ABSTRACT

FARM REAL ESTATE VALUE PATTERNS IN THE UNITED STATES, 1930-1962

By George E. Rossmiller

The primary objective of this study was to delineate the factors in the farm real estate market which have affected the price of farm real estate between 1930 and 1962. As an aid in analysis of these factors, a production function model and a residual return model were postulated to estimate the income streams accruing to farm real estate over the period under two different sets of assumptions for 19 different type-of-farming areas in the United States. The estimated annual income streams from both models were capitalized to yield for each area and each year an ex ante or expected price which could be paid for real estate based on the income streams of the past five years and an ex post or actual price which could have been paid based on actual income streams accruing to farm real estate under the assumptions of the models. Further the year-to-year changes in the estimated marginal value products or yearly income streams from the production function model were partitioned into price and productivity components to further aid in the analysis.

Theoretical arguments are employed which indicate that over the period the marginal physical product of farm real estate should have increased primarily due to the technological revolution going on in agriculture during the period which has allowed large increases

in agricultural production without the use of increased quantities of land and with the use of much less labor. Fixed asset theory was employed to argue that it is economically sound for farmers to bid up the price of farm real estate even though the returns to their labor may not be comparable to labor returns in the non-farm economy. Both of these arguments were verified by the data although it was found that farmers are influenced by the non-farm wage rate in determining what price they are willing to pay for farm real estate.

The net percentage of non-farmer buyers over sellers in the farm real estate market is decreasing due to urbanization and time breaking many of the strong ties a multitude of urban people once had with the rural sector and the increased costs of property taxes and management services involved in farm real estate investments.

While non-farmer investor interest is declining the farmer expansion buyer is rapidly becoming more dominant in the farm real estate market. As labor and capital saving technology becomes innovated excess capacity in these inputs develops and the answer for many farmers is to expand the size of the existing farm unit to make efficient use of the available capital and labor. Many farms are too small to make use of available technology and we find these farm units disappearing and being absorbed in the form of expansion purchases by the already larger than average farms.

Government programs are found, as expected, to have a greater impact in those areas where farm income levels depend directly and heavily on these programs. Although specific changes in land values

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were not traceable to specific programs, in general the impact of government programs appeared to be twofold. First, the reduction in uncertainty in the post war period due to price support programs appeared to have some influence in raising land prices in the wheat areas but no influence was detectable elsewhere. Second, through raising farm incomes either by price support or various direct payments farmers' incomes are higher relative to non-farm incomes and they seem more willing to bid land prices up if their labor incomes are more comparable to non-farm wages in their area. Further, the data indicate that the productivity component of income streams to land is rising at a rate which suggests that changes in government programs within the limits of political acceptability in the immediate future will probably not cause land MVP's to fall but rather will only affect the rate of increase.

Finally, the data suggest that current land prices are below what expansion buyers could afford to pay for farm real estate to add to their existing units. Thus, the cautious conclusion that farm real estate market prices will continue their upward trend is advanced.

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By

George E. Rossmiller

A THESIS

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PREFACE

This study was undertaken as part of a larger project sponsored by Resources for the Future, Inc., and designed to determine the impact of government programs on resource use and allocation in American agriculture for the period 1917-1962. Other studies contributing to the parent project include two Ph.D. theses completed at Michigan State University--one on labor by Bob F. Jones and one by Milburn L. Lerohl on product price expectations. Now in progress here are three theses on labor, land and capital by Venkareddy Chennereddy, Arne Larsen, and C. L. Quance respectively. This study of farm real estate values is independent of the others contributing to the main project and draws inferences and conclusions within its limited scope. When integrated with the other studies, however, the conclusions and inferences which can then be drawn on should have much wider significance.

I wish it were possible to acknowledge individually all those who had a part in making my graduate studies a stimulating and rewarding experience. To the faculty and graduate students at Michigan State University with whom I had the pleasure and benefit of crossing minds, I extend a sincere thank you.

A special thanks are in order to Dr. David H. Boyne, my major professor, whose guidance, encouragement and helpful criticisms throughout my graduate program and particularly with regard to this thesis are gratefully acknowledged. I also thank Dr. Glenn L. Johnson for perceptive comments and helpful criticisms during the development of this thesis.

For the generous financial support which made graduate work possible I am grateful to Dr. L. L. Boger, Chairman of the Department of Agricultural Economics, Michigan State University, and to Resources for the Future, Inc. Thanks also to William Ruble, Mary Merillat, Beth Unger, Arlene King, and Jackie Musell for their assistance and extra efforts in moving my data through the computer, and to Julie Seger who helped in countless ways.

Finally I wish to specially thank my wife, Betty, and children, David and Diane for their quiet encouragement and understanding while enduring the trials of graduate school with me. Betty undertook the typing of this manuscript.

Any errors either of commission or omission are, of course, entirely my own.

George E. Rossmiller

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CHAPTER I

INTRODUCTION

Farm real estate market values in the U.S. have followed an ever upward trend since the mid 1930's despite widely fluctuating and in recent years declining net farm income. This seemingly strange phenomena has been the fuel for a good bit of controversy in recent years and several hypotheses have been advanced purporting to explain it. The reason for the interest is clear. In an industry where income is low relative to incomes in other sectors of the economy and where absolute declines in income in several years during the period are in evidence, it seems a bit peculiar that one of the major inputs should exhibit the price behavior pattern that can be attributed to farm real estate.

Interest in explaining the phenomena should be strong for no other reason than that the phenomena exists. But reasons for the interest in this case go deeper. Farm operators and managers are interested because the price of real estate and changes in this price affect decisions regarding efficiency of resource allocation and production both within the agricultural sector and between agriculture and non-agricultural sectors of the economy. Further, asset owners are interested because changes in relative prices of assets materially effect relative welfare positions of owners of different types of assets. Taxpayers are interested from the viewpoint of who benefits by how much from various government programs which transfer income to

the agricultural sector. And finally policy makers are interested in the causal factors connected with this phenomena from the standpoint of predicting and evaluating consequences of different policies on participating groups in both the agricultural and non-agricultural sectors.

But even a cursory look at the available data points out another interesting and important facet of the behavior of farm real estate market values. State and regional aggregates show the same pattern of increasing values since the mid 1930's, but the increases have been at different rates between states and regions. This additional phenomena does not greatly affect the individual farm operator since his main concern is with the factor price relationships on a specific farm and how to adjust to the changing price relationships on that farm. Even if he is a potential expansion buyer of farm real estate his interest lies in the prices for real estate in the area immediately surrounding the farm unit upon which he is established.

The potential investor, however, is not tied nearly so close to any particular area. If, after he decides he wants to invest in farm real estate, he finds the trend in one area to be advancing at a faster rate than those in alternative locations, and if his expectations are that all trends will continue at their individual respective rates, he will, other things being equal, probably invest in that area in preference to another. So the potential investor is interested both in how farm real estate values behave relative to other types of investments and in any area differentials in real estate values within the agricultural sector.

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The taxpayer is interested primarily in the distribution of income transfers to agriculture via government programs as between owners of assets of different types. He is probably not too interested in the distribution of benefits to individuals within a particular group of owners of a specific type of asset. That is, it may be sufficient for the taxpayer's purposes for him to know that some portion of the income transfer benefits accrue to real estate holders in the form of higher capitalized real estate values. Although, if the income transfers go primarily to large landholders who are already relatively well off, the taxpayer may be more concerned about the use of his taxes for the program than if transfers went to relatively low income farmers and contributed toward raising their levels of living to standards society deems acceptable.

But the policy maker is concerned with all facets of the real estate value phenomena--aggregate changes in farm real estate values through time, changes in real estate values relative to values of other inputs, differential changes in real estate values as between areas, and most important, the causal relationships and changes in these relationships over time which contribute to both absolute and relative real estate values in agriculture. With more comprehensive knowledge of these relationships policy makers can make more accurate evaluation and prediction of consequences of future proposed programs, and if deemed appropriate, can develop programs to counteract effects of changes in these relationships through time. The policy maker needs specific kinds of information to develop informed programs for which he can predict effects on real estate values both in absolute terms and in relative terms between different areas of the country. This

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information should include definition of the variables in the economic system which determine the price of farm real estate, specification of the relationships of these variables to each other and to farm real estate prices, and determination of temporal changes in relevant parameters.

Existing studies in this general area will be cited as their contents dictate throughout this study, but some general comments are appropriate at this point. Most of the literature which attempts to explain the increasing farm real estate value phenomena deals with farmland in general. That is, the aggregate increase in value of farmland is considered without regard for differential rates of increase in different areas. Literature dealing with relationships between real estate values and production is normally couched in terms of land used in the production of a specific commodity and how various commodity oriented government programs will affect these values. The aggregate studies then leave the problem of differential rates of change in values for areas within the aggregate untouched while the studies relating production and land values are oriented toward land used in the production of an individual commodity.

But farms in the United States are generally multi-enterprise operations with the land being used for more than one crop and in most cases also used to sustain at least one type of livestock enterprise. Different areas throughout the country can be delineated within which enterprise combinations are broadly similar and between which they are quite different. To be optimally useful to policy makers enumeration of the variables, relationships, and parameters should be couched in terms which would point out the differential impacts of potential

programs on real estate values in various heterogeneous areas characterized by farms with relatively homogeneous enterprise combinations within each area. After all, we are interested in land values not for how land itself is affected but to determine how people, including landowners, are affected through these value relationships. And only by understanding the historical relationships of the past can we assess our present position, and attempt to see, however dimly, into the future.

The following chapters then will look into the past--back to about 1930--and in so doing attempt to describe some of the relationships and trends which have contributed to our present situation with regard to farm real estate values. Our starting point, the early 1930's is chosen because for several reasons that date is near the beginning of the historical era of which the present is a part.

Historical Perspectives

U.S. land policy went through four distinct phases starting back in 1784 with an emphasis on cash receipts for the federal government from sale of the public domain.[1] Next came the policy for rapid settlement of the public domain for agricultural purposes. The 1862 Homestead Act was the primary motivating force and this phase lasted until 1891, although full settlement was not accomplished until the second decade of the 1900's. The farm population reached its peak in 1916, due to federal land disposal policy, declined to 1930, rose again through 1933 due to the Depression, and has declined thereafter.

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[1]Marion Clawson and Held, Burnell, The Federal Lands: Their Use and Management, (Baltimore: John Hopkins Press, 1957), chap. 1.

Between 1891 and the beginning of the New Deal era in 1932, land policy emphasis turned to reservation and conservation implemented through various legislation including the Forest Reservation Act (1891), the Newlands Reclamation Act (1902), Federal Water Power Act (1920) and the Clark McNary Forest and Watershed Improvement Act (1924). The present phase of land policy began in 1933 with the New Deal and is characterized by public land management of the remaining public domain and legislative assistance to agriculture through various commodity, trade, and credit policies.

On the international scene partly as an outgrowth of events leading up to World War I, which disrupted existing patterns of world trade and partly as a result of the role the U.S. played during and after the war as a large supplier of industrial and agricultural products to the allied powers for waging the war and for the later reconstruction, we moved from being a debtor to being a creditor nation in 1919. We were hesitant in accepting the creditor nation role and along with it, if we wanted to maintain our export rate, accepting more imports or extending more credit. As a result, we discontinued our wartime credit to the Allies causing a catastrophic drop in foreign demand for products produced by an over-expanded U.S. agricultural industry.[2] Finally, due to the industrial revolution, the terms of trade turned against agriculture in favor of industry, in terms of both wages and goods.

Prices of farm products rose from an index of 100 in 1914 to a peak of 225 in early 1920. They then tumbled beginning in the fall of 1920 to an index of 124 in 1921. The high product prices during the

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[2]Murray R. Benedict, Farm Policies of the United States 1790-1950, (New York: The Twentieth Century Fund, 1953), p. 169.

war along with pent up savings by farmers in the form of Liberty Bonds and other liquid assets caused a land boom starting in 1916 and lasting through 1920 which raised land prices by 56 percent during the period.[3] From the 1920 peak, land prices declined steadily until the low was reached in 1933. So, hit by a slackened foreign demand, saddled by large mortgage debts contracted in the post war boom and by a suddenly tight money policy, all in the face of over expansion due to the war, the American farmer saw agricultural prices and incomes slump farther and stay down longer than their industrial counterparts. With the agricultural depression of the early twenties came the major growth of the national farm organizations, which were to influence the New Deal legislation of the 1930's and maintain a strong voice in agricultural policy to the present time.

The depressed agricultural situation in the 1920's resulted in governmental action in the form of farm credit legislation but the federal government was not ready to commit itself to full scale support of the agricultural industry as evidenced by the fate of the five McNary-Haugen bills introduced in Congress between 1924 and 1928. Two of the five bills were passed by Congress and both were killed by presidential veto.

Finally by 1930, U.S. agriculture was well on its way toward conversion from horse and mule power to tractors and motor vehicles and the larger scale machinery which went with them. So the early 1930's represent the door to our agricultural era in terms of land settlement, mechanization trends, agricultural policy and legislation, farmers organizations, and farm population trends.

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[3] Agricultural Statistics, (1937), pp. 403-406.

Study Objectives

The primary objective of this study then is the delineation of the factors in the farm real estate market which have affected the price of farm real estate since 1930 and analysis of the differential impact of these factors on different agricultural areas of the United States through time. In order to accomplish this objective secular marginal value product series for the period 1930-1962 for 19 commercial farming areas are derived by using a production function model. These MVP's are capitalized to form an ex post and an ex ante real estate value series for each area. The ex post series shows what could have been paid for farm real estate under the assumptions of the model and the ex ante series are derived by a mechanical expectation model and shows what a potential buyer could have paid given the assumptions of the model.

Under a different set of assumptions and using a residual return model, yearly returns to farm real estate are calculated for each of the areas by subtracting from net farm income an imputed return to labor and capital. The residual which is left is allocated to real estate and capitalized in the same way as the MVP's from the production function model to derive the ex ante and ex post real estate value series. Differences and changes over time within and between the four derived series and the market value series given in the data for each area are analyzed and related to their causal factors.

Outline of Study

Chapter II deals with the development of the two models and the derivation of ex post and ex ante farm real estate value series

from each. These series are presented in Tables 2-20 beginning on page 30. Marginal value products and related series from the production function model are presented in Tables 21-39 beginning on page 49. Chapter III is a historical account of farm real estate price behavior and its relationship to the rest of the economy during the studied period. The changing composition of the farm real estate market and factors contributing to these changes are also discussed.

Chapter IV presents theoretical arguments for expecting land price rises even though the other productive factors may be receiving relatively low returns. This is the theoretical framework within which the data derived in Chapter II are analyzed and conclusions drawn. Chapter V contains an appraisal of the usefulness and relevance of both models used in the study and an analysis of the data derived from these models against the historical events occurring during the studied period. Chapter VI presents the summary and conclusions of the total study.

CHAPTER II

THE MODELS AND THE REAL ESTATE VALUE SERIES

As an aid in analyzing the factors in the farm real estate market affecting farm real estate prices a production function and a residual return model are developed to estimate income streams accruing to farm real estate over the period 1930-1962. Each model is applied to data compiled for 19 commercial farm areas in the United States by the U.S. Department of Agriculture and published in its Costs and Returns on Commercial Farms series.[1] The production function model estimates the yearly income streams to farm real estate in the form of marginal value products while the residual return model subtracts an imputed return to labor and non-real estate capital to arrive at a residual which is allocated as a return to farm real estate. The series thus derived are compared with each other and with the current market value of farm real estate estimates found in the Costs and Returns series which is estimated by a market condition or comparable sales method.

The Data for the Production Function

The U.S.D.A.'s Costs and Returns series contains detailed data on commercial farms in 37 different areas in the U.S. designated by

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[1] U.S. Department of Agriculture, ERS, Costs and Returns on Commercial Farms, 1930-1957, Statistical Bulletin No. 297, 1961, and U.S. Dept. of Agriculture, ERS, Farm Costs and Returns, Agriculture Information Bulletin No. 230 series which updates the data in Statistical Bulletin 297 through 1962. Hereafter these data sources will be referred to as the Costs and Returns data.

the type of farm organization most commonly found in each area. The data are presented as yearly costs and returns figures for a typical farm unit representative of the area-type commercial farm organization. The representative farm unit data are built up with each figure being the geometric mean of the particular statistic calculated from sample commercial family operated farms in the specific area and type. Area-type farms which are too large or too small to be considered family operated commercial farms are excluded from the calculations. The extremes differ slightly from area to area but in general they are defined as farms whose size in terms of acres differ more than three standard deviations in either direction from the geometric mean. Eliminating the extremes makes the series more uniform and representative.

The Production Function Model

The function fit to the sample data is a restricted Cobb-Douglas linear in logarithms type of the general form

$$Y = aX_1^{b1}X_2^{b2} \ldots X_n^{bn}$$

where Y is the dependent variable--output, a is a constant, $X_1 \ldots X_n$ are the independent variables--inputs, and $b_1 \ldots b_n$ are constants measuring the elasticity of Y with respect to the corresponding X_i. The function is fit to combined cross-sectional and time-series data from representative type farms in 19 different areas over the 33-year period 1930-1962. As explained in Appendix B a restricted form of the general Cobb-Douglas model is employed because, while statistically it is no different from the general form, it yields more economically reasonable estimates of the functional parameters. The coefficient of multiple determination adjusted by the degrees of freedom (R^2) is

.8093 indicating that approximately 81 percent of the variance in output is "explained" by the variance of the independent variables included in the function.[2] The production function coefficients and their significance levels are presented in Table 1.

With the restricted model, standard errors of the regression coefficients were not readily available. Therefore, the normal significance level test for the individual regression coefficients using the t statistic was not possible. The method used to determine whether the individual coefficients were statistically different from zero was to run the function in the computer first with only the restriction on the sum of the relevant b_i. Then with the original restriction and an additional restriction holding each b_i in the function equal to zero in turn, the run was repeated, once for each b_i. The F statistic was then used to test the null hypothesis for each individual b_i that $\beta_i = 0$. The test statistic was

$$F_{(P,N-K-1df)} = \frac{(ESS_b - ESS_r)/P}{ESS_r/N-K-1} \quad \text{where}$$

ESS_b is the error sum of squares for the function run with both restrictions, ESS_r is the error sum of squares for the function run with only the original restriction, P is the number of degrees of freedom for the numerator and is equal to the number of restrictions (in this case 1), and N-K-1 is the denominator degrees of freedom with N the number of observations and K the number of independent variables.[3]

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[2]Appendix A shows the location and type of farm designation for the 19 areas included in the study. Appendix B is a detailed discussion of the production function model, the assumptions, and the variables included in the model.

