two classes.

If two classes are distinctly different from each other, they will form mutually exclusive sets. However, it may still be possible for the coefficients thus found to overlap even though a statistically significant difference between the two a priori classes exist. An overlap, such as an element of Class I's Z value lying in Class II's set, would mean a misclassification. But in our case it can also be interpreted as the "response-likely" farmland owner. That is, the farmland owner who does not exhibit the characteristics of his assigned a priori class and is likely to change status as far as his tenure is concerned.

However, if there are a large number of misclassifications (or "response likely" farmland owners), serious doubt is cast on the ability of the model to discern differences between classes. A large number of misclassifications may arise even when the discriminant function is significant -- the reason being the exaggerated influence of the extreme values on the mean differences.

The Model of Discriminant Analysis

The model for discriminant analysis, as applied to defining tenure classes and in testing differences between classes, is elaborated as follows.

Let \( X_{it} \), where \( i = 1, 2, \ldots, P \) and \( t = 1, 2, \ldots, N \), be a set of random variables drawn from a normally distributed multivariate population. Then these observations are grouped into two a priori classes according to

---

4The model of discriminant analysis for two classes is based on Tintner (97, pp. 96-102).
land tenure criteria,\(^5\) for

\[ t = 1, 2, \cdots, \ N_1 \quad \text{and} \quad t = N_1 + 1, N_1 + 2, \cdots, \ N_1 + N_2 \]

where

\[ N_1 + N_2 = N. \]

Defining the means in each class,

\[ \bar{X}^*_i = \frac{1}{N_1} \sum_{t=1}^{N_1} x_{it} \quad \text{and} \quad \bar{X}^*_i = \frac{1}{N_2} \sum_{t=N_1+1}^{N} x_{it}. \] (3.1)

The differences of the means then are

\[ d^*_i = \bar{X}^*_i - \bar{X}^*_i \quad (i = 1, 2, \cdots, p). \] (3.2)

We want to find the linear function of the differences of the means

\[ Z = k_1 d_1 + k_2 d_2 + \cdots + k_p d_p \] (3.3a)

or

\[ Z = \sum_{i=1}^{p} k_i d_i \] (3.3b)

that discriminates best between two sets of classes. The coefficients \( k_1, k_2, \cdots, k_p \) may be selected such as to maximize the square of the difference of its expectation in two populations, \( Z^2 \), which is

\[ (k_1 d_1 + k_2 d_2 + \cdots + k_p d_p)^2 \] (3.4)

\(^5\)Land tenure is the criteria adapted in this study. Accordingly, farmland owners can be classified into Class I if they are owner-operators or part owner-operators and Class II if they are operating landlords or non-operating landlords. In the next section, refinement of the classification procedure is indicated.
subject to the condition that the variance, \( Q \), is

\[
\sum_{i=1}^{p} \sum_{j=1}^{p} \alpha_{ij} k_i k_j
\]  

(3.5)
a constant (say unity), where

\[
S_{ij} = \sum_{t=1}^{N} x_{it} x_{jt} \quad (i,j = 1, 2, \ldots, p)
\]  

(3.6)
are the elements of the deviations sums of squares and cross products

matrix \( S \) and

\[
x_{it} = \bar{x}_i - \bar{x}_{it} \quad (i = 1, 2, \ldots, p)
\]  

(3.7)
are the deviations from the means.

Dividing each element of \( S \) by \( N - 1 \), we get the dispersion (or

variance-covariance) matrix \( D \) where \( \alpha_{ij} \) designates its elements.

In order to maximize Equation 3.4 subject to the condition that the

variance in Equation 3.5 is a constant, the function

\[
F = Z^2 - \lambda Q
\]  

(3.8a)

\[
= \sum_{i=1}^{p} \sum_{j=1}^{p} k_i k_j d_i d_j - \lambda \sum_{i=1}^{p} \sum_{j=1}^{p} \alpha_{ij} k_i k_j
\]  

(3.8b)
is formed where \( \lambda \) is a Lagrange multiplier.

Differentiating Equation 3.8b partially with respect to \( k_j \) where

\( j = 1, 2, \ldots, p \) leads to
\[
\sum_{i=1}^{p} k_i d_i = \lambda \sum_{i=1}^{p} \alpha_{ij} k_i \quad (i, j = 1, 2, \ldots, p) \tag{3.9}
\]

Simplifying computations by putting \( \lambda = \sum_{i=1}^{p} k_i d_i \) leads to

\[
\sum_{i=1}^{p} k_i d_i = \sum_{i=1}^{p} k_i d_i \sum_{i=1}^{p} \alpha_{ij} k_i \tag{3.10a}
\]

which is

\[
d_j = \sum_{i=1}^{p} \alpha_{ij} k_i \quad \tag{3.10b}
\]

In terms of system of equations,

\[
\begin{align*}
k_1 \alpha_{11} + k_2 \alpha_{12} + \cdots + k_p \alpha_{1p} &= d_1 \\
k_1 \alpha_{21} + k_2 \alpha_{22} + \cdots + k_p \alpha_{2p} &= d_2 \\
\vdots & \quad \vdots \quad \vdots \quad \vdots \\
k_1 \alpha_{p1} + k_2 \alpha_{p2} + \cdots + k_p \alpha_{pp} &= d_p 
\end{align*} \tag{3.11}
\]

The linear equations obtained in Equation 3.11 have the solutions

\[
k_i = \alpha_{i1} d_1 + \alpha_{i2} d_2 + \cdots + \alpha_{ip} d_p \quad (i = 1, 2, \ldots, p) \tag{3.12}
\]

where the matrix elements, \( \alpha_{ij} \), are inverse to the common dispersion matrix elements, \( \alpha_{ij} \).

Tintner emphasizes that "the solutions \( k_i \) are proportional to the coefficients of the linear function which in the population corresponding to the sample discriminates best between two groups in the sense defined above" (96, p. 475).
In the above case, the dispersion matrices for both classes were assumed to be the same. Rao (76, p. 289) has shown that if dispersion matrices are different, the likelihood ratio surface separating two classes is defined by the quadratic expression

\[
\sum_{i} \sum_{j} \left[ \alpha_{ij} (x_i - \bar{x}_i) (x_j - \bar{x}_j) - \beta_{ij} (x_i - \bar{x}_i^*) (x_j - \bar{x}_j^*) \right] = \text{constant} \quad (3.13)
\]

where \( \alpha_{ij} \) and \( \beta_{ij} \) are the inverses of the dispersion matrices corresponding to the two populations.\(^6\) As in the case where dispersion matrices were the same for two populations, again an individual for whom the value of the left hand function exceeds the constant value chosen is assigned to the first class, and when it is smaller he is assigned to the second class.

For this case, with two classes and the same dispersion matrices, a quantity analogous to the multiple correlation coefficient can be computed for a discriminant function

\[
R^2 = \frac{N_1 N_2}{N} \frac{(k_1 d_1 + k_2 d_2 + \cdots + k_p d_p)}{p (1 - R^2)} . \quad (3.14)
\]

Then the variance ratio

\[
F = \frac{(N - P - 1)R^2}{P (1 - R^2)} \quad (3.15)
\]

has Snedecor's F distribution which can be employed to test the

\(^6\)Population means \( \bar{x}_{11} \) and \( \bar{x}_{12} \) have been replaced with sample means \( \bar{x}_1^* \) and \( \bar{x}_1^* \), respectively, in this presentation in order to conform to our original notation.
significance of the discriminant function with \( N_1 = p \) and \( N_2 = N - p - 1 \) degrees of freedom. Thus the hypothesis that the empirical discriminant function may have been by pure chance where, in fact, there was no difference between the two classes of the population can be tested.

Tests for significant differences in dispersion matrices, extension of the model to more than two classes and the relevant tests are discussed in the next sections of this chapter.

Extensions of the Model

In most cases, the basic model of two classes can serve the purpose of investigation. In our case, farmland owners can be classified into two: operators (land owners who own full or part of their land but operate all of it) and landlords (land owners who rent part or all the land they own). However, the aggregation of four \textit{a priori} tenure groups into two classes may force the analysis into forming nonhomogeneous classifications and may lead to loss of information if there are in fact significant differences between the groups. Besides, other divisions of four tenure groups into two classes, such as operators vs. nonoperators, may provide more interesting results. What we are interested in, however, is to observe if FOO form the class of owners, POO and OL the class of operators, and NOL the class of nonoperators, or tenures form an operator class which consists of FOO, POO and OL, as opposed to a nonoperator class which consists of NOL. Thus, the analysis is extended to cases where there are more than two classes.\(^7\)

\(^7\)Extension of the model to more than two classes is based on (6, 16, 18, and 76).
The sequence of analysis for the extension of the model begins with the analysis of dispersion matrices for each group (four in our case). The null hypothesis $H_1$ of the test of homogeneity of dispersions asserts that the group populations have equal dispersions. The determinant of the dispersion matrix of a group $|D_g|$ is employed to be the scalar representation of the dispersion estimate in the homogeneity test. The determinant of the best estimate of the population dispersion matrix $|D|$ is computed from the pooled group deviation sums of squares and cross products matrices.

An $M$ criterion for testing the null hypothesis $H_1$ of the equality of $g$ group dispersion matrices are derived from Bartlett and presented in (16, pp. 62-63).

\[ M = n \log_e |D| - \sum_{g} \left( n_g \log_e |D_g| \right) \quad (3.16) \]

where $D = \left( \frac{1}{n} \right) W$ and $D_g = \left( \frac{1}{n_g} \right) W_g$, $W$ is the pooled within-groups deviation score cross products matrix, and $n = N - 1$ and $n_g = N_g - 1$ are number of total and group observations, respectively.

Required parameters for the above criterion are:

\[ A_1 = \left( \sum_{g} \frac{1}{n_g} - \frac{1}{n} \right) \frac{2p^2 + 3p - 1}{6(g - 1)(p + 1)} \quad (3.17) \]

\[ A_2 = \left( \sum_{g} \frac{1}{n_g} - \frac{1}{n} \right) \frac{(p - 1)(p + 2)}{6(g - 1)} \quad (3.18) \]

where $p$ is the number of variables (14 in our case) and $g$ is the number of groups (4 in our case).
Test statistic $F$ with $f_1$ and $f_2$ degrees of freedom depend on whether $A_2 - A_1^2$ is positive or negative. If $A_2 - A_1^2$ is positive, then

$$f_1 = .5(g - 1)p(p + 1), \quad f_2 = \frac{(f_1 + 2)}{(A_2 - A_1^2)} \quad \text{and} \quad b = \frac{f_1}{\left(1 - A_1 + \frac{f_1}{f_2}\right)}$$

and the test statistic is

$$F = \frac{f_1}{f_2}$$

(3.19)

However, if $A_2 - A_1^2$ is negative, then

$$f_1 = .5(g - 1)p(p + 1), \quad f_2 = \frac{(f_1 + 2)}{(A_1^2 - A_2)} \quad \text{and} \quad b = \frac{f_2}{\left(1 - A_1 + \frac{2}{f_2}\right)}$$

and the test statistic then becomes

$$F = \frac{f_1}{f_2} \frac{f_2 M}{f_1 (b - M)}$$

(3.20)

If the test of equality of dispersion matrices between groups is not rejected, we proceed to test $H_2$ which asserts the equality of the population centroids (i.e., mean vectors) $M_j$. This test is the multivariate generalization of analysis of variance of a one-way univariate case.

Test of $H_2$ utilizes matrices which represent the sums of squares and cross-products of deviations from the grand means $T$, and similarly from group means $W_g$. The latter are pooled (added together) to form $W$, within-groups estimate.
The criterion to test $H_2$ is defined as Wilks' lambda by Rao (76, pp. 258-262):

$$\Lambda = \frac{|W|}{|T|}$$  \hspace{1cm} (3.21)

where $W$ is the pooled within-groups deviation cross-products matrix and $T$ is the total sample deviation cross-products matrix. The elements of both matrices are defined as

$$W_{ij} = \sum_{k=1}^{g} \left\{ \sum_{n=1}^{N_g} (X_{ikn} - \bar{X}_{ik}) (X_{jkn} - \bar{X}_{jk}) \right\}$$  \hspace{1cm} (3.22)

and

$$T_{ij} = \sum_{n=1}^{N} (X_{in} - \bar{X}_i) (X_{jn} - \bar{X}_j)$$  \hspace{1cm} (3.23)

where

- $N_g = \text{number of persons in group } g$,
- $N = \text{total number of persons in all groups}$,
- $g = \text{number of groups (four in our case)}$, and
- $i, j = 1, 2, \cdots, p$ where $p$ equals number of variables (14 in our case).

As $|T|$ increase relative to $|W|$ then $\Lambda$ gets smaller, thus increasing the confidence to reject $H_2$. To test the significance of $\Lambda$, $\chi^2$ approximation of Barlett or Rao's $F$ approximation may be utilized. However, Monte Carlo methods indicate the latter to be slightly better (16, pp. 61-62), and so this test is used in the study.

Let
\[ s = \sqrt{\frac{(p^2 - 4q^2 - 4)}{(p^2 + q^2 - 5)}} \quad q = g - 1 \]
\[ m = n - \frac{p + q + 1}{2} \quad n = N - 1 \]
\[ \lambda = -\frac{pq - 2}{4} \]
\[ r = \frac{pq}{2} \]
and
\[ y = \sqrt[1/s]{1/s} \]

Then approximation of the F test which is
\[ F = \frac{2r}{ms + 2\lambda} \quad (3.24) \]

with \(2r\) and \(ms + 2\lambda\) degrees of freedom is used to test the significance of \(\lambda\) in \(H_2\).

If, however, \(H_1\) is rejected, the test of \(H_2\) is not valid since it assumes a common dispersion matrix. The study then proceeds to compute Mahalonobis' \(D^2\) for each observation and determine tenure classes and discriminant function.

**Sequence of Discriminant Analysis**

The sequence of discriminant analysis for this study is as follows:

1. Test of \(H_1\) for all tenure groups using all variables.
2. Test of \(H_2\) for all tenure groups if \(H_1\) could not be rejected.
3. If \(H_1\) is rejected, compute Mahalonobis' \(D^2\) for each observation in each tenure group and determine number of classes.
Determination of tenure groups in each class and the number of classes is identified in the second or the third stage. Discriminant function or multiple-discriminant functions are then run, depending on the number of tenure classes.

Cooley and Lohnes (16, pp. 116-118) indicate computations of multiple-discriminant functions as the vectors associated with the latent roots of the determinantal equation

$$|W^{-1}A - \lambda I| = 0$$  \hspace{1cm} (3.25)

where

- **W** is the pooled within-groups deviation cross-products matrix (defined previously),
- **I** is the identity matrix, and
- **A** = **T** - **W**  \hspace{1cm} (3.26)

where

- **T** = total sample deviation cross product matrix (defined previously), and
- **A** = among-groups cross products of deviations of group from grand means weighted by group sizes.

The elements of **A** matrix are defined

$$a_{ij} = \sum_{k=1}^{g} N_{i} (\overline{x}_{ik} - \overline{x}_{i}) (\overline{x}_{jk} - \overline{x}_{j}).$$

The matrix equation \((W^{-1}A - \lambda I)V = 0\) is derived from the partial derivatives of the ratio
\[ \lambda_i = \frac{v'_i A v_i}{v'_i W v_i} \]  
\[ (i = 1, 2, \ldots, r) \]  
(3.27)

(\text{where } r \text{ is the lesser of } g - 1 \text{ and } m) \text{ which is to be maximized such that } v'_i A v_i \text{ (among-groups sums of squares) may be large relative to } v'_i W v_i \text{ (within-groups sums of squares) on the discriminant functions represented by the latent roots } \lambda_i \text{ (eigenvalues) and their associated vectors } v_i \text{ (eigenvectors). The relative sizes of eigenvalues indicate the extent the associated discriminant functions distinguish among the groups (16, p. 118). Derivation of } \lambda_i \text{ (eigenvalues) and } v_i \text{ (eigenvectors) is explained in (54, pp. 95-103).}

\text{The Variables Used in the Discriminant Analysis}

The above-discussed model of discriminant analysis has been applied to a representative sample of returned questionnaires on the land ownership survey of 1970. It was first decided to utilize the simple, two class model. The landowners were to be divided into two classes: Class I (operators—full or part owners who operate all the land they own) and Class II (landlords—operating or nonoperating, but renting out part or all of the land they own).

A simple check of the respondents, however, revealed that this classification scheme was not appropriate. It has been seen that non-operating landlords (NOL) had characteristics different from the rest of the tenure groups, so it was decided to call them a class by themselves and to test if there were significant differences among the first three groups (i.e., FO0, PO0, and OL). Accordingly, the analysis was extended to more than two classes. The results of the test of differences in group
dispersions and means follow in the next sections.

It was decided to have a large number of observations (i.e., landowners) to base the results of the discriminant analysis. To this end, about one-third of the returned questionnaires have been drawn into the sub-sample. Care has been given to have a representative sub-sample of each tenure group. A check of owners in the sub-sample revealed unreported data present in some observations. These owners have been dropped from the discriminant analysis. Final count of observations in the analysis totaled 770 (i.e., N = total number of observations = 770). Of this, 200 were full owner operator (group 1 = FOO), 211 part owner operator (group 2 = POO), 194 operator landlord (group 3 = OL), and 165 non-operator landlord (group 4 = NOL). The analysis proceeded on these groups for 14 variables.

The variables included in the study, their designations, descriptions and mean values for each tenure group and total is provided in Table 4.

Two other variables, (1) number of years respondent worked in farm related occupations and (2) number of years respondent was in non-farm occupations, were considered for inclusion. However, an analysis of these two variates prior to runs indicated the inconsistencies of the respondents' replies (for some owners two occupation categories were not mutually exclusive and far too many of the rest had left the questions blank). It was decided that these two variables contained excessive problems to resolve successfully by editing and thus they were left out of the final analysis.
Table 4. Description and means of variables used in the discriminant analysis

<table>
<thead>
<tr>
<th>Designation</th>
<th>Description of variable</th>
<th>Means of variable for groups</th>
<th>Means for all observations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$F_00$ $n_1 = 200$</td>
<td>$F_00$ $n_2 = 211$</td>
</tr>
<tr>
<td>$X_1$</td>
<td>Land being bought under purchase contract (acres)</td>
<td>47.79</td>
<td>56.32</td>
</tr>
<tr>
<td>$X_2$</td>
<td>Land being bought under mortgage (acres)</td>
<td>62.26</td>
<td>80.40</td>
</tr>
<tr>
<td>$X_3$</td>
<td>Land bought and fully paid for (acres)</td>
<td>76.57</td>
<td>55.45</td>
</tr>
<tr>
<td>$X_4$</td>
<td>Acres of land in partnership or other joint ownership (other than husband and/or wife) (acres)</td>
<td>12.57</td>
<td>17.75</td>
</tr>
<tr>
<td>$X_5$</td>
<td>Total value of debt outstanding (under mortgage, deed or purchase contract) ($100)</td>
<td>163.06</td>
<td>224.20</td>
</tr>
<tr>
<td>$X_6$</td>
<td>Total value of land and buildings (includes owners' value of solely owned land + value of his share in partnership acres) ($100)</td>
<td>774.57</td>
<td>919.37</td>
</tr>
<tr>
<td>$X_7$</td>
<td>Acres of land acquired by purchase from relatives (acres)</td>
<td>42.96</td>
<td>60.01</td>
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Table 4. (Continued)

<table>
<thead>
<tr>
<th>Designation</th>
<th>Description of variable</th>
<th>Means of variable for groups</th>
<th>Means for all observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>X₈</td>
<td>Respondents' share (proportion) in partnership or other joint ownership acres with others (other than husband or wife)</td>
<td>0.031 0.037 0.070 0.082</td>
<td>0.053</td>
</tr>
<tr>
<td>X₉</td>
<td>Acres of owned land acquired by inheritance of full interest (acres)</td>
<td>9.59 6.37 31.73 50.84</td>
<td>23.12</td>
</tr>
<tr>
<td>X₁₀</td>
<td>Total amount of money received through gift, will or estate settlement and used in purchase, operation or improvement of farmland ($100)</td>
<td>15.96 19.98 20.74 19.16</td>
<td>18.98</td>
</tr>
<tr>
<td>X₁₁</td>
<td>Number of children of the owner</td>
<td>2.86 3.21 2.87 2.71</td>
<td>2.93</td>
</tr>
<tr>
<td>X₁₂</td>
<td>Number of years land owned by the owner (years)</td>
<td>18.16 13.26 24.04 25.66</td>
<td>19.91</td>
</tr>
<tr>
<td>X₁₃</td>
<td>Present age of the landowner (years)</td>
<td>53.04 46.39 59.06 63.72</td>
<td>54.99</td>
</tr>
<tr>
<td>X₁₄</td>
<td>Number of people (other than husband and/or wife) with ownership interest in this land</td>
<td>0.11 0.13 0.42 0.21</td>
<td>0.215</td>
</tr>
</tbody>
</table>
Interrelationship between Variables for All Tenure Groups

To observe the interrelationship between the variables included in the discriminant analysis, correlation matrices for each tenure, as well as for the group, are presented in this section. Table 5 provides the correlation matrix for all the land owners irrespective of their tenure status, while Tables 6 through 9 are correlation matrices for FOO, POO, OL and NOL tenure groups, respectively. Although there are expected variations in the magnitudes of the correlations between variables from one tenure group to the other, the signs of all elements are in the expected direction. For example, acres of land purchased under contract $X_1$ is negatively correlated with mortgage acres $X_2$ and fully paid acres $X_3$, while positively correlated with value of debt $X_5$ and value of land $X_6$ for all tenure groups (Tables 5-9).

The magnitude of the elements of correlation matrices are also important and reveal some interesting relationships. For example, it is hypothesized that although inheritance of land (and to some extent capital in the form of money) is important in becoming a full owner (thus the relationship between $X_3$ and $X_9$ positive), it is conducive to becoming a nonoperator landlord. In other words, high correlation between $X_3$ and $X_9$ for NOL suggests the possibility that acres of inherited land is one of the important factors in becoming a nonoperating landlord. Similarly, amount of money received as gift, will or estate settlement $X_{10}$ is correlated higher with $X_3$ for OL and NOL, as opposed to FOO and POO.

Number of children of the respondent $X_{11}$ has been included as the variable to test the partnership arrangements within the family.
Table 5. Correlation matrix for all tenure groups (total)

<table>
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<tr>
<th></th>
<th>$X_1$</th>
<th>$X_2$</th>
<th>$X_3$</th>
<th>$X_4$</th>
<th>$X_5$</th>
<th>$X_6$</th>
<th>$X_7$</th>
</tr>
</thead>
<tbody>
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<td>$X_1$</td>
<td>1.0000</td>
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<td></td>
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<tr>
<td>$X_2$</td>
<td>-0.0613</td>
<td>1.0000</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>$X_3$</td>
<td>-0.1200</td>
<td>-0.1359</td>
<td>1.0000</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>$X_4$</td>
<td>-0.0898</td>
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<td>0.1058</td>
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<td></td>
</tr>
<tr>
<td>$X_5$</td>
<td>0.4791</td>
<td>0.6231</td>
<td>-0.1748</td>
<td>-0.0460</td>
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<tr>
<td>$X_6$</td>
<td>0.2260</td>
<td>0.4916</td>
<td>0.5175</td>
<td>0.1405</td>
<td>0.5517</td>
<td>1.0000</td>
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</tr>
<tr>
<td>$X_7$</td>
<td>0.1446</td>
<td>-0.0939</td>
<td>0.1458</td>
<td>-0.0004</td>
<td>0.1057</td>
<td>0.2253</td>
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<td>$x_8$</td>
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<td></td>
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</tr>
<tr>
<td>$x_9$</td>
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<td>$x_{10}$</td>
<td>-0.0081</td>
<td>0.0460</td>
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<tr>
<td>$x_{11}$</td>
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<td>0.0018</td>
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<tr>
<td>$x_{12}$</td>
<td>0.0090</td>
<td>0.1195</td>
<td>0.0415</td>
<td>-0.0027</td>
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<tr>
<td>$x_{13}$</td>
<td>-0.0389</td>
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<td>0.0080</td>
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<td>0.7044</td>
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<tr>
<td>$x_{14}$</td>
<td>0.6316</td>
<td>-0.0099</td>
<td>-0.0035</td>
<td>-0.0193</td>
<td>0.0119</td>
<td>-0.0490</td>
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</table>
Table 6. Correlation matrix for tenure group 1--FOO

<table>
<thead>
<tr>
<th></th>
<th>$X_1$</th>
<th>$X_2$</th>
<th>$X_3$</th>
<th>$X_4$</th>
<th>$X_5$</th>
<th>$X_6$</th>
<th>$X_7$</th>
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<tbody>
<tr>
<td>$X_1$</td>
<td>1.0000</td>
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</tr>
<tr>
<td>$X_2$</td>
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</tr>
<tr>
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<tr>
<td>$X_4$</td>
<td>-0.0893</td>
<td>0.2238</td>
<td>-0.1006</td>
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<tr>
<td>$X_5$</td>
<td>0.4674</td>
<td>0.5825</td>
<td>-0.2742</td>
<td>0.2988</td>
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</tr>
<tr>
<td>$X_6$</td>
<td>0.2987</td>
<td>0.5030</td>
<td>0.2204</td>
<td>0.2166</td>
<td>0.6992</td>
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<td>$X_7$</td>
<td>0.2801</td>
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<td>0.0904</td>
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<td>0.0364</td>
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<td>$X_9$</td>
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<td>-0.0811</td>
<td>0.0557</td>
<td>-0.0717</td>
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<td>$X_{10}$</td>
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<td>-0.0088</td>
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Table 7. Correlation matrix for tenure group 2—POO

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Table 8. Correlation matrix for tenure group 3--OL

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Table 9. Correlation matrix for tenure group 4--NOL

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Accordingly, it was hypothesized that $X_{11}$ would be highly correlated with the respondents share of partnership with others $X_8$, especially for OL and NOL. Although the direction of the correlation (negative) has come out to be as expected, the magnitude was far too low for verifying the relationship.

The Results of Discriminant Analysis

In this section the results of discriminant analysis is presented on the sequence presented in the earlier sections. In order to be able to utilize the pooled within-groups dispersion matrix $W$, in the case of four tenure groups we have to test the homogeneity of tenures in $H_1$. If $H_1$ could not be rejected we proceed to test equality of mean vectors of groups in $H_2$. But if $H_1$ is rejected, we proceed to sequence three and, after establishing the number of tenure classes, to discriminant functions.

Test of homogeneity of all tenure groups

The null hypothesis that FOO, POO, OL and NOL have equal dispersions has been put to test as $H_1$. As previously indicated, test statistic $M$ requires the determinants of group dispersion matrices and the pooled determinant of all the observations in the sample.

They have been found to be

$$|D_1| = 670.1144 \times 10^{33} \quad \text{group 1 = FOO}$$

$$|D_2| = 598.5767 \times 10^{34} \quad \text{group 2 = POO}$$

$$|D_3| = 161.1993 \times 10^{39} \quad \text{group 3 = OL}$$
\[ |D_4| = 682.6965 \times 10^{-36} \quad \text{group 4 = NOL} \]
\[ |D_t| = 479.6279 \times 10^{-37} \quad t = \text{total} \]

Even before applying the test statistic \( M \) it can be observed that there is a wide variation in inter and intra groups and the variation in OL came to be the highest as may be expected.

Applying the \( M \) test from Equation 3.16, we get

\[ M = 702,630.0686 - 67,176.5421 = 3,086.5265, \]

thus obtaining the required parameters by Equations 3.17 and 3.18

\[ A_1 = (0.0197654)(1.6037) = 0.03169786 \]
\[ A_2 = (0.00011025)(11.5555) = 0.00127399 \]
and
\[ A_1^2 = 0.00100475. \]

Testing the difference \( A_2 - A_1^2 \) showed it to be a positive value of 0.00026924 and therefore the relevant \( F \) test becomes

\[ \frac{f_1}{f_2} = \frac{M}{b} , \]

from Equation 3.19. The degrees of freedom associated and the parameter \( b \) is found to be

\[ f_1 = 315, \quad f_2 = \frac{317}{0.00026924} = 1,177,388.2 \]

and
\[ b = \frac{315}{0.9685 - 0.000268} = 325.401605 . \]
Then the $F$ statistic is

\[ \frac{3086.5265}{325.4016} = 9.485. \]

With 315 and 1,177,388 degrees of freedom, any value of $F$ greater than 1 is highly significant at the 0.999 level; that is, there is less than one chance in 1000 to obtain a value of $F$ as high as was found. Therefore the null hypothesis is rejected, suggesting that significant differences between group dispersions exist.

The result of the $H_1$ test precludes the test of $H_2$ and the use of pooled within-groups dispersion matrix $W$ as presented in Equations 3.25 to 3.27 in obtaining the discriminant functions. The analysis for discriminant functions should proceed on the formulation in Equation 3.13; however, prior to it we have to obtain Mahalonobis' $D^2$ for each observation and determine the number of tenure classes.

**Obtaining Mahalonobis $D^2$'s for each observation**

The analysis of obtaining Mahalonobis $D^2$'s for each observation in each tenure group is based on a formulation of Dempster (18, p. 206)

\[ D_{ij}^2 = (X_{ijt} - \bar{X}_{jt})' S_i^{-1} (X_{ijt} - \bar{X}_{jt}) \]  

(3.28)

where

- $i = 1, \cdots, 4$,  
- $j = 1, \cdots, n_i$, and  
- $t = 1, \cdots, 14$,

$X_{ijt}$ = value of $t^{th}$ variable of $j^{th}$ observation in $i^{th}$ group,

$\bar{X}_{jt}$ = mean value of $t^{th}$ variable for $i^{th}$ group, and

$S_i$ = dispersion matrix for $i^{th}$ group.

Accordingly, if each tenure group is distinct and homogeneous within
itself, the $D_{ij}^2$'s for that tenure should cluster around their mean, resulting in maximum separation among tenure groups. However, the results of this analysis did not provide homogeneous tenure groups but formed what I call "tenure classes". That is to say, when most of the members of two or more tenure groups are so alike in their various characteristics that it is not possible to identify them separately without making gross misclassification errors, in which case these groups are joined together to form a tenure class.

Observing $D_{ij}^2$'s for each tenure group closely, an interesting pattern has emerged. Since for each observation there had been four $D_{ij}^2$ values computed (one for its own tenure group and three for others), it was possible to rank the closeness of tenure groups among themselves based on rankings of each observation in each tenure group. The result has been a combination of three tenure groups--FOO, POO and OL--to form operator tenure class, as opposed to NOL tenure group now called the nonoperator tenure class.

Conceptually the formation of tenure classes can best be explained with the aid of Figure 3.

The basis of Figure 3 and the formation of tenure classes depend on distance rankings by each observation in each tenure group. To be able to present them visually, two dimensional scatter plots were prepared.

---

8. $D^2$ plottings on figures are correct representation of rankings of individual owners. However, the points immediately around the intersection of the abscissa and the ordinate were too numerous to identify individually in all cases and therefore should not be accepted as perfect representation of the situation. Number of $D^2$ plottings left out of representation due to scale of axis are indicated in each figure.
Figure 3. Ranking of distance among tenure groups and formation of tenure classes
(Figures 4, 5, 6 and 7) having the group's own tenure $D^2$ on the horizontal axis contrasted to the rest of the three tenure $D^2$ on the vertical axis. Thus, for example, in Figure 4 members of the FOO group rank distance of other tenure groups on the vertical axis. Similarly, Figures 5, 6 and 7 are for P00, OL and NOL group membership rankings of other tenure groups, respectively. It may be observed that the farther away the plotted point from the horizontal axis, the greater the distance between the contrasted tenure groups and conversely. Where tenure groups are closest to each other, represented by the ranking of $D^2$'s as in Figures 4 and 5 for FOO and P00 for OL, they form tenure classes. That is, the most common characteristic of all these owner-operatorships is the uniting force which is stronger than the other separating factors. Whereas, the strongest factor which distinguishes NOL-nonoperatorship is the reason for it to form a distinct tenure class of renters by itself.

**Discriminant function between operators and nonoperators**

The $D^2$ values for four tenure groups, as well as for two classes, are presented with the discriminant analysis data in Appendix D. It must be noted that the power of predictability of the model and consequently the proper classification of the individual owner into the right tenure is increased when tenure groups form tenure classes. This is because each individual class is more homogeneous than each group, as has been pointed out in the dispersion matrices.

Figure 8 presents the plotting of $D^2$'s for the final two classes. $D_4^2$ is on the horizontal axis and $D_{1,2,3}^2$ is on the vertical axis. The $45^\circ$ line divides the graph into two equal portions and thus it represents
Figure 4. Ranking of distance of other tenure groups by members of FOO
(three $D^2$ points could not be plotted because they fell outside the scale of the graph)
Figure 5. Ranking of distance of other tenure groups by members of POO (three $D^2$ points could not be plotted because they fell outside the scale of the graph)
Figure 6. Ranking of distance of other tenure groups by members of OL (twelve $D^2$ points could not be plotted because they fell outside the scale of the graph)
Figure 7. Ranking of distance of other tenure groups by members of NOL (eighteen $D^2$ points could not be plotted because they fell outside the scale of the graph)
Figure 8. Contrasting the ranking of distance, $D^2$'s, of Class I operators versus Class II nonoperators (operator class is identified by black dots, nonoperator class by white dots; their intersection is marked by a black dot in a white dot; twenty-five $D^2$ points of operators and three $D^2$ points of nonoperators could not be plotted because they fell outside the scale of the graph)
Legend
- $D_4^2$
- $D_{1,2,3}^2$
- $D_4^2$ & $D_{1,2,3}^2$ occupying same $D^2$ value
an equal chance of an assignment error between the two tenure classes.