[3]This general procedure is described in Richard F. Foote,

Table 1 Regression Coefficients and Significance Levels from the Restricted Cobb-Douglas Production Function Model

Table 1 Regression Coefficients and Significance Levels from the Restricted Cobb-Douglas Production Function Model

Variable	Regression Coefficients	Variable	Regression Coefficients
Constant	.329	Time Dummies	
Physical Inputs		1930 (Base for Time Dummies)	-0-
Real Estate	.358***	1931	-.013
Labor	.366***	1932	-.013
Operating Expenses	.625***	1933	-.102***
Area Dummies		1934	-.110***
Central N.E. Dairy-(Base for Area Dummies)	-0-	1935	-.043
Eastern Wisconsin Dairy	.083***	1936	-.167***
Western Wisconsin Dairy	.049*	1937	-.050
Dairy-Hog, Minnesota	.125***	1938	-.001
Hog-Dairy, Corn Belt	.154***	1939	-.014
Hog-Beef Raising, Corn Belt	.080**	1940	.022
Hog-Beef Fattening, Corn Belt	.193***	1941	.043
Cash Grain, Corn Belt	.202***	1942	.084**
Southern Piedmont Cotton	-.097**	1943	.061*
Texas Black Prairie Cotton	.054	1944	.076**
No. Plains, Wheat-Small Grain-Livestock	-.100	1945	.080**
No. Plains, Wheat-Corn-Livestock	-.037	1946	.059
No. Plains, Wheat-Roughage-Livestock	-.199**	1947	.049
Southern Plains, Winter Wheat	-.015	1948	.047
Southern Plains, Wheat-Grain-Sorghums	-.071	1949	.017
Wheat-Fallow, Washington and Oregon	-.054	1950	.013
Northern Plains Cattle	-.348**	1951	.031
Intermountain Cattle	-.035	1952	.028
Northern Plains Sheep	-.413***	1953	.023
		1954	.016
*** Denotes significance at the .01 level.		1955	.039
		1956	.045
** Denotes significance at the .05 level.		1957	.082**
		1958	.122***
* Denotes significance at the .10 level.		1959	.065
		1960	.107**
		1961	.068
		1962	.118**

Marginal Value Products

All physical inputs and output are entered in the production function in either constant dollar or physical terms. Hence, marginal physical product series can be derived for real estate in each area for each year by converting the estimated Y_i from the production function to antilogs and substituting them into the formula $\frac{b_1 \hat{Y}_{ij}}{X_{1ij}}$ where b_1 is the real estate regression coefficient in the function, $\hat{Y}_{ij}$ is the estimated physical output in year i on the representative farm from area j, and X_{ij} is the number of acres in the representative farm in the ith year and jth area.

In specifying the dependent variable, conversion to constant dollars is accomplished by dividing current value of total output by the index of prices received in each area. This leaves total output in physical quantities multiplied by base price terms. The marginal physical products obtained from the production function then are also in these terms. The procedure can be reversed by multiplying the marginal physical products thus obtained by the prices received index to obtain secular marginal value product series for real estate.

The calculated real estate MVP for each year and each area is the point at which the farm is operating on its static production function. The statistical function with time and area dummy variables included to shift the function for each area and year pinpoints the

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Analytical Tools for Studying Demand and Price Structures, Agricultural Handbook No. 146, ERS, U.S.D.A. (Washington: U.S. Government Printing Office, 1958), pp. 179-184. The specific application of the general procedure used here was developed in a discussion between William Ruble, Agricultural Experiment Station, Michigan State University and the author.

location of the firm in a given area on its yearly static production function.[4] So the MVP's obtained from this statistical function are secular in that they apply through time. The calculated MVP for each year is the only known point on the firm's static function for that year.

Ex Post Real Estate Value Series

Now the secular MVP series derived above can be considered as the price which can be paid each year for the productive services of the real estate input. In order to develop land value data to compare with the real estate values found in the Costs and Returns series estimated by the market value or comparable sales method, the secular MVP's or income streams are capitalized to obtain a present value for real estate for each year.

A capitalization formula is needed which will allow both the net annual return or secular MVP and the capitalization rate to change from year to year. As the data are only available through 1962 the formula is couched in such a way that the last term contains a 5-year average of the MVP's and interest rates from 1958 through 1962. This term will repeat itself so there are always 34 terms in the formula even though a term per year is dropped at the beginning of the formula as values are capitalized for the years beginning with 1930 and moving to 1962. A 5-year average for the last term is used under the assumption that the best clue to the future is the immediate past. That is, expectations about future income streams to farm real estate under

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[4]The role of the time and area dummy variables is discussed in Appendix B.

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this assumption are based on the average of the actual income streams for the past 5 years.

Thirty-four terms in the formula for each year's value is chosen because there are 33 years in the period and the 34th term allows the formula to be generalized to include the year 1930 when MVP's for all 33 years can be used. Also, it is a long enough period that the addition to value from the last term provides a reasonable balance between approaching zero and weighting the last 5-year constant term too heavily in calculating the real estate value series.

The formula presented is comparable to the first 34 terms of the infinite series

$$V = \frac{a_1}{(1+r_1)^1} + \frac{a_2}{(1+r_2)^2} + \frac{a_3}{(1+r_3)^3} + \cdots + \frac{a_t}{(1+r_t)^t} + \cdots$$

where V is the capitalized present value, a is the expected net annual return, and r is the capitalization rate, and t approaches infinity. If a and r are assumed constant, the formula collapses to V = a/r. By including only the first 34 terms of the infinite series, under an assumed constant r of 5 percent, the calculated value is biased downward from the true value calculated by V = a/r to approximately 81 percent of the true level.[5] The higher the capitalization rate the smaller the percentage of downward bias. The downward bias can be interpreted as using a higher capitalization rate than the one stated in the formula. In this study with that interpretation the effective rate is approximately 1 percent higher than the series actually used here.[6]

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[5]Robert C. Weast (ed.), Standard Mathematical Tables, 13th Student Edition, (Cleveland: Chemical Rubber Co., 1964), pp. 483-499.

[6]The magnitude of the differential between the ex post series

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The capitalization rate used in the formula is the rate charged for new loans on January 1 of each year by the Federal Land Bank in each of the 19 farming areas studied.[7] The Formula is:

$$V_t = \sum_{i=1}^{k-t+1} \frac{MVP_{t+i-1}}{(1+r_{t+i-1})^i} + \sum_{j=k-t+2}^{34} \frac{MVP_c}{(1+r_c)^j} \qquad (I)$$

Where:

V_t = Per acre real estate value in year t

MVP = Secular MVP or income stream

r = Capitalization rate

t = Year 1930,...,1962

k = 1962

i = 1,...,k-t+1

j = k-t+2,...,34

$$MVP_c = \frac{\Sigma MVP_{1958-1962}}{5}$$

$$r_c = \frac{\Sigma r_{1958-1962}}{5}$$

these are constants

The yearly MVP's entering this formula are in current dollars for that year. If the general price level remains stable over the period, no inflationary or deflationary influences become capitalized into the real estate values and the series will reflect the price which a buyer could afford to pay for farm real estate in any year in that year's current dollars. In other words the purchasing power of a

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and ex ante series in addition to being due to the difference in assumptions is partly due to the difference of approximately one percent in effective capitalization rates in calculating the two series. This would cause a constant percentage differential, however, and other factors discussed later account for changes in relationships between the two series.

[7]For a discussion of the rationale for choosing this particular interest rates series see Appendix C. Appendix D presents the interest rate schedule used for each of the 19 areas.

dollar would be the same throughout the time period. This, of course, has not been the case. As evidenced by the Consumers Price Index the general price level fell in the early 1930's, reached a low in 1933 and increased between 1933 and 1962, except for a slight dip between 1938 and 1940 and again in 1949 and 1955. Thus, since 1933, the purchasing power of the dollar has generally declined. In 1962 it took $2.33 to buy the same bundle of goods and services as $1.00 would buy in 1933.

A land MVP in 1962 then would need to be 133 percent higher than in 1933 in order for the purchasing power of the income streams to be comparable and the landowner to be equally well off in the two years. When the income streams are capitalized back to 1933 without being adjusted for the rising price level the capitalized price in 1933 includes a factor attributable to the rising price level. If a buyer paid this price he would be paying in dollars with relatively high purchasing power for future income streams of dollars with relatively lower and declining purchasing power. With the rising price level his asset position would deteriorate through time because price calculations had been based on dollar streams of declining purchasing power.

In order to be able to compare the ex post land value series with the Costs and Returns estimates of current market prices paid for farm real estate, the income streams must be adjusted to reflect their purchasing power in the particular year for which the ex post value is being calculated. In other words, the ex post series must be adjusted for the effect of future price level changes. To accomplish this, the

MVP series is deflated by the Consumers Price Index based at 100 in the year for which the real estate value is derived. That is, the formula incorporates a general price level deflator in the form of the consumer price index as follows:

$$V_t = \sum_{i=1}^{k-t+1} \frac{MVP_{t+i-1}(CPI_t/CPI_{t+i-1})}{(1 + r_{t+i-1})^i} + \sum_{j=k-t+2}^{34} \frac{\left(\sum_{d=1958}^{1962} MVP_d(CPI_t/CPI_d)/5\right)}{\left(1+\left(\sum_{d=1958}^{1962} r_d/5\right)\right)^j} \qquad \text{(II)}$$

where:

V = Per acre real estate value in year t

MVP = Secular MVP or income stream

r = Capitalization rate

CPI = Consumer Price Index

t = Year 1930,...,1962

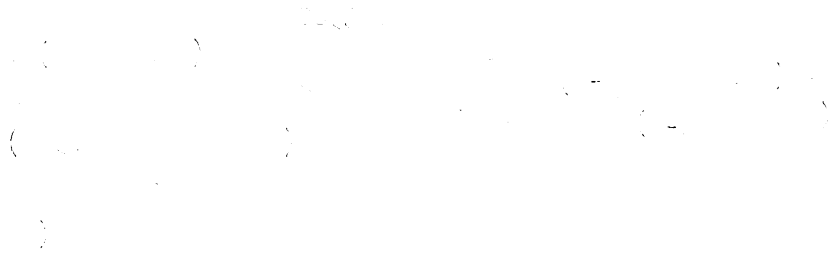
k = 1962

i = 1,...,k-t+1

j = k-t+2,...,34

d = 1958,...,1962

Here the MVP's for all future years are expressed in terms of constant purchasing power in the year for which price is being calculated so the buyer would neither gain nor loose due to general price level changes. The real estate values derived from the formula are ex post values in the sense that they use actual data on future income streams or MVP's in finding the capitalized value in year t rather than predicted data on expectations of future income streams. Admittedly the values are based on less fact and more prediction as t moves from 1930 toward 1962 but the point of complete prediction is not reached until t = 1963. The value derived from the formula for a given year



can be interpreted as the price a farm real estate buyer could have paid if he had known the size of the future income stream and if his capitalization rate coincided with that used in the formula.

Ex Ante Real Estate Value Series

The other series developed is called the ex ante series. It is a purely mechanical behavioral model which assumes that the land buyer looks at the average of the past 5 year's MVP's and interest rates in determining how much to pay for land. The formula for the capitalized value based on the preceding 5-year averages is:

$$V_t = \frac{\sum_{i=1}^{5} MVP_{t-i}/5}{\sum_{i=1}^{5} r_{t-i}/5} \qquad \text{(III)}$$

where:

V_t = Per acre real estate value in year t

MVP = Secular MVP or income stream

r = Capitalization rate

t = year, 1935,...,1962

i = 1,...,5

This value is interpreted as the price the buyer estimates he can pay for farm real estate on the basis of the returns to that factor during the past 5 years. The buyer is assuming that the past 5 years yield a reasonable estimate of prices and output levels which will prevail in the future. The model does not use all the information available to a buyer such as trends in general economic conditions or

rapidly increasing demand conditions due to wars, or changes in price or production outlook due to introduction of different government programs. Therefore, it will not adjust readily to abrupt changes in output and it cannot foresee turning points in prices or output. The range of land value estimates from the model will be much greater than if it were able to incorporate additional information of this kind. But under normal circumstances the model should be expected to yield values consistent in direction (even though the magnitude may be greater or less) with the more sophisticated approach an actual buyer would use.

One modification of the mechanical model is possible, however, and is included before the series are derived. The general price level change is taken into account in a manner similar to that used in deriving the ex post series. If the price level does not change, the purchasing power of each dollar in the income stream is constant over the past 5 years which are used as a base for the estimated price in the present year. But if the general price level increases over these 5 years the purchasing power of the dollar declines. Therefore, due to the price level increase alone the buyer should expect to pay a higher price in current dollars than the capitalization formula will estimate. Of course, if the price level declines the capitalization formula over estimates the price the buyer should be willing to pay. Thus, assuming a reasonably well informed potential buyer would make this kind of adjustment a price level adjustment is included in the capitalization formula and it becomes:

$$V_t = \frac{\left(\sum_{i=1}^{5} MVP_{t-i}(CPI_t/CPI_{t-i})\right)/5}{\sum_{i=1}^{5} r_{t-i}/5} \qquad \text{(IV)}$$

where:

V_t = Per acre real estate value in year t

MVP = Secular MVP or income stream

r = Capitalization rate

CPI = Consumer Price Index

t = Year 1935,...,1962

i = 1,...,5

The interpretation of the value derived from this formula is as discussed above except that price level changes are considered. The real estate value series resulting from the above ex post and ex ante calculations using formulas (II) and (IV) located on pages 19 and 22 respectively are presented in columns 2 and 3 of Tables 2-20 for the period 1930-1962 for the 19 farming areas in the study. Column 1 of these tables presents the estimated current market value of farm real estate in the respective areas from the Costs and Returns data.

Price and Productivity Components of Yearly Changes in Real Estate Marginal Value Products

Finally, in order to facilitate interpretation of the MVP data derived from the production function model several manipulations are performed on these series. The marginal physical product and marginal value product series are converted to indexes based on 1947-1949 = 100. These series along with the prices received index on the same base from

the Costs and Returns data are presented in the first 3 columns of Tables 21 through 39--a set of series per table for each area in the study.

The fourth column in each table is the MVP series for each area derived from the production function. The fifth, sixth, and seventh columns deal with year-te-year changes in the MVP series and are offset one-half space downward to show that they are calculated between one year and the next. The fifth column is merely the change in MVP from one year to the next. Now since MVP is equal to MPP times the product price, a change in MVP may be caused by a change in MPP, a change in product prices, or some combination of changes in both. The change in MVP is partitioned into that portion of the total change due to change in MPP and that portion due to change in price. These two portions of the MVP change are called the productivity component and the price component respectively and are presented in columns 6 and 7 of the tables.

The theoretical basis for the procedure is presented by Boyne in Michigan State University Technical Bulletin 294, "Changes in the Real Wealth Position of Farm Operators, 1940-1960."[8] Essentially the procedure is based on the Taylor series expansion of the function $V = PQ$ where for a change in value between time period t and time period $t + 1$ the partitioning into the various price-quantity components of the change is:

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[8]David H. Boyne, Changes in the Real Wealth Position of Farm Operators, 1940-1960, Technical Bulletin No. 294, (Michigan State University, Agricultural Experiment Station, 1964), pp. 31-33 and 70-71.

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$$\Delta V = P_t\Delta Q + Q_t\Delta P + \Delta P\Delta Q$$

Substituting MPP for Q and MVP for V we have

$$MVP_{t+1} - MVP_t = \underset{(1)}{P_t(MPP_{t+1} - MPP_t)} + \underset{(2)}{MPP_t(P_{t+1} - P_t)} + \underset{(3)}{(MPP_{t+1} - MPP_t)(P_{t+1} - P_t)}.$$

The productivity component is term (1) plus half of term (3) and the price component is term (2) plus the other half of term (3).

This assumes along with Boyne[9] that (1) the rate of change in both price and MPP during each period is constant, (2) the constant rates of change for price and MVP are not necessarily equal to each other, (3) the rates of change in a given time period are not necessarily equal to the rates of change in other time periods.

Normally we could derive either the price or the productivity component and subtract it from the total change to find the other. But in order to accomplish either method directly from the above formula we would need MPP expressed in pure physical and price in current dollar terms. Since price in this case is only available as a price index with 1947-1949 = 100 and MPP is only available in quantity times base (1947-1949 = 100) price or constant dollar terms a slight variation of the formula is needed.

In our case MVP is equal to the price index (based on 1947-1949 = 100) multiplied by MPP in constant dollars also based on 1947-1949 = 100. Now remembering that MPP is in quantity times base price terms we can multiply term (1) of the above formula by $\frac{MPP_t}{MPP_t}$ to get

$MVP_t\left(\frac{MPP_{t+1} - MPP_t}{MPP_t}\right)$. This converts the change in MPP between periods t

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[9] Ibid, p. 71

and t + 1 to percentage terms based on the level of MPP in year t. When this is done the base price terms or constant dollar scalar contained in MPP drops out.[10] MVP_t is in current t year dollars, so MVP_t times the percentage change in MPP between t and t+1 is equal to the change in MVP between t and t + 1 due to change in MPP during that period. This is a productivity component but is downward biased because it contains none of term (3) in the above formula while it should contain half of it to be unbiased.

To correct for this bias we can calculate a productivity component which, in addition to containing term (1), contains all of term (3). This productivity component will be upward biased by the same amount as the one just calculated is downward biased. An average of the two then will yield an unbiased productivity component which is equal to term (1) plus half of term (3) of the above formula.

The upward biased productivity component is calculated using MVP_{t+1} and percentage change in MPP based on the level of MPP_{t+1}. The formula then for the unbiased productivity component of a change in MVP between year t and t + 1 is:

$$\frac{MVP_t \left(\frac{MPP_{t+1} - MPP_t}{MPP_t}\right) + MVP_{t+1} \left(\frac{MPP_{t+1} - MPP_t}{MPP_{t+1}}\right)}{2}$$

and the price component is the change in MVP minus the productivity component.

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[10] That is, letting Q stand for the physical quantity portion and P_b stand for the base price portion of MPP,

$$\frac{MPP_{t+1} - MPP_t}{MPP_t} = \frac{Q_{t+1}P_b - Q_tP_b}{Q_tP_b} = \frac{Q_{t+1} - Q_t}{Q_t}$$ = the percentage change in physical MPP without any bias entering from the base price scalar.

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The Residual Return Model

One method of determining value used extensively by real estate appraisers is the income capitalization method. The approach generally starts with net farm income and subtracts an imputed return to the operator and family labor and non-real estate capital inputs. The residual or amount left over is the return or payment in any given year for the productive services of the real estate input. If the data are available residual returns are usually calculated for several years and averaged to level out year-to-year fluctuations. A capitalization rate is decided upon and then the return is capitalized to yield the present value of the future income streams accruing to land on the basis of the residual calculations.

The Variables Used in the Residual Calculations

Data for the representative farms from the same 19 agricultural areas chosen for the production function are used for the residual calculations. The variables are defined as follows:

Charge for non-real estate capital. The Costs and Returns data for each type of farm for each year contains an estimate of the current value of non-real estate capital. The crop and livestock inventory portion is valued using the prices at which these items could be sold, January 1 of each year. The machinery and equipment portion is valued at replacement cost minus depreciation value as of the beginning of the year. Thus the capital value each year is assumed to be the price which sale of the capital items on the open market would bring.

Any charge for farm capital investment must be an arbitrary one as discussed in Appendix C. Farm assets vary greatly in type and

productive life span and are purchased at different times. For our purpose here we use the interest rate charged on January 1 for new loans by the Federal Land Banks in the respective areas both because it is easily available and because it is assumed to be the opportunity cost interest rate that most farmers would look at during the period in assessing alternatives for capital investment. No charge is made for operating expense capital.

Charge for operator and family labor. Since we want to use a charge for operator and family labor which reflects an off farm opportunity cost return we need a series of annual wage rates in the non-farm economy which will approximate the return the farm operator could expect from full-time non-farm employment. Jones developed such a series based on national averages of annual income per employed factory worker adjusted by the national non-farm sector unemployment rate.[11]

Jones' calculations are adjusted to reflect the factory wage rates prevailing in each year within each of the 19 type of farming areas. This was accomplished by using state averages of factory wage rates weighted by number of factory workers for states in which each of the 19 areas fall to obtain a factory wage representative of each farm type area. The national unemployment rate for each year was used for all area calculations.[12]

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[11]For a rationale for using wage series for factory workers and method of adjustment for the unemployment rate see Bob F. Jones, "Farm-Non-Farm Labor Flows, 1917-1962," (unpublished Ph.D. dissertation, Mich. State University, 1964), pp. 136-147. For a further discussion of the unemployment rate weights used in Jones' calculations see Earl O. Heady and Luther G. Tweeten, Resource Demand and Structure of the Agricultural Industry, (Ames: Iowa State University Press, 1963), pp. 243-252.

[12]These factory wage rates adjusted by the national unemployment rate are presented for each area in Appendix D.

The residual return to real estate in any given year is net farm income for that year minus the imputed charges for capital and labor. The return to land is then put on a per acre basis by dividing the residual by the number of acres in the representative farm in that year.

The residual return model assumes an opportunity cost or salvage value return for labor and capital. If returns to these factors in their present agricultural use drop below the opportunity cost returns calculated for labor and capital these factors would be expected to move out of their present use and into their opportunity cost use. Thus these are the minimum returns which would be expected to keep these inputs in their present use. Therefore, the return to farm real estate calculated with the variables defined as above should establish the upper bound for farm real estate values derived by the residual model.

The yearly residual returns are capitalized into ex post and ex ante real estate value series in the same way that the production function MVP's are converted to value series. Columns 4 and 5 of Tables 2-20 present the resulting series derived from the residual model, again using formulas (II) and (IV) on pages 19 and 22 respectively.

Negative residual returns to land were found in some years. They were entered into the capitalization formula on the same basis as positive returns. A negative capitalized value is interpreted by a potential buyer as meaning that he should be willing to "buy" if in addition to acquiring ownership of the land he also receives at the

same time at least the negative capitalized value along with it. In other words the negative capitalized value is what he would need now to compensate him for the negative income streams or losses he will incur in the future from ownership of the land. Conversely a potential seller under the assumptions of the residual model should be willing to pay a buyer the negative capitalized value for taking over ownership of the property.

We would, no doubt, silently question the extent of mental derangement of a seller if he offered to make such a transaction, then quickly take him up on his proposition; particularly if his property was located in the hog-beef raising area of the Corn Belt or the Texas Black Prairie cotton area--both of which turn out to have negative real estate values in the residual model. Further discussion of the results from this model is found in Chapter V where we argue that while the underlying assumptions of the model are correct the model itself must be used with extreme caution for estimating real estate values.

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Table 2 Central Northeast Dairy--Estimated Market Value from Costs and Returns Series, Ex Post and Ex Ante Value Series from the Production Function and Residual Return Models for Farm Real Estate in Dollars per Acre 1930-1962

Year	Costs and Returns Market Value Estimate (1)	Production Function Estimates Ex Ante (2)	Production Function Estimates Ex Post (3)	Residual Return Estimates Ex Ante (4)	Residual Return Estimates Ex Post (5)
1930	37	---	151	---	39
1931	33	---	139	---	36
1932	27	---	129	---	32
1933	28	---	123	---	30
1934	29	---	132	---	31
1935	30	84	138	28	32
1936	30	83	140	39	30
1937	30	89	150	45	30
1938	30	100	149	52	27
1939	30	111	149	59	25
1940	30	128	154	62	25
1941	32	149	162	63	24
1942	33	190	181	67	25
1943	35	230	192	73	25
1944	39	263	194	54	27
1945	43	299	194	46	23
1946	49	353	206	52	27
1947	54	433	231	99	21
1948	58	475	245	122	17
1949	62	481	237	173	7
1950	60	458	240	136	4
1951	63	463	260	103	0
1952	70	443	264	150	- 5
1953	70	422	263	117	- 7
1954	68	387	268	46	- 4
1955	75	370	268	33	- 5
1956	78	372	276	23	- 7
1957	84	369	288	- 1	- 8
1958	86	371	298	- 2	-10
1959	92	367	297	24	-13
1960	94	373	304	19	-13
1961	93	370	306	7	-13
1962	95	363	311	11	-15

Table 3 Eastern Wisconsin Dairy--Estimated Market Value from Costs and Returns Series, Ex Post and Ex Ante Value Series from the Production Function and Residual Return Models for Farm Real Estate in Dollars per Acre 1930-1962.

Year	Costs and Returns Market Value Estimate (1)	Production Function Estimates Ex Ante (2)	Production Function Estimates Ex Post (3)	Residual Return Estimates Ex Ante (4)	Residual Return Estimates Ex Post (5)
1930	99	---	198	---	18
1931	86	---	185	---	17
1932	76	---	172	---	16
1933	67	---	166	---	15
1934	67	---	179	---	13
1935	73	85	189	23	12
1936	74	87	193	53	5
1937	82	98	206	73	2
1938	83	114	206	90	- 2
1939	80	133	206	104	- 8
1940	77	154	214	106	- 9
1941	74	177	227	85	-12
1942	83	228	255	86	-16
1943	83	284	271	65	-18
1944	91	133	273	22	-17
1945	94	392	273	- 8	-13
1946	101	470	291	-17	-16
1947	111	583	327	9	-27
1948	123	643	346	36	-36
1949	123	654	334	61	-39
1950	124	634	338	89	-40
1951	142	661	366	53	-39
1952	148	655	370	14	-43
1953	148	637	368	-31	-41
1954	143	603	372	-97	-33
1955	144	585	371	-122	-28
1956	146	585	383	-155	-16
1957	165	574	398	-227	- 6
1958	175	568	412	-263	5
1959	189	547	410	-237	14
1960	210	541	422	-240	24
1961	211	528	425	-150	22
1962	224	517	430	- 52	12

Table 4 Western Wisconsin Dairy--Estimated Market Value from Costs and Returns series, Ex Post and Ex Ante Value Series from the Production Function and Residual Return Models for Farm Real Estate in Dollars per Acre 1930-1962

Year	Costs and Returns Market Value Estimate (1)	Production Function Estimates Ex Ante (2)	Production Function Estimates Ex Post (3)	Residual Return Estimates Ex Ante (4)	Residual Return Estimates Ex Post (5)
1930	84	---	136	---	9
1931	62	---	126	---	9
1932	53	---	116	---	10
1933	47	---	112	---	8
1934	45	---	121	---	8
1935	44	62	128	4	7
1936	46	61	130	29	2
1937	46	67	139	46	- 1
1938	44	77	139	59	- 4
1939	42	87	139	70	- 8
1940	39	103	145	83	-11
1941	39	117	153	65	-13
1942	43	150	172	70	-18
1943	45	187	183	55	-20
1944	52	222	184	24	-20
1945	50	261	185	-17	-16
1946	57	315	196	-33	-16
1947	65	398	220	-38	-23
1948	72	443	232	-36	-27
1949	72	450	223	- 6	-32
1950	67	440	225	32	-35
1951	80	462	243	34	-37
1952	81	456	243	31	-43
1953	85	439	243	28	-46
1954	75	415	245	-25	-42
1955	70	402	244	-53	-39
1956	74	401	251	-87	-33
1957	82	391	261	-136	-30
1958	85	387	269	-161	-28
1959	96	374	267	-116	-30
1960	99	371	273	-111	-28
1961	105	355	276	- 81	-26
1962	114	343	280	- 49	-29

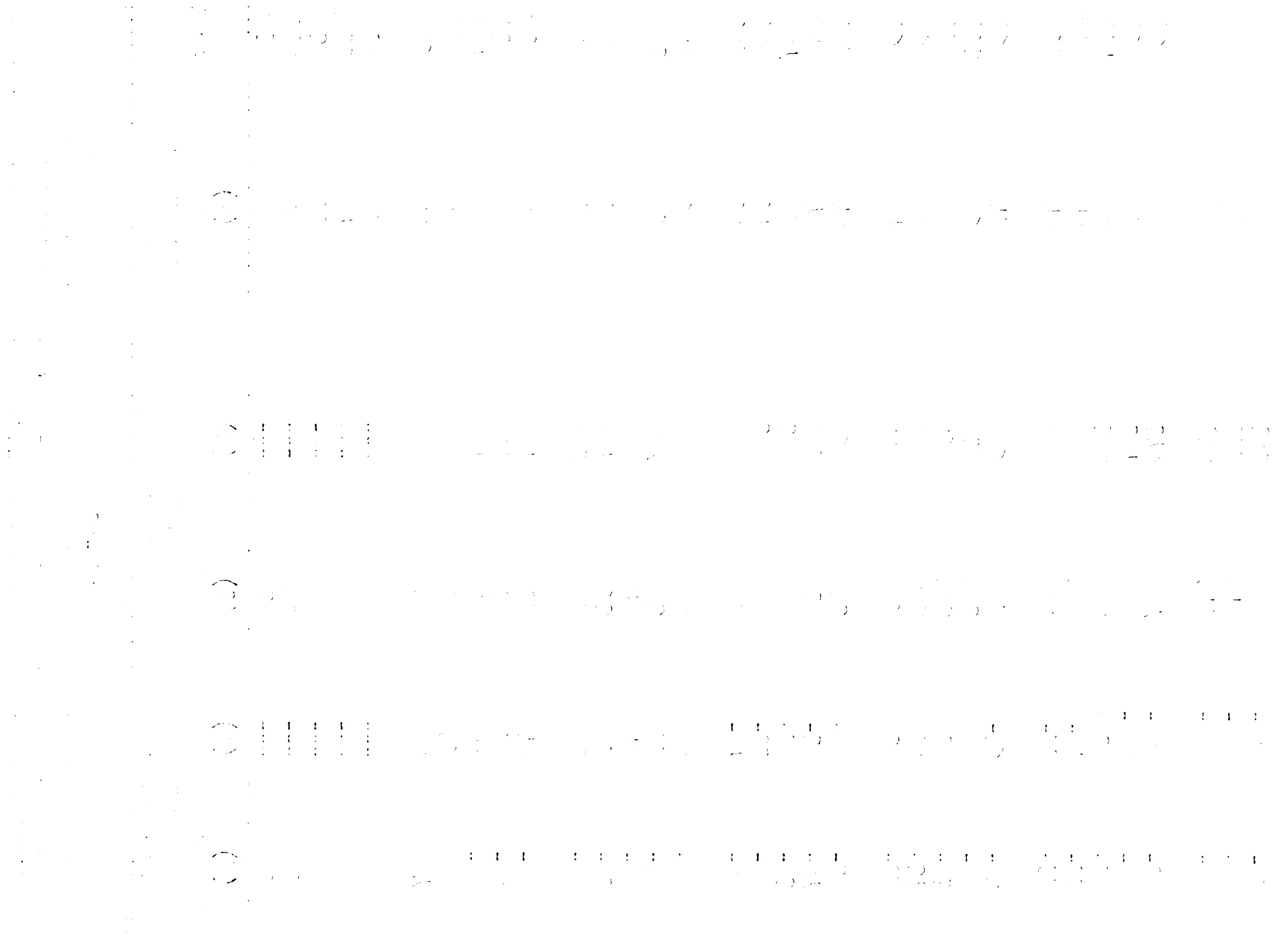

Table 5 Dairy-Hog, Minnesota--Estimated Market Value from Costs and Returns Series, Ex Post and Ex Ante Value Series from the Production Function and Residual Return Models for Farm Real Estate in Dollars per Acre 1930-1962

Year	Costs and Returns Market Value Estimate (1)	Production Function Estimates Ex Ante (2)	Production Function Estimates Ex Post (3)	Residual Return Estimates Ex Ante (4)	Residual Return Estimates Ex Post (5)
1930	96	---	170	---	67
1931	83	---	157	---	62
1932	69	---	146	---	58
1933	57	---	141	---	55
1934	63	---	152	---	58
1935	59	75	160	19	62
1936	63	75	164	43	57
1937	67	84	175	66	56
1938	68	96	175	85	51
1939	59	113	175	108	46
1940	62	130	182	146	43
1941	61	145	194	140	42
1942	66	182	219	158	43
1943	71	226	233	165	41
1944	76	267	235	145	40
1945	77	314	237	112	42
1946	89	393	251	120	41
1947	92	502	280	167	35
1948	101	566	296	192	27
1949	102	574	286	235	14
1950	107	565	289	263	9
1951	121	580	313	260	7
1952	134	566	317	224	- 1
1953	143	539	316	188	- 6
1954	129	514	319	120	- 9
1955	142	500	318	92	- 10
1956	148	503	327	75	- 10
1957	176	493	340	37	- 11
1958	191	490	353	35	- 18
1959	199	470	351	42	- 23
1960	205	463	361	18	- 21
1961	198	448	364	- 3	- 16
1962	206	441	368	7	- 20

Table 6 Hog-Dairy, Corn Belt--Estimated Market Value from Costs and Returns Series, Ex Post and Ex Ante Value Series from the Production Function and Residual Return Models for Farm Real Estate in Dollars per Acre 1930-1962

Year	Costs and Returns Market Value Estimate (1)	Production Function Estimates		Residual Return Estimates	
		Ex Ante (2)	Ex Post (3)	Ex Ante (4)	Ex Post (5)
1930	95	---	199	---	103
1931	82	---	184	---	98
1932	66	---	171	---	92
1933	50	---	165	---	89
1934	56	---	179	---	97
1935	61	84	189	6	105
1936	67	85	192	37	101
1937	67	95	205	57	105
1938	68	113	205	90	100
1939	68	136	204	128	94
1940	68	160	213	173	95
1941	68	176	226	162	99
1942	72	222	255	186	109
1943	76	276	270	209	110
1944	85	323	272	214	107
1945	87	373	274	202	109
1946	99	455	292	236	114
1947	112	568	329	329	116
1948	126	640	346	346	117
1949	130	653	334	385	99
1950	134	649	336	421	93
1951	148	686	363	444	96
1952	155	687	366	397	90
1953	159	650	364	369	85
1954	159	623	366	289	83
1955	170	609	363	274	75
1956	182	603	374	220	83
1957	190	588	389	167	89
1958	193	585	402	153	89
1959	215	558	399	175	79
1960	220	539	411	120	84
1961	209	519	415	119	90
1962	217	503	420	134	89

Table 7 Hog-Beef Raising, Corn Belt--Estimated Market Value from Costs and Returns Series, Ex Post and Ex Ante Value Series from the Production Function and Residual Return Models for Farm Real Estate in Dollars per Acre 1930-1962

Year	Costs and Returns Market Value Estimate (1)	Production Function Estimates		Residual Return Estimates	
		Ex Ante (2)	Ex Post (3)	Ex Ante (4)	Ex Post (5)
1930	69	---	101	---	18
1931	58	---	93	---	19
1932	50	---	87	---	17
1933	45	---	84	---	16
1934	37	---	91	---	18
1935	38	43	96	- 12	21
1936	40	43	98	10	17
1937	40	48	105	7	19
1938	40	56	105	18	16
1939	40	67	105	34	14
1940	40	76	109	63	11
1941	40	85	116	54	10
1942	45	108	131	76	9
1943	50	137	139	81	6
1944	56	166	140	74	4
1945	60	191	141	39	7
1946	67	234	150	19	9
1947	74	291	170	51	2
1948	77	335	177	30	1
1949	81	332	172	59	- 8
1950	83	331	174	108	- 14
1951	95	350	187	163	- 23
1952	108	354	189	137	- 30
1953	104	332	188	149	- 34
1954	100	323	189	80	- 32
1955	101	317	187	38	- 32
1956	107	313	193	- 19	- 29
1957	116	301	201	- 67	- 28
1958	122	294	208	- 88	- 29
1959	128	282	207	- 38	- 36
1960	135	272	213	- 51	- 33
1961	133	261	216	- 46	- 31
1962	139	255	218	- 31	- 32

Table 8 Hog-Beef Fattening, Corn Belt--Estimated Market Value from Costs and Returns Series, Ex Post and Ex Ante Value Series from the Production Function and Residual Return Models for Farm Real Estate in Dollars per Acre 1930-1962

Year	Costs and Returns Market Value Estimate (1)	Production Function Estimates		Residual Return Estimates	
		Ex Ante (2)	Ex Post (3)	Ex Ante (4)	Ex Post (5)
1930	133	---	286	---	205
1931	113	---	267	---	192
1932	90	---	249	---	179
1933	68	---	241	---	172
1934	73	---	263	---	188
1935	75	112	278	35	203
1936	79	112	285	67	200
1937	79	126	306	70	216
1938	79	146	307	111	209
1939	79	176	308	160	204
1940	79	205	323	222	210
1941	80	233	345	221	219
1942	85	294	391	285	247
1943	90	372	419	336	254
1944	97	442	425	372	251
1945	102	504	434	404	252
1946	122	605	469	461	269
1947	136	767	532	704	274
1948	155	894	561	789	273
1949	167	916	549	901	234
1950	173	944	555	955	220
1951	204	1045	598	1110	214
1952	222	1071	605	1006	199
1953	214	1018	604	907	190
1954	212	989	613	691	192
1955	230	963	611	633	180
1956	229	938	632	444	197
1957	238	913	660	326	208
1958	239	884	687	291	212
1959	255	847	688	338	199
1960	262	843	707	256	208
1961	271	814	719	255	221
1962	283	788	730	248	227

Table 9 Cash Grain, Corn Belt--Estimated Market Value from Costs and Returns Series, Ex Post and Ex Ante Value Series from the Production Function and Residual Return Models for Farm Real Estate in Dollars per Acre 1930-1962

Year	Costs and Returns Market Value Estimate (1)	Production Function Estimates Ex Ante (2)	Production Function Estimates Ex Post (3)	Residual Return Estimates Ex Ante (4)	Residual Return Estimates Ex Post (5)
1930	149	---	191	---	199
1931	130	---	178	---	190
1932	107	---	166	---	180
1933	88	---	161	---	175
1934	97	---	172	---	190
1935	99	81	180	29	200
1936	106	85	183	74	197
1937	114	105	194	127	204
1938	120	118	195	166	200
1939	114	128	195	198	197
1940	125	146	203	246	200
1941	127	165	214	241	211
1942	141	208	240	293	229
1943	146	267	254	344	239
1944	169	319	255	393	236
1945	176	369	256	402	237
1946	181	451	270	494	247
1947	206	569	299	644	259
1948	220	669	307	746	257
1949	231	659	299	748	241
1950	236	645	301	775	234
1951	278	680	321	820	243
1952	299	669	320	749	233
1953	310	607	316	660	225
1954	304	607	315	613	221
1955	309	603	309	584	211
1956	324	598	314	543	214
1957	352	585	323	522	212
1958	370	557	332	455	221
1959	394	514	330	400	220
1960	394	486	339	319	233
1961	394	442	343	283	237
1962	406	413	348	249	236

Table 10 Southern Piedmont Cotton--Estimated Market Value from Costs and Returns Series, Ex Post and Ex Ante Value Series from the Production Function and Residual Return Models for Farm Real Estate in Dollars per Acre 1930-1962