Members of tenure classes are correctly classified when they form a cluster around their $D^2$ and locate in the triangle which represents their class. That is, operator class is concentrated on the lower triangle and identified by black dots. Its location is due to the fact that as a class, members have lower vertical value, thus the least distance from each other and greater value horizontally which means maximum distance apart from the nonoperators.

Nonoperator class, shown in white dots, is concentrated on the upper triangle for similar reasons. That is, they have lowest $D^2$ value horizontally and therefore least different from each other and highest value vertically to reflect maximum distance from operators. Thus a white dot in the black dot concentration area or vice versa indicates the misclassified landowners.

Along the $45^\circ$ border line between these two tenure classes there exists a band of misclassified owners who would have belonged to either category by slight changes in their values of one or the other variable. These are the "borderline" landowners who still exhibit the identity of their class. 153 of the operators out of 605 owners in Class I and 21 of the nonoperators out of 165 owners in Class II have been identified as "borderline" cases. This is close to 25 percent for the former class and about 13 percent for the latter class.

A seriously misclassified landowner, one who definitely exhibits the identity of the other tenure class rather than his declared tenure class, is called "response likely" owner. "Response likely" landowners numbered
only 36 in Class I and 14 in Class II, which amounts to almost 6 and 8 percent of total owners in each class, respectively. Definition and characteristics of these "response likely" owners are treated separately in the final section of this chapter.

Predictive value of the model rests on its correct classification of the observations into their respective tenure classes and identification of the "response likely" farmland owners. Applying the analysis between two tenure classes resulted in a quadratic discriminant function since Equation 3.13 has been utilized and two dispersion matrices have been identified. The test for two dispersion matrices is again the $H_1$ test and has resulted in

\[
D_{1,2,3} = |0.245069|^{40} \quad n_1 = 605
\]
\[
D_4 = |0.6827016|^{39} \quad n_2 = 165
\]
\[
D_{t} = |0.4796280|^{40} \quad n_t = 770
\]

\[M = 70,263.0686 - 69,445.7256 = 817.343\]

\[A_1 = (0.00645279)(4.8111) = 0.03104508\]

\[A_2 = (0.00003823)(32.5) = 0.00124247\]

\[A_1^2 = 0.00096379\]

\[A_2 - A_1^2 = 0.00027868 \quad \text{and is positive.} \]

So

\[f_1 = 105, \quad f_2 = 383,952.9209\]


\[
b = \frac{105}{(0.96895492 - 0.00027347)} = 108.39476692
\]

and the F test statistic is

\[
M = \frac{817.3430}{108.3947} = 7.54
\]

with \(f_1\) and \(f_2\) degrees of freedom computed F of 7.5 is very significantly different at the .999 level of tabular F of 1, so \(H_1\) is rejected and it will be concluded that two dispersions are not alike and pooled dispersion matrix \(W\) can not be used but instead individual \(S_i\)'s should be utilized.

The quadratic discriminant function obtained is in the form

\[
\sum \sum \left[ \alpha_{ij} (x_i - \bar{x}_{i1}) (x_j - \bar{x}_{j1}) - \beta_{ij} (x_i - \bar{x}_{i2}) (x_j - \bar{x}_{j2}) \right]
\]

as previously pointed out in Equation 3.13. In matrix notation, it is

\[
(x - \bar{x}_1)' s_1^{-1} (x - \bar{x}_1) - (x - \bar{x}_2)' s_2^{-1} (x - \bar{x}_2)
\]

which is the same as

\[
\begin{pmatrix}
    x_1 - \bar{x}_{11} \\
    x_2 - \bar{x}_{21} \\
    \vdots \\
    x_i - \bar{x}_{i1} \\
    \vdots \\
    x_{14} - \bar{x}_{141}
\end{pmatrix}'
\begin{pmatrix}
    \alpha_{11} & \alpha_{12} & \cdots & \alpha_{14} \\
    \alpha_{21} & \alpha_{22} & \cdots & \alpha_{24} \\
    \vdots & \vdots & \ddots & \vdots \\
    \alpha_{i1} & \alpha_{i2} & \cdots & \alpha_{i4} \\
    \vdots & \vdots & \ddots & \vdots \\
    \alpha_{141} & \alpha_{142} & \cdots & \alpha_{1414}
\end{pmatrix}
\begin{pmatrix}
    x_1 - \bar{x}_{11} \\
    x_2 - \bar{x}_{21} \\
    \vdots \\
    x_i - \bar{x}_{i1} \\
    \vdots \\
    x_{14} - \bar{x}_{141}
\end{pmatrix}
\]
Accordingly, we need to present the vector of means for the first and second classes as well as inverse dispersion matrices $\alpha^{ij}$ and $\beta^{ij}$ so that new observations can be classified. If the cost of misclassification is thought to be equal for both classes, that is to say if both classes have equal chance of being misclassified and we attach an equal value for both misclassifications, then the constant in Equation 3.13 is taken to be zero, which is represented by the 45° line in Figure 8. Therefore, whenever an observation has positive $D_i^2$ it will be classified into Class I. Conversely, a negative $D_i^2$ will be classified in Class II.

The required Class I means $\bar{x}_{i1}$, where $i = 1, \ldots, 14$, are 48.612, 72.709, 97.769, 26.479, 187.398, 976.334, 49.750, 0.0455, 15.564, 18.896, 2.988, 18.337, 52.648, and 0.217. The required Class II means $\bar{x}_{i2}$, where $i = 1, \ldots, 14$, are 15.873, 40.921, 165.503, 41.691, 65.454, 1012.050, 39.000, 0.0815, 50.842, 19.158, 2.709, 25.661, 63.715, and 0.206. The inverse dispersion matrices of the first and second classes are presented in Tables 10 and 11, respectively.

Characteristics of "Response Likely" Owners

The application of the two class models with two different dispersion matrices provided a good classification setup for the land owners included
Table 10. Inverse matrix $a^{ij}$ class I—tenure groups 1, 2, 3

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Table 11. Inverse matrix $\beta^{ij}$ class II--tenure group 4

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within the study. Full owner-operators, part owner-operators and operator landlords formed the operator class (I) with almost 70 percent correct classification of observations, while the nonoperator landlord tenure formed the nonoperator class (II) with over 79 percent correct classification.

Identifying the misclassified respondents from Figure 8 and Appendix D, two kinds of landowners emerged: (1) "borderline" owners, who indicated some characteristics of the class other than the one they have declared but still retain their identity as members of their own class, and (2) "response likely" owners, who clearly exhibited the characteristics of the class other than the one to which they belong. These last groups of owners numbered 50 and were less than 7 percent of all respondents.

The "response likely" farmland owner is identified when respondent is classified into the class other than his declared tenure class very strongly. The strength of classification is measured by the value of the $D^2$'s computed. If a respondent's computed $D^2$ is twice as big or bigger for his declared class than his computed $D^2$ for the opposite class, then he is said to be strongly misclassified and called "response likely" farmland owner. These owners are expected to change tenure status within the foreseeable future. Thus the discriminant function obtained provides the tool to predict the owners who are most likely to change their tenure status by observing the relative values they attach to different variables.

Analyzing these "response likely" owners, it is seen that the ones who were classified as nonoperators (Class II) by the model, while they declared to be operators (Class I), exhibited these characteristics:
None of the owners were buying land under purchase contract or mortgage agreement and no group member had an outstanding debt. All of the lands they own have been fully paid for but ownership with one partner dominated the group portrait.

In acquiring ownership of their lands, very few of them purchased from their relatives and even of the ones who did, most have been less than 80 acres; however, close to 50 percent had inherited land and received some money as gift or estate settlement and used it for buying, improving or operating their lands. The value of their owned land varied from $2,500 to $300,000, but the great majority—close to 50 percent—had lands declared to be in excess of $75,000.

Years land owned varied between the land owners from 5 to 41; however, 33 percent of the time it was 24 or more years. Similarly, the age of the owners indicated the group to consist of older men; over 80 percent were older than 50 years, of which almost one-half were older than 70 years.

Further investigation of the individual respondents indicated that most "response likely" nonoperators were in all likelihood NOL, even though they declared themselves to be operators (FOO, POO and OL). The respondent's tenure identification of himself varies from individual to individual. Most older owners, even when their son, son-in-law or close relative has been actually operating the farm in some partnership form, indicated themselves to be involved in the decision-making process of the farm and therefore declared to be in Class I. The model has selected these landowners and identified them to be nonoperators (Class II) rather
than operators (Class I). As far as this study is concerned, it is possible and the model, therefore, will identify correctly the owner who is most likely to change his tenure status within the immediate future.

Analyzing the owners who were classified as operators (Class I) in the model but who declared to be nonoperators (Class II) have these characteristics:

Almost all landowners (over 80 percent) were buying land under purchase contract or mortgage arrangements. For the great majority of all the owners, their owned land had not been paid for and only a few were in partnership with others. Almost all owners have debts outstanding ranging from $400 to close to $200,000, but most were around $16,000.

In acquiring ownership of their land, very few bought from relatives. However, no owner has inherited land or received money as a gift to be used in getting started in farming. The value of their owned land varied from $20,000 to close to $400,000; most declared the value around $50,000.

Years land owned varied from 2 to 34, but almost 50 percent owned their lands for less than 15 years. Age of owners differed significantly compared to the other class of owners. In this class only about one-third of the owners were over 50 years old and one-fifteenth of these were over 70. Age is a good indicator of operatorship status, as can be expected.

Summarizing the findings of this chapter, it can be stated that the real distinction between different owner groups lies in their operatorship status rather than their ownership goals. This is apparent when the first three tenure groups (FOO, POO and OL) joined to form an operator class, as opposed to a nonoperator class (NOL). If ownership had been the real distinguishing criteria between the owners, one would have expected to
find FOO as a class by itself or at least forming a class with NOL as opposed to POO and OL separately or jointly.

The significance of this finding is that the norm of ownership has become second in importance to the norm of operatorship. That is, an individual farmer seems to be more interested in reaching close to an optimum operation scale even if that means renting additional land resources. No doubt the decline in per unit costs in operating larger acreage and increased land prices have diverted most people from their traditional norm of ownership. Further advances in agricultural technology should be expected to aggravate the problematic gap.

The model of discriminant analysis has also been useful in identifying the characteristics of the "response likely" landowners. The most important variables utilized in predicting the tenure status of an owner are his acquisition methods and debt outstanding, his inheritance of land and/or money and his age. The landowner who is most likely to become an operator is less than 50 years old, buying land under purchase contract or mortgage with a debt outstanding on the average of $16,000. In all probability, none of his lands is fully paid for; he may have purchased less than 80 acres from his relatives, but has not inherited land or money.

The landowner most likely to become a nonoperator, even if he is operating now, is more than 50 years old; he has fully paid for all his lands and was not buying any under purchase contract and/or mortgage and has no debts outstanding. He has not purchased from his relatives, but inherited most of his land together with gifts of money to operate or
improve his lands. Most of his owned lands are in partnership with one
other person, usually a son, son-in-law or a close relative.

In terms of the diagnostic hypotheses developed in the second
chapter the first two are rejected. That is, each tenure group is not a
tenure class in the sense that if they had been sufficiently homogeneous
each would have been expected to have an entirely different objective
function to maximize. That is, the full owner's objective function is
expected to consist primarily of obtaining debt-free title to land while
the objective function for operators (POO and OL) is expected to be
maximizing profits and maximizing rent income for the nonoperators (NOL).
Rather than forming three (or four) different classes, owners formed two
tenure classes based on their operatorship status. Nor is there evidence
to substantiate the norm of ownership against the goal of optimum opera­
torship. Economic and technical adjustment pressures are favoring the
latter, at least in the short run. The third diagnostic hypothesis is
accepted conditionally because, while acquisition methods of owned land
has been important in distinguishing owners into their proper classes,
age of owner, his debt outstanding and value of his assets have also
contributed to the identification process.
CHARACTERISTICS OF FARMLAND OWNERS

In the third chapter, the model of discriminant analysis applied to farmland owners suggested a revaluation of the ownership norm of the society. Operatorship, that is efficient utilization of resources at or close to minimum cost acreages, has gained increasing importance compared to ownership norm. The long-run goal may still be full ownership of land resources, but in the short run achieving an economically efficient operational unit even when land resources are leased appears to be the prime target. These findings should affect the economic organization of agricultural units as well as the characteristics of the farmland owners. These are the areas treated in this chapter.

Organization of Agricultural Units

The economic organization of American agricultural units "from the days of Jefferson to the present,... (has been) the family-type farm" (80, p. 19). Operationally the definition of such an economic unit has been rather vague, but generally understood to include at least these characteristics (1, p. 207; 35, p. 4 and 81, p. 32):

(a) ownership of sufficient resources,

(b) managerial decision vested with the family, and

(c) most labor contributed by the family members.

As has already been presented in discussing the ownership norm, the above form of organization has been strongly identified with the goals of society. The form of organization began to be increasingly substituted for the norm of ownership. This came about because the adjustments in
size and organization of farms were not considered only an economic phenomena but conceived as a socio-political problem identified with the roots of democracy and the American way of life (56, p. 1005; 60, p. 310; and 64). Such an approach to owner-operatorship confuses the means with the ends and does not contribute to our understanding of the causes of the problematic gap.

The continuing stream of new production technology which requires more capital and a larger scale of operation is said to be the major force in altering the form of business organization. This fact is not a central point of our thesis; however, emerging forms of organization may challenge the achievement of the norm of ownership and therefore should be identified. Scofield observes the developing trend when he discusses the pressure of these adjustments:

The emerging problems of the traditional farmer are increasingly those of obtaining access to land and capital, of business organization and financial management, and of being able to compete effectively for production inputs and an outlet for his products. These are the less obvious, and often hidden external economies of scale that give a competitive edge to large scale operations, which in turn can often be achieved more readily by the corporate form of organization (83, p. 18).

Thus changing technological and economic conditions in recent decades may lead to institutions, such as the family farm corporation, in Iowa agriculture. As Harl points out:

The changes of the next three decades may not be solely technological. It appears that agriculture may be on the verge of important and perhaps far-reaching structural changes as well. With farms of the future likely to be not only considerably larger and more highly capitalized but also likely to involve more instances of multiple owners, the one-man proprietorship is likely to undergo change. For the first time in centuries, important structural changes in the organization of the farm business may be imminent (40, p. 4).
The dominant form of organization in Iowa agriculture is still sole proprietorship organized around the farm family. However, alternative forms of organization, such as partnership and corporation, have been getting increased attention from the farm owners. In light of increased resource requirements in agriculture, these alternative forms of organizations may have advantages over sole proprietorship for the beginning farmer in acquisition, intra-family operating arrangements and eventual transfer of land (30, 44). These points fall outside the scope of our study and will not be pursued any further.\(^9\) It is sufficient to indicate that there are increasing pressures on the form of organization of agricultural units, and the outcome is bound to influence the ownership norm of the society.

Characteristics of Farmland Owners in 1970

If one Iowa farmland owner had to be chosen as the most typical one, who would he be in the year 1970 and would his characteristics be significantly different from the typical owner of 1946?

The typical Iowa farmland owner in 1970 is a male (83.6 percent) farmer (45 percent) over 55 years old (59.5 percent) who owns 100 to 279 acres of land (55.7 percent) which has a market value of about $90,000. This land is purchased from nonrelatives but some assistance in the form of inheritance and/or gift of land or money have been received (32.1 percent). Our typical owner operates his own land and rents in additional

\(^9\) A good discussion of farm partnership is in (67); for various aspects of family farm corporations see (39, 41, 42 and 77), and for capital and credit needs of changing agriculture see (10 and 66).
land (47 percent) resides on a farm (67.5 percent) in Iowa (93 percent).

These are some of the structural characteristics of the typical Iowa farmland owner in the year 1970. Have there been significant changes in these and other structural variables over the years and if so in what direction? These are the topics delimited under objective 2 and the diagnostic hypotheses below are put to test in this chapter:

2.a.1 Distribution of land and value of assets owned are getting unevenly distributed between owners.
2.a.2 Age distribution of owners are shifting to older groups.
2.a.3 The percentage of out-of-state owners is increasing.
2.a.4 The proportion of farm real estate in acres and value is shifting from farm operators to nonfarm operators.
2.a.5 Nonoperating landlords are in occupations other than farming and their ownership share is increasing.

Tables 12 to 21 identify the changing characteristics of the farm­land owners with respect to tenure, occupation, acres of land owned, present age and residence. All groupings are self-explanatory; however, women indicating no occupations have been classified as housewives even if they are not married. The business and professional group includes people primarily in business or in decision-making positions. Therefore, merchants, as well as doctors, lawyers, teachers, engineers and public officials, are classified into this group. The last occupation group consists of skilled or unskilled laborers and clerical workers.
Acreage, occupation, age and residency

Since the early settlement days there has been the constant fear of nonagricultural people getting into farmlands and thus creating absentee ownership and widespread tenancy. These fears are stressed in the classic article on farmland ownership:

The change in the ownership of farmland necessitated by death will result in the title passing by inheritance, marriage or otherwise, to nonfarmers (38, p. 526).

These common fears proved to be groundless. Table 12 shows that most owners are in farming, retired from farming or housewives (most probably farm widows). Within the nonoperating landlords, however, there is considerable concentration of ownership by nonfarm related occupants. The table does not reflect the true situation exactly since part-time farming has been on the increase and many owners who were classified as nonfarm related could have been called farmers.

As far as nonfarm occupants' acreages of owned land is concerned (Table 13), they do not differ significantly from the farmers. In fact, farmers and retired farmers own larger acres (> 520 acres) more often than nonfarm occupants. Therefore diagnostic hypothesis 2.a.5 will have to be rejected. Changes that have been taking place with respect to these variables will be tested after we look into age distribution with respect to owned acreage and residency.

Table 14 and Figure 9 show the distribution of farmland owners with respect to their present age and owned acreage. If we classify the owners as young (less than 44 years old), middle aged (between 45 and 64) and old (older than 65 years old) and proceed accordingly, it is observed that the
Table 12. Percentage distribution of farm owners by tenure, sex and occupations (Iowa, 1970)

<table>
<thead>
<tr>
<th>Tenure and sex groups</th>
<th>Owners reporting (number)</th>
<th>Percentage distribution by occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Farmers</td>
<td>Retired farmers</td>
</tr>
<tr>
<td>All owners</td>
<td>2,692</td>
<td>44.50</td>
</tr>
<tr>
<td>Owner operators</td>
<td>729</td>
<td>72.97</td>
</tr>
<tr>
<td>Part-owner operators</td>
<td>430</td>
<td>95.42</td>
</tr>
<tr>
<td>Operator landlords</td>
<td>358</td>
<td>45.55</td>
</tr>
<tr>
<td>Nonoperator landlords</td>
<td>1,175</td>
<td>1.80</td>
</tr>
</tbody>
</table>

|          | Men owners       | 2,442 | 97.96 | 97.12 | ---  | 78.77 | 88.58 |
| Women owners | 497    | 2.04  | 2.88  | 100.0 | 21.23| 11.42 |
Table 13. Owners by sex and occupation, by acres owned (Iowa, 1970)

<table>
<thead>
<tr>
<th>Occupation and sex</th>
<th>Cases reporting (number)</th>
<th>Percentage distribution by owned acreage intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0- 30- 70- 100- 140- 200- 280- 360- 520- 700 and over</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>497</td>
<td>3.20 10.90 17.13 13.87 23.25 17.90 6.33 4.35 1.83 1.24</td>
</tr>
<tr>
<td>All owners</td>
<td>2,939</td>
<td>3.55 7.71 14.42 14.93 23.62 17.02 8.70 6.52 2.15 1.37</td>
</tr>
<tr>
<td>Occupation groups</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmers</td>
<td>1,283</td>
<td>0.78 3.50 11.25 13.85 26.50 20.05 11.38 8.53 2.55 1.61</td>
</tr>
<tr>
<td>Retired farmers</td>
<td>441</td>
<td>1.85 2.76 14.73 15.77 27.99 18.85 7.22 6.59 3.14 1.10</td>
</tr>
<tr>
<td>Business and professional</td>
<td>453</td>
<td>5.89 14.57 16.10 17.22 17.64 12.12 8.40 4.47 1.78 1.80</td>
</tr>
<tr>
<td>Laborers and others</td>
<td>390</td>
<td>11.64 17.12 23.25 16.34 14.80 8.27 3.82 3.89 0.56 0.32</td>
</tr>
</tbody>
</table>
Table 14. Percentage distribution of farm owners by owned acres and present age (Iowa, 1970)

<table>
<thead>
<tr>
<th>Owned acreage intervals</th>
<th>Owners reporting (number)</th>
<th>Percentage distribution by age groups</th>
<th>24</th>
<th>25-34</th>
<th>35-44</th>
<th>45-54</th>
<th>55-64</th>
<th>65-74</th>
<th>75</th>
<th>All ages</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-29</td>
<td>89</td>
<td>--</td>
<td>12.42</td>
<td>17.70</td>
<td>17.00</td>
<td>18.03</td>
<td>21.06</td>
<td>13.76</td>
<td>3.52</td>
<td></td>
</tr>
<tr>
<td>30-69</td>
<td>199</td>
<td>4.06</td>
<td>7.59</td>
<td>14.12</td>
<td>19.29</td>
<td>26.92</td>
<td>17.52</td>
<td>10.50</td>
<td>7.71</td>
<td></td>
</tr>
<tr>
<td>70-99</td>
<td>373</td>
<td>0.27</td>
<td>6.41</td>
<td>14.39</td>
<td>16.08</td>
<td>26.02</td>
<td>23.92</td>
<td>12.91</td>
<td>14.51</td>
<td></td>
</tr>
<tr>
<td>100-139</td>
<td>406</td>
<td>0.30</td>
<td>5.17</td>
<td>11.32</td>
<td>19.58</td>
<td>27.61</td>
<td>22.70</td>
<td>13.33</td>
<td>15.06</td>
<td></td>
</tr>
<tr>
<td>140-199</td>
<td>639</td>
<td>0.16</td>
<td>4.22</td>
<td>10.68</td>
<td>23.80</td>
<td>23.51</td>
<td>23.27</td>
<td>14.35</td>
<td>23.64</td>
<td></td>
</tr>
<tr>
<td>200-279</td>
<td>489</td>
<td>0.44</td>
<td>3.39</td>
<td>14.78</td>
<td>22.39</td>
<td>23.72</td>
<td>21.60</td>
<td>13.68</td>
<td>17.01</td>
<td></td>
</tr>
<tr>
<td>280-359</td>
<td>270</td>
<td>--</td>
<td>2.95</td>
<td>13.97</td>
<td>26.58</td>
<td>28.09</td>
<td>16.59</td>
<td>11.82</td>
<td>8.53</td>
<td></td>
</tr>
<tr>
<td>360-519</td>
<td>246</td>
<td>--</td>
<td>2.41</td>
<td>13.33</td>
<td>24.78</td>
<td>27.16</td>
<td>23.80</td>
<td>8.52</td>
<td>6.47</td>
<td></td>
</tr>
<tr>
<td>520-699</td>
<td>93</td>
<td>--</td>
<td>3.05</td>
<td>10.05</td>
<td>24.75</td>
<td>26.70</td>
<td>19.56</td>
<td>15.89</td>
<td>2.16</td>
<td></td>
</tr>
<tr>
<td>≥ 700</td>
<td>90</td>
<td>--</td>
<td>1.66</td>
<td>4.15</td>
<td>36.97</td>
<td>20.15</td>
<td>18.92</td>
<td>18.14</td>
<td>1.38</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2,894</td>
<td>--</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>100.00</td>
<td></td>
</tr>
</tbody>
</table>
Figure 9. Percentage distribution of owned farmland acres by acreage intervals and age groups, Iowa 1970
PERCENTAGE OF OWNERS IN EACH ACREAGE INTERVAL

- GROUP 1: 44 YEARS OLD (20%)
- GROUP 2: 45-64 YEARS OLD (45%)
- GROUP 3: 65 YEARS OLD (35%)
young owners consistently own a lesser share of the owned acreage for all intervals compared to the old owners. The young owners' share of owned acreage is considerably reduced even further in the bigger ownership units (> 520 acres) while the middle aged owners increase their share of ownership and the old owners keep their share at a consistent level. These findings indicate that the Iowa farmland owner is quite old. This is an important factor in why young farmers have difficulty in achieving their goal of owner-operatorship and partially accounts for the fact that we have so many landlords appearing in the sample. There is considerable evidence to accept diagnostic hypotheses 2.a.2 although it is not tested statistically since most important groups of owned acreage intervals had less than 100 observations in both cases.

Turner attaches great importance to the residency of a landowner and suggests that "the more distant the landlords residence the more difficult for landlord and tenant to remain on satisfactory terms" (99, p. 16). To test if there were significant differences between the farm occupants and nonfarm occupants with respect to residency on or off a farm, Table 15 has been prepared. It can be observed that both groups of nonfarm occupants as well as housewives of the nonoperating landlord categories live off a farm. If living off a farm is considered to cause problems between the landlord and tenant, as has been suggested, then there is cause for concern with respect to this finding. However, means of communication and transportation have increased to such an extent that it is difficult to accept Turner's argument with respect to distance alone. It certainly may have been a contributing factor, but I believe the role of distance must have declined considerably.
Table 15. Residence and tenure of farm owners by occupation (Iowa, 1970)

<table>
<thead>
<tr>
<th>Occupation groups</th>
<th>Owner reporting residence (number)</th>
<th>Distribution by residence</th>
<th>Percentage distribution by tenure and residence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>on a farm</td>
<td>off a farm</td>
<td>on a farm</td>
</tr>
<tr>
<td>Farmers</td>
<td>1,277</td>
<td>94.88</td>
<td>5.12</td>
</tr>
<tr>
<td>Retired farmers</td>
<td>438</td>
<td>60.62</td>
<td>39.38</td>
</tr>
<tr>
<td>Housewives</td>
<td>304</td>
<td>34.39</td>
<td>65.61</td>
</tr>
<tr>
<td>Business and professional</td>
<td>445</td>
<td>28.75</td>
<td>71.25</td>
</tr>
<tr>
<td>Laborers and others</td>
<td>385</td>
<td>49.86</td>
<td>50.14</td>
</tr>
<tr>
<td>All owners</td>
<td>2,849</td>
<td>67.45</td>
<td>32.55</td>
</tr>
</tbody>
</table>
Changes in the Ownership Structure 1946-1970

Present characteristics of Iowa farmland owners have been analyzed in the last section and in the third chapter. It is important to identify if these found characteristics differ significantly from the previous studies on Iowa farmland ownership. If there have been significant changes, which direction have they been and can we make generalizations over the importance and implications of these trends? These points are discussed in this section and diagnostic hypotheses 2.a.1, 2.a.3 and 2.a.4 are tested.

Importance of tenure groups

In the third chapter the results of discriminant analysis suggested a possible shift in importance from the ownership goal towards the norm of operatorship. Table 16 provides additional material to test the earlier findings. According to this table, indications of a long-time trend is hinted. Consistently for both men and all owners share of the owned land for owner operators have declined while the share of the part owner operators have increased since 1946.

With respect to the behavior of the landlords the forthcoming trend is more difficult to evaluate. When 1970 is compared to 1946 there is a slight but nonsignificant decline in the share of the nonoperating landlords. However, when 1970 is compared to 1958 for the same tenure group, there is a very significant increase in their share of ownership. The situation is very similar to the nonoperator landlords where 1970 compared to 1946 does not detect a significant change but compared to 1958 there
Table 16. Percentage distribution of individual owners by sex and tenure within areas (Iowa, 1946, 1958 and 1970)*

<table>
<thead>
<tr>
<th>Tenure status and sex of owner</th>
<th>Number and percentage distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Iowa 1946</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Men</td>
<td>86.5</td>
</tr>
<tr>
<td>Women</td>
<td>13.5</td>
</tr>
<tr>
<td>All owners</td>
<td></td>
</tr>
<tr>
<td>Owner-operators</td>
<td>37.6</td>
</tr>
<tr>
<td>Part-owner-operators</td>
<td>11.2</td>
</tr>
<tr>
<td>Operator landlords</td>
<td>12.4</td>
</tr>
<tr>
<td>Nonoperating landlords</td>
<td>38.8</td>
</tr>
<tr>
<td>Number reporting</td>
<td>1285</td>
</tr>
<tr>
<td>Men owners</td>
<td></td>
</tr>
<tr>
<td>Owner-operators</td>
<td>42.3</td>
</tr>
<tr>
<td>Part-owner operators</td>
<td>12.8</td>
</tr>
<tr>
<td>Operator landlords</td>
<td>13.8</td>
</tr>
<tr>
<td>Nonoperating landlords</td>
<td>31.1</td>
</tr>
<tr>
<td>Number reporting</td>
<td>1111</td>
</tr>
<tr>
<td>Women owners</td>
<td></td>
</tr>
<tr>
<td>Owner-operators</td>
<td>7.5</td>
</tr>
<tr>
<td>Part-owner operators</td>
<td>1.2</td>
</tr>
<tr>
<td>Operator landlords</td>
<td>4.0</td>
</tr>
<tr>
<td>Nonoperating landlords</td>
<td>87.3</td>
</tr>
<tr>
<td>Number reporting</td>
<td>174</td>
</tr>
</tbody>
</table>

*Data on 1946 and 1958 from (89, p. 46a).

**Close to 90 percent significant difference.
is a very significant decline in this tenure group's share of the owned acreage.

The above findings indicate a reversal of the role of the owner operators and the part owner operators. Increasingly, the latter are getting a larger share of the ownership while the share of the former tenure group is declining. In terms of the ownership norm, this certainly means problematic gap is widening. It also implies production rather than ownership has become the high priority goal because the long-time trend of decreasing the share of owner operators has not been in favor of nonoperating landlords, as is commonly feared. Thus the diagnostic hypothesis 2.a.5 which states an increasing ownership share for nonoperating landlords will have to be rejected. The decreases in the ownership share for owner operators and nonoperating landlords is matched by an increase in the share of operating tenure groups emphasizing the achievement of an optimum scale of operation becoming the more important goal as opposed to full owner-operatorship of resources for the farm family.

Shifts in age groups

Is the Iowa farmland ownership increasingly concentrating on the older age groups and thus widening the problematic gap in terms of the ownership norm? Table 17 is prepared to indicate the percentage distribution of owners' age groups by their tenures for 1970 and for all tenures for 1946 to 1970. The diagnostic hypothesis 2.a.2 of concentration of owned land by older owners is tested. It can be observed that, apart from a statistically insignificant rise in the ownership share of younger owners (< 34 years old) for 1970 compared to the 1958 distribution, the
Table 17. Percentage distribution of farm owners by tenure, sex and age (Iowa, 1946, 1958 and 1970)*

<table>
<thead>
<tr>
<th>Sex and tenure groups</th>
<th>Number reporting (number)</th>
<th>Percent distribution by age groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>under 25</td>
</tr>
<tr>
<td></td>
<td>(number)</td>
<td></td>
</tr>
<tr>
<td>Men owners</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Owner operators</td>
<td>717</td>
<td>0.40</td>
</tr>
<tr>
<td>Part-owner operators</td>
<td>432</td>
<td>0.52</td>
</tr>
<tr>
<td>Operator landlords</td>
<td>326</td>
<td></td>
</tr>
<tr>
<td>Nonoperating landlords</td>
<td>774</td>
<td>0.35</td>
</tr>
<tr>
<td>Women owners</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Owner operators</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Part-owner operators</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Operator landlords</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>Nonoperating landlords</td>
<td>405</td>
<td>0.81</td>
</tr>
<tr>
<td>All owners</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Owner operators</td>
<td>734</td>
<td>0.39</td>
</tr>
<tr>
<td>Part-owner operators</td>
<td>434</td>
<td>0.52</td>
</tr>
<tr>
<td>Operator landlords</td>
<td>363</td>
<td></td>
</tr>
<tr>
<td>Nonoperating landlords</td>
<td>1179</td>
<td>0.51</td>
</tr>
</tbody>
</table>

Iowa 1970 2710 0.42 5.07 12.99 22.00 24.34 21.56 13.63*  
Iowa 1958 1825 0.1 4.2 14.9 24.3 25.7 21.7 9.1  
Iowa 1946 1247 0.3 5.3 15.6 25.3 23.0 20.4 10.1

aData for 1946 and 1958 in (89, p. 39).
ownership share of all age groups between 35 and 74 (up to but not including the oldest group whose share has increased significantly) have declined slightly. Similar observations are obtained comparing 1970 with the 1946 study, but the decline in the ownership reverses earlier (at age group 55-64). However, none of the comparisons were significant except comparison of the oldest group (75 and older) with 1958 and 1946 at the tested levels.