Year	Costs and Returns Market Value Estimate (1)	Production Function Estimates Ex Ante (2)	Production Function Estimates Ex Post (3)	Residual Return Estimates Ex Ante (4)	Residual Return Estimates Ex Post (5)
1930	26	---	75	---	4
1931	22	---	69	---	5
1932	16	---	65	---	5
1933	14	---	62	---	5
1934	19	---	67	---	3
1935	22	39	69	13	0
1936	21	41	70	30	- 3
1937	22	48	75	45	- 6
1938	21	53	75	49	- 6
1939	23	57	75	50	- 9
1940	23	61	78	50	- 12
1941	25	67	83	48	- 15
1942	27	87	93	37	- 17
1943	30	108	99	32	- 18
1944	35	126	100	1	- 16
1945	38	145	101	- 35	- 13
1946	43	174	108	- 61	- 12
1947	52	217	121	- 54	- 18
1948	55	242	128	- 51	- 21
1949	58	237	126	- 23	- 22
1950	57	228	128	- 9	- 21
1951	65	238	138	- 7	- 21
1952	68	226	140	- 15	- 25
1953	72	216	138	- 20	- 25
1954	71	211	139	- 35	- 24
1955	72	206	137	- 38	- 21
1956	76	204	141	- 26	- 23
1957	82	198	146	- 54	- 20
1958	83	197	151	- 73	- 17
1959	92	192	150	- 46	- 20
1960	98	191	154	- 44	- 19
1961	104	188	156	- 56	- 17
1962	110	186	158	- 34	- 18

Table 11 Texas Black Prairie Cotton--Estimated Market Value from Costs and Returns Series, Ex Post and Ex Ante Value Series from the Production Function and Residual Return Models for Farm Real Estate in Dollars per Acre 1930-1962

Year	Costs and Returns Market Value Estimate (1)	Production Function Estimates Ex Ante (2)	Production Function Estimates Ex Post (3)	Residual Return Estimates Ex Ante (4)	Residual Return Estimates Ex Post (5)
1930	84	---	111	---	39
1931	66	---	103	---	37
1932	47	---	97	---	35
1933	45	---	93	---	32
1934	49	---	100	---	28
1935	51	51	104	58	23
1936	52	51	107	86	16
1937	56	60	114	121	11
1938	55	68	114	136	6
1939	50	72	114	136	1
1940	51	78	119	136	- 5
1941	49	88	127	133	- 10
1942	55	114	143	127	- 15
1943	53	141	153	100	- 15
1944	59	167	155	63	- 16
1945	59	193	156	10	- 13
1946	71	234	168	- 36	- 11
1947	79	296	188	- 50	- 17
1948	91	343	198	1	- 28
1949	88	353	192	21	- 32
1950	97	363	192	79	- 40
1951	113	406	204	137	- 51
1952	108	410	204	104	- 52
1953	114	408	199	55	- 55
1954	120	417	196	46	- 60
1955	125	404	193	- 14	- 56
1956	136	397	196	- 62	- 57
1957	134	384	203	-118	- 47
1958	142	351	209	-166	- 42
1959	155	311	208	-165	- 43
1960	157	298	213	-163	- 40
1961	159	272	216	-150	- 39
1962	159	261	218	- 89	- 41

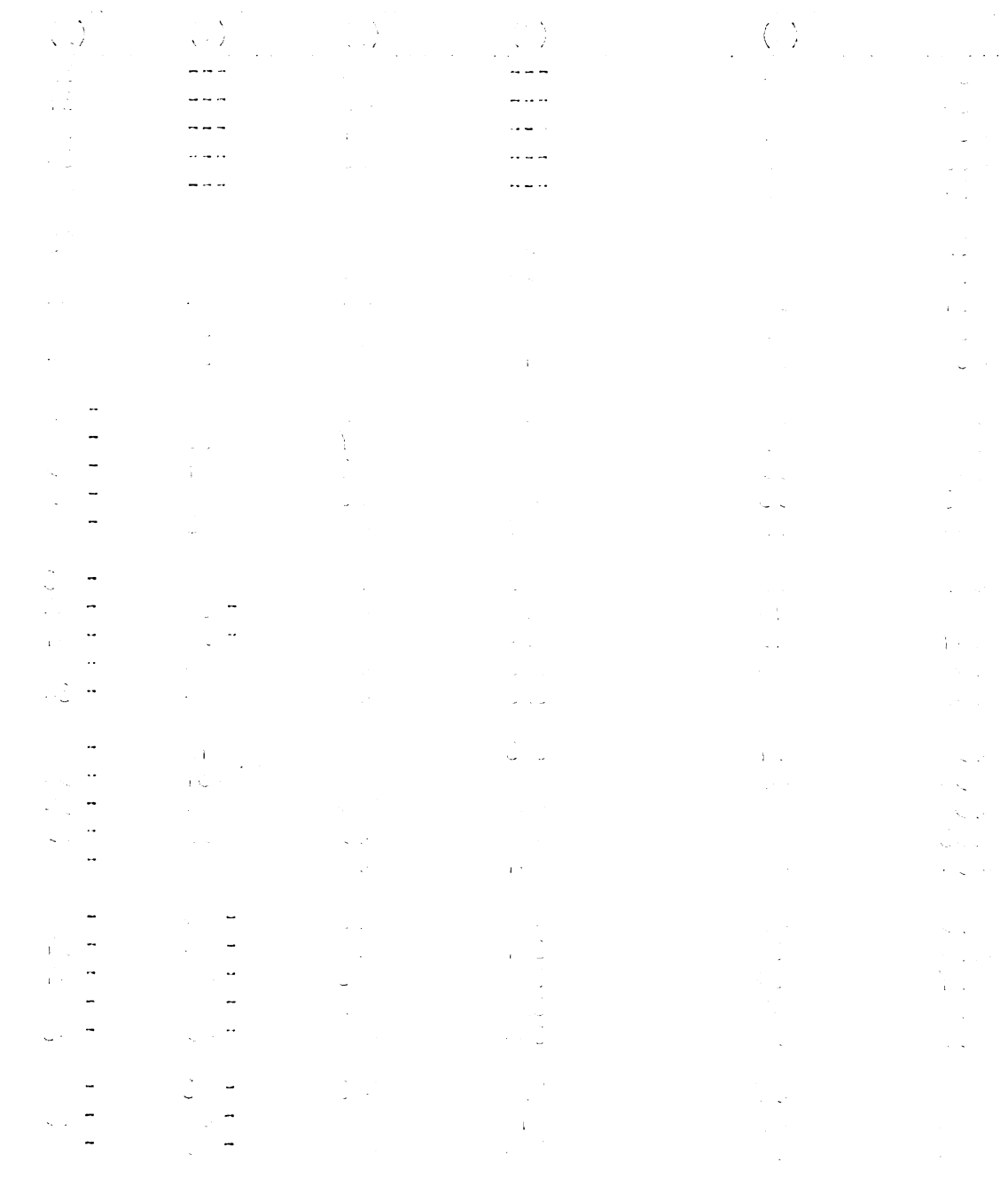

Table 12 Northern Plains, Wheat-Small Grain-Livestock--Estimated Market Value from Costs and Returns Series, Ex Post and Ex Ante Value Series from the Production Function and Residual Return Models for Farm Real Estate in Dollars per Acre 1930-1962

Year	Costs and Returns Market Value Estimate (1)	Production Function Estimates Ex Ante (2)	Production Function Estimates Ex Post (3)	Residual Return Estimates Ex Ante (4)	Residual Return Estimates Ex Post (5)
1930	27	---	42	---	23
1931	25	---	39	---	23
1932	21	---	36	---	23
1933	19	---	35	---	23
1934	19	---	38	---	25
1935	19	19	40	- 15	28
1936	19	20	40	- 12	29
1937	19	23	43	- 13	33
1938	19	27	43	- 11	34
1939	17	29	43	- 10	35
1940	14	34	44	- 2	36
1941	14	37	47	1	38
1942	14	48	53	25	42
1943	15	56	56	44	43
1944	18	68	56	72	40
1945	19	78	57	87	39
1946	21	96	60	118	38
1947	24	121	67	155	38
1948	28	144	69	203	31
1949	30	145	67	192	27
1950	29	145	67	179	27
1951	32	153	71	176	26
1952	36	148	72	159	22
1953	37	133	71	98	23
1954	37	129	72	68	24
1955	36	123	71	52	26
1956	37	121	73	47	25
1957	40	120	76	43	22
1958	44	119	78	41	24
1959	48	110	78	54	22
1960	49	109	79	52	26
1961	50	102	80	38	26
1962	52	100	81	- 4	33

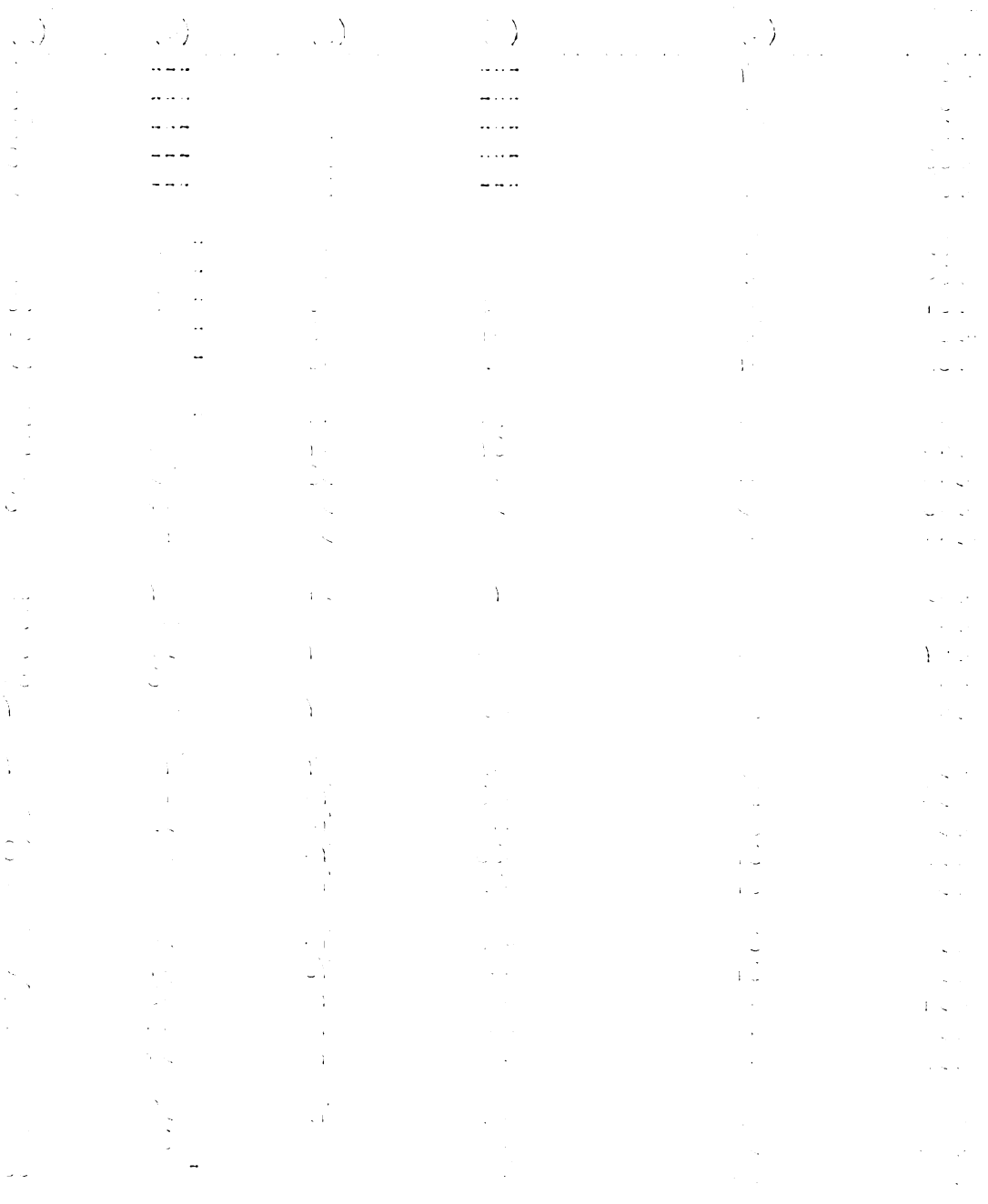

Table 13 Northern Plains Wheat-Corn-Livestock--Estimated Market Value from Costs and Returns Series, Ex Post and Ex Ante Value Series from the Production Function and Residual Return Models for Farm Real Estate in Dollars per Acre 1930-1962

Year	Costs and Returns Market Value Estimate (1)	Production Function Estimates Ex Ante (2)	Production Function Estimates Ex Post (3)	Residual Return Estimates Ex Ante (4)	Residual Return Estimates Ex Post (5)
1930	33	---	51	---	29
1931	30	---	47	---	27
1932	25	---	44	---	26
1933	23	---	42	---	25
1934	24	---	46	---	29
1935	23	21	48	- 11	33
1936	24	22	49	- 9	33
1937	23	24	53	- 15	38
1938	22	30	52	- 15	39
1939	20	35	52	- 4	38
1940	18	40	54	13	39
1941	18	44	58	16	41
1942	19	56	65	46	44
1943	20	66	69	78	43
1944	24	80	70	92	42
1945	27	93	70	98	41
1946	29	114	74	130	39
1947	32	146	83	175	38
1948	38	174	86	214	29
1949	41	176	83	229	22
1950	40	176	83	214	22
1951	44	188	89	200	22
1952	50	186	89	186	16
1953	50	170	88	103	19
1954	49	164	89	62	20
1955	50	158	88	56	21
1956	51	156	90	23	26
1957	54	152	93	- 22	29
1958	59	151	95	2	29
1959	64	143	95	29	24
1960	65	139	97	9	30
1961	66	129	98	32	30
1962	69	121	100	39	31

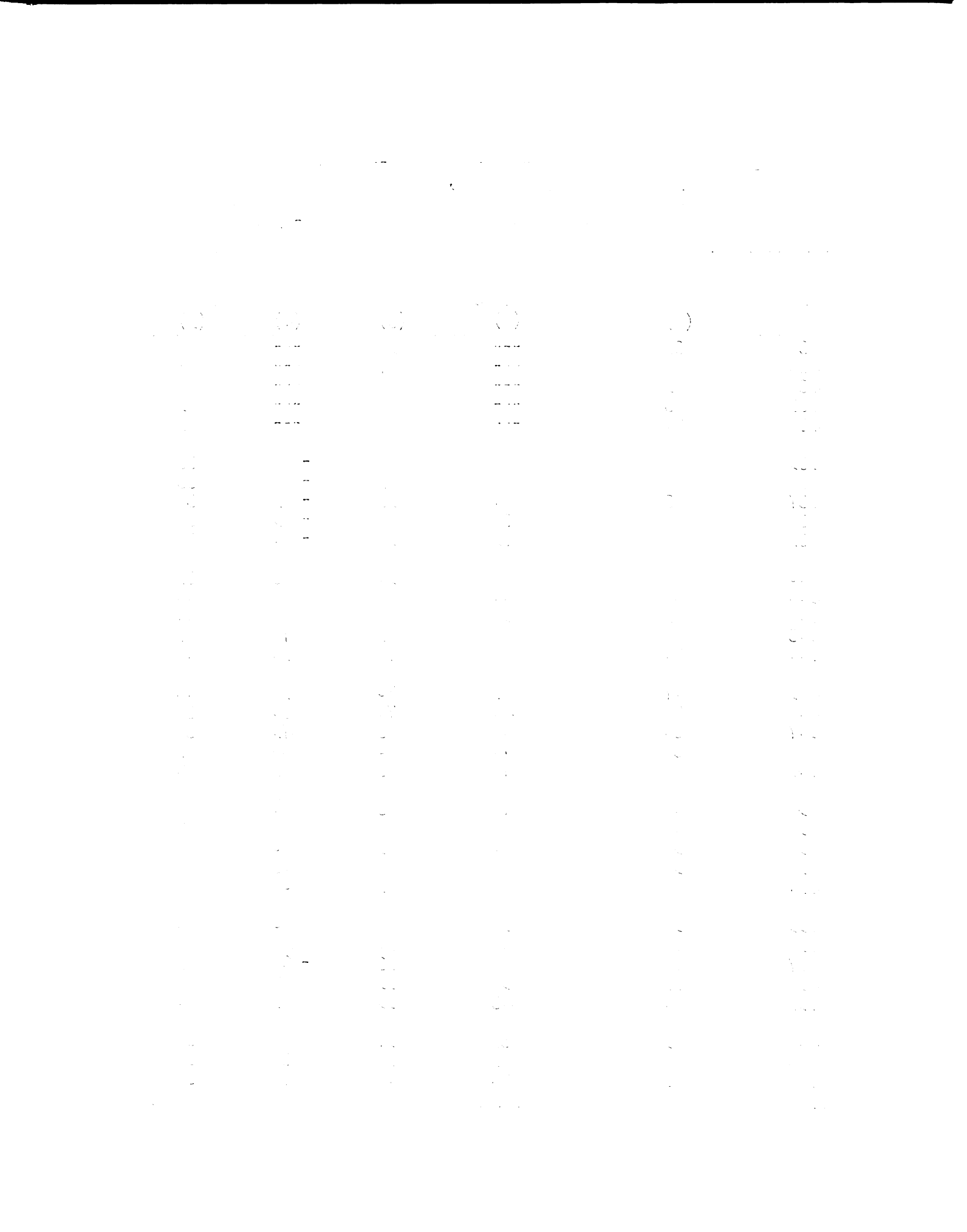

Table 14 Northern Plains Wheat-Roughage-Livestock--Estimated Market Value from Costs and Returns Series, Ex Post and Ex Ante Value Series from the Production Function and Residual Return Models for Farm Real Estate in Dollars per Acre 1930-1962

Year	Costs and Returns Market Value Estimate (1)	Production Function Estimates Ex Ante (2)	Production Function Estimates Ex Post (3)	Residual Return Estimates Ex Ante (4)	Residual Return Estimates Ex Post (5)
1930	21	---	28	---	6
1931	18	---	26	---	7
1932	15	---	24	---	8
1933	13	---	23	---	8
1934	13	---	25	---	10
1935	13	13	27	- 20	12
1936	13	14	27	- 17	13
1937	13	15	29	- 22	16
1938	13	18	28	- 27	18
1939	11	19	29	- 24	18
1940	10	23	30	- 16	19
1941	10	24	31	- 16	20
1942	11	31	35	7	21
1943	11	36	38	31	21
1944	14	43	38	49	19
1945	15	50	38	60	18
1946	17	62	41	78	17
1947	18	79	45	99	15
1948	22	93	47	124	9
1949	24	95	46	121	5
1950	23	95	46	108	5
1951	26	102	49	107	4
1952	29	100	49	94	1
1953	29	93	49	44	3
1954	29	90	48	24	3
1955	29	87	48	17	4
1956	30	86	49	8	4
1957	32	85	51	- 15	5
1958	34	83	52	- 3	5
1959	37	79	52	2	4
1960	38	78	53	- 10	8
1961	38	71	54	- 6	7
1962	40	68	54	- 14	12

Table 15 Southern Plains Winter Wheat--Estimated Market Value from Costs and Returns Series, Ex Post and Ex Ante Value Series from the Production Function and Residual Return Models for Farm Real Estate in Dollars per Acre 1930-1962

Year	Costs and Returns Market Value Estimate (1)	Production Function Estimates Ex Ante (2)	Production Function Estimates Ex Post (3)	Residual Return Estimates Ex Ante (4)	Residual Return Estimates Ex Post (5)
1930	42	---	55	---	54
1931	38	---	51	---	50
1932	33	---	47	---	47
1933	26	---	46	---	47
1934	27	---	49	---	53
1935	27	27	51	2	57
1936	27	28	52	0	59
1937	29	34	55	4	63
1938	29	41	54	7	65
1939	28	44	54	17	66
1940	27	49	56	19	71
1941	27	52	59	19	77
1942	29	64	66	36	86
1943	33	75	71	73	90
1944	38	89	71	97	90
1945	44	104	70	123	91
1946	48	127	74	165	97
1947	57	159	83	217	105
1948	66	181	86	289	98
1949	69	177	84	287	95
1950	68	173	84	282	97
1951	77	181	90	305	102
1952	84	179	91	266	105
1953	86	169	89	231	95
1954	80	166	90	200	100
1955	83	162	89	200	100
1956	85	159	91	165	107
1957	86	153	94	140	118
1958	91	146	98	70	126
1959	94	138	97	111	121
1960	99	132	100	99	127
1961	99	124	101	116	129
1962	104	119	103	141	131

Table 16 Southern Plains Wheat-Grain-Sorghums--Estimated Market Value from Costs and Returns Series, Ex Post and Ex Ante Value Series from the Production Function and Residual Return Models for Farm Real Estate in Dollars per Acre 1930-1962

Year	Costs and Returns Market Value Estimate (1)	Production Function Estimates Ex Ante (2)	Production Function Estimates Ex Post (3)	Residual Return Estimates Ex Ante (4)	Residual Return Estimates Ex Post (5)
1930	42	---	44	---	29
1931	41	---	40	---	28
1932	39	---	38	---	27
1933	28	---	36	---	29
1934	26	---	39	---	33
1935	25	21	41	- 10	36
1936	25	22	41	- 13	39
1937	25	25	44	- 12	42
1938	24	30	44	- 3	43
1939	24	32	44	6	44
1940	23	36	46	12	47
1941	23	38	49	19	51
1942	25	50	55	32	58
1943	29	57	59	48	62
1944	34	69	59	49	65
1945	44	82	59	78	64
1946	47	100	63	101	68
1947	55	126	71	134	76
1948	65	147	74	206	70
1949	71	146	72	226	68
1950	79	144	72	219	66
1951	84	150	78	224	74
1952	85	148	79	197	79
1953	89	137	79	124	80
1954	89	131	80	75	90
1955	89	121	81	26	97
1956	87	118	84	- 4	108
1957	87	112	88	- 27	121
1958	87	102	93	- 44	132
1959	95	98	93	21	130
1960	101	100	96	64	133
1961	106	101	97	114	133
1962	111	106	98	153	133

Table 17 Wheat-Fallow, Washington and Oregon--Estimated Market Value from Costs and Returns Series, Ex Post and Ex Ante Value Series from the Production Function and Residual Return Models for Farm Real Estate in Dollars per Acre 1930-1962

Year	Costs and Returns Market Value Estimate (1)	Production Function Estimates Ex Ante (2)	Production Function Estimates Ex Post (3)	Residual Return Estimates Ex Ante (4)	Residual Return Estimates Ex Post (5)
1930	24	---	44	---	39
1931	18	---	41	---	39
1932	16	---	38	---	39
1933	18	---	36	---	40
1934	19	---	39	---	44
1935	17	22	40	- 15	47
1936	19	24	41	- 7	48
1937	21	29	43	10	50
1938	18	33	43	21	51
1939	20	35	43	24	52
1940	20	39	44	29	55
1941	18	41	47	27	60
1942	20	49	53	31	67
1943	21	58	56	42	72
1944	22	67	57	62	73
1945	26	74	58	79	73
1946	32	87	62	105	79
1947	39	108	70	159	84
1948	40	125	74	192	86
1949	51	128	72	213	79
1950	52	131	72	213	80
1951	62	144	77	240	84
1952	66	146	78	220	82
1953	71	142	77	208	80
1954	73	143	77	190	78
1955	75	141	75	194	75
1956	77	141	77	165	80
1957	76	140	79	140	85
1958	78	135	81	139	85
1959	85	124	81	119	84
1960	85	117	83	107	86
1961	87	109	84	114	87
1962	88	102	85	112	89

Table 18 Northern Plains Cattle--Estimated Market Value from Costs and Returns Series, Ex Post and Ex Ante Value Series from the Production Function and Residual Return Models for Farm Real Estate in Dollars per Acre 1930-1962

Year	Costs and Returns Market Value Estimate (1)	Production Function Estimates Ex Ante (2)	Production Function Estimates Ex Post (3)	Residual Return Estimates Ex Ante (4)	Residual Return Estimates Ex Post (5)
1930	6	---	8	---	2
1931	5	---	8	---	2
1932	4	---	7	---	2
1933	4	---	7	---	2
1934	4	---	8	---	2
1935	3	4	8	- 1	2
1936	3	4	8	- 3	3
1937	4	4	9	- 4	3
1938	4	5	9	- 6	4
1939	4	6	9	- 7	4
1940	3	8	9	- 5	4
1941	3	9	10	- 3	4
1942	4	11	11	2	5
1943	4	12	12	9	4
1944	5	14	12	11	4
1945	6	14	12	12	4
1946	6	16	13	14	4
1947	8	20	15	18	4
1948	9	22	16	20	3
1949	9	24	16	22	2
1950	9	25	16	20	2
1951	10	29	16	21	2
1952	11	33	16	24	1
1953	11	33	16	19	0
1954	10	31	17	12	0
1955	10	29	17	12	0
1956	10	28	17	8	1
1957	10	24	18	- 2	1
1958	11	22	19	- 5	1
1959	11	22	19	- 2	1
1960	11	24	19	- 2	1
1961	11	23	20	- 1	1
1962	11	22	20	2	1

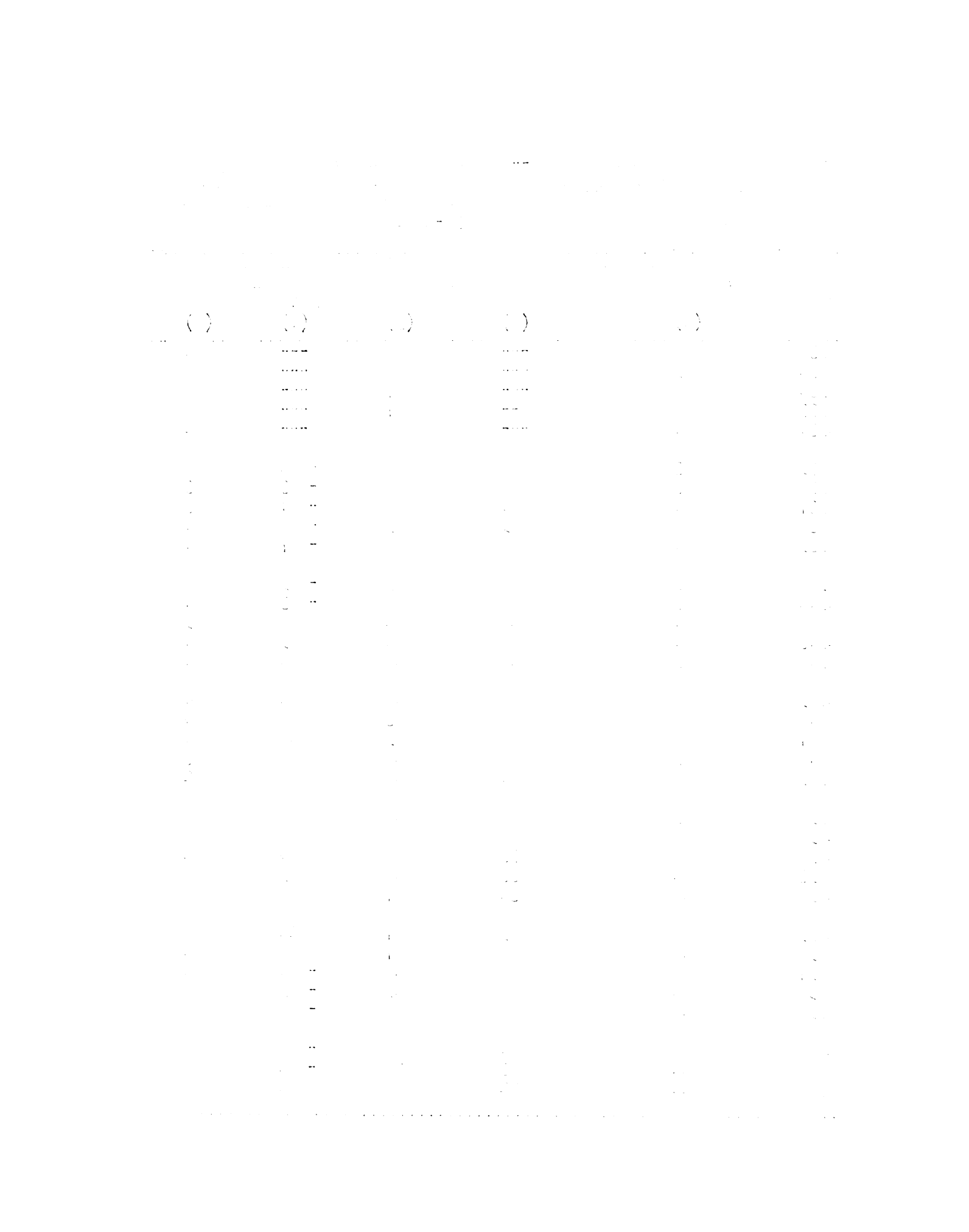

Table 19 Intermountain Region Cattle--Estimated Market Value from Costs and Returns Series, Ex Post and Ex Ante Value Series from the Production Function and Residual Return Models for Farm Real Estate in Dollars per Acre 1930-1962

Year	Costs and Returns Market Value Estimate (1)	Production Function Estimates		Residual Return Estimates	
		Ex Ante (2)	Ex Post (3)	Ex Ante (4)	Ex Post (5)
1930	12	---	25	---	20
1931	12	---	23	---	18
1932	10	---	21	---	17
1933	8	---	21	---	17
1934	9	---	22	---	18
1935	9	12	24	5	20
1936	9	12	24	5	20
1937	9	12	26	8	21
1938	9	13	27	11	21
1939	9	15	27	15	20
1940	9	18	28	24	21
1941	9	20	30	27	22
1942	10	26	34	35	24
1943	11	32	37	39	25
1944	12	36	38	38	26
1945	13	39	39	38	27
1946	15	47	42	41	29
1947	17	56	49	45	33
1948	16	63	53	54	34
1949	16	66	53	64	32
1950	16	69	54	68	32
1951	17	80	58	79	34
1952	18	92	58	96	31
1953	18	97	57	93	30
1954	17	93	59	73	32
1955	17	91	59	62	34
1956	17	87	62	46	37
1957	17	77	66	19	40
1958	18	72	69	12	42
1959	19	75	69	30	40
1960	20	79	70	45	40
1961	21	81	71	47	43
1962	21	81	72	50	43

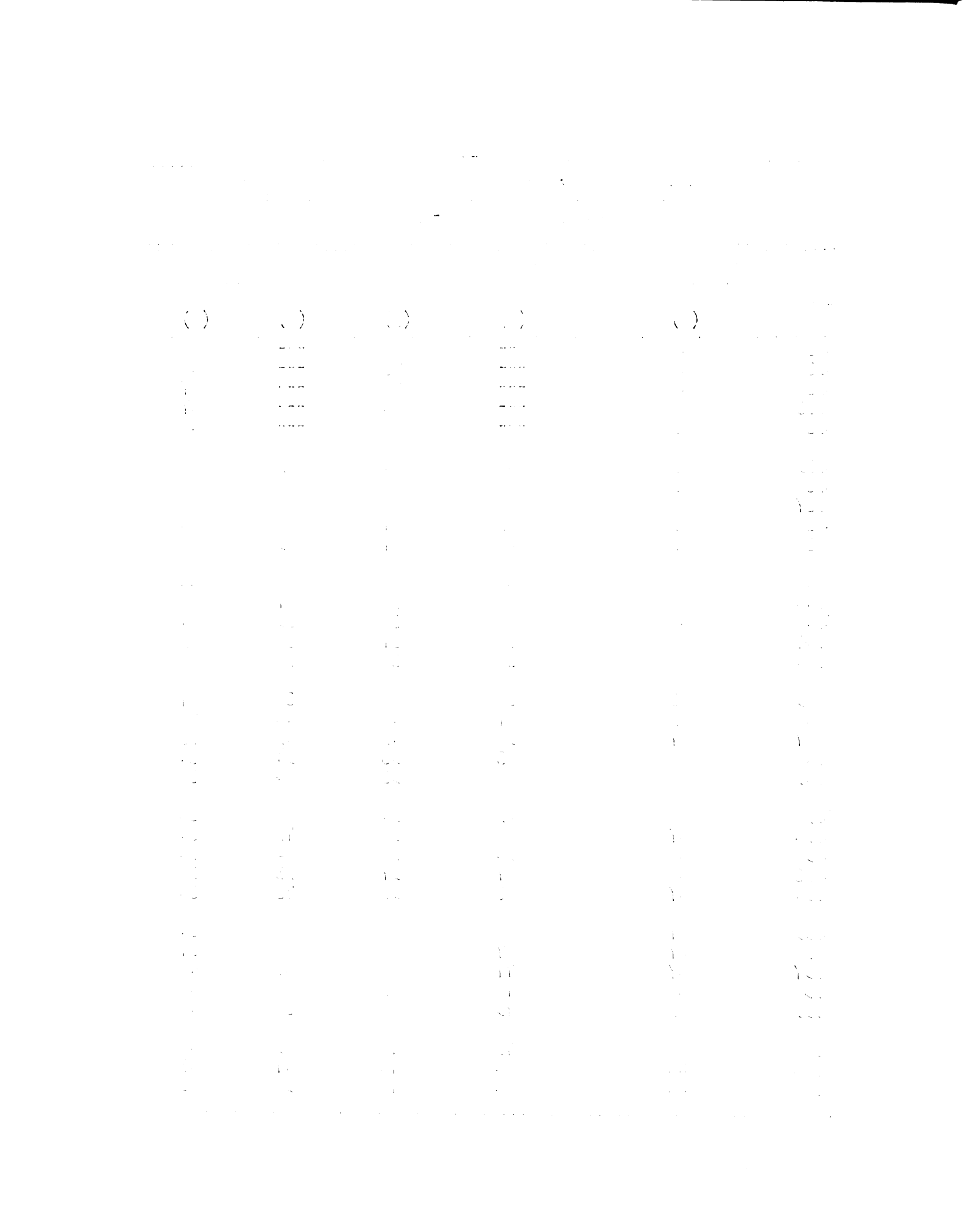

Table 20 Northern Plains Sheep--Estimated Market Value from Costs and Returns Series, Ex Post and Ex Ante Value Series from the Production Function and Residual Return Models for Farm Real Estate in Dollars per Acre 1930-1962

Year	Costs and Returns Market Value Estimate (1)	Production Function Estimates		Residual Return Estimates	
		Ex Ante (2)	Ex Post (3)	Ex Ante (4)	Ex Post (5)
1930	6	---	12	---	7
1931	5	---	11	---	7
1932	4	---	10	---	6
1933	3	---	10	---	6
1934	3	---	10	---	6
1935	3	7	11	3	7
1936	3	7	11	3	7
1937	3	8	11	4	7
1938	3	10	11	5	7
1939	3	10	11	4	7
1940	3	11	11	5	7
1941	3	13	12	7	8
1942	4	16	13	11	8
1943	4	18	14	16	8
1944	4	20	14	18	8
1945	5	22	14	18	8
1946	6	24	15	21	9
1947	7	27	17	24	9
1948	8	29	18	25	9
1949	8	30	18	24	9
1950	7	30	18	21	10
1951	8	34	19	25	9
1952	9	40	18	33	7
1953	9	41	18	28	8
1954	9	39	18	23	8
1955	9	37	18	24	8
1956	9	35	18	17	9
1957	9	30	19	4	10
1958	9	29	19	8	10
1959	10	28	19	13	9
1960	10	28	20	14	9
1961	10	27	20	14	9
1962	10	24	20	13	10

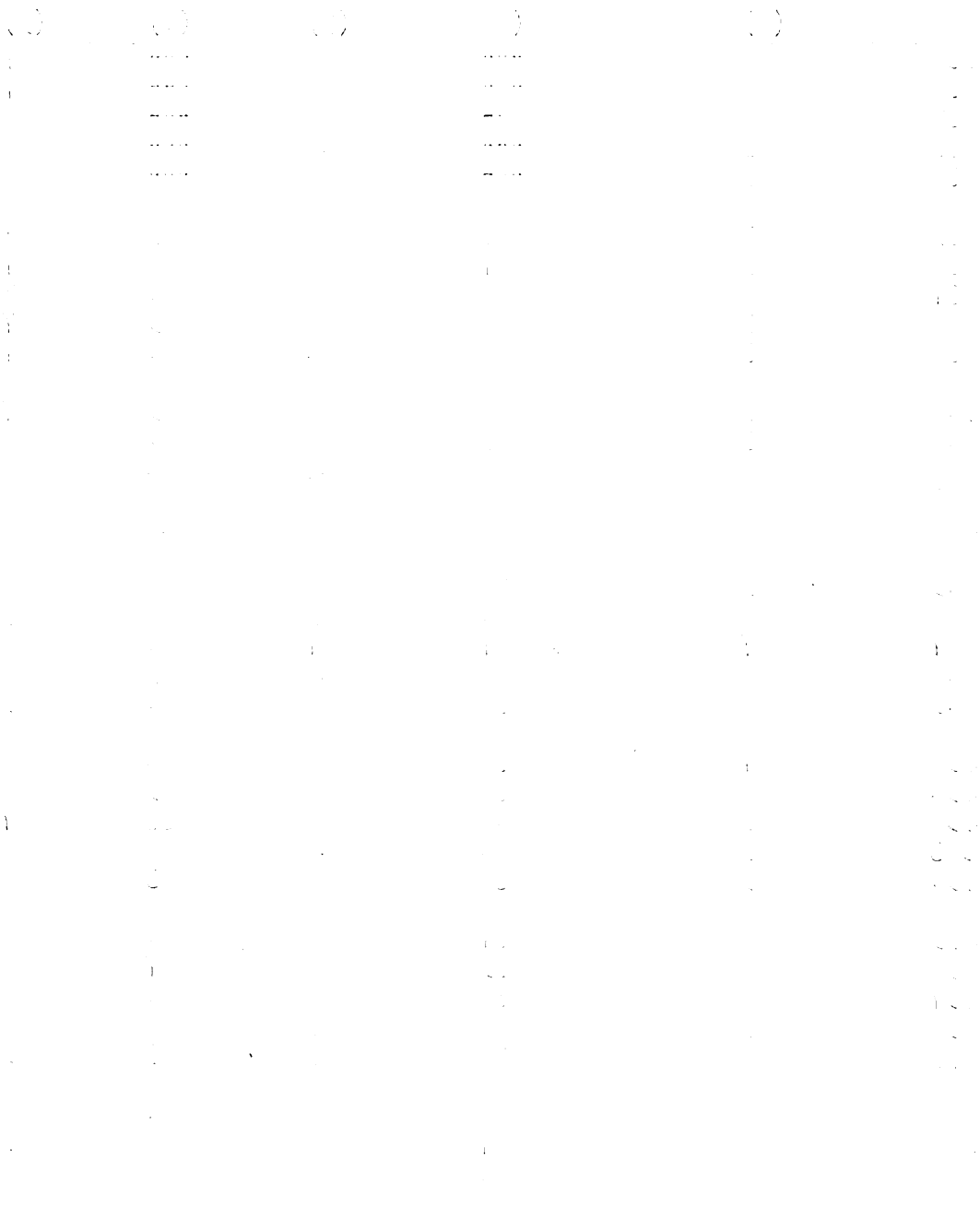

Table 21 Central Northeast Dairy--Yearly Marginal Value Products and Related Series

Year	MPP Index	Price Index	MVP Index	MVP	Yearly Change in MVP	Productivity Component	Price Component
1930	83	50	42	7.29			
1931	78	38	50	5.20	-2.09	- .39	-1.70
1932	80	28	22	3.93	-1.27	.12	-1.39
1933	66	30	20	3.47	- .46	- .72	.26
1934	66	34	22	3.92	.45	- .01	.46
1935	75	39	29	5.15	1.23	.61	.62
1936	58	41	24	4.14	-1.01	- 1.25	.24
1937	77	42	32	5.66	1.52	1.41	.11
1938	86	38	33	5.72	.06	.63	- .57
1939	91	38	35	6.07	.35	.35	.00
1940	95	42	40	6.95	.88	.23	.65
1941	101	49	49	8.67	1.72	.52	1.20
1942	110	59	65	11.35	2.68	.84	1.84
1943	106	70	74	12.93	1.58	- .50	2.08
1944	114	71	80	14.10	1.17	.98	.19
1945	114	73	83	14.52	.42	.02	.40
1946	106	89	94	16.46	1.94	- 1.13	3.07
1947	101	96	97	17.03	.57	- .70	1.27
1948	103	112	115	20.19	3.16	.30	2.86
1949	96	92	88	15.39	-4.80	- 1.32	-3.48
1950	98	89	87	15.28	- .11	.40	- .51
1951	100	103	103	18.08	2.80	.38	2.42
1952	99	103	102	17.84	- .24	- .24	.00
1953	99	90	89	15.62	-2.22	.02	-2.24
1954	95	88	83	14.61	-1.01	- .67	- .34
1955	99	90	89	15.65	1.04	.70	.34
1956	101	88	89	15.53	- .12	.23	- .35
1957	112	95	106	18.57	3.04	1.74	1.30
1958	126	98	123	21.54	2.97	2.35	.62
1959	112	98	109	19.15	-2.39	- 2.39	.00
1960	125	96	120	21.05	1.90	2.31	- .41
1961	120	94	113	19.73	-1.32	- .89	- .43
1962	139	92	127	22.33	2.60	3.05	- .45

Indexes based on 1947-1949 = 100; other series in current dollars.