The diagnostic hypotheses for all age groups (except the oldest) will have to be rejected at the indicated test levels. Even when there was not a statistically significant shift in the distribution of owned acreage between age groups for the time periods under study, it should be noted that while an Iowa farmland owner had a 30.5 percent chance of being over 65 years old in 1946, this chance has increased to 30.8 by 1958 and 35.2 by 1970. The indications are that Iowa farmland ownership is increasingly concentrating at the older age groups, thus contributing to the widening of the problematic gap.

Changes in ownership and value of owned resources

Concentration in Iowa farmland ownership and changes that have been taking place are studied more in detail in the fifth chapter. In this section the diagnostic hypothesis 2.a.1 which states that distribution of owned acreage and value of owned assets is getting uneven is put to test.

Tables 18 and 19 present the cumulative distribution of owned acreage and value, respectively. It can be observed that for both acreage and value there is a change from 1958 to 1970. Table 18 indicates that while almost 21 percent of the owners had less than 100 acres in 1958, they
Table 18. Cumulative distribution of individual ownership of land (Iowa, 1958-1970)\(^a\)

<table>
<thead>
<tr>
<th></th>
<th>Percent of owners</th>
<th>Percent of land (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 49</td>
<td>5.38</td>
<td>8.34</td>
</tr>
<tr>
<td>Less than 69</td>
<td>7.51</td>
<td>11.26</td>
</tr>
<tr>
<td>Less than 99</td>
<td>20.95</td>
<td>25.69</td>
</tr>
<tr>
<td>Less than 139</td>
<td>35.21</td>
<td>40.62</td>
</tr>
<tr>
<td>Less than 199</td>
<td>57.01</td>
<td>64.25</td>
</tr>
<tr>
<td>Less than 279</td>
<td>72.78</td>
<td>81.28</td>
</tr>
<tr>
<td>Less than 359</td>
<td>81.96</td>
<td>89.98</td>
</tr>
<tr>
<td>Less than 519</td>
<td>90.82</td>
<td>96.51</td>
</tr>
<tr>
<td>Less than 699</td>
<td>95.22</td>
<td>98.65</td>
</tr>
<tr>
<td>Total</td>
<td>100.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

\(^a\)Data on 1958 furnished from source material of (90).

Table 19. Cumulative distribution of value of individually owned land (Iowa, 1958-1970)

<table>
<thead>
<tr>
<th>Value ($1000)</th>
<th>Percent of owners</th>
<th>Percent of value ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 19.9</td>
<td>16.73</td>
<td>8.53</td>
</tr>
<tr>
<td>Less than 49.9</td>
<td>55.95</td>
<td>37.55</td>
</tr>
<tr>
<td>Less than 74.9</td>
<td>76.09</td>
<td>56.89</td>
</tr>
<tr>
<td>Less than 99.9</td>
<td>85.34</td>
<td>72.32</td>
</tr>
<tr>
<td>Less than 124.9</td>
<td>90.56</td>
<td>83.00</td>
</tr>
<tr>
<td>Less than 149.9</td>
<td>93.01</td>
<td>87.78</td>
</tr>
<tr>
<td>Less than 199.9</td>
<td>96.05</td>
<td>93.94</td>
</tr>
<tr>
<td>Less than 249.9</td>
<td>97.43</td>
<td>96.65</td>
</tr>
<tr>
<td>Total</td>
<td>100.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

\(^a\)Data on 1958 furnished from source material of (90).
increased to 25.7 percent by 1970. Conversely, for the above 520 acre ownership, while 9.2 percent of the owners were in this group in 1958, their percent declined to 3.5 by 1970 and the share of large (≥ 520 acre) ownership units similarly reduced from 32.6 percent to 23.5 percent by 1970. In other words, while the ownership of smaller acreages have remained fairly stable between 1958 and 1970 in the larger acreages a smaller group of owners own a larger share of the owned land.

With respect to the value of the owned resources, Table 19 indicates essentially what has been found in Table 18. Since the value figures for 1970 have not been deflated into the 1958 basis, one should not compare absolute ownership values but rather what percentage of people owned what percentage of the value of resources. On this basis it is seen that almost 7 percent of the highest value owners owned 28 percent of total value in 1958 for about the same percentage of owners in 1970 their share of total value had increased over 32 percent. Among the lowest value owners the distribution of their percentage share of the total value has not changed substantially between 1958 and 1970.

It can be concluded that there are indications to suggest that larger acreage owners are getting larger while the smallest acreage owners are fairly stable in their ownership of acreage and value. Increases of the owned acreages of the largest group have been at the expense of the middle acreage owner group (particularly owners around 100 to 280 acres). The measurement and magnitude of the shift in the ownership situation from 1958 to 1970 is discussed in the fifth chapter, but now let us identify the occupations groups affected most.
Table 20 presents farmland owners by their occupation, owned acres and value. It can be observed that numbers of farmers have been very significantly declining since 1946 against a very significant increase in the number of laborers while the rest of the occupation groups have been fairly stable (only housewives indicate a significant increase). Owned acres have shown the same change; that is, farmers have consistently lost their share against the laborers. Business and professional groups have indicated a significant decline in their share of acres owned since 1958 while the opposite is true for the housewives.

The findings for the changes in the value of farm real estate have all been significantly different, for farmers, retired farmers and business groups very significantly different. While the share of value of farm real estate has declined for retired farmers and business groups, it has increased for the farmers, as well as for the other groups. The last finding seems inconsistent for the farmers with the previous decline in their ownership shares. However, what seems to have occurred is that farmers may have less share of the total acreage owned, but these lands are in the most highly valued areas as evidenced with the highest average value of resources for the farmer compared to all other occupations.

The increases in the number, share of owned acreage and value for laborer occupations is quite surprising. A likely explanation is the great occurrence of part-time farming and part-time nonfarm related occupations in Iowa in 1970. Further studies on part-time farmers may yield interesting results.

While the farmers' average acres of ownership has consistantly
Table 20. Comparative distribution of number of farm owners, acres and value of land owned by principal occupation of owner (Iowa, 1946, 1958 and 1970)\textsuperscript{a}

<table>
<thead>
<tr>
<th>Owners, acres and value</th>
<th>Number reporting</th>
<th>Farmers</th>
<th>Retired farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owners</td>
<td>1158</td>
<td>1719</td>
<td>2692</td>
</tr>
<tr>
<td>Acres owned</td>
<td>1167</td>
<td>1719</td>
<td>2692</td>
</tr>
<tr>
<td>Value of farm real estate</td>
<td>1139</td>
<td>1522</td>
<td>2347</td>
</tr>
<tr>
<td>Average acres per owner</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Average value per owner (dollars)</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

\textsuperscript{a}Data on 1946 and 1958 in (89, p. 28).
<table>
<thead>
<tr>
<th></th>
<th>Housewives</th>
<th>Business and professional</th>
<th>Laborers and others</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4.0 7.1 10.80*</td>
<td>8.7 18.3 15.12</td>
<td>5.9 7.3 13.96**</td>
</tr>
<tr>
<td></td>
<td>3.9 7.0 10.36*</td>
<td>11.3 19.8 14.78*</td>
<td>2.9 5.5 13.84**</td>
</tr>
<tr>
<td></td>
<td>4.3 6.7 8.57*</td>
<td>9.7 20.4 14.06**</td>
<td>2.9 5.3 9.01*</td>
</tr>
<tr>
<td></td>
<td>173 206 188</td>
<td>240 226 181</td>
<td>92 157 129</td>
</tr>
<tr>
<td></td>
<td>23,381 61,031 81,510</td>
<td>24,222 56,328 76,237</td>
<td>10,577 36,889 56,272</td>
</tr>
</tbody>
</table>
increased since 1946, it has declined for the business group. The other
groups indicate unstable tendencies between periods. One tentative con­
clusion which can be reached is that farmers' share of farm real estate
and average owned acreage have not declined and, therefore, hypothesis
2.a.4 has to be rejected. Rather, what seems to be emerging in Iowa and
is more likely to continue in the 70's is the increasing incidence of
part-time farming coupled with skilled or unskilled work in nonfarm
related jobs. This certainly is an interesting development and may have
implications as far as agricultural income problems are concerned.

Changes in state residency

Ownership of the state's land resources by residents of other states
has been of concern to Iowa residents. The acquisition of land by out­
siders has often been considered as a form of speculation and connected
with the evils of absentee land ownership. Since the beginning of the
settlement days Iowa residents have been careful not to let the specula­
tors become established. To this end they have often taken the law into
their own hands before the courts of law were established (89, p. 40).
Whether the fears of Iowa residents have materialized in 1970 is analyzed
in Table 21.

Testing the diagnostic hypothesis 2.a.3 which states that the per­
centage of out-of-state owners is increasing, no significant difference
between the two time periods is observed. The hypothesis has to be
rejected because while 93.6 percent of the owners indicated state resi­
dency in 1958, this group slightly decreased to 93 percent which is
statistically insignificant.
Table 21. Percentage distribution of owners by occupation and state residence, Iowa 1958-1970

<table>
<thead>
<tr>
<th>Occupation</th>
<th>State residence</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmer</td>
<td>54.5</td>
<td>48.82**</td>
<td>17.1</td>
</tr>
<tr>
<td>Retired farmer</td>
<td>16.6</td>
<td>15.74</td>
<td>12.8</td>
</tr>
<tr>
<td>Housewife</td>
<td>6.3</td>
<td>9.72*</td>
<td>15.5</td>
</tr>
<tr>
<td>Business and professional</td>
<td>15.7</td>
<td>12.68</td>
<td>40.0</td>
</tr>
<tr>
<td>Laborers and others</td>
<td>6.9</td>
<td>13.01**</td>
<td>14.6</td>
</tr>
<tr>
<td>All owners</td>
<td>93.6</td>
<td>93.05</td>
<td>6.4</td>
</tr>
<tr>
<td>Number reporting</td>
<td>1432</td>
<td>2660</td>
<td>98</td>
</tr>
</tbody>
</table>

*Data on 1958 data in (89, p. 42).

Table 21 still uncovers an interesting fact. Shares of nonresidents of Iowa between two time periods, 1958 to 1970, have changes substantially in that while farmers (retired or not) owned almost 30 percent of all the land, nonresidents claimed their share declined by more than one-half to almost 14 percent. The group that has increased its share largest are the laborers, although business and professional people still have the largest absolute share of all the nonresident claimed land. Iowa land for investment purposes may be the motive behind the nonresident nonfarm group's behavior; however, this conclusion falls short of explaining the
declining share of resident business and professional occupation categories ownership. Again the increase in the share of laborers (resident and nonresident) is noticeable and gives weight to the tentative part-time farming conclusion.
CONCENTRATION IN IOWA FARMLAND OWNERSHIP

Farmland ownership studies (4, 5, 51, 69, 72, 85 and 98) have dealt with the general patterns rural people travel in achieving ownership rights in land. Within these studies, various characteristics of the farmland owners, such as age land was acquired, previous experience in farming prior to ownership, tenure of owner, etc., are compared to methods of acquisition and financing. The results of these studies provide the next generation guidelines to follow in achieving their goal of ownership. This same method provides the elements of the diagnostic hypothesis in dealing with the problematic situation.

An equally important but often neglected part of the land ownership studies is the part that deals with the distribution of the owned land and related concentration of ownership. If ownership of farm land is acquired increasingly through inheritance and gifts from parents and relatives, the unfortunate young farmer will always find himself at a disadvantage in achieving the goal of ownership. It is not surprising therefore that financement and obtaining land have been ranked to be the two most difficult problems encountered by the beginning farmers as early as the 1940's (87, p. 524). If the young farmer is to ever realize his goal of owner-operatorship, adequate land as well as financial resources should be available. The problems young farmers face today probably have not changed much from the early 1940's. Meanwhile, relative decline in farm product prices and the rising land values may have led to changes in the concentration of farmland ownership and aggravated the situation. Before
going into the analysis of concentration of farmland ownership, it is necessary to examine the meaning attached to it.

Ownership Concentration

Concentration of ownership (be it income, wealth or land) is necessarily derived from the distribution of the given attribute within the population. A high concentration is taken to mean that relatively large amounts of the given attribute are owned by a relatively few owners and as such depicts an undesirable situation as far as society's equalitarian norms are concerned. With respect to land, it means ownership of large acres of land by a handful of owners while most others own relatively fewer acres. This kind of situation has been closely associated with absentee landlordism, exploitation of masses and has been raison d'etre of land reforms in many underdeveloped countries.

The traditional measurement of concentration depends on absolute size and value, as can be witnessed from Turner:

The question of concentration of ownership of rented farm property may be considered with three different measures . . . farms, acres and values (99, p. 4).

The traditional approach to concentration may be employed in dealing with those underdeveloped countries which technological improvements in agriculture are nonexistent (thus no change in resource mix) and where land resources are owned for their social and investment values rather than their productive efficiency.

However, in countries where substitution of factors of production are both feasible and economical, the traditional approach to concentration fails to point out the dynamic nature of the problem. In cases where all
resources are undergoing qualitative as well as quantitative changes over time, the dynamic nature of the problem dictates new resource mixes as relative factor prices alter. Or as new capital resources are introduced, it may be privately as well as socially beneficial to increase the size of operations by owning larger tracts of land and capture the economies of scale associated with reductions in per unit costs. Thus it can be argued that setting absolute size norms to define concentration of ownership would be misleading. Instead, relative changes in ownership over time is stressed in this study.

In the subsequent sections of this chapter, we approach the measurement of concentration of land ownership in two distinct ways: (1) distribution of land and value among owners independent of absolute size or norm of equitable ownership and (2) concentration of land, farms and value according to some distinct characteristic (such as tenure, occupation, etc.) of the owner.

The first measure is developed from the Lorenz and Gini measures of income distribution and provides an aggregate coefficient independent of various characteristics of the owners while the second can be considered a more detailed analysis of the particular form concentration takes. Lorenz curves and concentration coefficients for each area and the state is constructed for 1958 and 1970 and compared in the next section of the first measure of concentration. The second measure of concentration is explained through the help of tables for the periods 1946, 1958 and 1970, and hypotheses developed are tested in later sections.
Measure of Concentration

Distribution of income and wealth and the associated concentration of these attributes in the hands of the few have been of interest to scientists as well as laymen for centuries. Foundations of income-wealth distribution theories and measurement techniques are founded on works of Pareto, Gini (36) and Lorenz (59). Although from time to time valid criticisms as to their interpretation are raised (11), Lorenz curves and Gini ratios are widely used in studies of income distribution (13, 34, 37, and 48). In the present land ownership study, Lorenz curves for owned land and value of this land is drawn for the owners and an accompanying concentration coefficient is calculated.

The Lorenz curve in Figure 10 is drawn by arranging a cumulative percentage of units, from smallest to largest, on the abscissa plotted against a cumulative percentage distribution of an attribute, again going from smallest to largest, on the ordinate. Since both axes are in the form of percentages running from 0 to 100, the diagonal 45° straight line depicts the line of perfect equality. That is to say, if each percentage unit receives identical shares of the attribute, then all the observations will lie on the diagonal line. On the other hand, if there was perfect inequality, say one percent of the individuals own all of the attribute, then the line of perfect inequality will be formed by the abscissa and the ordinate on the lower half of the triangle. However, in all cases of distribution of a given attribute, be it income, wealth, or land, the actual Lorenz curve is located between perfect equality and perfect inequality.
Figure 10. Measurement of concentration and the location of Lorenz curve

Figure 10. Measurement of concentration and the location of Lorenz curve.
In this study, Lorenz curves for individually owned acres of land and its value, in thousands of dollars, is plotted in terms of percentages against the observed number of owners for 1958 and 1970. The more the Lorenz curve is located away from the line of perfect equality, 45° diagonal, the more unequal is the distribution of the attribute and vice versa.

While Lorenz curves provide us with a conceptual tool to identify how an attribute is distributed in time or if it has become to be more unequally distributed over time, they do not provide a measure to evaluate or to compare the concentration in time or over time. To this end, we need to compute what is commonly referred to as the Gini index of concentration (or Gini ratio). The computation of the Gini index of concentration is presented in Miller (61, p. 27) based on Morgan (63) as follows:

Let

\[ A = \text{area between the Lorenz curve and the diagonal}, \]
\[ B = \text{area between the Lorenz curve and the lower portion of the triangle (area under the Lorenz curve), and} \]
\[ A + B = \text{total area of the triangle (formed by the diagonal)}. \]

Then

\[ G = \frac{A}{A + B} \quad (5.1) \]

where

\[ G = \text{Gini index of concentration.} \]

Since the cumulative percents on each axis add to 100, the area of the entire square is equal to 1 and the area of the triangle (formed by
the diagonal) is equal to $1/2$. Therefore, the above expression can be rewritten as follows:

$$G = \frac{1/2 - \text{Area under curve}}{1/2} \quad (5.2a)$$

which is

$$G = 1 - 2 \, \text{Area under curve}. \quad (5.2b)$$

If we assume that the curve between any two points is approximated by a straight line, the area for any segment of the curve can be expressed as

$$\left( f_{i+1} - f_i \right) \left[ \frac{y_i + y_{i+1}}{2} \right]. \quad (5.3)$$

When summed for all intervals, the area under the curve is

$$\sum_{i=1}^{k} \left( f_{i+1} - f_i \right) \left[ \frac{y_i + y_{i+1}}{2} \right]. \quad (5.4)$$

Substituting the expression for area under curve in $G$ above yields the formula used in the computation of the Gini index

$$G = 1 - 2 \sum_{i=1}^{k} \left( f_{i+1} - f_i \right) \left[ \frac{y_i + y_{i+1}}{2} \right] \quad (5.5a)$$

which becomes

$$G = 1 - \sum_{i=1}^{k} \left( f_{i+1} - f_i \right) \left( y_i + y_{i+1} \right). \quad (5.5b)$$

The Gini index of concentration is defined as the proportion of the total area under the diagonal that is between the diagonal and the Lorenz curve (61, p. 27). Thus, if the absolute value of the Gini index of
concentration increases, it means the distribution is getting more uneven and, conversely, if the Gini index gets smaller then distribution is said to be getting more equal. Thus a ratio getting close to 1 identifies the former and one getting close to 0 indicates the latter situation.

In computing the concentration measures in this study, a close approximation to the Gini index defined as "concentration coefficient" and called C is used. The decision to use C instead of G has been reached because a previous study on concentration of land ownership (102) has used the former measurement. Thus it was possible to cross-check the author's findings with that of a similar study and to identify if there were significant differences between the two geographical areas.

Computation of the concentration coefficient C is based on the formula (102, p. 1889):

\[
C = \frac{1}{2} \sum_{k=1}^{n} \left( P_{k-1} Q_k - P_k Q_{k-1} \right) \frac{1}{5000}
\]  \hspace{1cm} (5.6a)

which is

\[
C = \frac{1}{10,000} \sum_{k=1}^{n} \left( P_{k-1} Q_k - P_k Q_{k-1} \right)
\]  \hspace{1cm} (5.6b)

where

\( P_k \) = Percent of landowners at \( k^{th} \) interval,
\( Q_k \) = Percent of land acres (or value) at \( k^{th} \) interval,
\( k - 1 \) = Percent at interval (every fifth percent) preceding \( k^{th} \) interval, and
\( C \) = Coefficient of concentration, to distinguish it from \( G \) in Equation 5.5b.
The findings are presented in Table 22 for each area and for the state for 1958 and 1970. Cumulative percentage distribution of owned acreage and value is presented for Iowa (1958-70) in Tables 18 and 19, respectively. For each economic area, cumulative percentage distribution of acreage and value tables are provided in Appendix B. The accompanying Lorenz curves are in Figures 11 and 12.

While computing the concentration coefficients for owned acreage and value of farmland, we have used the line of perfect equality—the diagonal—as a standard of reference (13). This fact is regarded as a drawback by some authors (33, 103) and other criterias, such as: "the socially desirable minimum degree of inequality" taking into account family composition, age differentials, etc., as well as biological, anthropological and sociological factors, are suggested.

However, it should be reminded that drawing the Lorenz curves and computing the concentration coefficients for income, wealth, etc., does not in itself entitle one to pass on welfare judgments. As Aigner and Heins point out:

Unfortunately our operational measures of equality, e.g. the Gini concentration ratio, coefficient of variation, etc., are only statistical devices. They measure the relative dispersion of a frequency distribution of income without reference to the normative judgments necessarily involved in describing that same distribution as "good" or "bad" in terms of the welfare it imputes to society. It is not that these measures in themselves should contain welfare attributes. The point is when welfare judgments are made based upon them, the observer must be making certain assumptions about the relation between income, its distribution, and the welfare of society. Depending on what these assumptions are, objective, statistical measures of income equality may or may not yield a correct indication of equality in the normative sense (3, p. 13).
Table 22. Comparison of concentration coefficients (acreage and value, 1958-1970){a}

<table>
<thead>
<tr>
<th>Economic areas</th>
<th>Acreage</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$C_{58}^a$</td>
<td>$C_{70}^a$</td>
</tr>
<tr>
<td>Northwest Livestock</td>
<td>0.4908</td>
<td>0.4983</td>
</tr>
<tr>
<td>Southwest Livestock</td>
<td>0.4680</td>
<td>0.5351</td>
</tr>
<tr>
<td>Northern Grain</td>
<td>0.3986</td>
<td>0.4902</td>
</tr>
<tr>
<td>Northern Central Grain</td>
<td>0.4257</td>
<td>0.5264</td>
</tr>
<tr>
<td>Southern Pasture</td>
<td>0.4197</td>
<td>0.4302</td>
</tr>
<tr>
<td>Northeast Dairy</td>
<td>0.4099</td>
<td>0.4206</td>
</tr>
<tr>
<td>Eastern Livestock</td>
<td>0.4350</td>
<td>0.4721</td>
</tr>
<tr>
<td>Iowa{b}</td>
<td>0.4381</td>
<td>0.4836</td>
</tr>
<tr>
<td>Institutional Ownership</td>
<td>0.5793</td>
<td>0.5148</td>
</tr>
</tbody>
</table>

{a}1958 data on concentration have been drawn from source material of (90) and are not available in the bulletin.

{b}State of Iowa estimated without institutional owners.

As far as this study is concerned, Lorenz curves are drawn and concentration coefficients computed for each economic area and the state, so as to identify the magnitude of the change that has taken place between two time periods. While the absolute magnitudes are of value, we are mainly interested with the rate of change on the concentration coefficients and not on its welfare implications.
Figure 11. Distribution of acreage of owned land in Iowa, 1958 and 1970
Figure 12. Distribution of value of owned land in Iowa, 1958 and 1970
Comparison of Concentration Coefficients

Comparing the computed concentration coefficients in Table 22 for acreage between 1958 and 1970, it is observed that there is an increase of magnitude slightly over 10 percent for the state. Taking into account the pressures of size adjustments within the last 12 years, this increase can be considered slightly significant.  

When state concentration curves of acreage are considered alone, the magnitude of the shift is indeed minor. However, when individual economic areas are studied for 1958 and 1970, it can be observed that there has been a great variation in the magnitude of concentration coefficients. For the period 1958-1970, while the concentration coefficient of Northwest Livestock area (economic area 1) has almost been stationary—just over 1.5 percent increase—North Central Grain area (economic area 4) has experienced an increase in the coefficient of over 23.4 percent. It is interesting to note that the other grain area, Northern Grain (economic area 3) exhibits a close rate of increase with over 22.9 percent. On the other hand, pasture and dairy areas (economic areas 5 and 6) have shown little but almost identical increases of 2.5 and 2.6 percent, respectively. Livestock areas have shown variability, with minimum increase of 1.5 percent in the Northwest and maximum increase of 14.3 percent in the Southwest (economic area 2) with the middle range of 8.5 percent in the East (economic area 7). Consistent grouping of computed concentration coefficients with the economic background of areas indicates, to some extent, 

10 Compared to the concentration coefficient of Great Plain States, Iowa has the lowest ratio for 1958. Even 1970 concentration coefficient of Iowa is smaller than all Great Plain States' 1958 estimates, except North Dakota with 0.45 (102, p. 1889).
the validity of our findings.

Comparing the concentration coefficient of the value of owned land, a somewhat different picture emerges. It can be observed that between 1958 and 1970, there has been a considerable increase in this magnitude for economic areas as well as the state. Even though in no economic area of Iowa we do observe the considerable deviation from perfect equality which is characterized in the Great Plain States, nevertheless the shift of Lorenz curves within the time period considered has been significant with the range of over 12.7 percent for the state.

Geographically, the rate of increase in the concentration coefficient of value has been greatest in the Northwest, 28.2 percent, and similarly in the other Northern areas with 26.1 and 22.6 percent for economic areas 3 and 4, respectively. In the East and Northeast, the rate of increase in concentration coefficient of value has been almost identical, 12.4 and 12.1 percent, respectively. While the Southwest had an increase of 18.9 percent (combining economic and geographical factors), the rate of increase in the Southern Pasture (economic area 5) has been the minimal with 1.8 percent.

Again the consistent groupings of areas, this time more on geographical aspects, by similar rates of changes of coefficients is noted. This observation may indicate, to some degree, the correctness of the absolute

\[\text{Comparing the concentration coefficient of value of Iowa in 1958 with that of the Great Plain States, it is observed that Iowa had the least concentration of value. Even the 1970 estimate of concentration of value for Iowa is close to the lowest of 1958 of these states--both Dakotas and Nebraska with .45 and .49 (102, p. 1889).}\]
magnitude of the estimated coefficients. Comparing Iowa with the Great Plain States, it has already been indicated that the former still has more equal distribution of owned land acreage, as well as value of this land. However, within Iowa the concentration coefficients for acreage and value have increased in the last 12 years, indicating a shift towards a more unequal distribution of the owned resources. The Lorenz curves in Figures 11 and 12 indicate the magnitude of the shifts in acreage and in value, respectively, for the state between 1958 and 1970.

Thus, although the magnitude of the change in the coefficients has not been great for the state, as far as individual economic areas are concerned it has certainly been significant. In the next section we identify the group of owners who shouldered the burden of adjustment due to an increased concentration in Iowa.

Burden of adjustment

Farmland owners may be arrayed in quartiles according to their share of an attribute (acres of solely owned land or value). In doing so we can see the changes that have been taking place between 1958 and 1970 between quartiles and who in the aggregate is pressured due to adjustments in agriculture.

Table 23 identifies the changes that have taken place between quartiles from 1958 to 1970. It can be seen that the share of the highest five percent of the owners (owners who have 700 or more acres of land) in acreage and in value of owned land has increased considerably over time. While the lowest 25 percent of the owners (lowest quartile) has retained about the same share in acreage and value over time, the burden of
Table 23. Distribution of individually owned acreages and values by quartiles and highest five percent (Iowa, 1958-1970)\textsuperscript{a}

<table>
<thead>
<tr>
<th>Quartiles</th>
<th>Percent of acreage</th>
<th>Percent of value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowest quartile</td>
<td>6.75 6.25</td>
<td>6.00 4.90</td>
</tr>
<tr>
<td>Second quartile</td>
<td>21.33 19.00</td>
<td>20.82 17.55</td>
</tr>
<tr>
<td>Third quartile</td>
<td>43.75 39.48</td>
<td>43.10 38.60</td>
</tr>
<tr>
<td>Highest five percent</td>
<td>22.41 28.75</td>
<td>21.36 27.60</td>
</tr>
</tbody>
</table>

\textsuperscript{a}Data on 1958 from source material of (90).

adjustment to the increasing concentration of ownership has fallen on the medium sized (second and third quartile) farmland owners, mostly on the ones who have an ownership interest of 100 to 280 acres.

The possible explanation of this observation may be related to non-economic factors. It may be that small farmland owners (owners of less than 100 acres) resist transference out of agriculture due to possible burdens of readjustment in nonagricultural occupations. In most cases, their decision to remain in agriculture even though it may not be an economically feasible enterprise for them is based on old age, preference for farm living or sentimental attachment to land. Admittedly this analysis does not take into account those owners who in addition to owning and operating their own lands rent additional land to reach an economically
efficient farm size. But that point will be dealt with in the farm adjustment section of this chapter.

On the other hand, medium sized farmland owners, especially the ones at the lower end of the range, have felt the pressure of adjustment to the increasing concentration as well as changing agricultural technology. These owners have a large investment in land as well as other resources, which makes them more conscious of the opportunity cost of not operating close to the minimum average cost. So the pressures for adjustment in this group may lead them to increase their share of ownership by investing in land or by employing their resources more productively in another industry.

The result of increased concentration seems to have fallen on the medium group of farmland owners. They may have, in return, reacted by increasing their scale of operations through either buying additional land or renting-in or leaving agriculture. The analysis is not conclusive at this point since it is not necessary to own all the land resources in order to operate them. That is why the tenure form of part-owner-operatorship may be gaining increasing importance as a prior stage in reaching the goal of full ownership in the recent decades in Iowa.

Changes in the distribution of institutionally owned land

The increasing importance of other forms of ownership in Iowa (other than sole or joint proprietorship) has already been mentioned in the previous chapters. Farmlands owned by multiple owners and organized as legal entities such as corporations, institutions, estates, city, town, state or federal lands have been identified as institutional lands for the
purposes of this study. A separate questionnaire is mailed to the above farmland owners who were drawn into the sample. The response has been encouraging, as the rate of returned questionnaires has been almost double for the institutions as opposed to individual owners, as is shown in Table 3.

It was hypothesized that since the previous study in 1958 the structure of institutional ownership had changed. The diagnostic hypothesis 2.b.5 stated an uneven distribution for acreage and value of these resources. In other words, it was expected that from 1958 to 1970 institutional owners not only increased absolutely as opposed to individual owners, but within themselves the larger owners received a bigger share of totally owned lands in acreage as well as in value. Tables 24 and 25 present the distribution of institutionally owned land acreage and value, respectively, for 1958 and 1970.

It can be observed from Table 24 that although the absolute number of large institutional owners have increased, they have remained relatively the same. Furthermore, there has been a significant improvement in the distribution of owned acreage as can be understood from the reduction of concentration coefficient in Table 22.

Table 25, however, indicates that the readjustment has been towards higher valued lands increasingly being owned by the larger acreage owners. Concentration coefficient for value have therefore increased, as compared to 1958. Thus it can be concluded that the share of acreage owned by the larger institutional owners has not increased (in fact, it has decreased) but their share in the value of these resources has increased, indicating
Table 24. Distribution of institutionally\(^a\) owned land, acreage (Iowa, 1958-1970)

<table>
<thead>
<tr>
<th>Acreage intervals (acres)</th>
<th>Iowa, 1958(^b)</th>
<th></th>
<th></th>
<th>Iowa, 1970</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Average</td>
<td>Percentage distribution</td>
<td>Number</td>
<td>Average</td>
<td>Percentage distribution</td>
<td></td>
</tr>
<tr>
<td>7  49.9</td>
<td>7</td>
<td>38</td>
<td>5.15</td>
<td>0.33</td>
<td>15</td>
<td>30</td>
<td>7.06</td>
</tr>
<tr>
<td>50- 69.9</td>
<td>1</td>
<td>51</td>
<td>0.74</td>
<td>0.06</td>
<td>7</td>
<td>55</td>
<td>3.06</td>
</tr>
<tr>
<td>70- 99.9</td>
<td>8</td>
<td>83</td>
<td>5.88</td>
<td>0.84</td>
<td>24</td>
<td>81</td>
<td>10.82</td>
</tr>
<tr>
<td>100- 139.9</td>
<td>7</td>
<td>119</td>
<td>5.15</td>
<td>1.05</td>
<td>18</td>
<td>116</td>
<td>8.47</td>
</tr>
<tr>
<td>140- 199.9</td>
<td>28</td>
<td>167</td>
<td>20.59</td>
<td>5.88</td>
<td>51</td>
<td>162</td>
<td>22.21</td>
</tr>
<tr>
<td>200- 279.9</td>
<td>10</td>
<td>230</td>
<td>7.35</td>
<td>2.89</td>
<td>39</td>
<td>228</td>
<td>17.02</td>
</tr>
<tr>
<td>280- 359.9</td>
<td>26</td>
<td>322</td>
<td>19.12</td>
<td>10.54</td>
<td>28</td>
<td>315</td>
<td>10.31</td>
</tr>
<tr>
<td>360- 519.9</td>
<td>13</td>
<td>432</td>
<td>9.55</td>
<td>7.06</td>
<td>27</td>
<td>420</td>
<td>8.78</td>
</tr>
<tr>
<td>520- 699.9</td>
<td>7</td>
<td>620</td>
<td>5.15</td>
<td>5.45</td>
<td>19</td>
<td>615</td>
<td>4.86</td>
</tr>
<tr>
<td>700- 1499.9</td>
<td>15</td>
<td>934</td>
<td>11.02</td>
<td>17.61</td>
<td>23</td>
<td>1022</td>
<td>4.42</td>
</tr>
<tr>
<td>≥ 1500</td>
<td>14</td>
<td>2743</td>
<td>10.29</td>
<td>48.28</td>
<td>26</td>
<td>2315</td>
<td>2.99</td>
</tr>
<tr>
<td>Total responding</td>
<td>136</td>
<td>--</td>
<td>100.00</td>
<td>100.00</td>
<td>277</td>
<td>--</td>
<td>100.00</td>
</tr>
</tbody>
</table>

\(^a\) Land owned institutionally includes all land held in the form of estate, corporation, institution, city, town, state or federal lands.

\(^b\) 1958 data of distribution of institutional ownership have been furnished from source material of (90).
Table 25. Distribution of value of institutionally\(^a\) owned land, value (Iowa, 1958-1970)

<table>
<thead>
<tr>
<th>Value intervals ($1000)</th>
<th>Iowa, 1958(^b)</th>
<th></th>
<th>Iowa, 1970</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number reporting</td>
<td>Average value ($1000)</td>
<td>Percentage distribution</td>
<td>Number reporting</td>
</tr>
<tr>
<td></td>
<td>Number</td>
<td>Value</td>
<td>Number</td>
<td>Value</td>
</tr>
<tr>
<td>&lt;= 19.9</td>
<td>15</td>
<td>10.60</td>
<td>12.61</td>
<td>0.91</td>
</tr>
<tr>
<td>20-49.9</td>
<td>28</td>
<td>34.26</td>
<td>23.53</td>
<td>5.50</td>
</tr>
<tr>
<td>50-74.9</td>
<td>18</td>
<td>61.89</td>
<td>15.13</td>
<td>6.39</td>
</tr>
<tr>
<td>75-99.9</td>
<td>18</td>
<td>87.98</td>
<td>15.13</td>
<td>9.08</td>
</tr>
<tr>
<td>100-124.9</td>
<td>10</td>
<td>116.70</td>
<td>8.40</td>
<td>6.69</td>
</tr>
<tr>
<td>125-149.9</td>
<td>8</td>
<td>138.74</td>
<td>6.72</td>
<td>6.37</td>
</tr>
<tr>
<td>150-199.9</td>
<td>4</td>
<td>173.25</td>
<td>3.36</td>
<td>3.97</td>
</tr>
<tr>
<td>200-249.9</td>
<td>1</td>
<td>216.00</td>
<td>0.84</td>
<td>1.24</td>
</tr>
<tr>
<td>250-499.9</td>
<td>9</td>
<td>319.64</td>
<td>7.56</td>
<td>16.50</td>
</tr>
<tr>
<td>500-999.9</td>
<td>7</td>
<td>851.70</td>
<td>5.88</td>
<td>34.14</td>
</tr>
<tr>
<td>&gt;= 1000</td>
<td>1</td>
<td>1600.00</td>
<td>0.84</td>
<td>9.20</td>
</tr>
<tr>
<td>Total</td>
<td>119</td>
<td>---</td>
<td>100.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

\(^a\)Land owned institutionally includes all land held in the form of estate, corporation, institution, city, town, state or federal lands.

\(^b\)1958 data of distribution of institutional ownership have been furnished from source material of (90).
the difference in the quality of owned lands between owners. It may also be possible to think that larger institutional owners owned farmlands close to growing cities for investment purposes and hence the difference between these two distributions. Such a conclusion has not been put to test since the study was not designed for the purpose of identifying large farmlands around urban centers.

Farm Size Adjustments

Technological innovations in agriculture result in two kinds of adjustments in farm sizes to capture the benefit of cost economies.

First, adjustment can take place in the scale manner; that is, output can be expanded by increasing all resources in fixed proportions. Scale adjustment exists if we start with 240 acres, 18 months of labor, a tractor and $5,000 in operating expenses and increase all resources proportionately to 480 acres, 36 months of labor, two tractors and $10,000 in operating expenses. Constant returns to scale exist if the adjustment results, compared to the first resource mix, in exact doubling of the output. In which case cost per unit will be identical for both farms and there will be no incentive to increase the farm size due to cost economies.

However, if output more than doubles, increasing returns to scale exist and larger farm operates on lower per-unit costs than the smaller farm. In which case, there will be incentives to increase the size of operations. If, on the other hand, output increases but does not double, decreasing returns to scale exist and cost economies favor the smaller over the larger farm.

The second type of adjustment in farm size takes place when there is
a disproportionate increase in resources, that is the resource mix to produce an expanded output is altered by holding some resources constant while increasing others.\footnote{12} Taking the same example as in the first adjustment, farm may be held constant at 240 acres while more labor, improved seeds and better machinery may be utilized to expand output. Or the machinery may be held constant while acreage, labor and operating expenses are varied to increase the product. The changes in the resource mix result in lower per unit costs if fixed costs associated with the fixed resource is large and it is spread over greater output. Average total cost per unit of output declines as long as the decline in fixed costs is sufficiently greater than increases in variable costs per unit. The situation is reversed and average total costs begin to increase if variable costs increase faster than the decline of fixed costs after a point.

The above two adjustments we have presented depict the long-run cost relationships, when all resources are variable, and the short-run cost relationships, when some of the resources are constant. From the viewpoint of farm size problems, the concept of long-run costs is more important since this is the planning curve. A beginning farmer should consider costs in the long-run curve and decide on his farm size by a particular point on it. However, once the farm size is determined, the relevant decision-making cost curve becomes the short-run cost curve. But in agriculture this is rarely the case, as has been pointed out:

Not all farmers can view long-run costs in the sense of a planning curve wherein they select the most profitable point and collect together the relevant set of resources. Instead the size
of the unit in agriculture is partly a historical phenomenon wherein a beginning operator acquires a unit of a size determined by the limited resources he possesses. Following acquisition of the unit, additional inputs are added as capital accumulates (47, pp. 426-427).

This observation does not diminish the importance of the planning curve; on the contrary, the long-run cost curve is most meaningful to denote the nature of cost economies for farms of different sizes (45, p. 143).

To determine if average farm ownership was close to optimum farm size in each economic area, some estimates were made based on Iowa Farm Business Summary data for 1968. There are various shortcomings in the data which, for our purposes, should be kept in mind when making comparisons. The main shortcomings are: (1) farms of less than 70 acres are not included in tabulations, (2) average farm in each acreage class is assumed to represent the most efficient combination of resource use, and (3) different combinations of resources (qualitative and quantitative differences in machinery, management, etc.) can not be identified from the aggregate data. Keeping in mind the shortcomings of the data, an estimate of minimum average cost size in each economic area was made, finding average total cost for each acreage interval through the ratio

\[
\frac{\text{Fixed Costs + Operating Costs}}{\text{Average Acres in Interval}}
\]

The results are presented in Table 26. In all areas, the resulting average total cost curves were generally in agreement with the shape of the curve in theory. In economic areas 3 and 4, the curve has reached the absolute minimum in the presented average acre interval; in areas 5,
Table 26. Comparison of average size of ownership in 1958 and 1970 to estimated minimum average cost acreage in 1968

<table>
<thead>
<tr>
<th>Area and tenure groups</th>
<th>Average ownership acres, 1958</th>
<th>Average ownership acres, 1970</th>
<th>Estimated average cost acreage, 1968</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>294.2</td>
<td>196.2</td>
<td>312</td>
</tr>
<tr>
<td>2</td>
<td>315.8</td>
<td>219.0</td>
<td>311</td>
</tr>
<tr>
<td>3</td>
<td>257.8</td>
<td>219.5</td>
<td>317</td>
</tr>
<tr>
<td>4</td>
<td>241.0</td>
<td>180.2</td>
<td>424</td>
</tr>
<tr>
<td>5</td>
<td>228.3</td>
<td>192.1</td>
<td>422</td>
</tr>
<tr>
<td>6</td>
<td>217.2</td>
<td>190.4</td>
<td>420</td>
</tr>
<tr>
<td>7</td>
<td>231.1</td>
<td>184.6</td>
<td>310</td>
</tr>
<tr>
<td>Iowa</td>
<td>250.4</td>
<td>193.3</td>
<td>320</td>
</tr>
</tbody>
</table>

a Average ownership acres for 1958 computed from source material of (90). Since the 1958 study underestimated the number of persons who jointly owned land (because it was not possible to identify all the names of the partners from the corn lists and therefore weigh ownership shares appropriately) the resulting average ownership acres in 1958 is overestimated and therefore not directly comparable with the ownership acres found for 1970.

b Sources: (17, 22, 23, 24, 25, 26, 27, 28, and 29).
6 and the state, the curves did not reach an absolute minimum but flattened out and reduction of costs per acre were not significantly different when operated acreages increased to the next average acre intervals. In areas 1, 2, and 7, however, the average total cost curves have flattened at the reported acreages compared to the next intervals, but above a critical acreage (over 600 acres) there occurred a significant reduction of average costs (about $4 to $8 per acre) and a second minimum average cost acreage was reached at 650, 700 and 710 acres for areas 1, 2 and 7, respectively. The occurrence of double minimum average cost acreage in these areas suggests the possibility of two different enterprises (such as grain and livestock) being incorporated in the aggregate data. It may be that the reported minimum average cost acreages in Table 26 are for grain and the second largest acreages reported are for livestock enterprises. The latter findings are not too drastic, however, considering that a study by Saupe and Kaldor estimate 659 acres to be the minimum-cost Iowa farm by the year 1980 with a 1.75 percent productivity increase compounded annually (79, p. 135).

The reported estimates in Table 26 correspond quite closely to optimal farm sizes computed in the previous studies. For example, a study based on Carrington - Clyde soils in Northeast Iowa and Ida - Monona soils in Western Iowa (which correspond to our economic areas 1, 2 and 6) reach to this conclusion:

Under a farm organization including cash cropping and current rotations, minimum per-unit production costs (per dollar of product) are attained in the range of 600 to 680 crop-acres. However, the reduction in per unit costs is small as acreage is extended from 400 to 800 crop-acres. With a continuous rotation, minimum per-unit costs are attained at a size of 320 crop-acres.
The static budgeting analysis indicates that, while small cost reductions are possible as machinery investment is increased and as crop acreage is expanded beyond 320 acres, these savings alone probably are not great enough to "force" much larger farms. The greatest reduction in cost per-unit of product is attained at approximately 320 acres. Up to this point, the high fixed costs of modern machinery decline rapidly as acreage and output are extended (46, p. 444).

It is interesting to note that our findings of minimum average cost acreages is close to 320 acres in areas 1 and 2, but exceed it by 100 acres for area 6. However, the general nature of the average cost curve which is continuously declining but becoming a smooth one is apparent in both sets of estimates.

The optimal farm size findings of a study on the Shelby - Grundy - Haig soil association, which corresponds to area 5 of this study, is examined to check on the estimated minimum average cost acreage. The topographic character of the area has led to three estimates: (1) hilly farm, (2) average farm, and (3) upland farm. Since we are interested in the average farm, we take the findings for this type of farm. The Ihnen and Heady study (50, p. 136) indicates that minimum average cost is reached with 2 plow, 3 plow and 3 plow, 3 plow combinations at 320-440 crop acreages. This finding is also close to the estimated minimum acreage for area 5 in Table 26.

Analyzing Table 26, it can be observed that in all economic areas the average ownership unit by 1970 was considerably smaller than the optimal operating farm size. In terms of the ownership norm, this naturally indicates the magnitude of the problematic gap. Furthermore, there are indications that since 1958 this magnitude has been widening.\(^{13}\)

\(^{13}\) However, this point is not conclusive as has already been mentioned in footnote a of Table 26.
In other words, while the optimal operating farm size has been increasing due to technological advances, the individual share of the owner on the owned land has been decreasing due to increases in the number of people with interests in land. An owner finally in possession of land resources (after having paid for the shares of others) and beginning to operate an economically efficient sized farm may find his financial resources exhausted while acquiring the title to land. Therefore, there seems to be a revaluation and modification taking place with respect to the norm. Part-owner operatorship, owning part of the land fully and renting additional land to reach an optimum scale of operations seem to be gaining importance as the goal to be achieved in contrast to the goal of full ownership of land resources.

Other Characteristics of Concentration

Other characteristics of concentration are the number of farms owned, acreage distribution of owned units and average value of owned resources by tenure groups.

Table 27 is presented to test the hypothesis that within tenure groups landlords, as opposed to operators, own large acreages. It can be observed that of the large ownership acreages (lands owned in excess of 520 acres) full owner operators and part owner operators owned 2.45 and 2.92 percent, respectively, with no significant difference between themselves. Whereas, operator landlords and nonoperator landlords owned 7.75 and 4.20 percent, respectively, of the large ownership acreages. The findings for landlord tenures were significantly different between themselves, as well as from the operator tenure groups (the former at
Table 27. Distribution of owned land within tenure groups by acreage intervals (Iowa, 1970)

<table>
<thead>
<tr>
<th>Tenure groups</th>
<th>Number reporting</th>
<th>≤ 29</th>
<th>30-69</th>
<th>70-99</th>
<th>100-159</th>
<th>140-199</th>
<th>200-279</th>
<th>280-359</th>
<th>360-519</th>
<th>520-699</th>
<th>≥ 700</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owner operators</td>
<td>741</td>
<td>6.34</td>
<td>8.74</td>
<td>13.11</td>
<td>14.10</td>
<td>24.11</td>
<td>16.70</td>
<td>8.96</td>
<td>5.48</td>
<td>1.78</td>
<td>0.67</td>
</tr>
<tr>
<td>Part-owner operators</td>
<td>435</td>
<td>1.20</td>
<td>4.39</td>
<td>15.77</td>
<td>13.00</td>
<td>27.50</td>
<td>19.66</td>
<td>10.17</td>
<td>6.28</td>
<td>1.35</td>
<td>0.67</td>
</tr>
<tr>
<td>Operator landlords</td>
<td>367</td>
<td>4.89</td>
<td>9.18</td>
<td>12.57</td>
<td>14.76</td>
<td>15.53</td>
<td>15.06</td>
<td>8.67</td>
<td>11.59</td>
<td>3.90</td>
<td>3.85</td>
</tr>
<tr>
<td>Nonoperator landlords</td>
<td>1206</td>
<td>0.97</td>
<td>7.56</td>
<td>14.94</td>
<td>16.11</td>
<td>24.19</td>
<td>17.00</td>
<td>7.70</td>
<td>6.32</td>
<td>2.59</td>
<td>1.61</td>
</tr>
<tr>
<td>All tenure groups</td>
<td>2749</td>
<td>3.55</td>
<td>7.71</td>
<td>14.42</td>
<td>14.93</td>
<td>23.62</td>
<td>17.02</td>
<td>8.70</td>
<td>6.52</td>
<td>2.15</td>
<td>1.37</td>
</tr>
</tbody>
</table>
95 percent and the latter at 90 percent). The interesting point to note is that operator landlords rather than nonoperators—who rent all the land they own—concentrated on the large ownership acreages. On the basis of these findings, the diagnostic hypothesis 2.b.3 cannot be rejected.

The number of farms owned is another absolute indicator of concentration. Table 28 indicates the changes that have been taking place with respect to number of farms owned for all tenure groups from 1946 to 1958 and 1970.

It can be observed that for all tenure groups there has been a very significant increase in the number of farms owned compared to 1946 and 1958. This same phenomena is true for both landlord tenure groups. However, with respect to operator landlords the increase in the number of farms compared to 1958 reverses itself after two farms, but no such reversal is observed for the nonoperator landlord group.

Diagnostic hypothesis 2.b.2 states that landlords have concentrated on high value areas and own more-number of farms than operators. Distribution of the number of owned farms does not differ significantly between economic areas. However, the first part of the hypothesis cannot be rejected since there seems to be a relationship between the higher the per acre value of land (such as in areas 3 and 4) the more the number of farms owned by landlords and vice versa. Economic areas considered to be least expensive per acre have less than 19 percent in three or more farms. The second part cannot be tested directly since by definition owner-operators and part-owner-operators have only one farm. However, when all tenure groups are considered, there has definitely been a significant
Table 28. Percentage distribution of owners by tenure and number of farms owned within areas (Iowa, 1946, 1958 and 1970)*

<table>
<thead>
<tr>
<th>Tenure groups and number of farms owned</th>
<th>Iowa 1946</th>
<th>Iowa 1958</th>
<th>Iowa 1970</th>
<th>Percentage distribution within areas, 1970</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>All tenures</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 farm</td>
<td>85</td>
<td>86</td>
<td>50.51**</td>
<td>44.07</td>
</tr>
<tr>
<td>2 farms</td>
<td>12</td>
<td>10.2</td>
<td>38.14**</td>
<td>39.41</td>
</tr>
<tr>
<td>3 farms }</td>
<td>2.5</td>
<td>8.08**</td>
<td></td>
<td>11.07</td>
</tr>
<tr>
<td>4 farms }</td>
<td>0.8</td>
<td>2.52**</td>
<td></td>
<td>4.51</td>
</tr>
<tr>
<td>5+ farms Δb</td>
<td>0.5</td>
<td>0.75</td>
<td></td>
<td>0.93</td>
</tr>
<tr>
<td>Number reporting</td>
<td>1297</td>
<td>1922</td>
<td>2597</td>
<td>318</td>
</tr>
<tr>
<td>Owner-operators</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 farm</td>
<td>97</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>2 farms</td>
<td>3</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>3 or 4 farms Δ</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>5+ farms Δ</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Number reporting</td>
<td>488</td>
<td>596</td>
<td>740</td>
<td>62</td>
</tr>
<tr>
<td>Part-owner operators</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 farm</td>
<td>92</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>2 farms</td>
<td>7</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>3 or 4 farms 1</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>5+ farms Δ</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Number reporting</td>
<td>145</td>
<td>288</td>
<td>435</td>
<td>59</td>
</tr>
<tr>
<td>Operator landlord</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 farm</td>
<td>59</td>
<td>9.7</td>
<td>2.22**</td>
<td>4.27</td>
</tr>
<tr>
<td>2 farms</td>
<td>32</td>
<td>65.6</td>
<td>79.43**</td>
<td>68.38</td>
</tr>
<tr>
<td>3 farms }</td>
<td>8</td>
<td>18.3</td>
<td>14.75</td>
<td>21.37</td>
</tr>
<tr>
<td>4 farms }</td>
<td>1</td>
<td>2.5</td>
<td>5.13</td>
<td>3.30</td>
</tr>
<tr>
<td>5+ farms Δ</td>
<td>1</td>
<td>2.0</td>
<td>1.09</td>
<td>0.85</td>
</tr>
<tr>
<td>Number reporting</td>
<td>161</td>
<td>103</td>
<td>350</td>
<td>34</td>
</tr>
<tr>
<td>Nonoperator landlord</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 farm</td>
<td>82</td>
<td>80.5</td>
<td>0.69**</td>
<td>---</td>
</tr>
<tr>
<td>2 farms</td>
<td>12</td>
<td>14.1</td>
<td>75.29**</td>
<td>70.29</td>
</tr>
<tr>
<td>3 farms }</td>
<td>6</td>
<td>3.5</td>
<td>16.58**</td>
<td>19.35</td>
</tr>
<tr>
<td>4 farms }</td>
<td>1</td>
<td>1.2</td>
<td>5.80**</td>
<td>8.55</td>
</tr>
<tr>
<td>5+ farms Δ</td>
<td>0.7</td>
<td>1.63</td>
<td>1.81</td>
<td>1.46</td>
</tr>
<tr>
<td>Number reporting</td>
<td>503</td>
<td>935</td>
<td>1072</td>
<td>163</td>
</tr>
</tbody>
</table>

a Data on 1946 and 1958 in (89, p. 37).

b Less than 0.5 percent.
increase in the number of farms owned compared to the previous studies.

The value of land owned and its distribution between tenure groups and over years is another measure of concentration. Table 29 presents the comparative importance of tenure groups with respect to the average number of farms, acreage and value by owners.

The most interesting observation is the very significant increase in the share of part-owner-operators and operator-landlords with respect to the number of farm owners, total acreage owned and value of this owned land. This finding is highly significant and substantiates the earlier findings in the third and fourth chapters with respect to the modifications on the ownership norm.

Owner-operators, except for the number of farms owned, do not show significant changes with respect to other measures compared to 1958. However, there is definitely an indication (from 1946 to 1970) of their relative position getting worse. In terms of absolute size and value of owned land, it has been better.

The nonoperator-landlord's share has declined very significantly in all measures except the number of farms owned which has increased significantly. Relatively and absolutely, they have lost their share of total land resources. Their average owned acreage per owner is not different than what it was in 1946 while, of course, the value of this land has increased.

Testing the diagnostic hypothesis 2,b.1, which states that landlords own larger average sized farms and larger average value of farms than operators, it is observed that the hypothesis cannot be rejected in
Table 29. Comparative importance of tenure groups measured by number, acreage, and value of farms owned (Iowa, 1946, 1958 and 1970)*

<table>
<thead>
<tr>
<th>Items reported</th>
<th>Number reporting</th>
<th>Percentage distribution of Owner operators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of farm owners</td>
<td>1297</td>
<td>1909</td>
</tr>
<tr>
<td>Number of farms owned</td>
<td>1297</td>
<td>1909</td>
</tr>
<tr>
<td>Acreage owned</td>
<td>1297</td>
<td>1909</td>
</tr>
<tr>
<td>Value of land owned</td>
<td>1281</td>
<td>1888</td>
</tr>
<tr>
<td>Average number of farms per owner (farms)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Average owned acreage per owner (acres)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Average value of land per owner (dollars)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Average size of each farm owned (acres)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Average value of each farm owned (dollars)</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

*Data on 1946 and 1958 from (89, p. 27).
### average number of farms, acres or value owned by owner tenure groups

<table>
<thead>
<tr>
<th></th>
<th>Part-owner operators</th>
<th>Operator landlords</th>
<th>Nonoperator landlords</th>
</tr>
</thead>
<tbody>
<tr>
<td>average number of farms</td>
<td>11.2</td>
<td>14.6</td>
<td>19.04**</td>
</tr>
<tr>
<td>acres or value owned by owner tenure groups</td>
<td>10.2</td>
<td>12.3</td>
<td>11.59</td>
</tr>
<tr>
<td></td>
<td>8.0</td>
<td>11.1</td>
<td>18.48**</td>
</tr>
<tr>
<td></td>
<td>8.7</td>
<td>11.2</td>
<td>20.17**</td>
</tr>
<tr>
<td>customers owned by operator</td>
<td>1.1</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>average value owned by nonoperator</td>
<td>130.0</td>
<td>161.3</td>
<td>192.8</td>
</tr>
<tr>
<td>customers owned by nonoperator</td>
<td>16,444</td>
<td>39,316</td>
<td>89,390</td>
</tr>
<tr>
<td>customers owned by nonoperator</td>
<td>118.5</td>
<td>161.3</td>
<td>192.8</td>
</tr>
<tr>
<td>customers owned by nonoperator</td>
<td>14,883</td>
<td>39,316</td>
<td>89,390</td>
</tr>
</tbody>
</table>
absolute differences. However, when relative increases are considered, it can be seen that largest increases in owned acres and value have been made by the part-owner-operator group.

The problem of concentration of Iowa land ownership has been delimited as a shift from operators to landlords. The previous sections of this chapter identified that there has been some change in concentration of Iowa land, but this was not in favor of landlords. Rather, it has been towards operators and against nonoperators.
TENURE EXPERIENCE OF IOWA FARMLAND OWNERS

Some of the personal characteristics of farmland owners have already been discussed in the fourth chapter. One characteristic, past tenure experiences of farmland owners, is very important in influencing the achievement of the norm. Therefore, in this chapter the objective is to identify and analyze the routes individuals follow in achieving farm ownership. Traditionally farmland owners have followed a sequence of tenures in their assent to ownership. Whether the same routes are being utilized or if the impact of economic and technical changes has led to alternative routes is the topic analyzed in this chapter.

The Agricultural Ladder Concept

Spillman has introduced the concept of the agricultural ladder into economics (86) in order to establish how young farmers become owners. However, it has been argued that the popular belief on which the theory is based is generations old and rests on the roots of American tradition (9, p. 31).

Generally the concept of a ladder implies various economic rungs people ascend to the very top. The rungs of this ladder are unequal in width and become narrower as one gets to the top, so only a certain number can be accommodated at each stage. The duration of each person at each rung is not necessarily equal since some will be climbing up faster than the others. Such a concept as the ladder implies economic and social mobility. Essentially it is the schematization of the American dream that with hard work and perseverance every young man has a chance of
climbing to the very top of his chosen field of endeavor even if he starts at the very bottom.

With respect to agriculture, more specifically, this ladder was thought to consist of four basic stages or rungs:

(1) number of years occupied as an unpaid family laborer on the parents' farm,
(2) number of years spent as hired man on other peoples' farms,
(3) number of years spent as tenant operator--renting and operating a farm, and finally
(4) number of years spent as owner-operator--operating all the land owned.

A farmer who had touched all the rungs of the ladder (but not necessarily in the same order) is said to have gone through the basic agricultural ladder experience.

This original agricultural ladder definition has been enlarged and modified in later studies (9). The final stage has been modified to include the landlord stage, first as an operator--operating some and renting the rest of his lands--and then as a nonoperator--renting all the owned land. The nonfarm experience--time spent out of agriculture--of the individual prior to ownership may be included as a check for possible accumulation of resources in other sectors for financing land ownership.

In this study, individual owners are analyzed according to their patterns of experience with respect to: tenure groups, economic areas, acres of owned land, age groups, and occupations. Implicit in the discussion of the agricultural ladder concept are the successive stages of the rungs. However, this need not be so. A farm owner may have nonfarm
experience prior to being a renter or vice versa without affecting the form of the experience pattern. That is the ordering of the ladder is not important. Another note connected with the agricultural ladder is the implication that each successive rung has higher tenure status. As Barlowe and Timmons (9) argue, this implication is somewhat artificial and cannot be defended without reservations. No such status is implied throughout the study.

Patterns of Tenure Experience

This study breaks down the experience of farmland owners since their 14th birthday into 5 patterns in Table 30, following the classification of owners with or without nonfarm (with or without N) experience. The first pattern of experience is the basic agricultural ladder group and consists of owners who have indicated touching all rungs of the ladder or skipping just one (for example, not worked on parent's farm, so no P or not worked as hired hand, so no H but not both). They may or may not have nonfarm experience N and they may be operator or nonoperator landlords L at the final rung of the ladder.

The second pattern is called other patterns of experience previous to owner operatorship and consists of individuals who have stepped more than one rung of the ladder. This pattern consists of H/RO, H/RNO, PO and PNO groupings; R stands for renter--tenant operator renting all the land he operates--and O stands for owner-operator--operating only all the land owned. The owner-operator without previous farm

14 Which tenure experience pattern consists of which tenure grouping is indicated in Appendix B, Table 3. The sign / stands for and/or.
Table 30. Tenure experience patterns reported by men owners by tenure groups (Iowa, 1946, 1958 and 1970)

<table>
<thead>
<tr>
<th>Tenure experience patterns</th>
<th>Number reporting</th>
<th>All owners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owners reporting nonfarm experience</td>
<td>551</td>
<td>620</td>
</tr>
<tr>
<td>Owners reporting farm experience only</td>
<td>375</td>
<td>550</td>
</tr>
<tr>
<td>Basic agricultural ladder experience</td>
<td>462</td>
<td>688</td>
</tr>
<tr>
<td>Other patterns of experience previous to ownership</td>
<td>342</td>
<td>314</td>
</tr>
<tr>
<td>Owner-operator without previous farm experience</td>
<td>49</td>
<td>34</td>
</tr>
<tr>
<td>Nonoperator landlords with previous farm experience but not as owner operator</td>
<td>23</td>
<td>89</td>
</tr>
<tr>
<td>Nonoperator landlords with no previous farm experience</td>
<td>16</td>
<td>45</td>
</tr>
<tr>
<td>Number reporting</td>
<td>926</td>
<td>1170</td>
</tr>
</tbody>
</table>

*aWomen indicating tenure experience have been included in 1970 data on 1946-1958 in (89, p. 53).

**Δ indicates less than 0.05 percent.
Percentage distribution by tenure groups

<table>
<thead>
<tr>
<th>Owner operators</th>
<th>Part-owner operators</th>
<th>Operator landlords</th>
<th>Nonoperator landlords</th>
</tr>
</thead>
<tbody>
<tr>
<td>55.6 53.4 60.70**</td>
<td>56.9 41.3 59.46**</td>
<td>60.7 35.3 56.86**</td>
<td>65.8 62.6 70.31**</td>
</tr>
<tr>
<td>44.4 46.6 39.30**</td>
<td>43.1 58.7 40.54**</td>
<td>39.3 64.7 43.14**</td>
<td>34.2 37.4 29.69**</td>
</tr>
<tr>
<td>56.9 62.6 62.91</td>
<td>67.5 75.0 82.44**</td>
<td>40.7 65.7 51.56</td>
<td>36.1 43.4 31.77**</td>
</tr>
<tr>
<td>36.3 32.4 30.73</td>
<td>31.7 24.1 16.62**</td>
<td>51.1 31.6 27.04</td>
<td>33.1 21.2 12.72**</td>
</tr>
<tr>
<td>6.8 5.0 6.36</td>
<td>0.8 0.9 0.94</td>
<td>8.2 2.7 7.15</td>
<td>3.7 1.6 1.62</td>
</tr>
</tbody>
</table>

\[ \Delta^b \Delta -- \Delta \Delta -- \Delta \Delta 9.47 \ 21.2 \ 22.5 \ 30.34^{**} \]

\[ \Delta \Delta -- \Delta \Delta -- \Delta \Delta 4.77 \ 5.9 \ 11.3 \ 23.55^{**} \]

339 445 529 123 239 352 135 79 278 269 397 817
Experience patterns consist of operators or landlords indicating nonfarm experience only.

The fourth pattern consists of nonoperator landlords with previous farm experience but not as an owner-operator and includes RL, RNL, P/HL and P/HNL groups.

The final pattern consists of nonoperator landlords with no previous farm experience. That is, these people only indicate a nonfarm experience prior to becoming nonoperator landlords, thus NL group.

The number of years an owner has stayed on any one rung has not been utilized in this study. The reason for it is that checks of respondents' answers to tenure experiences prior to statistical runs revealed far too many errors and inconsistencies. For some of the owners, time spent on each rung was not mutually exclusive and therefore problems of correct allocation of years between occupations did arise. Instead of introducing a possible bias by editing in the number of years spent on each rung, the owners' response to ever having been at a particular stage is utilized in the tabulations. The findings are presented in Tables 30-34.

Experience Patterns and Tenure of Owners

Diagnostic hypothesis 3.a states that owners reporting farm experience only have been declining while nonoperator landlords with no previous farm experience are on the rise. This hypothesis is tested and the results of the findings are presented in Table 30.

It can be observed that there has been a very significant change in both the patterns of ownership for all tenure groups. That is to say, owners reporting nonfarm experience (with N) prior to ownership have
very significantly increased while owners with farm experience only (without N) declined very significantly for all tenure groups compared to those of 1958. On the basis of these findings, the first part of the diagnostic hypothesis cannot be rejected.

For all owners the findings indicate that there has been a very significant decline in the pattern of basic agricultural ladder experience. This decline is very significant for nonoperating landlord tenure; however, while owner-operator tenure indicates no significant change, the increase in the use of the agricultural ladder by the part-owner operators is very significant and somewhat surprising. This finding partly rejects the diagnostic hypothesis 3.c which argues for a lesser use of the agricultural ladder.

Other patterns of experience prior to ownership have declined for all tenure groups as can be seen in Table 30. The second part of diagnostic hypothesis 3.a, when tested under the light of the findings, cannot be rejected at the 95 confidence level, but a qualification is needed. Landlord tenures are exhibiting an increasing deviation from the traditional agricultural ladder and in some cases skipping all the in-between-rungs in climbing up to the top. However, part-owner operators have been increasingly using the ladder as a means of achieving the ownership norm.

Do the tenure experience patterns with respect to owned acreages differ among the owners? It will be tested, in other words, if as formulated in the diagnostic hypothesis 3.d, owners with nonbasic agricultural ladder experience own a greater share of the total lands, can be rejected.

Table 31 presents the findings with respect to the breakdown of
Table 31. Tenure experience patterns by owned acreage intervals (Iowa, 1970)

<table>
<thead>
<tr>
<th>Tenure experience patterns</th>
<th>Number reporting</th>
<th>Percentage distribution by owned acreage intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>&lt; 39</td>
</tr>
<tr>
<td>P/HRO</td>
<td>329</td>
<td>0.31</td>
</tr>
<tr>
<td>P/HNRO</td>
<td>322</td>
<td>0.72</td>
</tr>
<tr>
<td>H/RO</td>
<td>18</td>
<td>--</td>
</tr>
<tr>
<td>H/RNO</td>
<td>50</td>
<td>--</td>
</tr>
<tr>
<td>PO</td>
<td>54</td>
<td>--</td>
</tr>
<tr>
<td>PNO</td>
<td>154</td>
<td>0.73</td>
</tr>
<tr>
<td>NO</td>
<td>55</td>
<td>--</td>
</tr>
<tr>
<td>N</td>
<td>4</td>
<td>--</td>
</tr>
<tr>
<td>R</td>
<td>23</td>
<td>--</td>
</tr>
<tr>
<td>P/Hi.</td>
<td>33</td>
<td>--</td>
</tr>
<tr>
<td>P/HNL</td>
<td>131</td>
<td>--</td>
</tr>
<tr>
<td>NL</td>
<td>154</td>
<td>0.81</td>
</tr>
<tr>
<td>All tenure experience</td>
<td>1327</td>
<td>0.43</td>
</tr>
</tbody>
</table>
tenure experience patterns and acreage intervals. The first two tenure experience groups make up the agricultural ladder experience, identified as I, as in Table 30. Similarly, the make-up of each tenure experience pattern is identified with the Roman numerals and the groups which go into it.