Table 22 Eastern Wisconsin Dairy--Yearly Marginal Value Products and Related Series

Year	MPP Index	Price Index	MVP Index	MVP	Yearly Change in MVP	Productivity Component	Price Component
1930	70	45	32	7.57			
1931	70	32	22	5.32	-2.25	- .07	-2.18
1932	70	24	17	4.02	-1.30	.03	-1.33
1933	57	26	15	3.54	- .48	- .78	.30
1934	57	30	17	4.08	.54	.00	.54
1935	68	38	26	6.20	2.12	.93	1.19
1936	53	42	22	5.30	- .90	-1.47	.57
1937	69	43	30	7.11	1.81	1.66	.15
1938	78	37	29	6.89	- .22	.84	-1.06
1939	81	34	28	6.60	- .29	.28	- .57
1940	90	37	33	7.97	1.37	.76	.61
1941	94	49	46	10.99	3.02	.38	2.63
1942	111	59	65	15.67	4.68	2.23	2.45
1943	103	70	72	17.33	1.66	-1.16	2.82
1944	114	70	80	19.14	1.81	1.80	.00
1945	110	72	79	18.90	- .24	- .78	.54
1946	102	91	93	22.29	3.39	-1.43	4.82
1947	102	99	101	24.23	1.94	- .02	1.96
1948	102	113	115	27.64	3.41	.00	3.41
1949	96	88	84	20.12	-7.52	-1.61	-5.91
1950	95	90	85	20.45	.33	- .13	.46
1951	99	109	108	25.84	5.39	.98	4.41
1952	99	106	105	25.11	- .73	- .01	- .72
1953	100	95	94	22.62	-2.49	.12	-2.61
1954	99	86	85	20.37	-2.25	- .12	-2.13
1955	102	83	85	20.34	- .03	.70	- .73
1956	104	85	88	21.18	.84	.34	.50
1957	117	88	103	24.71	3.53	2.74	.79
1958	131	90	118	28.29	3.58	2.98	.60
1959	115	86	99	23.72	-4.57	-3.39	-1.18
1960	134	90	120	28.77	5.05	3.86	1.19
1961	124	91	112	26.98	-1.79	-2.10	.31
1962	140	89	125	29.92	2.94	3.57	- .63

Indexes based on 1947-1949 = 100; other series in current dollars.

Table 23 Western Wisconsin Dairy--Yearly Marginal Value Products and Related Series

Year	MPP Index	Price Index	MVP Index	MVP	Yearly Change in MVP	Productivity Component	Price Component
1930	80	44	35	5.82			
1931	79	30	24	3.95	-1.87	- .03	-1.84
1932	83	22	18	3.02	- .93	.15	-1.08
1933	61	24	15	2.41	- .61	- .85	.24
1934	60	27	16	2.69	.28	- .02	.30
1935	69	37	26	4.24	1.55	.48	1.07
1936	52	41	21	3.52	- .72	-1.12	.40
1937	70	42	29	4.87	1.35	1.25	.10
1938	76	35	27	4.41	- .46	.39	- .85
1939	80	33	26	4.37	- .04	.21	- .25
1940	91	35	32	5.28	.91	.63	.28
1941	90	48	43	7.15	1.87	- .08	1.95
1942	109	58	63	10.43	3.28	1.64	1.64
1943	105	69	72	11.96	1.53	- .41	1.94
1944	112	68	76	12.60	.64	.83	- .19
1945	110	71	78	12.90	.30	- .25	.55
1946	105	91	95	15.83	2.93	- .63	3.56
1947	105	98	103	17.04	1.21	- .01	1.22
1948	102	113	114	19.00	1.96	- .60	2.56
1949	93	89	83	13.77	-5.23	-1.36	-3.87
1950	95	91	87	14.37	.60	.29	.31
1951	99	110	109	18.10	3.73	.66	3.07
1952	98	105	102	16.99	-1.11	- .30	- .81
1953	98	94	92	15.33	-1.66	.13	-1.79
1954	99	85	84	13.93	-1.40	.07	-1.47
1955	104	81	84	13.96	.03	.70	- .67
1956	106	82	87	14.42	.46	.29	.17
1957	117	86	100	16.64	2.22	1.48	.74
1958	131	90	118	19.56	2.92	2.10	.82
1959	115	86	99	16.39	-3.17	-2.35	- .82
1960	124	88	109	18.11	1.72	1.32	.40
1961	113	91	102	17.02	-1.09	-1.68	.59
1962	127	89	112	18.67	1.65	2.05	- .40

Indexes based on 1947-1949 = 100; other series in current dollars.

Table 24 Dairy-Hog, Minnesota--Yearly Marginal Value Products and Related Series

Year	MPP Index	Price Index	MVP Index	MVP	Yearly Change in MVP	Productivity Component	Price Component
1930	75	45	34	7.04			
1931	76	31	24	4.90	-2.14	.06	-2.20
1932	78	23	18	3.71	-1.19	.09	-1.28
1933	63	22	14	2.87	- .84	- .70	- .14
1934	61	26	16	3.26	.39	- .12	.51
1935	67	39	26	5.45	2.19	.47	1.72
1936	51	43	22	4.53	- .92	-1.41	.49
1937	66	44	29	5.99	1.46	1.34	.12
1938	74	38	28	5.87	- .12	.75	- .87
1939	78	33	26	5.31	- .56	.23	- .79
1940	85	34	29	5.99	.68	.51	.17
1941	89	46	41	8.48	2.49	.33	2.16
1942	101	60	61	12.62	4.14	1.38	2.76
1943	100	71	71	14.67	2.05	- .24	2.29
1944	105	70	73	15.20	.53	.75	- .22
1945	107	80	85	17.73	2.53	.34	2.19
1946	106	93	98	20.36	2.63	- .23	2.86
1947	103	102	105	21.83	1.47	- .48	1.95
1948	102	110	112	23.30	1.47	- .23	1.70
1949	95	88	83	17.27	-6.03	-1.54	-4.49
1950	95	89	85	17.61	.34	.14	.20
1951	100	106	106	21.99	4.39	.94	3.45
1952	99	100	99	20.60	-1.39	- .15	-1.24
1953	100	96	95	19.81	- .79	.04	- .83
1954	99	87	86	17.90	-1.91	- .06	-1.85
1955	105	82	86	17.89	- .01	1.05	-1.06
1956	107	81	86	17.99	.10	.32	- .22
1957	118	84	99	20.51	2.52	1.82	.70
1958	132	89	118	24.45	3.94	2.64	1.30
1959	120	82	98	20.36	-4.09	-2.26	-1.83
1960	138	84	116	24.07	3.71	3.17	.54
1961	125	91	113	23.53	- .54	-2.44	1.90
1962	141	87	122	25.47	1.94	3.04	-1.10

Indexes based on 1947-1949 = 100; other series in current dollars.

Table [illegible] Hog-Dairy, Corn Belt--Yearly Marginal Value Products and Related Series

	Yearly Change	Productivity	Price

Table 25 Hog-Dairy, Corn Belt--Yearly Marginal Value Products and Related Series

Year	MPP Index	Price Index	MVP Index	MVP	Yearly Change in MVP	Productivity Component	Price Component
1930	76	44	33	8.41			
1931	75	30	22	5.64	-2.77	- .11	-2.66
1932	75	20	15	3.75	-1.89	- .01	-1.88
1933	60	20	12	3.01	- .74	- .74	.00
1934	62	24	15	3.74	.73	.12	.61
1935	66	39	26	6.51	2.77	.35	2.42
1936	51	43	22	5.50	-1.01	-1.60	.59
1937	67	44	29	7.37	1.87	1.72	.15
1938	77	37	28	7.12	- .25	1.01	-1.26
1939	82	33	27	6.79	- .33	.46	- .79
1940	86	32	27	6.92	.13	.34	- .21
1941	90	46	41	10.37	3.45	.36	3.09
1942	103	60	62	15.51	5.14	1.75	3.39
1943	102	68	69	17.36	1.85	- .20	2.05
1944	107	65	70	17.54	.18	.97	- .79
1945	107	69	73	18.51	.97	- .10	1.07
1946	104	84	87	21.99	3.48	- .49	3.97
1947	100	105	105	26.51	4.52	- .87	5.39
1948	103	108	111	28.01	1.50	.73	.77
1949	96	87	84	21.09	-6.92	-1.65	-5.27
1950	98	88	86	21.61	.52	.28	.24
1951	104	102	105	26.59	4.98	1.43	3.55
1952	102	94	96	24.19	-2.40	- .33	-2.07
1953	102	95	97	24.37	.18	- .07	.25
1954	100	89	89	22.36	-2.01	- .49	-1.52
1955	107	75	80	20.24	-2.12	1.53	-3.65
1956	109	77	84	21.11	.87	.33	.54
1957	119	83	98	24.80	3.69	1.97	1.72
1958	129	90	116	29.29	4.49	2.31	2.18
1959	118	77	90	22.81	-6.48	-2.44	-4.04
1960	129	83	107	27.03	4.22	2.35	1.87
1961	121	88	106	26.69	- .34	-1.90	1.56
1962	138	85	117	29.48	2.79	3.76	- .97

Indexes based on 1947-1949 = 100; other series in current dollars.

Table 26 Hog-Beef Raising, Corn Belt--Yearly Marginal Value Products and Related Series

Year	MPP Index	Price Index	MVP Index	MVP	Yearly Change in MVP	Productivity Component	Price Component
1930	74	43	32	4.13			
1931	73	29	21	2.75	-1.38	- .05	-1.33
1932	75	19	14	1.83	- .92	.04	- .96
1933	61	20	12	1.58	- .25	- .33	.08
1934	74	24	18	2.29	.71	.36	.35
1935	65	37	24	3.12	.83	- .34	1.17
1936	52	39	20	2.61	- .51	- .66	.15
1937	65	39	25	3.28	.67	.67	.00
1938	79	35	28	3.57	.29	.66	- .37
1939	80	32	26	3.31	- .26	.04	- .30
1940	84	32	27	3.47	.16	.16	.00
1941	88	45	40	5.12	1.65	.20	1.45
1942	102	59	60	7.73	2.61	.89	1.72
1943	114	66	75	9.66	1.93	.96	.97
1944	109	62	67	8.71	- .95	- .37	- .58
1945	111	67	74	9.61	.90	.19	.71
1946	102	82	84	10.82	1.21	- .85	2.06
1947	107	105	112	14.53	3.71	.61	3.10
1948	98	107	105	13.53	-1.00	-1.26	.26
1949	95	88	83	10.74	-2.79	- .43	-2.36
1950	96	91	87	11.23	.49	.13	.36
1951	101	106	107	13.82	2.59	.69	1.90
1952	104	96	99	12.84	- .98	.34	-1.32
1953	103	94	96	12.47	- .37	- .11	- .26
1954	100	91	91	11.71	- .76	- .37	- .39
1955	107	74	79	10.20	-1.51	.76	-2.27
1956	109	73	80	10.29	.09	.23	- .14
1957	119	82	97	12.55	2.26	.94	1.32
1958	133	89	118	15.26	2.71	1.58	1.13
1959	122	75	91	11.83	-3.43	-1.12	-2.31
1960	134	78	104	13.44	1.61	1.11	.50
1961	125	84	105	13.56	.12	- .88	1.00
1962	145	86	124	16.08	2.52	2.17	.35

Indexes based on 1947-1949 = 100; other series in current dollars.

Table 27 Hog-Beef Fattening, Corn Belt--Yearly Marginal Value Products and Related Series

Year	MPP Index	Price Index	MVP Index	MVP	Yearly Change in MVP	Productivity Component	Price Component
1930	76	38	29	11.02			
1931	71	28	20	7.57	-3.45	- .65	-2.80
1932	71	20	14	5.43	-2.14	.03	-2.17
1933	58	17	10	3.75	-1.68	- .94	- .74
1934	62	22	14	5.19	1.44	.30	1.14
1935	56	38	21	8.13	2.94	- .66	3.60
1936	57	34	19	7.36	- .77	.09	- .86
1937	59	41	24	9.25	1.89	.34	1.55
1938	71	34	24	9.23	- .02	1.72	-1.74
1939	77	30	23	8.81	- .42	.71	-1.13
1940	80	33	26	10.04	1.23	.33	.90
1941	93	39	36	13.82	3.78	1.80	1.98
1942	103	54	55	21.13	7.31	1.72	5.59
1943	111	57	63	24.05	2.92	1.71	1.21
1944	101	58	58	22.26	-1.79	-2.19	.40
1945	106	60	63	24.22	1.96	1.16	.80
1946	99	83	82	31.23	7.01	-1.95	8.96
1947	106	103	109	41.45	10.22	2.44	7.78
1948	99	106	104	39.81	-1.64	-2.80	1.16
1949	96	91	87	33.15	-6.66	-1.11	-5.55
1950	99	96	95	36.27	3.12	1.26	1.86
1951	103	108	112	42.53	6.26	1.63	4.63
1952	106	96	101	38.69	-3.84	.94	-4.78
1953	110	87	95	36.28	-2.41	1.28	-3.69
1954	104	87	90	34.29	-1.99	-1.99	.00
1955	115	71	82	31.22	-3.07	3.60	-6.67
1956	114	78	89	33.99	2.77	- .29	3.06
1957	120	80	96	36.49	2.50	1.61	.89
1958	134	87	116	44.31	7.82	4.44	3.38
1959	132	81	106	40.60	-3.71	- .68	-3.03
1960	144	77	110	42.11	1.51	3.60	-2.09
1961	143	79	112	42.85	.74	- .35	1.09
1962	184	89	163	62.20	19.35	13.15	6.20

Indexes based on 1947-1949 = 100; other series in current dollars.

Table 28 Cash Grain, Corn Belt--Yearly Marginal Value Products and Related Series

Year	MPP Index	Price Index	MVP Index	MVP	Yearly Change in MVP	Productivity Component	Price Component
1930	78	39	31	7.30			
1931	78	21	16	3.92	-3.38	- .01	-3.37
1932	80	18	14	3.42	- .50	.07	- .57
1933	61	30	18	4.37	.95	-1.05	2.00
1934	56	34	19	4.57	.20	- .36	.56
1935	70	37	26	6.14	1.57	1.12	.45
1936	50	53	27	6.34	.20	-2.08	2.28
1937	70	34	24	5.65	- .69	2.02	-2.71
1938	79	30	24	5.63	- .02	.69	- .71
1939	83	33	27	6.54	.91	.34	.57
1940	87	36	31	7.43	.89	.28	.61
1941	91	50	46	10.90	3.47	.50	2.97
1942	103	60	62	14.76	3.86	1.55	2.31
1943	99	69	68	16.31	1.55	- .62	2.17
1944	104	70	73	17.38	1.07	.83	.24
1945	107	76	81	19.32	1.94	.44	1.50
1946	104	94	98	23.47	4.15	- .38	4.53
1947	101	127	128	30.64	7.17	- .93	8.10
1948	103	90	93	22.12	-8.52	.49	-9.01
1949	96	83	79	18.97	-3.15	-1.49	-1.66
1950	96	97	93	22.20	3.23	.03	3.20
1951	102	108	110	26.41	4.21	1.61	2.60
1952	102	99	100	24.01	-2.40	- .21	-2.19
1953	100	97	97	23.21	- .80	- .32	- .48
1954	100	92	92	22.00	-1.21	- .01	-1.20
1955	106	84	89	21.30	- .70	1.27	-1.97
1956	107	83	87	21.21	- .09	.16	- .25
1957	117	78	91	21.70	.49	1.83	-1.34
1958	129	78	101	24.07	2.37	2.37	.00
1959	114	73	83	19.81	-4.26	-2.81	-1.45
1960	124	71	88	21.07	1.26	1.83	- .57
1961	113	78	88	21.06	- .01	-1.99	1.98
1962	131	80	105	25.09	4.03	3.44	.59

Indexes based on 1947-1949 = 100; other series in current dollars.

Table 29 Southern Piedmont Cotton--Yearly Marginal Value Products and Related Series

Year	MPP Index	Price Index	MVP Index	MVP	Yearly Change in MVP	Productivity Component	Price Component
1930	118	33	39	3.31			
1931	115	20	21	1.95	-1.36	- .07	-1.29
1932	103	22	23	1.93	- .02	- .20	.18
1933	71	30	21	1.82	- .11	- .69	.58
1934	72	42	30	2.57	.75	.02	.73
1935	84	38	32	2.72	.15	.42	- .27
1936	65	42	27	2.32	- .40	- .65	.25
1937	92	31	29	2.43	.11	.84	- .73
1938	95	32	30	2.58	.15	.07	.08
1939	97	32	31	2.63	.05	.05	.00
1940	100	33	33	2.82	.19	.11	.08
1941	100	55	55	4.67	1.85	- .02	1.87
1942	106	62	66	5.58	.91	.30	.61
1943	107	71	76	6.48	.90	.08	.82
1944	108	73	79	6.73	.25	.07	.18
1945	107	75	80	6.83	.10	- .08	.18
1946	101	107	108	9.22	2.39	- .44	2.83
1947	100	108	108	9.13	- .09	- .17	.08
1948	100	101	101	8.58	- .55	.05	- .60
1949	101	91	92	7.77	- .81	.05	- .86
1950	89	113	100	8.51	.74	-1.03	1.77
1951	100	117	117	9.95	1.44	1.11	.33
1952	106	119	126	10.72	.77	.59	.18
1953	117	101	118	10.02	- .70	1.00	-1.70
1954	105	104	109	9.25	- .77	-1.05	.28
1955	106	98	104	8.85	- .40	.14	- .54
1956	104	96	100	8.50	- .35	- .17	- .18
1957	116	96	111	9.45	.95	.95	.00
1958	132	103	136	11.53	2.08	1.34	.74
1959	118	96	114	9.65	-1.88	-1.14	- .74
1960	127	96	122	10.33	.68	.68	.00
1961	121	99	119	10.15	- .18	- .50	.32
1962	131	102	134	11.35	1.20	.88	.32

Indexes based on 1947-1949 = 100; other series in current dollars.