The share of the largest owned acreages (lands $\geq$ 360 acres) owned by landlords who have indicated nonbasic agricultural ladder experiences (such as only N or P/HN) are about 52 percent of their total land ownership. This corresponds to almost 75 percent for operators who have experienced the agricultural ladder without nonfarm employment and 57 percent with nonfarm employment. The diagnostic hypothesis 3.d is rejected at 95 percent confidence. In 1970 the largest Iowa acreage owners have still followed the traditional agricultural ladder.

Similarly, to test for the changing use of the basic agricultural ladder in Iowa and in different economic regions, Table 32 is presented. It can be observed that generally the distribution of tenure experience patterns did not differ widely between economic areas.\textsuperscript{15} In all economic areas the majority of the owners indicated to have utilized the agricultural ladder. However, with respect to the state total and over time, there has been a significant decline in the utilization of this pattern since 1946, even though the majority of the owners still utilize it.

\textsuperscript{15}It should be noted that economic area 5 (Southern Pasture) compared to richer areas (in terms of per acre value of land) has significantly less NL and more PNO tenure experience grouping, implying the greater use of nonfarm earnings to accumulate enough capital to achieve owner-operatorship. The same finding has been observed in 1958 (89, p. 57).
Table 37. Tenure experience of men owners (Iowa, 1946, 1958 and 1970;\textsuperscript{a} economic areas, 1970)

<table>
<thead>
<tr>
<th>Economic areas reporting</th>
<th>Number</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>P/HRO</td>
<td>P/HNRO</td>
<td>H/RO</td>
<td>H/RNO</td>
<td>PO</td>
</tr>
<tr>
<td>1</td>
<td>250</td>
<td>29.56</td>
<td>25.92</td>
<td>0.48</td>
<td>3.46</td>
<td>2.28</td>
</tr>
<tr>
<td>2</td>
<td>234</td>
<td>26.06</td>
<td>25.92</td>
<td>0.99</td>
<td>3.48</td>
<td>4.68</td>
</tr>
<tr>
<td>3</td>
<td>152</td>
<td>36.47</td>
<td>22.78</td>
<td>0.41</td>
<td>2.05</td>
<td>5.20</td>
</tr>
<tr>
<td>4</td>
<td>326</td>
<td>25.80</td>
<td>25.22</td>
<td>2.01</td>
<td>3.04</td>
<td>4.07</td>
</tr>
<tr>
<td>5</td>
<td>249</td>
<td>22.49</td>
<td>26.89</td>
<td>3.21</td>
<td>4.07</td>
<td>6.21</td>
</tr>
<tr>
<td>6</td>
<td>388</td>
<td>27.12</td>
<td>27.80</td>
<td>1.30</td>
<td>4.49</td>
<td>5.70</td>
</tr>
<tr>
<td>7</td>
<td>471</td>
<td>27.85</td>
<td>28.04</td>
<td>1.20</td>
<td>4.21</td>
<td>7.42</td>
</tr>
<tr>
<td>State</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1946</td>
<td>926</td>
<td>27.2</td>
<td>22.5</td>
<td>0.8</td>
<td>7.3</td>
<td>10.8</td>
</tr>
<tr>
<td>1958</td>
<td>1237</td>
<td>34.2</td>
<td>24.5</td>
<td>1.1</td>
<td>2.3</td>
<td>11.3</td>
</tr>
<tr>
<td>1970</td>
<td>2070</td>
<td>27.17**</td>
<td>26.57</td>
<td>1.49</td>
<td>3.75</td>
<td>5.40**</td>
</tr>
</tbody>
</table>

\textsuperscript{a} In cases where women respondents have indicated that they have had tenure experience (on or off the farm) they have been included in 1970 analysis. Data on 1946-1958 in (89, p. 55).
A very significant increase is observed in PO and NL tenure experiences which implies the increasing importance of inheritance and nonfarm occupation (for accumulating the financial resources) in achieving farmland ownership.

As a result the diagnostic hypothesis 3.c, which states that the basic agricultural ladder is used to a lesser extent than in the past and other patterns are evolving, cannot be rejected.

Modifications of Tenure Experience Patterns

Over the years improvements in techniques of agricultural production have brought about changes in methods of farming. Economic criteria forced increasing capital substitution for labor and the introduced machines cultivated larger acres by fewer men. The result of changes in the resource mix have led to decreased demand for labor in agriculture and correspondingly would-be hired farm hands had to seek employment in nonfarm sectors. In terms of the tenure experience patterns, these changes in the resource mix have resulted in one rung of the traditional agricultural ladder completely losing its importance. In its place non-farm employment is gaining increasing importance as a rung in the ladder where individuals spend a number of years accumulating enough financial resources prior to farming.

The tenure experience patterns discussed in the previous section do not take into account the relative changes with respect to various rungs of the ladder. A new grouping of tenure experiences is required if the relative importance of these rung changes are to be contrasted. Since importance has been on the hired hand and nonfarm experience, these
groupings are contrasted in Tables 33 and 34. It should be reminded that these groupings do not represent a new ladder, but simply to contrast the relative importance of two rungs.

The nonfarm experience group in Tables 33 and 34 consists of all owners who have indicated having been employed in nonfarm occupations prior to ownership, but at no time were they farmhands. Hired hand experience alone, on the contrary, consists of owners who were never employed out of agriculture but indicated touching the H rung. Nonfarm and hired hand experience is for owners who touched both rungs while the last group is for owners who touched neither of the rungs.

Testing diagnostic hypothesis 3.b, which states that "younger owners are using nonfarm employment as a replacement for hired hand and tenancy steps of the agricultural ladder," it is observed in Table 33 that for all ages there is a very significant increase in nonfarm and a very significant decline in hired hand experiences. The last tenure grouping has declined very significantly as well.

Some age groups have less than 100 respondents for either of the years and therefore have not been tested for significant differences but for age groups 35-44 and 45-54 nonfarm experience has increased and hired hand experience has declined very significantly. Both age groups also indicate a very significant decline in the last tenure experience group (neither nonfarm nor hired hand experience) while the younger age group indicates a very significant increase in nonfarm and hired hand experience. The interpretation of these findings is that the hypotheses cannot be rejected; however, it seems that nonfarm employment and the
Table 33. Tenure experience of men within age groups (Iowa, 1958-1970)\(^a\)

<table>
<thead>
<tr>
<th>Tenure experience groups</th>
<th>Percentage distribution within age groups</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonfarm experience</td>
<td>28.3</td>
<td>37.96**</td>
<td>100</td>
<td>38.72</td>
<td>52.5</td>
<td>39.06</td>
<td>34.7</td>
<td>48.84**</td>
<td>20.7</td>
<td>40.36**</td>
<td>27.9</td>
</tr>
<tr>
<td>Hired hand experience</td>
<td>18.2</td>
<td>13.75**</td>
<td>-</td>
<td>19.07</td>
<td>6.7</td>
<td>5.00</td>
<td>16.6</td>
<td>4.19**</td>
<td>18.7</td>
<td>9.84**</td>
<td>19.2</td>
</tr>
<tr>
<td>Nonfarm and hired hand experience</td>
<td>24.0</td>
<td>25.45</td>
<td>-</td>
<td>16.52</td>
<td>23.4</td>
<td>42.59</td>
<td>20.6</td>
<td>35.23**</td>
<td>27.9</td>
<td>29.69</td>
<td>23.9</td>
</tr>
<tr>
<td>Neither non-farm nor hired hand experience</td>
<td>29.5</td>
<td>22.84**</td>
<td>-</td>
<td>25.69</td>
<td>17.7</td>
<td>13.34</td>
<td>28.1</td>
<td>11.74**</td>
<td>32.7</td>
<td>20.11**</td>
<td>29.0</td>
</tr>
<tr>
<td>Number reporting</td>
<td>1230</td>
<td>2046</td>
<td>1</td>
<td>11</td>
<td>73</td>
<td>111</td>
<td>228</td>
<td>288</td>
<td>347</td>
<td>485</td>
<td>509</td>
</tr>
</tbody>
</table>

\(^a\)Data on 1958 from (89, p. 60). Women indicating tenure experience have been included in the 1970 study. Identification of tenure groupings are in Appendix B.
Table 34. Tenure experience of owners according to occupational distribution (Iowa, 1970)

<table>
<thead>
<tr>
<th>Tenure experience groups</th>
<th>Number reporting</th>
<th>Percentage distribution by occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Farmers</td>
<td>Retired farmers</td>
</tr>
<tr>
<td>Nonfarm experience</td>
<td>795</td>
<td>27.19</td>
</tr>
<tr>
<td>Hired hand experience</td>
<td>270</td>
<td>20.07</td>
</tr>
<tr>
<td>Nonfarm and hired hand experience</td>
<td>500</td>
<td>23.11</td>
</tr>
<tr>
<td>Neither nonfarm nor hired hand experience</td>
<td>471</td>
<td>29.63</td>
</tr>
<tr>
<td>Total reporting</td>
<td>2036</td>
<td>951</td>
</tr>
</tbody>
</table>


hired hand stage are not used as substitutes but rather as compliments in achieving ownership of land. As has been expected, there has been no decline in hired hand experience of older owners.

Tenure experience of these owners according to various occupational groups is presented in Table 34. It is again noted that farmers very significantly differ from the retired farmers with respect to all the four tenure experience groups. Again the findings indicate that over time importance of nonfarm experience has increased and hired hand experience has declined when farmers and retired farmers are contrasted. Similarly, the complementarity of nonfarm and hired hand experience is implied when a very significantly greater number of the farmers, as opposed to retired farmers, indicate nonfarm and hired hand experience. The last tenure experience group, however, is very significantly more for the retired farmers. A tentative explanation is that in the earlier days resource requirements for getting established in farming may have been much less than today and consequently fewer people had to accumulate financial resources prior to being a renter or an owner.
FARMLAND ACQUISITION THROUGH GIFT, INHERITANCE AND PURCHASE

The important consequences of accelerated technological innovations in agriculture and changing economic conditions within the last decades have already been touched upon in the previous chapters. This chapter concentrates on the effect of these changes in farmland acquisition through gift, inheritance and purchase.

Acquiring Farmland Ownership

Acquisition of property, be it farmland, an automobile, or a house, requires capital to finance it if it is not an outright gift or an inheritance. To finance an acquisition, the prospective buyer has to rely on his own savings, savings of others, and institutional savings. He should also consider the net returns of his investment, repayment of his debt outstanding, and the ultimate value of his land.

With respect to farmland owner-operatorship, acquisition of a debt-free title to land has been a basic goal of Iowa farmers. However, the problem of accumulating enough capital to reach this end has become more difficult and takes a longer time due to changes in technology and economic conditions. Bachman has observed the developing trend by the early 1950's:

Perhaps the greatest potential danger of instability in income arises because of the increased capital requirements in modern farming that occur with increased sizes of farms and increases in machinery and other types of capital required. Investments averaging above $30,000 per farm commonly are required for operation of the medium and larger commercial farms in the United States. This represents more than a lifetime of saving for the average individual. A reasonable degree of stability for the less advantaged young farmer seeking to establish efficient
and up-to-date farm may call for substantial revisions in tenure and credit practices (8, pp. 171-172).

Existence of family assistance, in the form of land and nonland gifts and inheritances, has simplified the problem of acquiring land and beginning farming for the fortunate few, but for the majority the problem has been aggravated, as has been pointed out below:

Farm mortgage lenders, prospective land buyers, and observers have expressed increased concern in recent years about the continued rise in farm real estate prices without apparent support from farm income. Nationally, farmland prices have advanced more than 50 percent in the past decade, whereas net farm income per acre in 1963 was only 4 percent higher than 10 years earlier. This widening disparity between land prices and farm income, coupled with the rapid increase in farm size, has contributed to a doubling in outstanding farm real estate debts in the past decade. Credit policies of commercial lenders have undergone substantial changes in response to these forces, and noninstitutional sources of credit have emerged. Beginning farmers have found it increasingly difficult to accumulate from farm earnings the funds needed for land purchases. Steadily mounting capital requirements have forced many to modify their traditional goal of debt-free ownership. Alternative tenure arrangements such as part-ownership and the family farm corporation have become more prevalent (82, p. 13).

Acquisition of Farmland through Gift and Inheritance

The consequence of the increasing amounts of initial capital outlays being required in present-day agriculture is the attaching of a great importance to gratuities in land acquisition. As a result, farmers increasingly rely on family assistance to acquire ownership of land.

Gratuities can take the form of gifts and/or inheritance of full or part interest on land. Family assistance can also be provided by gifts or inheritances other than land. These family assisted funds, in return, may be used in improving operations and/or purchase of land. The problems
of financing the acquisition of farmland is simplified for the family assisted farmer. Even when the land is partly inherited, he will have a beginning resource and the possibility of buying the shares of the other parties with interest in this land.

The increasing importance of gratuities in acquiring farmland ownership is delimited as hypothesis 4.a and tested in this section. Diagnostic hypothesis 4.a.1 states that family assistance to farmers seeking ownership is on the rise. This hypothesis is tested below and the findings are presented in Tables 35 and 36.

As can be observed in Table 35 for all owners of both sexes the importance of single methods in acquisition of farmlands have declined very significantly compared to a combination of methods. It is still true that a majority of the owners still purchase their lands without gifts and inheritances from their families but their percentages have declined very significantly as compared to 1946 and 1958. However, it is interesting to note that acquisition through outright inheritance or gift has not changed over the years. Instead, what seems to have occurred is a very significant increase in the method of acquisition which is a combination of purchase with family assistance in the form of gift and/or inheritance of land.

This above finding is true for all occupation categories as well, as can be tested in Table 36. There has been a very significant decline in purchase methods and a very significant increase in the methods which combines purchase of land with family assistance. This finding is supported very significantly for the farmers. Other occupation groups
Table 35. Percentage distribution of farm owners by method of farm ownership acquisition (Iowa, 1946, 1958 and 1970)*

<table>
<thead>
<tr>
<th>Method of acquisition</th>
<th>All owners</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single methods</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land purchase</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. From relatives only</td>
<td>11.9 14.0 13.76</td>
<td>12.9 14.6 14.51</td>
<td>5.4 10.2 9.94</td>
</tr>
<tr>
<td>b. From nonrelatives only</td>
<td>51.2 51.1 44.35**</td>
<td>55.3 54.6 47.90**</td>
<td>24.2 30.7 26.19</td>
</tr>
<tr>
<td>c. Both relatives and nonrelatives</td>
<td>4.4 5.8 4.91</td>
<td>4.7 6.1 5.27</td>
<td>2.7 4.4 3.08</td>
</tr>
<tr>
<td>Gift or inheritance</td>
<td>11.1 11.7 10.24</td>
<td>5.5 7.3 6.48</td>
<td>47.5 37.1 29.43</td>
</tr>
<tr>
<td>Other or undetermined method</td>
<td>2.1 0.2 --</td>
<td>2.0 0.1 --</td>
<td>3.4 0.9 --</td>
</tr>
<tr>
<td>Combinations of methods</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combinations involving gift or inheritance</td>
<td>17.5 17.2 21.81**</td>
<td>17.8 17.3 20.64**</td>
<td>15.4 16.7 27.81</td>
</tr>
<tr>
<td>Combinations involving purchase from relatives but no gift or inheritance</td>
<td>0.7 -- 2.09</td>
<td>0.8 -- 2.26 -- -- 1.23</td>
<td></td>
</tr>
<tr>
<td>Combinations involving no family assistance</td>
<td>1.1 Δb --</td>
<td>1.0 Δ --</td>
<td>1.3 -- --</td>
</tr>
<tr>
<td>Number reporting</td>
<td>1121 1810 2871</td>
<td>972 1548 2375</td>
<td>149 262 496</td>
</tr>
</tbody>
</table>

*Data on 1946 and 1958 in (89, p. 66).

bLess than 0.05 percent.
Table 36. Distribution of farm owners by occupation and by farm acquisition (Iowa, 1946, 1958\(^a\) and 1970)

<table>
<thead>
<tr>
<th>Occupation groups</th>
<th>Number reporting</th>
<th>Gift or inheritance</th>
<th>Combinations including gift or inheritance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmers</td>
<td>642  791  1246</td>
<td>5.9  5.1  5.21</td>
<td>17.5  18.1  22.52**</td>
</tr>
<tr>
<td>Retired farmers</td>
<td>162  252  424</td>
<td>2.5  6.8  6.21</td>
<td>20.4  23.7  25.32</td>
</tr>
<tr>
<td>Housewives(^c)</td>
<td>106  300</td>
<td>34.8  30.17</td>
<td>20.0  25.45</td>
</tr>
<tr>
<td>Business and professional(^c)</td>
<td>303  446</td>
<td>17.5  14.54</td>
<td>17.0  22.09(^b)</td>
</tr>
<tr>
<td>Laborers and others(^c)</td>
<td>115  385</td>
<td>10.6  12.54</td>
<td>9.6  17.61(^b)</td>
</tr>
<tr>
<td>All owners</td>
<td>1567  2801</td>
<td>10.1  10.36</td>
<td>18.2  22.49**</td>
</tr>
</tbody>
</table>

\(^a\) Data for 1946 and 1958 in (89, p. 69).

\(^b\) Close to 90 percent significance.

\(^c\) Data for 1946 unavailable.

\(^d\) Less than 0.05 percent.
<table>
<thead>
<tr>
<th></th>
<th>Purchase</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
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<td>-------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td>72.8</td>
<td>76.8</td>
<td>68.97b</td>
<td>1.9</td>
<td>--</td>
<td>3.30</td>
<td>1.9</td>
<td>--</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>75.3</td>
<td>69.5</td>
<td>65.28b</td>
<td>1.8</td>
<td>--</td>
<td>3.19</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>44.4</td>
<td>42.93</td>
<td></td>
<td></td>
<td></td>
<td>1.45</td>
<td>0.8</td>
<td>--</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>65.2</td>
<td>63.09</td>
<td>0.1</td>
<td>0.2</td>
<td>0.2</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>79.8</td>
<td>69.72b</td>
<td></td>
<td></td>
<td></td>
<td>0.13</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>71.5</td>
<td>64.95b</td>
<td></td>
<td></td>
<td></td>
<td>2.20</td>
<td>0.2</td>
<td>--</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
show evidence of this fact but the findings are not significant at the tested levels. Thus there is evidence to support the hypothesis that farmers, as opposed to other occupations, are increasingly utilizing gift and inheritance of land combined with their own resources in acquiring ownership of farmlands.

Gratuities are an important factor in acquiring farmland for the beginning farmer. However, it also enables nonoperators to receive lands and therefore contribute to the widening gap of the problematic situation. In other words, do the nonoperator landlords receive their lands mainly by gratuities as stated in diagnostic hypothesis 4.a.2?

Table 37 presents the methods of acquisition in 1958 and 1970 with respect to tenure groups. Evidence indicates that were it not for gifts or inheritances from the family, a sizeable portion of the nonoperator landlords would not have been farmland owners, and definitely a portion of the operator landlords would have remained as owner-operators. The share of lands acquired by gifts and inheritances (even when partly purchased) in both landlord groups is definitely and very significantly larger than operator tenures. In other words, family assistance has encouraged farmland owners to become landlords.

The importance of family assistance in acquiring farmlands early in one's life is shown in Table 38. Testing diagnostic hypothesis 4.a.3, which states that young owners are increasingly utilizing combinations of gifts and inheritances in acquiring ownership of farmlands, it has been found that there has not been a significantly different distribution of acquisition methods by age groups in 1970, as compared to those in 1958.
Table 37. Tenure of owners by method of acquisition (Iowa, 1958 and 1970)\(^a\)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase only</td>
<td>1171</td>
<td>70.7</td>
<td>1645</td>
<td>61.33**</td>
<td>81.9</td>
<td>75.44**</td>
<td>83.9</td>
<td>75.27**</td>
<td>60.3</td>
<td>58.84</td>
<td>60.0</td>
<td>53.94**</td>
</tr>
<tr>
<td>Gift or inheritance only</td>
<td>208</td>
<td>12.5</td>
<td>277</td>
<td>10.33</td>
<td>6.0</td>
<td>5.89</td>
<td>6.8</td>
<td>4.66</td>
<td>2.4</td>
<td>8.35</td>
<td>20.1</td>
<td>17.52*</td>
</tr>
<tr>
<td>Combinations involving gift or inheritance</td>
<td>273</td>
<td>16.6</td>
<td>694</td>
<td>25.88**</td>
<td>11.9</td>
<td>16.41*</td>
<td>9.3</td>
<td>16.59**</td>
<td>37.3</td>
<td>30.43</td>
<td>19.6</td>
<td>27.02**</td>
</tr>
<tr>
<td>Combinations involving no gift or inheritance</td>
<td>1</td>
<td>(\Delta)</td>
<td>66</td>
<td>2.46</td>
<td>--</td>
<td>2.26</td>
<td>--</td>
<td>3.69</td>
<td>--</td>
<td>2.39</td>
<td>0.1</td>
<td>1.52</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>0.2</td>
<td>--</td>
<td>--</td>
<td>0.2</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.2</td>
<td>--</td>
</tr>
<tr>
<td>Total reporting</td>
<td>1656</td>
<td>100.0</td>
<td>2682</td>
<td>100.00</td>
<td>502</td>
<td>718</td>
<td>265</td>
<td>430</td>
<td>99</td>
<td>363</td>
<td>790</td>
<td>1171</td>
</tr>
</tbody>
</table>

\(^a\)Data on 1958 in (89, p. 70).

\(^b\)Less than 0.05 percent.
Table 38. Distribution of owners by method of farmland acquisition according to age at first acquisition (Iowa, 1958 and 1970)\textsuperscript{a}

<table>
<thead>
<tr>
<th>Method of Acquisition</th>
<th>Number</th>
<th>Percentage distribution by age at first land acquisition</th>
<th>0 - 24</th>
<th>25-34</th>
<th>35-44</th>
<th>45-54</th>
<th>55-over</th>
<th>All ages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase from relatives</td>
<td>205 363</td>
<td>9.2 7.73 37.0 35.75 36.1 35.68 14.1 15.04 3.6 5.80 14.32</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purchase from nonrelatives</td>
<td>837 1189</td>
<td>9.5 10.04 36.0 39.40* 35.7 32.65* 14.0 13.70 4.8 4.20 46.19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purchase from gift or</td>
<td>89 147</td>
<td>13.1 18.61 48.0 47.31 29.7 28.69 9.2 3.30 -- 2.10 5.17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>inheritance</td>
<td>110 257</td>
<td>9.7 8.60 27.6 20.37\textsuperscript{b} 31.9 26.66 18.3 30.80** 12.5 13.57 9.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>2 --</td>
<td>-- -- -- -- -- -- -- -- -- -- -- --</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combinations with gift or</td>
<td>264 698</td>
<td>15.7 13.84 35.8 31.71* 31.8 30.04 13.9 17.46 2.8 6.95* 22.40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>inheritance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combinations without gift</td>
<td>3 66</td>
<td>7.22 27.5 54.64 74.3 33.47 -- 4.67 -- -- 2.22</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>or inheritance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All methods</td>
<td>1510 2714</td>
<td>10.7 10.80 36.3 36.06 34.4 31.73* 14.0 15.66 4.6 5.75 100.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{a}Data on 1958 is in (89, p. 67).

\textsuperscript{b}Close to 90 percent significance.
In fact, evidence suggests the opposite, that family assistance to the young owners has declined since 1958. However, the importance of family assistance for all age groups is still considerable. In light of present evidence this hypothesis is rejected; that is, no relationship between the age of farmland owners and the increasing utilization of family assistance is detected.

Family Assistance Other Than Land

Family assistance in acquiring farmland ownership has so far been measured in terms of gifts and inheritances of land. Another equally important measure of assistance in the acquisition process is the use of gifts and inheritances other than land. This form of assistance is mainly gifts of capital in the form of money. Evidence indicates that this form of gift is quite common, since almost 37 percent have reported receiving such assistance, and of this group 52 percent indicated to have used it in acquiring, improving or operating their land, as shown in Table 39.

Diagnostic hypothesis 4.a.4 states that operators, as opposed to landlords, and farmers, as opposed to nonfarmers, use inheritances other than land for land ownership purposes. This hypothesis is tested with the help of Tables 39 and 40.

It can be seen in Table 39 that a slightly larger percentage of women, as opposed to men, have received inheritance other than land for both 1958 and 1970. This finding can be explained by the observation that women receive their share of inheritance in the form of money more
Table 39. Proportion of farm owners by sex, tenure and occupation who used inheritances other than land for land purposes (Iowa, 1958-1970)\(^a\)

<table>
<thead>
<tr>
<th>Classification</th>
<th>Received inheritance other than land</th>
<th>Used inheritance for land</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>1582</td>
<td>921</td>
</tr>
<tr>
<td>Women</td>
<td>243</td>
<td>218</td>
</tr>
<tr>
<td><strong>Tenure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Owner-operator</td>
<td>559</td>
<td>253</td>
</tr>
<tr>
<td>Part-owner</td>
<td>262</td>
<td>136</td>
</tr>
<tr>
<td>Operator landlord</td>
<td>103</td>
<td>169</td>
</tr>
<tr>
<td>Nonoperator landlord</td>
<td>785</td>
<td>530</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmer</td>
<td>817</td>
<td>485</td>
</tr>
<tr>
<td>Retired farmer</td>
<td>255</td>
<td>182</td>
</tr>
<tr>
<td>Housewife</td>
<td>109</td>
<td>136</td>
</tr>
<tr>
<td>Business or professional</td>
<td>306</td>
<td>180</td>
</tr>
<tr>
<td>Laborer</td>
<td>114</td>
<td>136</td>
</tr>
<tr>
<td><strong>All owners</strong></td>
<td>1825</td>
<td>1119</td>
</tr>
</tbody>
</table>

\(^a\) Data on 1958 is in (89, p. 92).
Table 40. Comparison of percentage of owners compared to total farmland owners who used inheritances other than land for acquiring land ownership (Iowa, 1946, 1958 and 1970)*

<table>
<thead>
<tr>
<th>Classification</th>
<th>Number reporting</th>
<th>Percentage of owners compared to total farmland owners who used their nonland inheritances for acquiring land ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>837</td>
<td>1582</td>
</tr>
<tr>
<td>Women</td>
<td>131</td>
<td>243</td>
</tr>
<tr>
<td>Tenure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Owner-operator</td>
<td>364</td>
<td>559</td>
</tr>
<tr>
<td>Part-owner operator</td>
<td>108</td>
<td>262</td>
</tr>
<tr>
<td>Operator landlord</td>
<td>120</td>
<td>103</td>
</tr>
<tr>
<td>Nonoperator landlord</td>
<td>376</td>
<td>785</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmer</td>
<td>629</td>
<td>817</td>
</tr>
<tr>
<td>Retired farmer</td>
<td>155</td>
<td>255</td>
</tr>
<tr>
<td>Housewife</td>
<td>39</td>
<td>109</td>
</tr>
<tr>
<td>Business or professional</td>
<td>87</td>
<td>306</td>
</tr>
<tr>
<td>Laborers and others</td>
<td>58</td>
<td>114</td>
</tr>
<tr>
<td>All owners</td>
<td>968</td>
<td>1825</td>
</tr>
</tbody>
</table>

*Data on 1946 and 1958 from (89, p. 74).
often than men. This observation is supported by the finding that women use their inheritance less often than men for land ownership or utilization purposes.

The distribution of received inheritance other than land between tenure and occupation groups have not altered between the two studies, except nonoperator landlords have received this assistance very significantly more often than in 1958 but used it less often for land purposes. A similar observation is true for the operator landlords, though in a diminished magnitude.

Within the occupation groups, the number of people receiving assistance other than land have not altered between 1958 and 1970. However, among occupations a very significant difference of utilization of inherited capital is observed. Nonfarmers have increasingly utilized it for nonland purposes, as opposed to farmers. The evidence gathered in Table 39 rejects the diagnostic hypothesis 4.a.4.

Observing the long-run changes since 1946 of nonland inheritance used for acquiring land ownership in Table 40, it is seen that there is an overall decline in the percentage of tenures, as well as occupations, who have used their nonland inheritances for land purposes. This decline is particularly significant for the landlords and housewives. These findings can be taken as one evidence that alternative investment opportunities in nonagricultural sectors have been attractive for most non-operator or nonland inheritors and their gifts have been used to a lesser extent than in the past in investing in farmlands. Thus this form of family assistance has been contributing less to a rise in farmland prices.
The value of nonland inheritance, as well as its distribution between tenure groups, is important if it is to assist in acquisition of farmland. Table 41 presents the distribution of nonland inheritance between the tenure groups for 1970.

It can be observed that for all tenure groups almost 45 percent of the inheritors received $7,000 or more. In terms of a down payment for acquiring farmlands and beginning farming, the total value of nonland inheritances is certainly impressive. However, with respect to the distribution of this inheritance within tenure groups, nonoperator landlords have significantly received more than $11,000, compared to owner-operators (26.7 percent for the former and 17.3 percent for the latter). Part-owner-operators and operator-landlords indicate 25.2 percent and 22.6 percent, respectively.

The evidence with respect to these findings indicates that families have used inheritances other than land more often as an intra-family transfer method. The nonoperator survivors have received the nonland inheritance and the operating members of the family remaining in agriculture inherited the land. These conclusions reject the diagnostic hypothesis 4.a.5, which states that operators, as opposed to landlords, receive a higher value of nonland inheritance.

Acquisition Methods of Institutional Owners

Farmland resources increasingly owned by institutions (such as schools, churches, city, state and federal governments or corporations) necessarily widen the problematic gap for the individual pursuing his
Table 41. Percentage distribution of value of inheritance other than land by tenure groups (Iowa, 1970)

<table>
<thead>
<tr>
<th>Total value of nonland inheritance (dollars)</th>
<th>Number reporting</th>
<th>All tenures (percent)</th>
<th>Owner operators</th>
<th>Part-owner operators</th>
<th>Operator landlords</th>
<th>Nonoperator landlords</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; $500</td>
<td>10</td>
<td>2.46</td>
<td>5.31</td>
<td>--</td>
<td>--</td>
<td>1.80</td>
</tr>
<tr>
<td>$500- 1,999</td>
<td>46</td>
<td>10.50</td>
<td>10.46</td>
<td>4.43</td>
<td>19.95</td>
<td>10.08</td>
</tr>
<tr>
<td>$2,000- 3,999</td>
<td>81</td>
<td>19.15</td>
<td>23.49</td>
<td>13.23</td>
<td>12.46</td>
<td>20.21</td>
</tr>
<tr>
<td>$4,000- 6,999</td>
<td>104</td>
<td>23.32</td>
<td>22.57</td>
<td>22.25</td>
<td>26.49</td>
<td>23.43</td>
</tr>
<tr>
<td>$7,000-10,999</td>
<td>101</td>
<td>21.82</td>
<td>20.83</td>
<td>34.89</td>
<td>18.55</td>
<td>17.71</td>
</tr>
<tr>
<td>$11,000-15,999</td>
<td>41</td>
<td>8.65</td>
<td>4.59</td>
<td>10.69</td>
<td>12.31</td>
<td>10.22</td>
</tr>
<tr>
<td>$16,000-21,999</td>
<td>36</td>
<td>7.23</td>
<td>8.24</td>
<td>8.08</td>
<td>5.68</td>
<td>6.43</td>
</tr>
<tr>
<td>$22,000-29,999</td>
<td>15</td>
<td>2.76</td>
<td>2.78</td>
<td>--</td>
<td>0.85</td>
<td>4.72</td>
</tr>
<tr>
<td>≥ $30,000</td>
<td>25</td>
<td>4.11</td>
<td>1.73</td>
<td>6.42</td>
<td>3.72</td>
<td>5.39</td>
</tr>
<tr>
<td>Number reporting</td>
<td>459</td>
<td>100.00</td>
<td>136</td>
<td>69</td>
<td>73</td>
<td>181</td>
</tr>
</tbody>
</table>
owner-operatorship goal. This individual will have to compete for scarce farmland resources against a better organized and financed group of would-be farmland owners. Unequal competition may be further aggravated if the institutional owners have been increasingly receiving farmlands in the form of gifts and inheritances.

Table 42 presents the acquisition methods of institutional land owners in the years 1958 and 1970. As can be observed from the table, important changes seem to have occurred between two time periods. There is a considerable increase in the number of institutional owners who have acquired their land by purchase as opposed to inheritance in 1958. Generally acquisition by a combination of methods has not changed in total, but the composition of this subgroup seems to have changed in favor of a combination of purchase methods. Significance tests are not performed since the number of respondents in 1958 were less than 100.

Purchase Methods of Acquiring Farmlands

Acquiring farmlands through purchase methods can be basically in four categories: (1) outright cash payment, (2) purchase contract, (3) mortgage, and (4) some combination of the second and third categories.

It has already been stated that outright cash payment in financing farmland acquisition necessitates long periods of tenancy or nonfarm jobs. Furthermore, the optimal operating size of farms has been such as to preclude practically all beginning farmers from financing their acquisition by their own accumulation of savings. As a result, farmland acquisitions have been increasingly financed by purchase contract,
Table 42. Comparison of acquisition methods of institutional farm land-owners (Iowa, 1958-1970)

<table>
<thead>
<tr>
<th>Method of acquisition</th>
<th>1958</th>
<th>1970</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number reporting</td>
<td>Percentage distribution</td>
</tr>
<tr>
<td></td>
<td>number</td>
<td>owned acres</td>
</tr>
<tr>
<td>Purchase</td>
<td>37</td>
<td>43.53</td>
</tr>
<tr>
<td>Gift</td>
<td>3</td>
<td>3.53</td>
</tr>
<tr>
<td>Inheritance</td>
<td>33</td>
<td>38.82</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>1.18</td>
</tr>
<tr>
<td>Combination with gift and inheritance</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Combination with purchase and gift</td>
<td>3</td>
<td>3.53</td>
</tr>
<tr>
<td>Combination with purchase and inheritance</td>
<td>6</td>
<td>7.06</td>
</tr>
<tr>
<td>Combination of purchase, gift and inheritance</td>
<td>2</td>
<td>2.36</td>
</tr>
<tr>
<td>All methods of acquisition</td>
<td>85</td>
<td>100.00</td>
</tr>
</tbody>
</table>

aData on 1958 have been furnished from source material of (90).

b157 institutional owners have reported their ownership as an estate but have not indicated their methods of acquisition, which therefore makes 1970 estimates not directly comparable with that of the 1958 study.
mortality or some combination of both. The next sections of this chapter
briefly discuss the advantages and disadvantages of these methods and
proceeds to identify the changes that have been taking place with respect
to the use of purchase methods.

**Acquisition by purchase contracts and mortgage**

Purchase contract (or installment land contract) is an agreement
reached by the buyer and the seller to transfer ownership of land. In
this agreement, the buyer agrees to pay a certain down payment and
promises to pay the rest of the purchase price in installments over a
period of time. Usually the seller promises to transfer possession and
use of the land at the time the contract is made, but retains legal
title until the last installment has been completed.

Land contracts differ from mortgages in two main aspects:

1. Land contracts require lower down payments—about one-fifth
to one-fourth of the purchase price compared to two-fifths
or over for mortgages.

2. In case of default, installment land contracts may be forfeited
summarily upon a thirty-day notice of default (53). For mort­
gages there is the requirement that all mortgages be foreclosed
by a statutory special execution sale from which a one-year
period of redemption is provided (52).

The greater difficulty involved in foreclosing a mortgage makes the
lenders unwilling to make a mortgage loan unless the down payment is high.

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16 For a more detailed study of purchase contracts, see (44).
On the other hand, the association of a low down payment and the forfeiture provision provide a unique legal-economic character to the installment contract.

A low down payment may be an advantage for both buyer and seller. To the former, low-equity financing provides a means to own land without seriously depleting his operating capital. To the latter, a low rather than a high down payment provides an income tax advantage by spreading this taxable gain over a number of years. Because the interests of both parties are not in conflict, land contracts seem to be favored more than mortgages.

Another advantage of the land contract is the security it provides for both parties. To the buyer, it provides security of possession at an early age. Because of this security, the buyer has more freedom to improve the land. To the seller, it provides relatively rapid and inexpensive settlement of his claim in case the buyer defaults. Another advantage to the seller would be to consider the installment payments as a convenient "annuity program" to retire on.

The disadvantages of land contract for the buyer occur because of default. He has less time (30 days) after a default to make up his payments than with a mortgage. He may lose his equity in the farm (along with his expenses on improvements) if the seller regains possession through forfeiture. The land contract buyer is without the protection of the mortgage laws for his equity in the farm.
The disadvantage of the land contract for the seller is the high burden of the risk involved. Although the seller may repossess the farm in case of default, there still is some risk of loss to the seller due to cost of foreclosure and deterioration of the property. Another point in this connection is the seller's difficulty of getting his money out of the farm in case of unexpected need.

One other point with respect to land contracts is related to the fluctuations in general economic conditions over time. Depending upon the economic conditions (inflationary or recessionary) following the contract agreement, the buyer or the seller, or both, may be worse off. Thus, depending on the general state of the economy as well as the trend of agricultural prices and land values over a long period of time, it may make the use of land contracts disadvantageous for the buyers and the sellers.

**Combinations of purchase methods**

Although used to a lesser extent, a combination of purchase contract and mortgage arrangement is possible. This combination arrangement is possible by including a provision permitting the conversion of the purchase contract into a deed-and-mortgage arrangement. Essentially the conversion takes place when the buyer's interest reaches a previously agreed level. The seller then delivers the deed to the buyer and accepts a mortgage to secure the unpaid balance. This combined method of purchase contract and mortgage agreement is beneficial to both parties concerned.

The advantages of such a combination for the buyer may be summarized in three points: (1) the removal of the forfeiture clause, (2) more
favorable financial terms if installment payments were spread over a short period of time in the contract, and (3) the improvement in his credit rating—especially to obtain production credit to operate the farm.

The advantages accruing to the seller can also be grouped into three points if it calls for (1) a higher rate of interest, (2) rescheduling of repayment of principal according to his changed needs, and (3) the possibility of a discount market for mortgage but nonexistence of such a market for the purchase contract due to its original high risk.

While there are definite advantages to both parties in a combination of purchase contract and mortgage arrangement, the low incidence of use in Iowa is surprising. This is explained to be due to the "unfamiliarity and inexperience with such provisions and lack of knowledge of their economic value" (44, p. 71). In future research, these combined arrangements of finance methods should be studied in detail and their shortcomings, if any, should be identified. Another contribution of these studies would be to enlighten the would-be beginning farmers to this specific purchase method.

Purchase Methods of Iowa Farmland Owners

Diagnostic hypothesis 4.b.1 states that the use of purchase contracts is increasing for all owners as a means of acquiring farmlands. Testing it in Table 43, it can be observed that there has been a very significant decline in the number of farmland owners free of debt. The other two very significant changes since 1958 have been between the increasing utilization of purchase contracts as opposed to the use of mortgage-for-deed. However, the former cannot be tested statistically since the
Table 43. Percentage distribution of purchase methods of all owners within areas (Iowa, 1958*-1970; economic areas, 1970)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Free of debt</td>
<td>1025</td>
<td>63.6</td>
<td>1410</td>
<td>56.25**</td>
<td>52.48</td>
</tr>
<tr>
<td>Purchase contract</td>
<td>88</td>
<td>5.8</td>
<td>414</td>
<td>16.96</td>
<td>16.69</td>
</tr>
<tr>
<td>Mortgage</td>
<td>491</td>
<td>30.0</td>
<td>620</td>
<td>24.38**</td>
<td>27.62</td>
</tr>
<tr>
<td>Mortgage and purchase contract</td>
<td>10</td>
<td>0.6</td>
<td>50</td>
<td>1.73</td>
<td>2.12</td>
</tr>
<tr>
<td>Other unspecified methods</td>
<td>---</td>
<td>---</td>
<td>25</td>
<td>0.68</td>
<td>1.09</td>
</tr>
<tr>
<td>Number reporting</td>
<td>1614</td>
<td>100.0</td>
<td>2519</td>
<td>100.00</td>
<td>299</td>
</tr>
</tbody>
</table>

*aData on 1958 compiled from (89, pp. 82-84).
179 observations for 1958 were less than 100.

These above-mentioned changes have occurred in all economic areas, as can be seen in Table 43. There are variations between the percentage of farmland owners with respect to the purchase method employed among areas. However, in no area is this significant change of increasing use of purchase contracts, as opposed to mortgage-for-deed, reversed. Therefore the diagnostic hypothesis 4.b.1 cannot be rejected.

It is hypothesized, as in 4.b.2, that part-owner operators, as opposed to other tenure groups, would make increasing use of purchase contracts and mortgage-for-deed. Table 44 contrasts the purchase methods of tenure groups in 1958 and 1970.

It can be observed from Table 44 that there have been some shifts between landlords as far as land held free of debt is concerned. Although nonoperator landlords are still the majority users of this method, they have lost a significant share to operator-landlords. The other two tenure groups have also lost their shares of free-of-debt ownership, but this decline is not statistically significant at the tested levels.

There are definite indications to support the diagnostic hypothesis 4.b.2, in that the use of purchase contracts as well as mortgage methods have increased for the part-owner-operators. However, the former cannot be tested statistically, as has already been pointed out while discussing Table 43, and the latter is very close to a significant difference at the 90 percent significance level. An equally interesting finding is the similarly significant increase in both methods for the operator landlords.

Owner-operators and nonoperator-landlords, however, indicate
Table 44. Percentage distribution of purchase methods of owners by tenure groups (Iowa, 1958-1970)\textsuperscript{a}

<table>
<thead>
<tr>
<th>Method of purchase</th>
<th>Number reporting</th>
<th>Percentage distribution of purchase methods by tenure groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free of debt</td>
<td>1025</td>
<td>1410</td>
</tr>
<tr>
<td>Purchase contract</td>
<td>88</td>
<td>414</td>
</tr>
<tr>
<td>Mortgage</td>
<td>491</td>
<td>620</td>
</tr>
<tr>
<td>Mortgage and purchase contract</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>Other unspecified methods</td>
<td>--</td>
<td>25</td>
</tr>
</tbody>
</table>

\textsuperscript{a}Data on 1958 in (89, p. 82).

\textsuperscript{b}Close to 90 percent significant difference.
significant declines in the use of purchase contracts and mortgage-for-deed since 1958. These above findings support the above stated diagnostic hypothesis. It also validates the grouping of operator tenures into one class and contrasting them against a nonoperator class as has already been applied in the third chapter.

How significant the difference is between the purchase methods of occupation groups is presented in Table 45. This table is also used to test the first part of the diagnostic hypothesis 4.b.3 which states that farmers, more than nonfarmers, young owners, as opposed to older owners, are utilizing purchase contracts. The second part of this hypothesis is tested in Table 46.

It can be observed in Table 45 that almost 56 percent of all farm-land owners held their ownership titles free of debt, but the distribution of lands held free of debt between occupation groups has been very surprising. The common belief and expectation was to find retired farmers and housewives in the free-of-debt category. The returns, on the contrary, revealed that farmers very significantly dominated this method as opposed to all other occupation groups.

The first part of the above-stated diagnostic hypothesis is supported, however, at the 95 percent confidence level. It can be observed in Table 45 that farmers, as opposed to all other occupation groups combined, utilized both purchase contracts and deed-for-mortgage more often.

The age distribution of the purchase methods of owners is presented in Table 46 and the second part of diagnostic hypothesis 4.b.3 is tested.
Table 45. Percentage distribution of purchase methods of owners by occupation groups (Iowa, 1970)

<table>
<thead>
<tr>
<th>Method of purchase</th>
<th>All owners</th>
<th></th>
<th>Percentage distribution of purchase methods by occupation groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percent</td>
<td>Farmers</td>
</tr>
<tr>
<td>Free of debt</td>
<td>1370</td>
<td>55.85</td>
<td>37.21</td>
</tr>
<tr>
<td>Purchase contract</td>
<td>407</td>
<td>17.08</td>
<td>67.49</td>
</tr>
<tr>
<td>Mortgage</td>
<td>612</td>
<td>24.61</td>
<td>60.00</td>
</tr>
<tr>
<td>Mortgage and purchase contract</td>
<td>50</td>
<td>1.77</td>
<td>77.64</td>
</tr>
<tr>
<td>Other unspecified methods</td>
<td>25</td>
<td>0.70</td>
<td>83.56</td>
</tr>
</tbody>
</table>
Table 46. Percentage distribution of purchase methods of owners by age groups (Iowa, 1970)

<table>
<thead>
<tr>
<th>Method of purchase</th>
<th>Number reporting</th>
<th>Percent of methods</th>
<th>≤ 24</th>
<th>25-34</th>
<th>35-44</th>
<th>45-54</th>
<th>≥ 55</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free of debt</td>
<td>1390</td>
<td>56.11</td>
<td>--</td>
<td>0.74</td>
<td>4.21</td>
<td>15.66</td>
<td>79.39</td>
</tr>
<tr>
<td>Purchase contract</td>
<td>410</td>
<td>17.02</td>
<td>1.38</td>
<td>17.83</td>
<td>31.27</td>
<td>29.49</td>
<td>20.02</td>
</tr>
<tr>
<td>Mortgage</td>
<td>613</td>
<td>24.45</td>
<td>0.60</td>
<td>4.50**</td>
<td>17.78**</td>
<td>31.77</td>
<td>45.34**</td>
</tr>
<tr>
<td>Mortgage and purchase contract</td>
<td>50</td>
<td>1.75</td>
<td>--</td>
<td>14.01</td>
<td>40.62</td>
<td>28.51</td>
<td>16.85</td>
</tr>
<tr>
<td>Other unspecified methods</td>
<td>24</td>
<td>0.67</td>
<td>--</td>
<td>--</td>
<td>25.98</td>
<td>52.92</td>
<td>21.10</td>
</tr>
<tr>
<td>All respondents</td>
<td>2487</td>
<td>100.00</td>
<td>0.38</td>
<td>4.79</td>
<td>12.92</td>
<td>22.43</td>
<td>59.47</td>
</tr>
</tbody>
</table>
As can be expected, the great majority of free-of-debt owners are over 55 years old; however, the utilization of purchase contracts and mortgage-for-deed is surprisingly high for this age group. Contrasting purchase contracts with mortgage-for-deed, it is observed that young farmland owners (25 to 44 years old) have very significantly utilized the former method more often than the latter. The two methods are used in about equal frequency for the 45 to 54 age group and reverse very significantly at the next oldest age group. These findings support the second half of the diagnostic hypothesis 4.b.3 which states that young owners, as opposed to older owners, are utilizing purchase contracts.

Earlier tables have indicated that close to one-half of the farmland owners have debts outstanding with respect to acquisition of farmlands. The total value of debt outstanding in achieving farmland ownership, as well as its distribution within tenure groups, is presented in Table 47. The diagnostic hypothesis 4.b.4 which states that the larger amounts of value of the outstanding debt is on the operator class of owners is tested within the findings of this table.

It can be observed in Table 47 that close to 31 percent of all owners have an outstanding debt of $30,000 or more. In each tenure group, however, this rate varies from the least of 24 percent for the nonoperator landlords to the most of 41 percent for the part-owner-operators. The other two groups average about 30 percent of the owners reporting this much debt. There is evidence to support the above-cited hypothesis, since all operator tenures have larger percentages of people reporting a larger value of the outstanding debt, as opposed to nonoperator landlords. This
Table 47. Percentage distribution of value of outstanding debt of owned land by tenure groups (Iowa, 1970)

<table>
<thead>
<tr>
<th>Total value of outstanding debt (dollars)</th>
<th>All tenures</th>
<th>Percentage distribution of value of outstanding debt by tenure groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Owner operators</td>
</tr>
<tr>
<td></td>
<td>reporting</td>
<td>Percent</td>
</tr>
<tr>
<td>≤ $500</td>
<td>4</td>
<td>0.36</td>
</tr>
<tr>
<td>$500-1,999</td>
<td>14</td>
<td>1.45</td>
</tr>
<tr>
<td>$2,000-3,999</td>
<td>71</td>
<td>6.54</td>
</tr>
<tr>
<td>$4,000-6,999</td>
<td>111</td>
<td>10.30</td>
</tr>
<tr>
<td>$7,000-10,999</td>
<td>129</td>
<td>11.89</td>
</tr>
<tr>
<td>$11,000-15,999</td>
<td>119</td>
<td>10.73</td>
</tr>
<tr>
<td>$16,000-21,999</td>
<td>174</td>
<td>15.26</td>
</tr>
<tr>
<td>$22,000-29,999</td>
<td>139</td>
<td>12.47</td>
</tr>
<tr>
<td>$30,000-49,999</td>
<td>203</td>
<td>16.96</td>
</tr>
<tr>
<td>$50,000-99,999</td>
<td>144</td>
<td>11.74</td>
</tr>
<tr>
<td>≥ $100,000</td>
<td>35</td>
<td>2.30</td>
</tr>
<tr>
<td>All owners with outstanding debt</td>
<td>1143</td>
<td>100.00</td>
</tr>
</tbody>
</table>
finding has not been tested statistically, however, since the number of observations in outstanding debt classes were too few to make any statistical comparison reliable.

Diagnostic hypothesis 4.b.5 which states that farmland of institutional owners compared to individual owners is increasingly being held free of debt is tested with the findings of Table 48. In this table, purchase methods of institutional owners in 1970 is compared to the findings of the 1958 data.

The result of the breakdown of purchase methods of institutional owners reveals that free-of-debt owners have very significantly declined in number, as well as in the amount of acreage held in 1970. Within these groups of farmland owners, the most significant increases seem to have been in the increased use of purchase contracts. However, the breakdown of the number of reporters according to purchase methods provide far too few observations to test the significance of these findings. On the basis of the fewer free-of-debt institutional owners in 1970, as opposed to 1958, the diagnostic hypothesis is rejected. However, it is still true that a greater percentage of owned acres are held free of debt for institutional, as opposed to individual, owners.
Table 48. Comparison of purchase methods of institutional farmland owners (Iowa, 1958-1970)

<table>
<thead>
<tr>
<th>Method of purchase</th>
<th>1958</th>
<th></th>
<th></th>
<th>1970</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percentage distribution</td>
<td>Acreage</td>
<td>Number</td>
<td>Percentage distribution</td>
<td>Acreage</td>
</tr>
<tr>
<td>Free of debt</td>
<td>114</td>
<td>87.76</td>
<td>94.17</td>
<td>192</td>
<td>76.78**</td>
<td>65.78**</td>
</tr>
<tr>
<td>Mortgage</td>
<td>11</td>
<td>8.66</td>
<td>4.86</td>
<td>22</td>
<td>9.27</td>
<td>11.27</td>
</tr>
<tr>
<td>Purchase contract</td>
<td>1</td>
<td>0.79</td>
<td>0.86</td>
<td>11</td>
<td>4.69</td>
<td>6.14</td>
</tr>
<tr>
<td>Mortgage and purchase contract</td>
<td>1</td>
<td>0.79</td>
<td>0.11</td>
<td>3</td>
<td>1.05</td>
<td>1.43</td>
</tr>
<tr>
<td>Part purchase contract and partly paid for</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>10</td>
<td>2.98</td>
<td>4.18</td>
</tr>
<tr>
<td>Part mortgage and partly paid for</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>16</td>
<td>4.48</td>
<td>6.18</td>
</tr>
<tr>
<td>Purchase contract, mortgage and partly paid for</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>7</td>
<td>0.75</td>
<td>5.02</td>
</tr>
<tr>
<td>Total</td>
<td>127</td>
<td>100.00</td>
<td>100.00</td>
<td>265</td>
<td>100.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

aData on 1958 have been furnished from source material of (90).
TRANSFER OF FARMLAND WITHIN GENERATIONS

Family assistance in acquiring ownership of farmland resources is becoming increasingly more important in Iowa, as has already been pointed in the seventh chapter. The most important way this assistance takes shape is the intra-family farm transfer. However, serious problems confront the farm family when there are conflicting objectives and continuity of rights in farm property.

Most farm families would like to keep their farm within the family and help their children who want to farm get started at an early age. However, most Iowa farm families have only one farm but two or more children. How all the children can be treated fairly without breaking up the farm or the heir remaining on the farm with a heavy mortgage (assumed to pay his brothers and sisters) is the dilemma the farm parents will have to face sometime. To resolve the problem of transferring the farmland within generations, it is important to specify the objectives to be achieved and consider all the alternative means in reaching these objectives.

Intra-family Transfer Objectives

Obviously, each farm family may have certain specific objectives in mind when planning for transfer of farm property and it is difficult to generalize for the individual case. However, intra-family farmland transfer objectives may be generalized into nine categories of which one or more may be appropriate for the individual case. These nine categories (68, p. 8) are:

1) To provide sufficient income for the parents during the rest
(2) To treat all children fairly;
(3) To help one or more of the children start farming;
(4) To keep the farm within the family;
(5) To maintain continuity in farming operations between generations without dispersing the herds, flocks, land, and improvements built up over a lifetime;
(6) To reward certain children for special favors or contributions to parents' welfare or for improvement of the farm;
(7) To indicate to prospective heirs what to expect relatively early in life so they can plan their lives accordingly;
(8) To minimize estate settlement costs; and
(9) To minimize all taxes to the family, including gift, inheritance, estate, and income taxes.

In any particular case, these objectives may lead to conflicts and an acceptable resolution of all ends to all the parties concerned may depend on the trade-offs between the objectives. Suppose a specific farm family has objectives 2 through 5 in mind when they leave their farm to one of their four children. It may be that the son who chooses to remain in agriculture must mortgage the farm to pay off equal shares to his three brothers and sisters. If this results in excessive debts beyond the ability of the heir in agriculture to amortize, the family farm may be lost, thus not achieving objective 4.

When farm families have no specific objectives in mind and when no plans are made for eventual transfer of farmland property, expensive and
extended estate settlements as well as excessive taxes may result. The farm may have to be divided into uneconomic units or the going concern value of the farm may disintegrate through a dispersal sale required to settle the estate (68, p. 4). The importance of planning in farm transfer between generations is emphasized by the above example. The most appropriate means to achieve the objectives of transferring the family farm is not within the limits of this study and will not be pursued any further. Rather our concern is to identify various methods of intra-family transfers and to see if the use of wills, transfer plans, and family assistance has been increasing in Iowa compared to the last decades.

Transfer arrangements

There are essentially three kinds of transfer arrangements: (1) inter-vivos transfer--transferring property prior to the death of the owner, (2) transferring ownership by will to be implemented at the death of the owner, and (3) transferring property according to laws of descent.

Farmland owners who are not indifferent to the disposition of their ownership rights will have to choose a plan based on the first or the second alternative above. When a farm owner dies without leaving a specific plan or will behind, his property is distributed among his spouse and heirs-at-law according to a fixed plan based on the state statutes (68, p. 16). Naturally, this form of a transfer arrangement, i.e., according to laws of descent, is the least desirable one if the owner has specific objectives in mind. Furthermore, the property may pass on to distant relatives and even if not, involves costly settlement
arrangements or inconveniences.

Contrary to the third, under first and second alternatives, the owner can plan his transfer of ownership rights and maximize his objectives outlined in the previous section. To this end, inter-vivos transfer has great advantages over the use of a will. This is especially true when the next generation can get the resources sufficiently early in their lives so as to enable them to combine the talent of the older generation together with their own knowledge to develop the farm resources efficiently. The possible disadvantage of such a transfer plan arises from the older generation's viewpoint. Aside from the moral or psychological factors (such as, the belief that a person should acquire ownership by his own toil and "hard work" or reluctance to part with things acquired), there is a strong economical disincentive consideration. In most cases, the family farm represents not only the source of present living expenditures but also the accumulation of savings stored up for use in the future, i.e., the income of the farm parents until their death. If the older generation depends on this resource for their future income, their reluctance toward transferring the property to the next generation prior to death is understandable.

Extension of Social Security payments to farmers may have the effect of facilitating inter-vivos transfers since the economic disincentive factor is eliminated to a great extent. This point will be analyzed further in the next sections.

A will is another form of planned transfer of property to the next generation. A will is made for the purpose of disposing the owner's
property at death according to his wishes. The law is quite free of restrictions on an owner's right to dispose of his property by will. A few restrictions exist, the major limitation being the prevention of a surviving spouse of a share of property. In other words, the surviving spouse is entitled to a share no less than the laws of descent would have provided (68, p. 19). Otherwise he or she may reject the will and get the share according to law. Whether the use of wills as a transfer plan has been increasing in Iowa is another point that will be dealt with in the next sections.

**Differences in farm organization on intra-family transfer methods**

Transfer methods discussed in this section can be used during life, or by will at death, or a combination beginning during lifetime but completed only after death. The objective in all cases is transferring land as a unit within the family to one or more heirs while at the same time providing enough income (or inheritance) for other persons involved.

Some of the most important intra-family transfer methods (68, p. 23) are: (1) sale of property, (2) sale and gift combined, (3) life estate, (4) joint tenancy, (5) tenancy-in-common, (6) private annuities, (7) commercial annuities, (8) life insurance, (9) trusts, (10) partnerships, and (11) corporations.

As can be observed, the list of tools of intra-family transfer methods is extensive and can also include lease with an option to buy. Each of the methods provided above may have definite advantages over the others, depending on the particular situation. However, as far as the form of organization is concerned, all except the last two methods are
concerned with sole proprietorship. Joint tenancy and tenancy-in-common are joint ownership forms, close to partnership arrangement. In fact the latter could be combined with a father-son partnership form.

The first two methods—sale of property and sale and gift combined—are the simplest ways of transferring ownership. If the heir has accumulated savings, he can provide the full payment and the parents together with other heirs can get their share at once. In most cases, however, other sale arrangements could be worked out with payments spread over time at low or no interest. This transaction could be effected by a purchase contract or a deed and mortgage. The second method is essentially the same except a portion of the property is given as a gift.

Life estate is the third method whereby the son is assured to receive the farm at the death of his parents while the latter reserve a life estate or life use. Accordingly, while the son actually owns an interest in the land, the right to use it belongs to his parents in their lifetime. However, life estate will have to be combined with other methods in order to provide for other heirs.

Joint tenancy and tenancy-in-common are forms of joint ownership whereby several persons can own the same farm in undivided shares. The important distinction between these two methods is that in the former, the surviving owner has a right to the whole farm since equal shares of all other owners pass to him at death, whereas no such right exists for tenancy-in-common. In this last method, each share is owned outright and passes to the heirs of the owner and not to other shareholders. The danger of using these two methods as a transfer plan may arise due to the
right of each joint tenant or tenants-in-common to break up the arrange-
ment and insist on his physical share of the land. This aspect may create
an uncertainty on the farming heir which may result in disincentives for
him to invest and improve the farm.

Private and commercial annuities are two other methods of trans-
ferring the farm into the next generation and providing an income for the
parents. In the first method, the parents may transfer the farm to their
son in return for a promise to pay an annual sum for their life. Or a
flexible arrangement could be worked out where the son may pay according
to the yearly income of the farm. The parents can retain the right of
foreclosure if the payments are not paid, thus providing them the neces-
sary security. A commercial annuity differs from a private one in that
it is purchased from an insurance company by the heir who pays the costs.
In return the insurance company assumes the obligation of regular monthly
or annual payments to the parents named in the contract. Life insurance
is another method which can be used in family plans to settle claims. The
objective here is to prevent sale or mortgage of the farm due to the
owner's death. The son then may insure his father's life and collect the
insurance at the latter's death in order to provide the purchase money for
buying the farm and settling all other claims.

A trust is another useful method to handle the transfer problems of
the farm to the next generation. "A trust is an arrangement whereby the
management, control, and legal title to property is placed in one person,
the trustee, who manages or operates the property for the benefit of other
persons, the beneficiaries" (68, p. 29). In many respects, this form of
transfer has a lot of advantages when there are several heirs (especially minors) involved. Thus the operations of the farm as a going concern might not be hampered whereas the shares of all heirs are protected. However, the liability and responsibility of a trustee should be clearly and effectively determined prior to the formation of a trust. Otherwise, costly legal problems may result.

Partnership in agriculture can also be effectively used as a tool of intra-family transfer arrangement. Operating partnership between father and son can be extended whereby the son is permitted to buy the father's interest over the years. The father may sell his shares to the son until the minimum point is reached consistent with the income he expects out of this partnership. The son can purchase the father's interest at death and agree to pay his mother and other persons who would inherit the father's interest. O'Byrne et al. argue that:

Properly planned, the farm partnership with a buy and sell agreement is an effective and flexible device that can be adjusted to suit the needs of the family and particularly to provide some inheritance for the nonfarming members of the family without dividing the land itself (68, p. 31).

Corporations in agriculture have great advantages as far as a tool of intra-family farm transfer plans are concerned. The obvious advantage is that it converts the physical resource shares of the diverse owners to readily transferrable certificates without disturbing the functional unit of the farm. A father may incorporate his farm and in return be hired as a manager by the corporation which issued all shares of stock to him. His son can also be hired by the corporation and his interest in the farm can be increased as he purchases his father's share of stock of the
corporation. The remaining share of the father could be left to other members of the family at his death with options for the son to buy. Thus, like the partnership arrangement, efficient operation of the farm is assured while all other members of the family are protected for their share without destroying the unity of the farm. Besides their limited liability provisions which were discussed earlier, farm corporations have definite advantages in intra-family transfers. These two points, together with tax advantages, are making them increasingly interesting to Iowa farm owners.

Transfer Plans of Iowa Farmland Owners

The objective of identifying intra-family transfer plans of Iowa farmland owners is delimited into two hypotheses: 5.a, which states that individual transfer plans are on the rise, and 5.b, which states that social security payments to farmers are encouraging receivers to retire earlier, providing opportunities for transfer of land ownership to the younger generation. The problematic gap with respect to the former delimited hypotheses is treated in this section below while the latter in the next section.

Facilitating transfer arrangements

While discussing the differences in farm organization on intra-family transfer methods, the possible use of operating partnership arrangements as one tool of inter-vivos transfer has already been mentioned. Is this form of an arrangement being used to facilitate intra-family farm transfers? In other words, diagnostic hypothesis 5.a.1, which states that
landlords rent their lands to their immediate family members so as to acquaint them with farming and eventually help in transfer of farmland to the next generation, is tested. Table 49 presents the percentage of landlords reporting land rented to sons or sons-in-law.

It can be observed in Table 49 that compared to 1958 there has been a very significant decline in the percentage of landlords who rent their lands to their sons or sons-in-law. Compared to 1946, however, the percentage of people renting to immediate family members has not changed appreciably. These findings are difficult to interpret. It is not apparent if differences between the 1958 and 1946-1970 results are due to sampling variations or to genuine economic considerations on the part of the landlords. The findings are therefore unreliable and a statistical test of significance should be used with discretion. Even then it is apparent that a fairly good percentage of landlords are using partnership operating arrangements as an initial tool of intra-family transfer arrangements.

Diagnostic hypothesis 5.a.2 states that all owners are making greater use of individual transfer plans, both inter-vivos transfers and wills. The importance of planning for intra-family transfer arrangements has been touched upon in the first part of this chapter. In Table 50 the percentage of owners reporting transfer arrangements are presented.

It can be observed in Table 50 that individual transfer plans in Iowa have gained increasing importance since 1946. The use of inter-vivos transfer arrangements, as well as wills, has increased. The change in the latter is highly significant at the 95 percent confidence level.
Table 49. Percentage of landlords reporting land rented to sons or sons-in-law (economic areas and Iowa, 1958-1970)\textsuperscript{a}

<table>
<thead>
<tr>
<th>Economic areas and the state</th>
<th>Number of landlords reporting</th>
<th>Percentage of landlords renting to their sons or sons-in-law</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>120</td>
<td>60</td>
</tr>
<tr>
<td>2</td>
<td>86</td>
<td>39</td>
</tr>
<tr>
<td>3</td>
<td>114</td>
<td>29</td>
</tr>
<tr>
<td>4</td>
<td>115</td>
<td>87</td>
</tr>
<tr>
<td>5</td>
<td>123</td>
<td>30</td>
</tr>
<tr>
<td>6</td>
<td>81</td>
<td>58</td>
</tr>
<tr>
<td>7</td>
<td>143</td>
<td>95</td>
</tr>
<tr>
<td>Iowa</td>
<td>782</td>
<td>398</td>
</tr>
</tbody>
</table>

Iowa, 1946 665 27.0 30.0 19.0

\textsuperscript{a}Data on 1946 and 1958 in (90, p. 35).
Table 50. Percentage of owners reporting inter-vivos transfers and plans for land transfers (Iowa, 1946, 1958 and 1970)

<table>
<thead>
<tr>
<th>Nature of transfer</th>
<th>Number reporting</th>
<th>Percentage of owners reporting ownership transfers and plans for transfers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inter-vivos transfer</td>
<td>961</td>
<td>1664</td>
</tr>
<tr>
<td>Have made out wills</td>
<td>1093</td>
<td>1915</td>
</tr>
<tr>
<td>Have made other^a definite plans to transfer ownership</td>
<td>--b</td>
<td>725</td>
</tr>
</tbody>
</table>


^b Data on 1946 not available.

The percentage of owners who have reported to have used inter-vivos transfers are quite small although it shows a slight increase over 1958. This percentage does not reflect the true situation, however, since only the landowners who had transferred some of their land already are included. Individuals who have transferred all of their lands are no longer farmland owners and therefore did not enter the sample. It is expected that the actual percentage of inter-vivos transfers is much larger than is shown in Table 50.

It is seen that the great majority of Iowa farmland owners (almost 80 percent) have some plan to transfer their rights of ownership to the younger generation. In light of this evidence, the diagnostic hypothesis
The existence of a will and the age of a farmland owner is positively correlated as can be expected. But it was hypothesized in 5.a.3 that younger owners prepare wills more frequently than in the past. The reason for this diagnostic hypothesis is the increasing awareness on the part of all owners to plan for an orderly transfer of the family farm in case of an unexpected event.

The distribution of percentage of owners with wills in each age group is shown in Table 51. This distribution is surprisingly similar to the one obtained in 1958. The oldest group of owners (65 years old and older) are barely significant at the 90 percent confidence level from the same group of owners in 1958. Compared to 1946, however, this group of owners does not indicate significant change. The difference between 1958 and 1970 for these owners can probably be attributed to sampling variation. The results of tests of significance of differences are negative and the diagnostic hypothesis is rejected.