Table 30 Texas Black Prairie Cotton--Yearly Marginal Value Products and Related Series

Year	MPP Index	Price Index	MVP Index	MVP	Yearly Change in MVP	Productivity Component	Price Component
1930	82	35	27	4.11			
1931	89	18	16	2.30	-1.81	.27	-2.08
1932	78	20	16	2.24	- .06	- .30	.24
1933	69	28	19	2.77	.53	- .31	.84
1934	52	42	22	3.16	.39	- .83	1.22
1935	59	36	21	3.04	- .12	.37	- .49
1936	49	42	21	2.97	- .07	- .54	.47
1937	78	32	25	3.59	.62	1.53	- .91
1938	76	29	22	3.15	- .44	- .11	- .33
1939	78	31	24	3.46	.31	.09	.22
1940	83	31	26	3.68	.22	.22	.00
1941	78	53	41	5.93	2.25	- .28	2.53
1942	90	59	53	7.62	1.69	.97	.72
1943	89	68	60	8.65	1.03	- .12	1.15
1944	90	70	63	9.07	.42	.16	.26
1945	90	73	66	9.48	.41	.02	.39
1946	86	103	89	12.76	3.28	- .52	3.80
1947	96	108	104	14.94	2.18	1.52	.66
1948	100	102	102	14.58	- .36	.48	- .84
1949	104	90	94	13.43	-1.15	.60	-1.75
1950	91	114	104	14.87	1.44	-1.92	3.36
1951	98	115	112	16.10	1.23	1.09	.14
1952	106	116	123	17.58	1.48	1.33	.15
1953	120	98	118	16.93	- .65	2.27	-2.92
1954	94	99	94	13.42	-3.51	-3.67	.16
1955	107	88	95	13.54	.12	1.71	-1.59
1956	94	88	83	11.85	-1.69	-1.69	.00
1957	108	85	92	13.13	1.28	1.71	- .43
1958	115	89	103	14.68	1.55	.91	.64
1959	108	84	91	13.07	-1.61	- .81	- .80
1960	115	83	96	13.70	.63	.79	- .16
1961	102	91	93	13.33	- .37	-1.62	1.25
1962	117	90	106	15.14	1.81	1.97	- .16

Indexes based on 1947-1949 = 100; other series in current dollars.

Table 31 Northern Plains, Wheat-Small Grain-Livestock--Yearly Marginal Value Products and Related Series

Year	MPP Index	Price Index	MVP Index	MVP	Yearly Change in MVP	Productivity Component	Price Component
1930	92	31	28	1.59			
1931	83	25	21	1.15	- .44	- .15	- .29
1932	94	17	16	.89	- .26	.13	- .39
1933	68	26	18	.98	.09	- .32	.41
1934	65	23	15	.83	- .15	- .04	- .11
1935	91	31	28	1.57	.74	.39	.35
1936	50	40	20	1.10	- .47	- .82	.35
1937	76	41	31	1.74	.64	.61	.03
1938	81	27	22	1.22	- .52	.09	- .61
1939	86	31	27	1.49	.27	.09	.18
1940	91	31	28	1.56	.07	.07	.00
1941	98	42	41	2.29	.73	.16	.57
1942	109	49	53	2.98	.69	.29	.40
1943	104	63	65	3.66	.68	- .15	.83
1944	105	64	67	3.72	.08	.02	.06
1945	107	68	72	4.04	.32	.09	.23
1946	100	90	90	5.02	.98	- .29	1.27
1947	103	117	120	6.70	1.68	.16	1.52
1948	104	95	99	5.51	-1.19	.08	-1.27
1949	93	88	82	4.56	- .95	- .57	- .38
1950	94	90	84	4.69	.13	.03	.10
1951	98	94	92	5.12	.43	.22	.21
1952	94	96	90	5.03	- .09	- .20	.11
1953	96	91	87	4.89	- .14	.12	- .26
1954	92	82	76	4.22	- .67	- .19	- .48
1955	101	78	79	4.40	.18	.39	- .21
1956	97	80	78	4.34	- .06	- .17	.11
1957	108	82	88	4.93	.59	.48	.11
1958	122	78	95	5.29	.36	.61	- .25
1959	106	83	87	4.89	- .40	- .72	.32
1960	121	73	88	4.91	.03	.66	- .63
1961	101	99	100	5.57	.66	- .95	1.61
1962	118	81	95	5.33	- .24	.86	-1.10

Indexes based on 1947-1949 = 100; other series in current dollars.

Table 32 Northern Plains, Wheat-Corn-Livestock--Yearly Marginal Value Products and Related Series

Year	MPP Index	Price Index	MVP Index	MVP	Yearly Change in MVP	Productivity Component	Price Component
1930	85	36	31	2.10			
1931	77	26	20	1.38	- .72	- .17	- .55
1932	80	17	14	.93	- .45	.03	- .48
1933	61	19	11	.79	- .14	- .23	.09
1934	69	21	14	.99	.20	.12	.08
1935	79	32	25	1.73	.74	.18	.56
1936	46	38	18	1.20	- .53	- .79	.26
1937	74	43	32	2.18	.98	.77	.21
1938	75	31	23	1.59	- .59	.02	- .61
1939	78	31	24	1.65	.06	.06	.00
1940	81	32	26	1.77	.12	.06	.06
1941	89	43	38	2.60	.83	.19	.64
1942	102	52	53	3.63	1.03	.45	.58
1943	95	67	63	4.35	.72	- .29	1.01
1944	99	66	65	4.45	.10	.18	- .08
1945	103	70	72	4.92	.47	.19	.28
1946	100	89	88	6.06	1.14	- .17	1.31
1947	101	116	117	8.03	.97	.12	1.85
1948	103	98	100	6.88	-1.15	.10	-1.25
1949	96	86	82	5.63	-1.25	- .43	- .82
1950	97	90	87	5.94	.31	.05	.26
1951	103	98	101	6.90	.96	.42	.54
1952	101	93	94	6.43	- .47	- .12	- .35
1953	101	88	88	6.05	- .38	- .03	- .35
1954	100	82	82	5.62	- .43	- .02	- .41
1955	108	73	78	5.63	- .26	.37	- .63
1956	110	74	81	5.56	.20	.12	.08
1957	122	78	95	6.48	.92	.60	.32
1958	125	81	101	6.91	.43	.18	.25
1959	104	84	87	5.96	- .95	-1.19	.24
1960	118	75	88	6.04	.08	.76	- .68
1961	107	84	90	6.14	.10	- .59	.69
1962	122	85	104	7.09	.95	.87	.08

Indexes based on 1947-1949 = 100; other series in current dollars.

Table 33 Northern Plains, Wheat-Roughage-Livestock--Yearly Marginal Value Products and Related Series

Year	MPP Index	Price Index	MVP Index	MVP	Yearly Change in MVP	Productivity Component	Price Component
1930	106	31	33	1.20			
1931	93	24	22	.81	- .39	- .14	- .25
1932	105	17	18	.65	- .16	.09	- .25
1933	67	25	17	.61	- .04	- .29	.25
1934	70	20	14	.51	- .10	.03	- .13
1935	94	33	31	1.13	.62	.23	.39
1936	50	36	18	.65	- .48	- .55	.07
1937	81	40	32	1.19	.54	.44	.10
1938	78	28	22	.80	- .39	- .04	- .35
1939	82	32	26	.96	.16	.04	.12
1940	84	32	27	.98	.02	.02	.00
1941	95	43	41	1.48	.50	.14	.36
1942	108	49	53	1.93	.45	.23	.22
1943	100	62	62	2.26	.33	- .16	.49
1944	105	65	68	2.49	.23	.12	.11
1945	107	68	72	2.64	.15	.04	.11
1946	102	90	92	3.35	.71	- .12	.83
1947	104	112	116	4.23	.88	.06	.82
1948	102	99	100	3.67	- .56	- .07	- .49
1949	95	89	84	3.06	- .61	- .25	- .36
1950	95	95	90	3.28	.22	.01	.21
1951	101	102	102	3.74	.46	.21	.25
1952	99	99	98	3.58	- .16	- .05	- .11
1953	101	89	89	3.26	- .32	.04	- .36
1954	102	83	84	3.08	- .18	.04	- .22
1955	110	78	85	3.11	.03	.22	- .19
1956	111	77	85	3.10	- .01	.03	- .04
1957	116	82	95	3.46	.36	.15	.21
1958	126	85	107	3.90	.44	.31	.13
1959	102	91	93	3.39	- .51	- .76	.25
1960	115	77	88	3.23	- .16	.39	- .55
1961	101	94	95	3.47	.24	- .43	.67
1962	119	80	95	3.48	.01	.57	- .56

Indexes based on 1947-1949 = 100; other series in current dollars.

Table 34 Southern Plains, Winter Wheat--Yearly Marginal Value Products and Related Series

Year	MPP Index	Price Index	MVP Index	MVP	Yearly Change in MVP	Productivity Component	Price Component
1930	106	34	36	2.28			
1931	104	19	20	1.25	-1.03	- .03	-1.00
1932	101	18	18	1.16	- .09	- .03	- .06
1933	81	26	21	1.33	.17	- .29	.46
1934	82	31	25	1.62	.29	.03	.26
1935	87	39	34	2.15	.53	.10	.43
1936	67	45	30	1.90	- .25	- .53	.28
1937	86	45	39	2.46	.56	.56	.00
1938	93	30	28	1.77	- .69	.16	- .85
1939	89	34	30	1.93	.16	- .07	.23
1940	90	34	30	1.94	.01	.01	.00
1941	103	46	47	3.00	1.06	.33	.73
1942	116	54	62	3.98	.98	.42	.56
1943	113	67	75	4.80	.82	- .12	.94
1944	120	68	81	5.16	.36	.29	.07
1945	115	72	83	5.28	.12	- .17	.29
1946	110	90	99	6.29	1.01	- .28	1.29
1947	108	107	115	7.31	1.02	- .15	1.17
1948	99	99	98	6.24	-1.07	- .55	- .52
1949	93	94	87	5.56	- .68	- .37	- .31
1950	94	100	94	6.00	.44	.08	.36
1951	99	114	112	7.16	1.16	.31	.85
1952	100	106	106	6.75	- .41	.10	- .51
1953	96	97	93	5.89	- .86	- .30	- .56
1954	92	99	91	5.81	- .08	- .20	.12
1955	94	92	86	5.50	- .31	.10	- .41
1956	95	88	84	5.34	- .16	.08	- .24
1957	100	86	86	5.48	.14	.26	- .12
1958	121	88	106	6.74	1.26	1.12	.14
1959	102	89	91	5.76	- .98	-1.05	.07
1960	118	85	100	6.37	.61	.88	- .27
1961	108	90	97	6.18	- .19	- .55	.36
1962	122	99	120	7.65	1.47	.81	.66

Indexes based on 1947-1949 = 100; other series in current dollars.

Table 35 Southern Plains, Wheat-Grain-Sorghums--Yearly Marginal Value Products and Related Series

Year	MPP Index	Price Index	MVP Index	MVP	Yearly Change in MVP	Productivity Component	Price Component
1930	96	36	34	1.91			
1931	98	19	19	1.03	- .88	.03	- .91
1932	88	18	16	.88	- .15	- .10	- .05
1933	80	26	21	1.14	.26	- .10	.36
1934	67	31	21	1.16	.02	- .18	.20
1935	80	37	30	1.64	.48	.24	.24
1936	57	32	18	1.01	- .63	- .44	- .19
1937	82	44	36	1.98	.97	.52	.45
1938	83	30	25	1.37	- .61	.03	- .64
1939	80	33	26	1.47	.10	- .03	.13
1940	85	33	28	1.55	.08	.08	.00
1941	90	45	41	2.25	.70	.12	.58
1942	97	57	55	3.05	.80	.19	.61
1943	98	69	68	3.75	.70	.05	.65
1944	111	69	76	4.22	.47	.47	.00
1945	109	70	76	4.22	.00	- .06	.06
1946	102	87	88	4.90	.68	- .31	.99
1947	107	108	115	6.38	1.48	.27	1.21
1948	96	100	96	5.33	-1.05	- .60	- .45
1949	97	92	89	4.92	- .41	.02	- .43
1950	91	90	81	4.51	- .41	- .30	- .11
1951	89	109	97	5.39	.88	- .07	.95
1952	91	108	98	5.42	.03	.08	- .05
1953	85	97	82	4.56	- .86	- .33	- .53
1954	84	79	66	3.68	- .88	- .04	- .84
1955	87	81	70	3.88	.20	.10	.10
1956	82	84	69	3.81	- .07	- .21	.14
1957	91	79	71	3.96	.15	.39	- .24
1958	118	85	100	5.56	1.60	1.25	.35
1959	101	88	89	4.94	- .62	- .80	.18
1960	146	80	117	6.48	1.54	2.09	- .55
1961	138	85	117	6.49	.01	- .38	.39
1962	155	90	139	7.69	1.20	.80	.40

Indexes based on 1947-1949 = 100; other series in current dollars.

Table 36 Wheat Fallow, Washington and Oregon--Yearly Marginal Value Products and Related Series

Year	MPP Index	Price Index	MVP Index	MVP	Yearly Change in MVP	Productivity Component	Price Component
1930	97	36	35	1.81			
1931	96	20	19	1.00	- .81	- .01	- .80
1932	100	19	19	.99	- .01	.04	- .05
1933	82	28	23	1.19	.20	- .22	.42
1934	78	33	26	1.34	.15	- .06	.21
1935	92	38	35	1.82	.48	.25	.23
1936	69	44	30	1.58	- .24	- .49	.25
1937	89	36	32	1.66	.08	.40	- .32
1938	100	25	25	1.30	- .35	.18	- .54
1939	101	32	32	1.68	.38	.01	.37
1940	104	31	32	1.67	- .01	.04	- .05
1941	105	41	43	2.23	.56	.02	.54
1942	111	50	56	2.89	.66	.16	.50
1943	100	61	61	3.18	.29	- .31	.60
1944	101	64	64	3.34	.16	.00	.16
1945	100	68	68	3.52	.18	- .03	.21
1946	99	86	85	4.42	.90	- .03	.93
1947	98	110	108	5.60	1.18	- .04	1.22
1948	102	97	99	5.16	- .46	.22	- .68
1949	99	93	93	4.80	- .36	- .15	- .21
1950	100	98	98	5.08	.28	.02	.26
1951	104	107	111	5.77	.69	.21	.48
1952	106	105	111	5.76	- .01	.10	- .11
1953	106	101	107	5.55	- .21	.01	- .22
1954	105	101	106	5.49	- .06	- .06	.00
1955	107	90	96	4.99	- .50	.10	- .60
1956	110	88	97	5.03	.04	.15	- .11
1957	118	90	106	5.49	.46	.34	.12
1958	126	86	108	5.61	.12	.37	- .25
1959	112	84	94	4.88	- .73	- .60	- .13
1960	126	85	107	5.54	.66	.60	.06
1961	116	90	105	5.44	- .10	- .41	.31
1962	126	92	116	6.01	.57	.44	.13

Indexes based on 1947-1949 = 100; other series in current dollars.

Table 37 Northern Plains Cattle--Yearly Marginal Value Products and Related Series

Year	MPP Index	Price Index	MVP Index	MVP	Yearly Change in MVP	Productivity Component	Price Component
1930	100	32	32	.34			
1931	85	23	20	.21	- .13	- .04	- .09
1932	85	20	17	.18	- .03	.00	- .03
1933	79	17	13	.14	- .04	- .01	- .03
1934	86	18	15	.17	.03	.02	.01
1935	91	29	27	.28	.11	.01	.10
1936	80	27	22	.23	- .05	- .03	- .02
1937	106	35	37	.40	.17	.09	.08
1938	93	33	31	.33	- .07	- .05	- .02
1939	95	34	32	.35	.02	.01	.01
1940	97	36	35	.37	.02	.01	.01
1941	94	43	41	.43	.06	- .01	.07
1942	107	52	56	.60	.17	.07	.10
1943	98	57	56	.60	.00	- .05	.05
1944	99	55	55	.58	- .02	.01	- .03
1945	95	59	56	.60	.02	- .02	.04
1946	94	76	72	.77	.17	.00	.17
1947	95	97	92	.99	.22	.01	.21
1948	99	110	109	1.17	.18	.04	.14
1949	106	93	98	1.06	- .11	.08	- .19
1950	99	106	105	1.12	.06	- .08	.14
1951	120	131	158	1.69	.57	.28	.29
1952	103	107	110	1.18	- .51	- .22	- .29
1953	101	83	84	.90	- .28	- .02	- .26
1954	99	79	78	.84	- .06	- .02	- .04
1955	102	76	78	.83	- .01	.02	- .03
1956	95	76	72	.77	- .06	- .06	.00
1957	106	85	90	.97	.20	.10	.10
1958	119	108	129	1.37	.40	.13	.27
1959	108	109	118	1.26	- .11	- .12	.01
1960	119	96	114	1.22	- .04	.12	- .16
1961	102	99	101	1.08	- .14	- .18	.04
1962	120	117	141	1.50	.42	.22	.20

Indexes based on 1947-1949 = 100; other series in current dollars.

Table 38 Intermountain Region--Yearly Marginal Value Products and Related Series

Year	MPP Index	Price Index	MVP Index	MVP	Yearly Change in MVP	Productivity Component	Price Component
1930	94	37	35	.98			
1931	100	27	27	.76	- .22	.06	- .28
1932	109	21	23	.65	- .11	.07	- .18
1933	95	18	17	.48	- .17	- .08	- .09
1934	91	19	17	.49	.01	- .02	.03
1935	87	31	27	.76	.27	- .03	.30
1936	63	29	18	.51	- .25	- .20	- .05
1937	74	35	26	.73	.22	.10	.12
1938	91	32	29	.82	.09	.16	- .07
1939	93	34	32	.90	.08	.03	.05
1940	87	36	31	.88	- .02	- .07	.05
1941	95	43	41	1.15	.27	.09	.18
1942	110	52	57	1.61	.46	.20	.26
1943	108	57	62	1.74	.13	- .02	.15
1944	109	55	60	1.70	- .04	.02	- .06
1945	110	62	68	1.93	.23	.01	.22
1946	97	74	71	2.02	.09	- .26	.35
1947	100	93	93	2.62	.60	.07	.53
1948	100	110	110	3.11	.49	.01	.48
1949	100	97	97	2.75	- .36	.00	- .36
1950	108	116	126	3.55	.80	.24	.56
1951	115	147	170	4.80	1.25	.27	.98
1952	119	119	141	3.99	- .81	.12	- .93
1953	113	80	90	2.55	- .44	- .16	- .28
1954	133	77	103	2.90	.35	.45	- .10
1955	133	74	99	2.79	- .11	.00	- .11
1956	121	71	86	2.43	- .36	- .25	- .11
1957	133	84	111	3.15	.72	.25	.47
1958	145	110	160	4.52	1.37	.36	1.01
1959	148	111	164	4.63	.11	.07	.04
1960	171	99	169	4.78	.15	.69	- .54
1961	144	105	151	4.26	- .52	- .78	.26
1962	162	111	180	5.09	.83	.57	.26

Indexes based on 1947-1949 = 100; other series in current dollars.