The occupations of farmland owners are expected to affect the transfer plans. Since farmers, as opposed to nonfarmers, have a greater interest in their own lands, they should make greater use of transfer plans as stated in diagnostic hypothesis 5.a.4. The results of these findings did not support the above hypothesis, as can be observed in Table 52.

Farmers as a class have very significantly less members who have prepared a will compared to business and professional men. In this respect, only laborers have very significantly less of their members who
Table 51. Percentage of owners reporting wills within age groups (Iowa, 1946, 1958 and 1970)\textsuperscript{a}

<table>
<thead>
<tr>
<th>Year</th>
<th>Number reporting</th>
<th>(\leq 24)</th>
<th>25-34</th>
<th>35-44</th>
<th>45-54</th>
<th>55-64</th>
<th>(\geq 65)</th>
<th>All ages</th>
</tr>
</thead>
<tbody>
<tr>
<td>State, 1946</td>
<td>340</td>
<td>(\Delta)</td>
<td>1.0</td>
<td>10.0</td>
<td>22.0</td>
<td>26.0</td>
<td>41.0</td>
<td>1093</td>
</tr>
<tr>
<td>State, 1958</td>
<td>1105</td>
<td>0.1</td>
<td>3.2</td>
<td>13.2</td>
<td>22.2</td>
<td>26.5</td>
<td>34.8</td>
<td>1120</td>
</tr>
<tr>
<td>State, 1970</td>
<td>2846</td>
<td>--</td>
<td>3.01</td>
<td>11.15</td>
<td>22.27</td>
<td>25.64</td>
<td>37.93*</td>
<td>2894</td>
</tr>
</tbody>
</table>

\textsuperscript{a}Data on 1946 and 1958 in (89, p. 89).

\textsuperscript{b}Less than 0.05 percent reported.
Table 52. Percentage distribution by occupation of farm owners and of owners reporting wills (Iowa, 1946, 1958 and 1970)*

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Percentage of owners reporting wills</th>
<th>Percent of owners with wills compared to their own occupation, 1970</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1946</td>
<td>1958</td>
</tr>
<tr>
<td>Farmers</td>
<td>41.6</td>
<td>45.5</td>
</tr>
<tr>
<td>Retired farmers</td>
<td>28.1</td>
<td>19.1</td>
</tr>
<tr>
<td>Housewives</td>
<td>5.1</td>
<td>7.0</td>
</tr>
<tr>
<td>Business and professional</td>
<td>13.7</td>
<td>22.2</td>
</tr>
<tr>
<td>Laborers and others</td>
<td>4.5</td>
<td>6.2</td>
</tr>
<tr>
<td>Number reporting</td>
<td>313</td>
<td>991</td>
</tr>
</tbody>
</table>

*Data on 1946 and 1958 in (89, p. 93).
have planned for transfer of lands. A high number of retired farmers and housewives, as can be expected, have planned for eventual transfer of their land. This high percentage of planning for these groups can be accounted for by their old age.

Changes over time with respect to the percentage of owners with wills have indicated significant reallocations between occupation groups. The first three columns identify the increasing use of wills by housewives and laborers with declines in retired farmer and business groups. This observation is another manifestation of the changing ownership shares of each occupation group over time.

Social security payments and transfer plans

Older generations regard their family farm as their stored up wealth to be consumed throughout their remaining lifetime. In the earlier sections of this chapter this fact has been mentioned as the most important economic disincentive for inter-vivos transfers. A reliable and continuous income throughout the remainder of a farmland owner's lifetime may just be the required factor to facilitate inter-vivos transfers. Social security payments can serve this purpose very suitably. Therefore, this last section delimits the problem with respect to social security payments and its effects on transfer plans, as stated in diagnostic hypothesis 5.b.

It is expected that the receipt of social security payments by farmers encourages retirement by age 65, which has been formulated as diagnostic hypothesis 5.b.1. The use of social security and its influence on retirements is presented in Tables 53 and 54.
Table 53. Percentage distribution of farmers 50 years or older according to social security and retirement status (Iowa, 1970)

<table>
<thead>
<tr>
<th>Social security status</th>
<th>Have retired from farming</th>
<th>Have not retired from farming</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percent</td>
</tr>
<tr>
<td>Receive payments</td>
<td>139</td>
<td>28.99</td>
</tr>
<tr>
<td>Do not receive payments</td>
<td>653</td>
<td>89.22</td>
</tr>
</tbody>
</table>

The findings of Table 53 are very interesting. It is observed that farmers 50 years or older who receive social security payments have retired from farming (probably) very significantly higher than comparably aged farmers who do not receive payments and have not retired from farming yet. But looking at the data from a different perspective, it is seen that farmers who do not receive social security payments indicate retirement from farming very significantly more than those who do receive payments! There is a contradiction in these findings which may be explained by arguing that while social security payments contribute to early inter-vivos transfer between generations, other factors, such as farmer's health, philosophy of life and work ethic, may be more important in individual circumstances.

Farmer's use of social security payments by retirement age (Table 54) can also be utilized in testing the above diagnostic hypothesis 5.b.1. It can be observed from this table that farmers as a whole have started
Table 54. Use of social security payments by retirement age of farmers (Iowa, 1958^a-1970)

<table>
<thead>
<tr>
<th>Retirement age</th>
<th>Receive payments</th>
<th>Do not receive payments</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>0.6</td>
<td>0.92</td>
</tr>
<tr>
<td>50-54</td>
<td>0.3</td>
<td>1.84</td>
</tr>
<tr>
<td>55-59</td>
<td>3.3</td>
<td>4.47</td>
</tr>
<tr>
<td>60-64</td>
<td>11.6</td>
<td>23.82**</td>
</tr>
<tr>
<td>65-69</td>
<td>52.4</td>
<td>49.54</td>
</tr>
<tr>
<td>70-74</td>
<td>23.0</td>
<td>12.97**</td>
</tr>
<tr>
<td>75-over</td>
<td>8.8</td>
<td>6.44</td>
</tr>
<tr>
<td>Number reporting</td>
<td>120</td>
<td>321</td>
</tr>
</tbody>
</table>

^a Data on 1958 in (89, p. 97).
retiring at an earlier age in 1970, as compared to 1958. However, there is no indication that social security payments have caused an inducement for this fact. In fact the evidence is to the contrary; close to 70 percent of the owners who receive social security payments retired 65 or older, as compared to only about 19 percent for the nonreceivers of social security. The diagnostic hypothesis tested is inconclusive on social security payments and its effect on retirement age, since the number of respondents were few to make a statistically safe argument.

The direct effect of social security payments for all owners on the transfer of ownership to next generations is formulated as diagnostic hypothesis 5.b.2 and presented in Table 55.

Table 55. Percentage of owners who have and have not transferred ownership to their children by social security status (Iowa, 1958-1970)

<table>
<thead>
<tr>
<th>Social security status</th>
<th>Number reporting</th>
<th>Have transferred ownership (percent)</th>
<th>Have not transferred ownership (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receive payments</td>
<td>187</td>
<td>456</td>
<td>5.8</td>
</tr>
<tr>
<td>Do not receive payments</td>
<td>1148</td>
<td>1488</td>
<td>1.9</td>
</tr>
</tbody>
</table>

aData on 1958 data in (89, p. 99).
From the above table it can be observed that from 1958 to 1970 there has been an increase in the number of owners who receive social security payments and have transferred ownership of some of their lands. However, this increase is not statistically significant. This observation again neglects the number of owners who have transferred all their lands and therefore did not show up in the sample. The actual percentage of the transferred ownership figure should be higher, but by how much is not known.

With respect to the diagnostic hypothesis, one cannot support or reject it since the evidence is not conclusive. Evidence, however, indicates that there may be some positive relationship between social security payments and farmland transfers. In depth research in this area is needed to identify the magnitude of this relationship.

The last diagnostic hypotheses, 5.b.3, states that farmers receiving social security payments are adopting inter-vivos transfers more often than those who do not receive social security payments. This hypothesis is tested for 1970 and the findings are presented in Table 56.

A cross classification of farmers reporting with respect to the nature of transfer and social security status has fallen below the statistically acceptable levels and therefore no test has been performed. However, indications are such that as far as inter-vivos transfers (or nature of transfers) alone are concerned, there exists no significant difference between receiving social security payments and not receiving. The data on this problem consists of a very small sample, as has been mentioned earlier already, and therefore no statistically conclusive results are to be expected or attempted.
Table 56. Transfer plans of farmers 50 years or older according to their social security status (Iowa, 1970)

<table>
<thead>
<tr>
<th>Nature of transfer</th>
<th>Social security status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Receive payments</td>
</tr>
<tr>
<td></td>
<td>Number</td>
</tr>
<tr>
<td>Inter vivos transfers</td>
<td>27</td>
</tr>
<tr>
<td>Have made out wills</td>
<td>253</td>
</tr>
<tr>
<td>Have made other plans</td>
<td>8</td>
</tr>
<tr>
<td>Have made no plans</td>
<td>51</td>
</tr>
<tr>
<td>Total reporting</td>
<td>339</td>
</tr>
</tbody>
</table>
SUMMARY AND CONCLUSIONS

The farmland ownership norm has remained an important goal of rural Iowans. In order to test the degree of achievement of this norm, the problematic gap between the existing situation and the achievement norm has to be identified. Then the diagnostic hypotheses formulated have been tested to see if they have contributed to widening or narrowing this gap.

The primary objective of the study was to evaluate the conflict between the pressures of rapid technological innovations which are leading to increased resource requirements and the ownership norm of the society. The investigation is conducted in two parts. The first part concentrated on the identification and measurement of factors influencing tenure of farmland owners. The second part concentrated on the determination and changing characteristics of the Iowa farmland owners.

The whole state of Iowa was selected as the area of investigation. From ASCS records in each county, a statistically representative sample of farmland owners were drawn. These farmland owners were divided into individual or institutional owners, depending on the form in which the farmlands were held. If farmlands were owned by corporations, estates, city, town or federal governments or institutions, such as churches and schools, then they were mailed an institutional questionnaire. In all other cases they were mailed an individual questionnaire. Both sets of schedules returned were edited prior to assignment of statistical weights and tabulations. The results of the findings, according to various characteristics of farmland owners, are exhibited in the tables of the previous chapters. These findings are statistically tested for
significant differences at 95 and 90 percent confidence levels and, if so, are identified with two stars (**) and one star (*), respectively.

In identifying the tenure patterns of farmland owners the technique of discriminant analysis was used. The reason for the use of this method was to distinguish between the four tenure groups optimally. These four tenure groups consisted of: (1) full-owner operators (FOO)—owners who operate only the land they own, (2) part-owner operators (POO)—owners who own and operate their lands but rent additional lands, (3) operating landlords (OL)—who operate part of their land and rent out the rest, and (4) nonoperating landlords (NOL)—who rent all the land they own and operate none. Identification of at least three distinct tenure classes was expected: (1) owners, (2) operators, and (3) nonoperators. The first to be formed by FOO, the second by POO and OL, and the third by NOL, since each expected class, if sufficiently homogenous, had to have an entirely different objective function that is maximized. The owner's objective function was expected to have consisted primarily of obtaining ownership of debt-free title to land, while this function was expected to be maximizing profits for the operators and maximizing rent income for the nonoperators.

The findings did not confirm the expectations and the first three tenure groups, FOO, POO and OL, formed the operators class. This result casts doubt to the overriding importance of the norm of ownership, at least in the short run. Because characteristics of operatorship have been the strongest linking force between these tenure members, as opposed to ownership, the last tenure group, as expected, formed the nonoperator
tenure class.

A discriminant analysis performed on operator and nonoperator classes of owners has successfully classified farmland owners into their declared tenures. The rate of successful classifications was 70 percent for the operators and 79 percent for the nonoperators. The misclassified owners were identified as "borderline owners" if they exhibited some of the characteristics of the opposite class, as opposed to their declared class, but still retained their class identity. However, there were still a minority of owners, less than 7 percent, who strongly indicated belonging to the opposite class instead of their declared class, and these owners have been identified as "response likely" owners. These are the owners who are expected to change tenure status within a foreseeable future. Thus the analysis has been extended to predicting the owners who are likely to change their tenure status, that is, predicting who will become operators or, conversely, nonoperators.

The second part of the study concentrated on identification of the characteristics of Iowa farmland owners in 1970 and tested for significant changes on these since 1946. Two previous studies (90 and 95) on Iowa farmland ownership have been utilized in reaching this objective. Changing characteristics of Iowa farmland owners are studied under the above mentioned four tenure groups, occupations, acquisition and transfer methods since 1946. Ownership concentration and farm size were treated in one separate chapter in order to identify the effects of increased pressures of economic size adjustments on the farm ownership situation. Separate tables have been prepared to identify the changes in the
characteristics of the institutional farmland owners.

The results of the second part of the study indicate that farmers are still the majority (60 percent) of Iowa farmland owners. Although the nonoperator landlords' share of the control of ownership of total farmland is more than any other tenure group (over 41 percent owned), it has declined significantly from the findings of 1958. A similar observation is true for the full-owner operators who indicate a decline in their ownership share, from 37.6 percent in 1946 to close to 30 percent. The compensating increases in the share of part-owner operators and operator landlords provide new evidence to the increasingly important goal of operatorship at or close to minimum cost acreages rather than ownership norm.

The distribution of owned acres between farmland owners has become slightly more uneven for the state since 1958. This same observation is true for the distribution of the value of owned land between owners. However, the difference in the rate of change of concentration between economic areas since 1958 is very noticeable. The increases in ownership concentration are largest in grain areas (3 and 4) where it is around 23 percent, as opposed to a minimal 2.5 percent, in pasture and dairy areas (5 and 6). Livestock areas have shown variability with a minimum increase in the ownership concentration of 1.5 percent in the Northwest (area 1) and a maximum increase of 14.3 percent in the Southwest (area 2) while the East (area 7) indicates a middle range of 8.5 percent. Even with the increasingly uneven distribution of owned land between the number of owners and the consequent increases in the concentration, Iowa still ranks
close to the least concentrated state as compared to the Great Plains states.

Both the size of an economic farm and the consequent adjustments required by the owner seeking full-owner operatorship are increasing. In other words, ownership acres in all economic areas are significantly lower than the expected minimum cost acreages, and thus an owner is pressured into buying additional land resources if he wants to reach the norm of ownership and be economically competitive at the same time. As a result, part-owner operatorship is gaining increasing importance. These owners utilize their own lands and rent additional lands in order to reach an economically efficient farm size. This observation again supports the thesis of the first part of the study, namely that operatorship, rather than the ownership of land, has become the goal.

The agricultural ladder concept was developed to explain the various stages of tenure an individual progresses through in becoming a farmland owner. It was decided to test if farmland owners were still utilizing the agricultural ladder or if new means leading to ownership had evolved. Evidence indicates that there has been a very significant drop in the percentage of all owners who used the agricultural ladder from 58.8 percent in 1958 to 53.7 percent in 1970. The new methods leading to ownership are indicated to be nonfarm occupation and then direct nonoperator landlordism. In other words, the increases in the percentage of people who indicate no agricultural experience and yet farmland ownership indicate transfer of lands to nonfarm owners through inheritance or outright purchase by these owners. It is also interesting to note that part-owner
operators have very significantly indicated to have increased using the basic agricultural ladder, from 67.5 percent in 1946 to 82.44 percent for 1970. Similar but modest increases are observed for the full-owner operators.

Acquiring farmlands without family assistance is becoming less and less possible in Iowa. Although still the majority of the owners purchase the land they have bought, 63 percent in 1970 as opposed to 70.9 percent in 1958, some combinations of gifts and inheritance with purchase are increasingly used. The fact that purchasing from relatives only is also considerable and should indicate monetary or nonmonetary assistance rendered to the new owner. A considerable portion of the nonoperator landlords, 17.5 percent, have received their lands solely by gift and inheritance. The comparable figure is less than 6 percent for owner-operators or part-owner operators. This is one evidence to suggest that nonoperator landlords have obtained ownership in the course of farm settlement between generations and have not actually sought it.

The importance of planning for transfer of farmlands between generations is understood by the Iowa farmland owners. In order to attain the specific objectives of farmland transfers between generations, the owners have been using wills increasingly. The percentage of people who indicated making wills increased from 31.3 percent in 1946 to 58.3 percent and 70.8 percent in 1958 and 1970, respectively. There is also a slight increase in the percent of owners who have utilized inter-vivos transfers. The effects of social security payments on retirement plans of farmers are hard to evaluate. There is an indication that social security receivers
have retired from farming more often than the farmers who do not receive payments and have not retired. However, the majority of the retired farmers do not receive social security payments. The results are not conclusive and the data is not sufficient to make statistically reliable comparisons.

It can be concluded that significant changes as to the norm of ownership and the characteristics of the Iowa farmland owners were identified. An evaluation of the norm of ownership is needed for further studies before accepting it as the goal of society and delimiting the problematic gap within its boundaries. The evidence of this study indicates that, at least in the short run, the norm has become operatorship at the minimum cost acreage rather than full-ownership of resources. In order to achieve an economically efficient operating unit, farmers have been renting additional land. This process naturally increases the importance of the part-owner operator who may or may not use this tenure stage in reaching the ownership norm in the long run.

The common fears of nonfarm related landlords owning most of Iowa farmlands have not materialized. However, getting established in farming is becoming increasingly more difficult for the younger generations. Some form of family assistance has almost become mandatory in order to ever hope to acquire farmlands. Public lending policies should be adjusted so as to provide an equal opportunity for the tenant with no family assistance. The changes that can be made to improve purchase methods and the effects of using combinations of purchase contract and mortgage methods would be areas for further study.
The role institutional owners are playing, especially corporations, in widening the gap between the achievement of the ownership norm and the existing situation is another area for study. Providing security of income for the older generation and therefore promoting inter-vivos transfer of farmlands to younger generations, is among the many important problems of Iowa agriculture that are left unanswered, waiting for further detailed studies.

Remedial measures in closing the gap between the ownership norm and the existing situation consists of designing policies promoting younger generations easy access to land resources early in their lifetime. To this end changes in acquisition methods would be helpful. The new methods should require less down payments from the would-be-farmland owner but credit policies should be designed based more on his potential productivity. New and imaginative approaches to credit policies are necessary if potential farmers are to rely less on gratuities from their families.

Another remedial hypothesis consists of finding positive inducements for older generation of farmland owners to transfer their lands to younger generations. Social security payments is one possible method of providing steady income for older generations. Other methods, such as partnership between father and son where the latter over the years buys the share of the former and pays it in yearly installments, thus providing a continuous stream of income for the father. This is another possible inter-vivos transfer arrangement which promotes farmland ownership at an early age. Other possible methods of arrangements should be explored for achieving
the ownership norm.

The increasing role of part-time farming and part-owner-operatorship in Iowa is another indication of the magnitude of the problematic gap. Remedial measures in this area are related to agricultural price levels and low farm incomes. The solutions to these problems with respect to ownership norm is related to long-term structural changes in U.S. agriculture. The end result of these changes may not only be a lower number of farms and farmers, but a different organization of agricultural units, such as the family farm corporation. The impact of price and income policies in agriculture should be evaluated for its contribution in achieving the ownership norm, as well as its role in affecting the organization of agricultural units.

Finally, increasing concentration of ownership necessarily widens the gap between the existing situation and the norm of ownership. If the trend of increasing concentration of farmland ownership continues, an equal access to farmlands for the would-be-farmers becomes difficult if not impossible. In order to prevent further accumulation of farmlands in the hands of a few farmland owners, policies of direct and progressive taxation of farmlands could be implemented. Specific fiscal policies could also be used effectively as a negative inducement for the nonoperator landlord who is interested in Iowa farmlands for investment and speculative purposes.


44. _______ and Hines, William N. Installment land contracts in Iowa. Univ. of Iowa Agricultural Law Center. Monograph No. 5. 1965.


64. Motheral, Joe R. The family farm and the three traditions. J. Farm Econ. 33: 514-529. 1951.


77. Raup, P. M. What policies should we have toward corporations in farming? Department of Agricultural Economics, University of Minnesota, Institute of Agriculture. Staff Paper P69-25. 1969.


93. Timmons, John F. Farm ownership in the United States: an appraisal of the present situation and emerging problems. J. Farm Econ. 30: 78-100. 1948.

94. ________. Methods of inquiry into land problems. Mimeo. Ames, Iowa, Iowa State University of Science and Technology, Department of Economics. circa 1957.


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Last but not least to my wife Zeynep and my son Bora goes my deepest affection and sincere appreciation for putting up without me during long and lonely days and nights.
APPENDIX A

Iowa Land Ownership Survey
Individual Questionnaire

A. 1. How many acres of farm land do you (and your wife or husband) own in Iowa? Include land mortgaged or land in which you own only an interest as well as land owned free of debt. ________ acres

   a. How many of these acres in "A.1." above do you (and your wife or husband) own as sole owner(s)? ________ acres

   Of these solely owned acres:

   (1) How many acres are you buying under purchase contract or contract for deed? (Do not include mortgaged land) ________ acres

      (a) How much debt is still owed? $________

   (2) How many acres are mortgaged? ________ acres

      (a) How much debt is still owed? $________

   (3) How many acres are fully paid for? ________ acres

   b. How many of the acres in "A.1." above do you have a life estate in? (Life estate refers to land which you own and control during your lifetime, but cannot sell, trade, or otherwise transfer) ________ acres

   c. How many of the acres in "A.1." above are in unsettled estates (other than life estate), partnerships, or other undivided interest? ________ acres

   Total acres from a, b, and c (should agree with acres in "A.1.") ________ acres

B. How much do you think all of your Iowa farm land including present buildings would sell for? $________

C. How many acres of your farm land did you (and your wife or husband) acquire through:

1. Purchase from relatives? ________ acres

2. Purchase from others? ________ acres

3. Gift? (other than inheritance) ________ acres
4. Inheritance of full interest? _______ acres

5. Inheritance of part interest and purchase of rest from others? _______ acres

6. Inheritance of part interest without purchase of rest from others? (Report total acres, not just your share) _______ acres

7. Other? _______ acres
   a. Please explain "other". ____________________________________

Total acres (should agree with acres in question "A.1.") _______ acres

D. 1. Have you ever received money (including proceeds from the sale of property) through gift, will or estate settlement?  
   Yes______ No_______
   a. If yes, did this enable you to purchase, improve or operate any of your land? Yes______ No_______
   b. If yes, about how much of this money did you use for this purpose? $_______

E. 1. Are you actually farming (by yourself or with hired labor) any of the land you own in Iowa? Yes_______ No_______
   a. If yes, how many of the acres you own do you operate? _______ acres

2. Do you rent out any of your Iowa farm land to others? (including livestock-share partnership or lease) Yes_______ No_______
   a. If yes, how many acres do you rent to others? _______ acres
   b. If yes, how many different farms or tracts do you rent to others? _______ number
   c. If yes, how many of these farms or tracts do you rent to sons or sons-in-law? _______ number

3. If you rent land to others, is any of this land supervised by a professional farm management service? Yes_______ No_______
   a. If yes, how many acres? _______ acres

4. Do you farm any land which you rent from others? Yes_______ No_______
a. If yes, how many acres? ________ acres

F. 1. Have you made out a will covering your land?________ Yes No________
   a. If no, have you made other definite plans for any of your children or other relatives to eventually acquire ownership of your land?________ Yes No________

G. Is any of the land you (and your wife or husband) own in Iowa owned as a corporation? (incorporated under Iowa Law)________ Yes No________

H. 1. How many children do you have? ________ number

   2. Have you already transferred ownership of any land to your children?________ Yes No________
      a. If yes, how many acres? ________ acres

I. 1. If you have ever operated a farm, have you retired from farming by turning over most or all of the farm work and management to someone else?________ Yes No________
      a. If yes, at what age did you retire? ________ age (or ______ year)

   2. Do you receive social security benefits based on past farming operations?________ Yes No________

J. Has or will some member(s) of your family or other relative take over or continue the actual operation of your farm?________ Yes No________ Don't Know________

K. 1. At what age did you first own land? ________ years

   2. Since you were 14 years old have you spent any time:
      a. working with or without wages on your parent's farm?________ Yes No ________ If yes, years ______
      b. working on other farms as a hired hand?________ Yes No ________ If yes, years ______
      c. working full time at nonfarm employment, including armed services, school, etc.?________ Yes No ________ If yes, years ______
      d. operating a farm either individually or in partnership with others?________ Yes No ________ If yes, years ______
If yes, for how many of these years did you:

(1) rent from others all the land you farmed? ________ years
(2) own all the land you farmed? ________ years
(3) own part and rent part of the land you farmed? ________ years

L. 1. How is your land owned?

   a. By husband and/or wife, jointly or separately ________ acres
   b. As a single woman (including widow or divorced) ________ acres
   c. As a single man (including widower or divorced) ________ acres
   d. In joint ownership, other than with husband or wife ________ acres

   Total acres (should agree with acres in question "A.1.") ________ acres

   (1) Explain nature of joint ownership of land entered in d. above

   (2) How many people, other than yourself and your husband or wife, have ownership interests in this land? ________ number

   (3) How many of these people live in states other than Iowa? ________ number

M. General Information:

1. What is your present age? ________ years

2. Are you single _______, married _______, widow or widower ________?

3. What is (was, if retired) your principal occupation? ________

   a. Are you retired from that occupation? Yes_______ No_______

4. Do you live on a farm? Yes_______ No_______

5. Are you depending on the land you rent to others as your principal source of income? Yes_______ No_______

6. Do you (and your wife or husband) live in Iowa? Yes_______ No_______
N. 1. On how many ASCS farms in Iowa are you listed as an owner (or co-owner)? ____________ number

2. Please complete the table below using one line for each ASCS record on which you are listed as an owner (or co-owner).

<table>
<thead>
<tr>
<th>Line</th>
<th>ASCS farm number</th>
<th>Township</th>
<th>Farm</th>
<th>County</th>
<th>Total acres listed</th>
<th>ASCS record</th>
<th>Number of other owners (other than husband or wife) listed on this ASCS record who are:</th>
<th>Residents</th>
<th>Not residents</th>
<th>Is this land in an estate? (Check appropriate column)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2</td>
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<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
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</tr>
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<td>4</td>
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</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

0. Any further information about your land ownership situation you wish to send us will be greatly appreciated: ____________________________________________________________

P. Do you want us to send you a copy of the report of this study?
Yes________ No________
A. Are you reporting for a corporation ________, estate ________, city or town ________, institution ________, or other ________?

If "other", please explain. ______________________________________

B. 1. How many acres of farm land does the corporation, institution, estate, government, etc. now own in Iowa? (Include land mortgaged or land in which only an interest is owned, as well as land owned free of debt.) ________ acres

Of these acres:

a. How many are being bought under purchase contract or contract for deed? (Do not include mortgaged land.) ________ acres

b. How many are mortgaged? ________ acres
c. How many are fully paid for? ________ acres
d. How many are owned under other ownership arrangements? ________ acres

(1) Please explain "other" ownership arrangements

C. How much do you think all this Iowa farm land, including buildings, would sell for? $________

D. How many acres of this land were acquired through:

1. Purchase? ________ acres

2. Gift from person living at time of transfer? ________ acres

3. Inheritance from estate of deceased persons? ________ acres

4. Other? ________ acres

a. Please explain "other". ______________________________________

Total acres (should agree with acres in question "B.1") ________ acres

E. 1. Is any of this Iowa land actually being farmed by hired laborers under the direct supervision and management of the corporation, institution, estate, government, etc.? Yes_______ No_______
a. If yes, how many acres are being operated in this manner? 

__________ acres

2. Is any of this Iowa land being rented to others? 

Yes__________ No__________

a. If yes, how many acres are being rented to farm operators? 

__________ acres

b. If yes, how many different farms or tracts are being rented to farm operators? 

__________ number

c. If yes, is any of this land being handled through professional farm management services? 

Yes__________ No__________

(1) If yes, how many acres? 

__________ acres

F. If you are reporting for an estate, how many of the heirs live:

1. In Iowa? _________

2. In other states? _________

3. Residence not known? _________
Table B.1. Comparison of basic characteristics of respondents to non-respondents (in economic area 4) of Iowa land ownership survey

<table>
<thead>
<tr>
<th>Item</th>
<th>Respondents</th>
<th>Nonrespondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number reporting</td>
<td>408</td>
<td>99</td>
</tr>
<tr>
<td>Acres per farm</td>
<td>134.3</td>
<td>126.2</td>
</tr>
<tr>
<td>Acres per owner</td>
<td>198.6</td>
<td>202.7</td>
</tr>
<tr>
<td>Average value of land per owner ($)</td>
<td>103,823</td>
<td>19,134</td>
</tr>
<tr>
<td>Percentage distribution by tenure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Owner-operators</td>
<td>23.66</td>
<td>21.14</td>
</tr>
<tr>
<td>Part-owner operators</td>
<td>18.11</td>
<td>17.52</td>
</tr>
<tr>
<td>Operating landlords</td>
<td>9.88</td>
<td>7.25</td>
</tr>
<tr>
<td>Nonoperating landlords</td>
<td>48.34</td>
<td>54.09</td>
</tr>
<tr>
<td>Percentage distribution by occupation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmers</td>
<td>38.67</td>
<td>36.24</td>
</tr>
<tr>
<td>Retired farmers</td>
<td>18.21</td>
<td>16.71</td>
</tr>
<tr>
<td>Housewives</td>
<td>15.48</td>
<td>16.61</td>
</tr>
<tr>
<td>Business or professional men</td>
<td>14.73</td>
<td>15.34</td>
</tr>
<tr>
<td>Laborers and others</td>
<td>12.91</td>
<td>15.10</td>
</tr>
<tr>
<td>Percentage distribution by acquisition method</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purchase from relatives</td>
<td>13.74</td>
<td>13.89</td>
</tr>
<tr>
<td>Purchase from nonrelatives</td>
<td>46.58</td>
<td>49.53</td>
</tr>
<tr>
<td>Purchase from relatives and non-relatives</td>
<td>3.72</td>
<td>1.81</td>
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<tr>
<td>Gifts or inheritance and combinations with purchase</td>
<td>35.96</td>
<td>34.77</td>
</tr>
<tr>
<td>Percentage of owners who reside in Iowa</td>
<td>85.79</td>
<td>82.48</td>
</tr>
<tr>
<td>Percentage of owners who have made wills</td>
<td>77.73</td>
<td>95.77**</td>
</tr>
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</table>
Table B.2. Average number of farms, acres or value owned and percentage distribution by owner tenure and economic areas

<table>
<thead>
<tr>
<th>Item</th>
<th>Economic area</th>
<th>Number of farm owners</th>
<th>Number of part-owner operators</th>
<th>Number of operator landlords</th>
<th>Number of nonoperator landlords</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Reporting</td>
<td>Operators</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>1</td>
<td>287</td>
<td>23.09</td>
<td>21.31</td>
<td>8.30</td>
</tr>
<tr>
<td>of farm</td>
<td>2</td>
<td>261</td>
<td>25.06</td>
<td>15.09</td>
<td>35.68</td>
</tr>
<tr>
<td>owners</td>
<td>3</td>
<td>168</td>
<td>24.22</td>
<td>22.05</td>
<td>10.18</td>
</tr>
<tr>
<td>(percent)</td>
<td>4</td>
<td>350</td>
<td>21.63</td>
<td>20.37</td>
<td>10.13</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>296</td>
<td>42.74</td>
<td>20.37</td>
<td>10.48</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>444</td>
<td>40.51</td>
<td>16.18</td>
<td>9.09</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>541</td>
<td>29.29</td>
<td>19.27</td>
<td>14.03</td>
</tr>
</tbody>
</table>

Iowa, 1958

| Number     | 1             | 597                   | 12.95                         | 11.95                       | 10.83                         | 64.27                         |
| of farms   | 2             | 521                   | 13.82                         | 8.32                        | 19.68                         | 58.18                         |
| owned      | 3             | 344                   | 14.13                         | 12.86                       | 11.88                         | 61.13                         |
| (percent)  | 4             | 678                   | 12.55                         | 11.83                       | 12.11                         | 63.52                         |
|            | 5             | 443                   | 30.07                         | 14.33                       | 16.04                         | 39.56                         |
|            | 6             | 722                   | 26.71                         | 10.67                       | 12.60                         | 50.02                         |
|            | 7             | 1001                  | 17.60                         | 11.58                       | 19.33                         | 51.49                         |

Iowa, 1970

| Number     | 1             | 2347                  | 30.72                         | 19.04                       | 11.34                         | 38.91                         |
| of farms   | 2             | 2867                  | 19.95                         | 11.04                       | 10.67                         | 64.27                         |
| owned      | 3             | 2550                  | 20.62                         | 17.91                       | 14.75                         | 46.72                         |
| (percent)  | 4             | 3890                  | 21.06                         | 19.48                       | 16.42                         | 43.04                         |
|            | 5             | 4435                  | 22.29                         | 20.62                       | 11.47                         | 45.53                         |
|            | 6             | 722                   | 22.29                         | 17.75                       | 10.41                         | 52.56                         |
|            | 7             | 1001                  | 27.25                         | 17.94                       | 15.99                         | 38.82                         |

Iowa, 1958

| Total      | 1             | 1909                  | 26.8%                         | 12.3%                       | 9.6%                          | 51.3%                         |
| of acreage | 2             | 4306                  | 18.71                         | 11.59                       | 15.18                         | 54.52                         |
| owned      | 3             | 597                   | 20.62                         | 17.91                       | 14.75                         | 46.72                         |
| (percent)  | 4             | 521                   | 22.21                         | 14.04                       | 19.00                         | 44.75                         |
|            | 5             | 344                   | 22.38                         | 20.62                       | 11.47                         | 45.53                         |
|            | 6             | 678                   | 20.55                         | 17.59                       | 15.67                         | 46.18                         |
|            | 7             | 443                   | 20.55                         | 17.59                       | 15.67                         | 46.18                         |
|            | 1             | 722                   | 39.29                         | 17.75                       | 10.41                         | 32.56                         |
|            | 7             | 1001                  | 27.25                         | 17.94                       | 15.99                         | 38.82                         |

Iowa, 1970

| Total      | 1             | 1909                  | 27.1%                         | 11.1%                       | 10.1%                         | 51.7%                         |
| of value   | 2             | 4306                  | 28.46                         | 18.48                       | 14.11                         | 38.95                         |
| of land    | 3             | 1909                  | 19.72                         | 19.84                       | 15.01                         | 45.43                         |
| owned      | 4             | 21.06                 | 19.48                         | 16.42                       | 15.36                         | 46.49                         |
| (percent)  | 5             | 22.29                 | 23.68                         | 12.22                       | 41.81                         |
|            | 6             | 22.32                 | 18.29                         | 15.36                       | 46.49                         |
|            | 7             | 37.45                 | 24.93                         | 10.88                       | 26.74                         |
|            | 6             | 38.06                 | 19.57                         | 9.84                        | 32.53                         |
|            | 7             | 27.24                 | 19.47                         | 14.83                       | 38.46                         |
Table B.2. (Continued)

<table>
<thead>
<tr>
<th>Item</th>
<th>Economic area reporting</th>
<th>Number operators</th>
<th>Owner operators</th>
<th>Part-owner operators</th>
<th>Operator landlords</th>
<th>Nonoperator landlords</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iowa, 1958</td>
<td>1888</td>
<td>27.2%</td>
<td>11.2%</td>
<td>9.2%</td>
<td>52.4%</td>
<td></td>
</tr>
<tr>
<td>Iowa, 1970</td>
<td>26.90</td>
<td>20.17</td>
<td>13.68</td>
<td>39.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>number of farms per owner (number)</td>
<td>1</td>
<td>1.0</td>
<td>1.0</td>
<td>2.3</td>
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<td>1.0</td>
<td>2.3</td>
<td>2.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.0</td>
<td>1.0</td>
<td>2.0</td>
<td>2.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.0</td>
<td>1.0</td>
<td>2.1</td>
<td>2.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.0</td>
<td>1.0</td>
<td>2.2</td>
<td>2.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.0</td>
<td>1.0</td>
<td>2.1</td>
<td>2.2</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iowa, 1958</td>
<td>1.0</td>
<td>1.0</td>
<td>2.3</td>
<td>1.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iowa, 1970</td>
<td>1.0</td>
<td>1.0</td>
<td>2.20</td>
<td>2.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>owned</td>
<td></td>
<td>177.3</td>
<td>166.8</td>
<td>352.7</td>
<td>196.1</td>
<td></td>
</tr>
<tr>
<td>acreage</td>
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<td>194.2</td>
<td>203.9</td>
<td>263.7</td>
<td>222.5</td>
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<tr>
<td>per owner (acres)</td>
<td>205.1</td>
<td>207.6</td>
<td>250.1</td>
<td>232.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>177.8</td>
<td>161.5</td>
<td>289.2</td>
<td>180.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>183.8</td>
<td>233.8</td>
<td>213.3</td>
<td>205.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>186.2</td>
<td>210.4</td>
<td>219.7</td>
<td>182.7</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>178.6</td>
<td>178.8</td>
<td>218.9</td>
<td>199.3</td>
<td></td>
</tr>
<tr>
<td>Iowa, 1958</td>
<td>1909</td>
<td>178.2</td>
<td>161.3</td>
<td>416.5</td>
<td>228.1</td>
<td></td>
</tr>
<tr>
<td>Iowa, 1970</td>
<td>184.1</td>
<td>192.8</td>
<td>247.2</td>
<td>198.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>value of land per owner (dollars)</td>
<td>77,339</td>
<td>84,315</td>
<td>163,743</td>
<td>86,988</td>
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<td></td>
<td>72,213</td>
<td>110,847</td>
<td>89,326</td>
<td>83,905</td>
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<td>100,155</td>
<td>116,829</td>
<td>130,608</td>
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<td>91,303</td>
<td>154,196</td>
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<td>68,820</td>
<td>88,560</td>
<td>79,241</td>
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<td>82,847</td>
<td>90,016</td>
<td>94,220</td>
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<td>44,000</td>
<td>39,316</td>
<td>91,325</td>
<td>59,214</td>
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<tr>
<td>Iowa, 1970</td>
<td>73,892</td>
<td>89,390</td>
<td>101,834</td>
<td>85,137</td>
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Table B.2. (Continued)

<table>
<thead>
<tr>
<th>Item</th>
<th>Economic area reporting</th>
<th>Number of operators</th>
<th>Owner operators</th>
<th>Part-owner operators</th>
<th>Operator landlords</th>
<th>Nonoperator landlords</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>1</td>
<td>177.3</td>
<td>166.8</td>
<td>151.6</td>
<td>80.9</td>
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<tr>
<td>size of</td>
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<td>203.9</td>
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<td>92.9</td>
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</tr>
<tr>
<td>each</td>
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<td>207.6</td>
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<td>161.5</td>
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<tr>
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<td>5</td>
<td>183.8</td>
<td>233.8</td>
<td>98.0</td>
<td>96.3</td>
<td></td>
</tr>
<tr>
<td>(acres)</td>
<td>6</td>
<td>186.2</td>
<td>210.4</td>
<td>104.6</td>
<td>82.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>178.6</td>
<td>178.8</td>
<td>95.5</td>
<td>87.0</td>
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</tbody>
</table>

Iowa, 1958  
Iowa, 1970

Average
value
of each
farm
owned
(dollars)

<table>
<thead>
<tr>
<th>Iowa, 1958</th>
<th>178.2</th>
<th>161.3</th>
<th>184.5</th>
<th>177.6</th>
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</thead>
<tbody>
<tr>
<td>Iowa, 1970</td>
<td>184.1</td>
<td>192.8</td>
<td>112.4</td>
<td>86.4</td>
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Average
value
of each
farm
owned
(dollars)

<table>
<thead>
<tr>
<th>Iowa, 1958</th>
<th>44,000</th>
<th>39,316</th>
<th>40,305</th>
<th>46,270</th>
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<td>Iowa, 1970</td>
<td>73,892</td>
<td>89,390</td>
<td>46,300</td>
<td>36,989</td>
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</tbody>
</table>

Table B.3. Tenure experience of all owners

<table>
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<tr>
<th>Tenure experience</th>
<th>Number reporting</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHNRO</td>
<td>168</td>
<td>6.24</td>
</tr>
<tr>
<td>PHNO</td>
<td>52</td>
<td>1.95</td>
</tr>
<tr>
<td>PHRO</td>
<td>116</td>
<td>4.24</td>
</tr>
<tr>
<td>PNRO</td>
<td>158</td>
<td>5.93</td>
</tr>
<tr>
<td>PHO</td>
<td>14</td>
<td>0.52</td>
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<td>3.17</td>
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<tr>
<td>PRO</td>
<td>176</td>
<td>6.59</td>
</tr>
<tr>
<td>PO</td>
<td>34</td>
<td>1.17</td>
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</table>
Table B.3. (Continued)

<table>
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<tr>
<th>Tenure experience</th>
<th>Number reporting</th>
<th>Percent</th>
</tr>
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<td>HNRO</td>
<td>32</td>
<td>1.16</td>
</tr>
<tr>
<td>HRO</td>
<td>26</td>
<td>0.99</td>
</tr>
<tr>
<td>HNO</td>
<td>27</td>
<td>1.06</td>
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<td>0.43</td>
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<tr>
<td>RL</td>
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</tr>
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<td>OL</td>
<td>7</td>
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</tr>
<tr>
<td>L</td>
<td>37</td>
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Table B.4. Estimates of number of owners, by sex, tenure and number of farms owned in Iowa, 1970

<table>
<thead>
<tr>
<th>Sex</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
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<tbody>
<tr>
<td></td>
<td>149,323</td>
<td>29,209</td>
<td>178,532</td>
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</table>

<table>
<thead>
<tr>
<th>All owners</th>
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<tbody>
<tr>
<td>Owner operator</td>
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<td>49,414</td>
</tr>
<tr>
<td>1 farms</td>
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</tr>
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<td>2 farms</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3 farms</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>4 farms</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>5+ farms</td>
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<td>---</td>
<td>---</td>
</tr>
<tr>
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<td>49,414</td>
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<table>
<thead>
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<th>Part-owner operator</th>
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<th>28,677</th>
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</thead>
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<tr>
<td>1 farm</td>
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</tr>
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<td>2 farms</td>
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</tr>
<tr>
<td>3 farms</td>
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<tr>
<td>4 farms</td>
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<td>---</td>
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<tr>
<td>5+ farms</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operator landlord</th>
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<th>14,377</th>
<th>19,096</th>
</tr>
</thead>
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<td></td>
</tr>
<tr>
<td>2 farms</td>
<td></td>
<td></td>
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<td>3 farms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 farms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5+ farms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>996</td>
</tr>
<tr>
<td>Total</td>
<td>19,096</td>
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</table>

<table>
<thead>
<tr>
<th>Nonoperator landlord</th>
<th>416</th>
<th>45,155</th>
<th>68,473</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
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<td>4 farms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5+ farms</td>
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<td></td>
<td></td>
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<tr>
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<td>8,502</td>
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<tr>
<td>Total</td>
<td>68,473</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Owners with unknown tenures</th>
<th>9,867</th>
<th>1,957</th>
<th>12,872</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 farm</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2 farms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 farms</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>4 farms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 farms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown no. of farms</td>
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<td>968</td>
</tr>
<tr>
<td>Total</td>
<td>12,872</td>
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<td>12,872</td>
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State total 178,532
Table B.5. Estimate of number of owners by tenure, occupation and state residency in Iowa, 1970

<table>
<thead>
<tr>
<th>Occupation and tenure groups</th>
<th>State residency</th>
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<tbody>
<tr>
<td></td>
<td>In Iowa</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
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</tr>
<tr>
<td>Farmer</td>
<td>79,306</td>
</tr>
<tr>
<td>Retired farmer</td>
<td>25,577</td>
</tr>
<tr>
<td>Housewife</td>
<td>15,794</td>
</tr>
<tr>
<td>Businessman</td>
<td>20,608</td>
</tr>
<tr>
<td>Laborer and other</td>
<td>21,141</td>
</tr>
<tr>
<td>Unknown occupation</td>
<td>3,534</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>165,960</td>
</tr>
</tbody>
</table>

| Tenure                       |         |             |         |
|------------------------------|         |             |         |
| Full-owner operator          | 48,845  | 501         | 67      |
| Part-owner operator          | 28,442  | 235         | --      |
| Operator landlord            | 18,381  | 654         | 61      |
| Nonoperator landlord         | 57,685  | 10,766      | 22      |
| Unknown tenure               | 12,607  | 266         | --      |
| **Total**                    | 165,960 | 12,422      | 150     |
Table B.6. Tenure experience of farmland owners; classification scheme for agricultural ladder experience

<table>
<thead>
<tr>
<th>Owners reporting nonfarm experience</th>
<th>P/HNR(0/L) with N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owners reporting farm experience only</td>
<td>P/H/RO/L without N</td>
</tr>
</tbody>
</table>

- **Basic agricultural ladder experience**
  - P/HRO group
    - PHRO
    - PHROL
    - PRO
    - PROL
    - HRO
    - HROL

- **Other patterns of experience previous to ownership**
  - H/RO group
    - HO
    - HOL
    - RO
    - ROL
  - H/RNO group
    - HNO
    - HNOL
    - NR0
    - NROL
  - PO group
    - PHO
    - PHOL
    - PO
    - POL
    - O
    - OL
  - PNO group
    - PHNO
    - PHNOL
    - PNO
    - PNOL
    - PNL
Table B.6. (Continued)

| Owner operator without previous farm experience | NO group | { NO, NOL, PHNRL, PNR, PHNL, PNL, HNL, NL } |
| Nonoperator landlord with previous farm experience | RL group | { NO, NOL, PHRL, PRL, HRL, RL } |
| | RNL group | { NO, NOL, PHNRL, PNR, PHNL, PNL, HNL, NL } |
| | P/HL group | { NO, NOL, PHNL, PNL, HNL } |
| | P/HNL group | { NO, NOL, PHNL, PNL, HNL } |
| Nonoperator landlord with no previous farm experience | NL group | { NO, NOL, PHNL, PNL, HNL } |

Table B.7. Tenure classifications of owners according to previous experiences reported

<table>
<thead>
<tr>
<th>Experience</th>
<th>Tenure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonfarm experience</td>
<td>{ PNO, RNO, NO, PRNO, RNOL, PNOL, PRNL }</td>
</tr>
</tbody>
</table>
Table B.7. (Continued)

<table>
<thead>
<tr>
<th>Experience</th>
<th>Tenure</th>
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</thead>
<tbody>
<tr>
<td>Nonfarm experience</td>
<td>PN L</td>
</tr>
<tr>
<td></td>
<td>RN L</td>
</tr>
<tr>
<td></td>
<td>NL</td>
</tr>
<tr>
<td></td>
<td>PRNOL</td>
</tr>
<tr>
<td></td>
<td>NOL</td>
</tr>
<tr>
<td></td>
<td>PRHO</td>
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<tr>
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<td>RHO</td>
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<td>PHO</td>
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<tr>
<td></td>
<td>HO</td>
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<td>HL</td>
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<td>RHOL</td>
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<td>PROL</td>
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<tr>
<td></td>
<td>PRL</td>
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<tr>
<td></td>
<td>PL</td>
</tr>
<tr>
<td></td>
<td>RL</td>
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<tr>
<td>Hired hand experience</td>
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<tr>
<td></td>
<td>HRNO</td>
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<td>RHNOL</td>
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<td>PHNL</td>
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<td></td>
<td>HNL</td>
</tr>
<tr>
<td>Nonfarm and hired hand experience</td>
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<tr>
<td></td>
<td>RO</td>
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<tr>
<td></td>
<td>POL</td>
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<tr>
<td></td>
<td>ROL</td>
</tr>
<tr>
<td>Neither nonfarm nor hired hand experience</td>
<td>PL</td>
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<tr>
<td></td>
<td>RL</td>
</tr>
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</table>
Table B.8. Concentration of farmland ownership acreage (area I, 1958-1970)

<table>
<thead>
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<th>Acres of owned land</th>
<th>Percent of owners</th>
<th>Percent of farm acreage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 49</td>
<td>4.62</td>
<td>5.31</td>
</tr>
<tr>
<td>Less than 69</td>
<td>6.51</td>
<td>8.46</td>
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<td>Less than 99</td>
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<td>Less than 139</td>
<td>26.61</td>
<td>40.92</td>
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<td>Less than 199</td>
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<tr>
<td>Less than 279</td>
<td>65.81</td>
<td>79.65</td>
</tr>
<tr>
<td>Less than 359</td>
<td>75.54</td>
<td>88.28</td>
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<tr>
<td>Less than 519</td>
<td>87.06</td>
<td>96.82</td>
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<td>Less than 699</td>
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</tr>
<tr>
<td>Total</td>
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</table>

Table B.9. Concentration of farmland ownership acreage (area II, 1958-1970)

<table>
<thead>
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<th>Acres of owned land</th>
<th>Percent of owners</th>
<th>Percent of farm acreage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 49</td>
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<td>Less than 69</td>
<td>4.15</td>
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<td>17.57</td>
<td>23.82</td>
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<td>Less than 139</td>
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<td>35.64</td>
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<td>Less than 199</td>
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<td>57.86</td>
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<td>Less than 279</td>
<td>63.39</td>
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<td>Less than 359</td>
<td>74.03</td>
<td>86.57</td>
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</table>
Table B.10. Concentration of farmland ownership acreage (area III, 1958-1970)

<table>
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<th>Acres of owned land</th>
<th>Percent of owners</th>
<th>Percent of farm acreage</th>
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<tbody>
<tr>
<td>Less than 49</td>
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<td>4.99</td>
</tr>
<tr>
<td>Less than 69</td>
<td>4.52</td>
<td>5.30</td>
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<td>Less than 99</td>
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<td>15.59</td>
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<td>Less than 139</td>
<td>24.57</td>
<td>28.69</td>
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<td>Less than 199</td>
<td>52.67</td>
<td>54.58</td>
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<tr>
<td>Less than 279</td>
<td>69.49</td>
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<tr>
<td>Less than 359</td>
<td>79.52</td>
<td>87.94</td>
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<td>Less than 519</td>
<td>89.55</td>
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<td>Less than 699</td>
<td>95.37</td>
<td>97.97</td>
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<tr>
<td>Total</td>
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<td>100.00</td>
</tr>
</tbody>
</table>

Table B.11. Concentration of farmland ownership acreage (area IV, 1958-1970)

<table>
<thead>
<tr>
<th>Acres of owned land</th>
<th>Percent of owners</th>
<th>Percent of farm acreage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 49</td>
<td>5.44</td>
<td>11.11</td>
</tr>
<tr>
<td>Less than 69</td>
<td>6.40</td>
<td>13.63</td>
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<tr>
<td>Less than 99</td>
<td>23.06</td>
<td>30.03</td>
</tr>
<tr>
<td>Less than 139</td>
<td>36.52</td>
<td>45.20</td>
</tr>
<tr>
<td>Less than 199</td>
<td>56.39</td>
<td>70.03</td>
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<tr>
<td>Less than 279</td>
<td>69.85</td>
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<td>Less than 359</td>
<td>80.10</td>
<td>91.44</td>
</tr>
<tr>
<td>Less than 519</td>
<td>91.31</td>
<td>95.94</td>
</tr>
<tr>
<td>Less than 699</td>
<td>94.51</td>
<td>98.82</td>
</tr>
<tr>
<td>Total</td>
<td>100.00</td>
<td>100.00</td>
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</table>
Table B.12. Concentration of farmland ownership acreage (area V, 1958-1970)

<table>
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APPENDIX C

Statistical Tests

Most important objective of a sample survey is the inferences which can be drawn about the characteristics of the population which it represents. If we want to estimate $P$, the proportion (expressed as percentage) of landowners with certain characteristics in the state, then we have to look up for $p$, the corresponding characteristic computed from the units that fell in the sample. Throughout this study, care has been given to draw up a representative sample. To this end, each individual landowner was corrected for his varied chance of entrance into the sample through a weight assigned to him. Similarly, weights were assigned to each area when estimating for the state.

Even with all the care given in drawing a representative sample, it may be possible for $p$, the sample proportion, to differ from $P$, the "true" or population proportion. There are two main reasons for the difference:

1. Due to sampling variation or sampling error.

   If instead of one, a number of different samples are drawn from the same population, the sample proportion $p$ would vary from one to the other. This is one of the reasons.

---

1 The explanation of statistical tests and use of nomograms have been derived from Strand (88, pp. 6-11). The actual formulas used in the construction of nomograms are included in this study. They were found together in the source material of the previous land ownership studies (89 and 90) and had not been published in the bulletin.

2 For each individual owner, a weight of 1 was given if he had one ASCS number, 0.5 if he had two, and so on.
(2) Due to nonsampling errors.

This difference arises because the questions were interpreted differently by different persons, or responses were vague and uncertain or were not correctly edited. This fact is not a shortcoming of a sample survey and could easily arise even when 100 percent of the population, like the census, is included in the study.

Variations in the sample proportion are measured by the "standard deviation" or "standard error". While it is complex to have a precise estimation of standard error, a good approximation of $S_p$ of the sample proportion $p$ is provided by the binomial formula. The magnitude of $S_p$ is seen to depend on $p$ and $N$, the number of units in the sample.

Significance of difference of proportions

The standard deviation $S_p$ may be used to provide approximate confidence interval for the population proportion $P$. As an example, with 95 percent of confidence, we can argue that the true proportion $P$ would lie between $p \pm 1.96 S_p$. In the 90 percent confidence level, the formula is $p \pm 1.65 S_p$.

In this study, we are interested in comparing the percentages for two characteristics. The differences we observe between sample proportions may arise either from actual differences on the corresponding population proportions or due to "sampling" or "nonsampling" errors. A decision criteria is needed to determine whether the observed differences

---

3 Binomial standard deviation of a proportion is $S_p = \sqrt{\frac{p(1-p)}{N}}$. 
might have arisen from the variation inherent in the sample. When the
differences between sample proportions are large enough, it is reasonable
to argue that at least part of the difference is due to "real" differences
between the corresponding populations and not due only to the variation of
the samples. This difference is termed "significant". Even then it is
highly improbable for the differences to be due entirely to the variation
in the sample but not impossible.

Calculation of the standard deviation of a difference between two
population percentages is similar to the way used in obtaining the stan­
dard deviation of a proportion. However, now the estimated standard devi­
ation of a difference $S_d$ depends on the sample proportions $p_1$ and $p_2$,
and the corresponding sample sizes $N_1$ and $N_2$. Similarly, 95 and 90
percent confidence intervals for the population differences $D$ may be
derived from $d \pm 1.96 S_d$ and $d \pm 1.65 S_d$, respective, where $d$ stands
for the sample difference.

If such a confidence interval does not extend from a negative number
at the one limit to a positive number at the other limit (thus does not
include zero), then it is highly improbable at 95 or 90 percent level that
such a difference has arisen from sampling considerations alone. Such
sample differences are concluded to be significant at the particular level
they are tested. In this case, it can be argued that there are real
differences between the two population proportions.

In this study, nomograms for 80 percent least significant differences
are not included and tests are not conducted on the 80 percent signifi­
cance level. The reason for it is that while it is 1 in 20 and 1 in
10 to make an error of significance at 95 percent and 90 percent confidence levels, respectively, this error increases to 1 in 5 with 80 percent confidence level. That is, if we use the 80 percent level we will be making an error by calling a difference significant once every five times, even when no real difference exists. This the author thinks is a high margin of error and so does not test data on this confidence level.

Construction of Nomograms for Testing Significance of Differences of Percentages --Mutually Exclusive

Two sets of nomograms, Figures C.1 to C.6, have been constructed to aid in comparing differences between two percentages. Through the use of these graphical constructs, two percentages can be tested for significance at either 95 percent or 90 percent confidence level without the calculation of the standard error.

Two different types of nomograms are presented for testing significant differences of percentages. Figures C.1 and C.2 should be used for determination of a significant difference in percentages of units in the same sample with two "mutually exclusive" characteristics. By mutually exclusive, it is to be understood that the unit (which is the farmland owner in this case) should possess one and only one of the characteristics. For example, in relation to tenure classification, the owner should be identified with either of the four categories but he cannot be in two categories at the same time. The rule to follow when in doubt is to see if all characteristics appear in the same table and sum up to 100 percent. In such cases, sample sizes $N_1$ and $N_2$ are the same and are called $N$. 
NOMOGRAM FOR DETERMINATION OF 95% LEAST
SIGNIFICANT DIFFERENCE OF PERCENTAGES OF
UNITS IN A SAMPLE WITH MUTUALLY EXCLUSIVE
CHARACTERISTICS FOR VARYING SAMPLE SIZE N

Figure C.1. Nomogram for determination of 95 percent least significant
difference between two dependent percentages for varying
sample size N (89, p. 120)
Figure C.2. Nomogram for determination of 90 percent least significant difference between two dependent percentages for varying sample size N (91, p. 10)
In other words, \( N \) is the total number in the table which corresponds to 100 percent.\(^4\)

Computation of least significant differences for mutually exclusive categories of varying sample sizes, Figures C.1 and C.2, for 95 percent and 90 percent levels, respectively, are based on the formula

\[
P_1 = P_2 + \frac{t}{N + t^2} \left[ 1 + \sqrt{1 + 2(N + t^2)P_2^2} \right]
\]

where

- \( t = t \) statistic (1.96 or 1.65) for 95 percent and 90 percent, respectively,
- \( P_2 = \) given percentage levels going from 2 to 50 percent,
- \( P_1 = \) confidence interval for the other percentage given \( P_2 \), and
- \( N = \) total number of respondents.

To give an example for the use of Figures C.1 and C.2, suppose that 800 respondents are represented in the table of "tenure of farmland owners". We use Figure C.1 first to determine significant difference at the 95 percent level. Since 800 is 100 percent of the table, \( N = 800 \). Suppose owners indicated that 15 percent are nonoperating landlords while 10 percent are operating landlords. Since 15 percent is the larger, mark

\[\text{standard deviation of the difference then is}
\]

\[
S_d = \sqrt{\frac{P_1(1 - P_1)}{N} + \frac{P_2(1 - P_2)}{N} + \frac{2P_1P_2}{N}}.
\]

The final term is known as the covariance term and enters the formula because the two percentages are not independent.
this on the horizontal border of Figure C.1 and 10 percent on the vertical border. Drawing horizontal and vertical lines in the graph from 15 and 10 percent marks, respectively, indicates their point of intersection. In this example it is observed that the intersection point falls below the line indicated by \( N = 800 \), which means that the differences of percentages are significant at the 95 percent confidence level, so should be identified by two stars (**).

Levels of \( N \) other than the ones drawn for must be interpolated between the curves to the nearest values shown. Scales of neither graph extend to 100 percent since the smaller percentage can never be greater than 50 percent. When the larger percentage is greater than 60 percent, it will always be significantly different from any other percent for samples of 100 or greater.

Construction of Nomograms for Testing Significance of Differences of Percentages--Independence

In the previously discussed mutually exclusive case, Figures C.1 and C.2, the percentages that are compared are dependent on each other since an increase in one of the characteristics leads the other characteristic to decrease and vice versa. These characteristics add up to 100 percent. However, in this case, characteristics are no longer mutually exclusive; the decline in one does not force the other to rise, and therefore they are called independent. Then Figures C.3 to C.6 should be used whenever the percentages that are tested are independent of each other. These figures should be used whenever two independent sample percentages are to be tested, such as the 1958 survey vs. the 1970 survey. They should also
Figure C.3. Nomogram for determination of 95 percent least significant difference between two independent percentages from samples of various sizes 100 to 800 (89, p. 123)
NOMOGRAM FOR DETERMINATION OF 95% LEAST SIGNIFICANT DIFFERENCE OF PERCENTAGES OF UNITS WITH SPECIFIC CHARACTERISTICS FROM TWO SAMPLES OF VARYING SAMPLE SIZES.
DETERMINATION OF 95% LEAST SIGNIFICANT DIFFERENCE
STAGES OF UNITS WITH SPECIFIC CHARACTERISTICS
0 SAMPLES OF VARYING SAMPLE SIZES 100 TO 800

OBSERVED PERCENTAGES

DIFFERENCE - PERCENT

N = 100
N = 200
N = 300
N = 400
N = 600
N = 800

OBSERVED PERCENTAGES
Figure C.4. Nomogram for determination of 95 percent least significant difference between two independent percentages from samples of various sizes 1000 to 2000 (89, p. 125)
NOMOGRAM FOR DETERMINATION OF 95% LEAST SIGNIFICANT DIFFERENCE OF PERCENTAGES OF UNITS WITH SPECIFIC CHARACTERISTICS FROM TWO SAMPLES OF VARYING SAMPLE SIZES
INATION OF 95% LEAST SIGNIFICANT DIFFERENCE
OF UNITS WITH SPECIFIC CHARACTERISTICS
S OF VARYING SAMPLE SIZES 1000 TO 2000

\[
\begin{array}{cccccccc}
N=1000 & N=1200 & N=1400 & N=1600 & N=800 & N=2000 \\
\end{array}
\]

\[
\begin{array}{cccccccccc}
15 & 10 & .5 & 0 & 5 & 10 & 15 & 20 & 25 & 30 & 35 & 40 & 45 & 50 \\
95 & 90 & 85 & 80 & 75 & 70 & 65 & 60 & 55 & 50 \\
\end{array}
\]

OBSERVED PERCENTAGES
Figure C.5. Nomogram for determination of 90 percent least significant difference between two independent percentages from samples of various sizes 100 to 1000 (91, p. 11)
NOMOGRAM FOR DETERMINATION OF 90% LEAST SIGNIFICANT DIFFERENCE BETWEEN TWO INDEPENDENT PERCENTAGES FROM SAMPLES OF VARIOUS SIZES 1000 TO 3000

Figure C.6. Nomogram for determination of 90 percent least significant difference between two independent percentages from samples of various sizes 1000 to 3000 (91, p. 12)
be used whenever comparisons of percentages from two independent tabulations of the same sample are required, such as comparison of the same tenure classes in two different areas.\(^5\)

Computation of least significant difference for independent percentage categories of varying sample sizes, Figures C.3 through C.6, for 95 percent and 90 percent confidence levels are based on the formula

\[
\frac{t}{\sqrt{\frac{1}{N} + \frac{1}{N}} \sqrt{p - p^2}}
\]

where

\[
t = t \text{ statistic (1.96 or 1.65) for 95 percent and 90 percent, respectively,}
\]

\[
p = \text{percentage level intervals from 2 to 50 percent, and}
\]

\[
N = \text{total number of respondents,}
\]

The use of these nomograms (Figures C.3 to C.6) is more complex than the previous ones. Their use will be explained by an example.

Suppose that we would like to determine if there is a significant difference between the percentages of nonoperating landlords in one area as opposed to their percentage in another economic area. Assume that 31 percent of 200 respondents are nonoperating landlords in one area as

\[S_d = \sqrt{\frac{P_1(1 - P_1)}{N_1} + \frac{P_2(1 - P_2)}{N_2}} \]

\(^{5}\)When the two percentages to be compared are independent of each other, the standard deviation of difference is without the interaction term, i.e.
opposed to 39 percent of 300 respondents in another area. Is the difference between the two percentages for these two areas significantly different?

To test for the significance, we go first to the 95 percent confidence level, which is Figure C.3. First enter 31 on the lower right scale marked "observed percentages" and draw a vertical line until the curve \( N = 200 \) is reached. From this point draw a horizontal line until the vertical scale in the central portion of the nomogram is reached and mark the point of intersection. Similarly, enter 39 on the lower right scale, but reach the curve \( N = 300 \) instead and continue the operation.

There are now two marks on the vertical scale in the central portion of the nomogram. From the lower mark, trace an imaginary arc, guided by the arcs on either side and indicate its point of intersection on the lower left scale. In this example, it will be about 5.6. From this intersection on the lower left scale, draw a vertical line to intersect a horizontal line drawn from the upper mark on the vertical scale. From this point of intersection, again trace an arc to the lower left scale and mark it. In this case, it is 8.5 which the nomogram states is the least significant difference in percentage form.

Then the actual percentage difference which is 39 - 31 = 8 is compared to the nomogram least significant difference of 8.5 percent just determined. Since the observed difference is smaller than the least significant difference, at the 95 percent confidence level, it is concluded that the difference is not significant. Had the observed difference been 41 - 31 = 10 percent (thus greater than 8.5), we would have concluded that
the difference was significant at the 95 percent level.

Now the same percentages will have to be tested for significance at the 90 percent confidence level since it was not found to be significant at the 95 percent level. Similar operations are performed but this time on Figure C.5. The nomogram in this case shows 6.7 percent to be the least significant difference. Since the observed percentage of difference was 8 and larger than the least significant difference, we conclude that there is a significant difference at the 90 percent confidence level and identify the result with one star (*).

It will be observed that the lower left scales of Figures C.3 and C.4 end at 14 and 4 percents, respectively. The reason for this is due to the fact that any larger difference in percents based on samples of 100 or more in the former and 1000 or more in the latter will always be significant at the 95 percent level. Figures C.5 and C.6 are used in the similar manner in determination of the 90 percent least significant differences. Again for the previously mentioned reason, the lower left scale of Figures C.5 and C.6 end at 12 and 3.75 percents, respectively.

The independent percentage nomograms, Figures C.3 through C.6, can also be used for determining the confidence interval for a population proportion, again for the 95 and 90 percent levels. Taking the previous example again, if it is desired to estimate the true population percentage of the nonoperating landlords in the second area reporting 39 percent of

\[ CI = \sqrt{\hat{p} + 2 \frac{p(1 - p)}{N}}. \]

^ An approximate formula for the confidence interval is
300 respondents, the similar procedure is followed, as has been described earlier, up to the point where the lower left scale was intersected at 5.6 percent. Then with 95 percent confidence, we can state that 33.4 to 44.6 percent of the owners are nonoperating landlords in that particular area. In other words, it is 39.0 ± 5.6 percent. Using Figure C.5 instead of Figure C.3, we can get the confidence interval with 90 percent level which is 39.0 ± 4.5 percent.
APPENDIX D. DATA USED IN DISCRIMINANT ANALYSIS AND COMPUTED $D^2$ FOR TENURE GROUPS AND CLASSES