Table 39 Northern Plains Sheep--Yearly Marginal Value Products and Related Series

Year	MPP Index	Price Index	MVP Index	MVP	Yearly Change in MVP	Productivity Component	Price Component
1930	100	42	42	.52			
1931	110	29	32	.40	- .12	.05	- .17
1932	106	22	23	.29	- .11	- .02	- .09
1933	86	30	26	.32	.03	- .07	.10
1934	93	34	32	.40	.08	.03	.05
1935	94	37	35	.43	.03	.00	.03
1936	76	43	33	.41	- .02	- .08	.06
1937	100	51	51	.64	.23	.14	.09
1938	90	36	32	.40	- .24	- .05	- .19
1939	88	44	39	.48	.08	- .01	.09
1940	96	47	45	.56	.08	.04	.04
1941	103	56	57	.72	.16	.05	.11
1942	109	64	70	.87	.15	.05	.10
1943	97	70	68	.84	- .03	- .10	.07
1944	103	66	68	.85	.01	.06	- .05
1945	100	69	69	.86	.01	- .03	.04
1946	93	78	72	.90	.04	- .07	.11
1947	96	94	90	1.12	.22	.03	.19
1948	102	106	108	1.35	.23	.08	.15
1949	102	100	102	1.27	- .08	.00	- .08
1950	91	121	110	1.37	.10	- .15	.25
1951	104	171	178	2.22	.85	.25	.60
1952	102	111	113	1.41	- .81	- .03	- .78
1953	96	90	87	1.08	- .33	- .07	- .26
1954	92	94	86	1.08	.00	- .05	.05
1955	102	83	85	1.06	- .02	.11	- .13
1956	106	90	96	1.19	.13	.05	.08
1957	101	102	103	1.28	.09	- .06	.15
1958	122	95	115	1.44	.16	.26	- .10
1959	113	87	98	1.22	- .22	- .10	- .12
1960	129	84	108	1.35	.13	.17	- .04
1961	107	77	82	1.03	- .32	- .22	- .10
1962	131	92	120	1.50	.47	.25	.22

Indexes based on 1947-1949 = 100; other series in current dollars.

CHAPTER III

FARM REAL ESTATE MARKET BEHAVIOR AND COMPOSITION

In order to view the data derived from the production function and residual return models in perspective a short review of aggregate land value behavior as well as a look at the changing composition of the farm real estate market during the period will be useful.

Real Estate Value Behavior 1930-1964

As Table 40, column 2 shows net farm income hit its depression low in 1932. Between 1932 and 1937 it improved but did not climb as fast as prices since a large portion of the price rise was due to shorter supplies caused by widespread drought. Also contributing to the rise in prices were the recovery of the non-farm economy and the New Deal farm legislation, probably in that order. A decrease in net farm income occurred in 1938 and 1939 due to a general recession which began in late 1937. Farm prices were down 20 percent and gross farm income declined from $11.7 billion in 1937 to $10 billion in 1938. The recession was a result of several factors including rapid increase in costs, high inventories, stiffening of credit policies and the declining influence of certain emergency New Deal policies.[1] In 1941 net farm income turned up again prior to the U.S. entering World War II and then increased sharply during the war years.

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[1] Murray R. Benedict, Farm Policies of the United States 1790-1950, (New York: The Twentieth Century Fund, 1953), p. 365.

Table 40 Indexes of Average Value per Acre of Farm Real Estate, Total net Farm Income, Consumer Prices, Gross National Product, and Physical Farm Output, United States 1930-1964 (1957-1959 = 100) and Selected Spearman Rank Correlation Coefficients

Date	Farm Real Estate Value per Acre (1)	Total Net Farm Income (2)	Consumer Price Index (3)	Gross National Product (4)	Net Income Per Farm (5)	Physical Farm Output (6)
1930	43	35	58	--	22	59
1931	38	27	53	--	18	65
1932	32	17	48	--	11	63
1933	26	21	45	--	13	58
1934	27	24	47	--	15	50
1935	28	43	48	--	27	59
1936	30	35	48	--	22	54
1937	31	49	50	--	32	68
1938	31	36	49	--	23	65
1939	30	37	48	--	24	65
1940	30	37	49	22	25	68
1941	31	54	51	28	36	70
1942	33	81	57	35	55	79
1943	36	97	61	42	67	78
1944	42	97	62	46	68	80
1945	46	101	63	47	72	78
1946	52	125	68	46	89	81
1947	59	127	78	51	92	78
1948	63	145	84	57	106	86
1949	66	106	83	57	78	86
1950	65	114	84	62	86	85
1951	75	134	91	72	104	86
1952	82	125	93	76	102	89
1953	83	109	93	80	92	90
1954	82	104	94	79	92	91

Table 40--Continued

Date	Farm Real Estate Value Per Acre (1)	Total Net Farm Income (2)	Consumer Price Index (3)	Gross National Product (4)	Net Income Per Farm (5)	Physical Farm Output (6)
1955	85	96	93	87	87	94
1956	89	95	95	92	89	96
1957	95	96	98	97	93	96
1958	99	111	101	97	111	103
1959	106	93	101	106	96	101
1960	111	98	103	110	105	105
1961	112	106	104	114	117	106
1962	118	108	105	122	124	107
1963	123	106	107	128	126	110
1964	131	104	108	136	127	NA

Sources: (1) Farm Real Estate Market Developments. ERS, USDA, October 1964, p. 53.
(2) Farm Income Situation. ERS, USDA, July 1964, p. 37.
(3) Federal Reserve Bulletin.
(4) Survey of Current Business, Bureau of Labor Statistics.
(5) Farm Income Situation, ERS, USDA, July 1964, p. 45.
(6) Agricultural Statistics, 1962, Table 661; 1964, Table 657.

Spearman Rank Correlation Coefficient

For the Period	Between Land Values and: Total Net Farm Income	Consumer Price Index	Gross National Product	Net Income Per Farm	Physical Farm Output
1930 - 1964	.64	.99	NC	.90	.95
1933 - 1954	.88	NC	NC	NC	NC
1940 - 1964	NC	NC	.99	NC	NC
1955 - 1963	NC	NC	NC	NC	.98
1955 - 1964	.50	1.00	1.00	.96	NC

NC Not calculated.

A close relationship between land values (Table 2, col. 1) and net farm income (Table 2, col. 2) during this period has been established. The low point for land values came in 1933, one year later than the net farm income low, when the index stood at 26 (1957-1959 = 100). The index rose to 31 in 1937 and 1938, then dropped to 30 for the years 1939 and 1940, again a one-year lag behind net farm income--then rose steadily during the war. During the early war years, land values rose slowly because of uncertainty as to how high farm income levels would climb and because of the nearness of the depression years. A post war depression did not occur as expected and continuing international tensions along with a large foreign aid program caused a generally rising price level. Farm income continued to increase causing upward pressure on farm real estate values till the index stood at 66 for the year ending March 1949. This was a 120 percent increase in land values since 1940. During 1949 farm real estate values dipped due to a drop in farm product prices and general economic activity, which started late in 1948.

The 1949 Agricultural Adjustment Act would probably have checked the downturn in land values had not the Korean war brought some inflationary factors back into the economy which did the job instead. In late 1951 farm product prices again began to slide, stopping the upward trend in land values. The index of farm real estate values for the year 1951 was 75; for 1952 was 82, for 1953 was 83 and for 1954 was 82. So the trends in real estate values for the period 1930 through 1953 agree closely with changes in farm income and product prices.

Then in 1954 while farm income dropped again for the fourth consecutive year real estate values turned upward. By early 1957,

land values were 12 percent above their 1953 low despite stable farm income at a relatively low level throughout the 1954-1957 period. Between 1954 and 1964 farm real estate values have followed an ever upward trend with the farm real estate value index in 1964 at 131. This represents a 60 percent increase in land value during the period, while total net farm income was below the 1954 level for 5 of the 10 years and only slightly above that level for the other 5 years.

A Spearman rank correlation coefficient[2] calculated for the indexes of land values and total net farm income in Table 40 for the period 1930 through 1964 is .64. Taking only the period 1933, when land values hit bottom, to 1954, when land values rose despite the fall in net farm income, the $r_s = .88$; and for the period 1955 through 1964, $r_s = .50$. This indicates that the correlation between the two series was much higher before 1954 than after.

The seemingly odd land value behavior since 1954 has called forth a host of hypotheses and explanations trying to rationalize it. Expectations concerning future income streams to farm real estate play a particularly heavy role in determining market price, and assumptions about the existence, direction, and magnitude of certain trends in the composition of the land market itself, the general economy, and the structure of agriculture production are the foundations upon which these expectations are based.

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[2]The Spearman rank correlation coefficient is $r_s = 1 - \frac{6\Sigma d_i^2}{N(N^2-1)}$ where d_i is the difference between the ranks of the series and N is the number of observations. For further explanation of the statistic and its use see Sidney Siegel, Nonparametric Statistics for the Behavioral Sciences, (New York: McGraw-Hill Book Co., Inc., 1956), pp. 202-213.

Land Values and Other Economic Indicators

Historically farm real estate prices have been highly correlated with the general price level.[3] For the period 1930-1964, the Spearman rank correlation coefficient (r_s) is .99 between land values and the consumer price index. From 1954 to 1962 the r_s is 1, indicating that the correlation is perfect throughout the period. The correlation between land values and gross national product (GNP)[4] for the period 1940-1964, r_s = .99 and for the period 1955-1964, r_s = 1 indicating that this correlation is also very strong throughout the period covered. In order to expect this relationship to continue, assuming certain other relationships constant, agricultural earnings would have to move in the same direction as non-agricultural earnings. This has not been the case, for since 1953 net farm income in current dollars has leveled off while the purchasing power of farm income has declined.

Hathaway has found that the agricultural business cycle is conforming more closely with the non-farm business cycle in the later years. Large non-farm business cycles affect agriculture in the same direction as measured by net income, income per worker, and value of farm assets. The effect of milder cycles on agriculture is less pronounced and other factors tend to overwhelm their effects. Since farmers are more and more dependent on non-farm sources of supply for

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[3] William H. Scofield, "Dominant Forces and Emerging Trends in the Farm Real Estate Market." Paper presented at a seminar on land prices, North Central Regional Land Economics Committee, Chicago, Illinois, November 12, 1964.

[4] William H. Scofield, "Prevailing Land Market Forces," Journal of Farm Economics, Vol. 39, (1957), pp. 1500-1510.

production items and since aggregate demand for farm products is very income inelastic, mild expansions increase farmers production costs without appreciably increasing their returns. The main benefit to agriculture of a mild business expansion is the opportunity it affords excess labor to move more easily from farm to non-farm jobs rather than any increase in demand for farm products.[5]

Even though aggregate net farm income has leveled off, out movement of labor and farm consolidation has proceeded at a rate which has caused the net income per farm to show an upward trend since the post World War II low in 1950. This trend was slightly upward from 1950 through 1957 and then accelerated into the 1960's. Therefore, in recent years there has been a larger net income per farm to distribute among the productive factors. Thus, if the total physical quantity of the so-called unpaid factors--capital, operator and family labor, and land--per farm is increasing at a slower rate than per farm net income, they will be eligible to split a larger return. The Spearman rank correlation coefficient between land values and average total net farm income per farm for 1930-1964 is $r_s = .90$ and for the period 1955-1964, $r_s = .96$. If land values are primarily based on productivity returns, it appears that this splitting of larger returns has been happening over the period and further that land values may be based more on productive returns or that the land market is quicker to respond to farm income changes in the years since 1955 than formerly. This would also cause the high correlation between the land prices index, and both the consumer price index, and GNP even though total net farm income has been declining.

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[5]Dale E. Hathaway, "Agriculture and the Business Cycle," Policy for Commercial Agriculture, Joint Economic Committee, (Washington: U.S. Government Printing Office, 1957), pp. 51-76.

The Real Estate Market and the Expansion Buyer

The expansion buyer has become more prominent in the farm real estate market in recent years. Table 41 indicates the percent of the total farm real estate buyers who were expansion buyers. The trend has been consistently upward since 1948 from 35.5 percent to 51 percent. The slight drop in 1956 was not due to a decrease in the number of expansion buyers but to the relative increase in the number of non-farmer buyers in that year, probably to take advantage of the Soil Bank Program. According to Table 42 the market has dwindled in size from

Table 41 Farmer Expansion Buyers as a Percentage of Total Buyers in the Farm Real Estate Market (1948-1963)

Year	Farmer Expansion Buyers Percentage of Total
1948	35.5
1949	36.5
1950	36.5
1951	37.5
1952	38.1
1953	38.3
1954	38.4
1955	38.7
1956	37.9
1957	39.9
1958	39.8
1959	41.4
1960	46.9
1961	48.1
1962	47.9
1963	51.0

Source: Compiled from data in various issues of Farm Real Estate Market Developments, ERS, U.S.D.A., 1949-1964.

approximately 291 thousand farm transfers in 1950 to about 140 thousand in 1963. So even though expansion buyers are an increasing portion of

the total market, the total market has declined rapidly enough that the number of farm expansion buyers has decreased through the years from about 106.2 thousand in 1950 to about 71.4 thousand in 1963. But since farm numbers have been declining during the period expansion buyers as a percent of total farms in 1950 stood at 1.97 percent and in 1963 at 2.28 percent. The figures for the two intervening census periods are lower but the figure for 1963 is higher than for 1954 indicating an upward trend at least since 1954. The expansion buyer then is becoming more dominant in the land market and the upward pressure he exerts on price is becoming stronger. Scofield is convinced that "Land prices in commercial farming areas today are set chiefly by the expansion buyer who can compete effectively with the non-farmer investor buyer. Farmers themselves have been chiefly responsible for the upward trend in land prices over the last decade."[6]

Land as an Investment

Another influence in the real estate market whose role has changed during the period under study is the non-farmer investor. There appears to be a widely held belief both among farmers and many non-farm investors that land offers safety and protection of capital from loss of purchasing power during periods of inflation. Boyne found that real capital gains accruing to farm operators due to farm real estate investment in the United States between 1940 and 1960 amounted to $26.5 billion in 1960 dollars.[7] He found further that the real capital gain has

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[6]Scofield, loc cit.

[7]David H. Boyne, "Changes in the Real Wealth Position of Farm Operators 1940-1960," Technical Bulletin 294, (Agricultural Experiment Station, Michigan State University, 1964), p. 38.

Table 42 Number of Farm Transfers, Number of Expansion Purchases and Expansion Purchases as a Percentage of Number of Farms for Selected Years

Year	No. of Farms (Thousands) (1)	Farm Transfers Per 1000 Farms (2)	No. of Farms Transferred (Col (1)/1000)x Col (2) (Thousands) (3)	Expansion Buyers in Market (Percent of Total) (4)	No. of Expansion Purchases Col (3)x Col (4) (Thousands) (5)	Expansion Purchases as Percent of No. of Farms Col (5)/Col (1) (Percent) (6)
1950	5,382	54.0	291	36.5	106.2	1.97
1954	4,782	46.6	223	38.4	85.6	1.79
1959	3,704	47.1	174	41.4	72.0	1.94
1963	3,136*	44.8	140	51.0	71.4	2.28

* Estimated.

Source:

Column (1) Agricultural Statistics, 1964, p. 431, Table 625.

Column (2) Farm Real Estate Market Developments (CD-55), May 1960, p. 18 and (CD-66), October 1964, p. 26.

Column (3) From Table 41.

increased at a rate through time which has approximately offset the decline in rate of return from production in the later years. Five-year averages of total return on investment which includes both real capital gain and productive returns are 1940-1944, 10.6 percent; 1945-1949, 7.1 percent; 1950-1954, 8.3 percent and 1955-1959, 7.8 percent.[8]

Behind the argument that land is a "safe" investment lies a deep-rooted value based in our agricultural history that land ownership carries with it a certain prestige or status. Further, land is a tangible asset which can be seen, walked on, felt, surveyed, and identified with, qualities which are important in a rural-oriented society and which few other assets possess.

As the U.S. becomes increasingly urbanized, succeeding generations will more and more lose their identification with rural life and rural values. These non-economic rationales for investment in farm real estate will then diminish and economic factors being equal non-farmers can be expected to show less interest as buyers of farm real estate. This trend is already in evidence when we look at the percentage distribution of non-farmer buyers and sellers in the land market through time.

Table 43 shows the percentage of non-farmer buyers of farm real estate to be quite constant since 1950 except for the 1956-1959 period when non-farmer buyers of farm real estate increased as a percentage of the total. The increase during this period may be attributed in part to the investment benefits derivable from real estate ownership due to the Soil Bank and Conservation Reserve programs.

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[8] Ibid. p. 43.

Table 43 Non-Farmer Buyers and Sellers in the Farm Real Estate Market as a Percentage of the Total Market

Year	Non-Farmer Buyers (1)	Non-Farmer Sellers (2)	Net Buyers Over Sellers (3)
1948	28.2	17.0	11.2
1949	27.9	11.9	16.0
1950	28.4	15.3	13.1
1951	32.1	15.5	16.6
1952	30.3	14.5	15.8
1953	33.4	14.6	18.8
1954	33.9	15.9	18.0
1955	32.8	14.6	18.2
1956	35.5	14.2	21.3
1957	35.9	15.1	20.8
1958	35.0	15.2	19.8
1959	36.2	26.1	10.1
1960	33.8	26.0	7.8
1961	32.1	24.1	8.0
1962	32.2	25.4	6.8
1963	31.0	24.9	6.1

Source:

Data compiled from various issues of Farm Real Estate Market Developments, ERS, U.S.D.A., 1949-1964.

On the seller side of the market the percentage of non-farmers remains quite constant until 1959 when the market experiences a substantial jump in the percentage of non-farmer sellers from 15.2 to 26.1 percent. From 1959 to 1964 the percentage of non-farmer sellers has remained relatively constant at this higher level. This jump may be attributed to a combination of forces including lower rates of rental returns from real estate investment, profit taking of accrued capital gains, higher rates of return from opportunity cost investments and expiration of Soil Bank contracts.

The difference between the non-farmer percentage of total buyers and the non-farmer percentage of total sellers in a given year yields the net percentage of transfers from farmer sellers to non-farmer buyers since the percentage of non-farmer buyers during the period is always greater than the percentage of non-farmer sellers. (See Table 43, col. 3). High net farm incomes in the late 1940's and early 1950's probably caused a rising net percentage of non-farmer buyers in the farm real estate market. The jump in 1956 is, as stated above, probably due substantially to the Soil Bank and Conservation Reserve programs. Between 1958 and 1960 the trend was sharply downward, leveling off between 1960 and 1964. Economic factors being equal and assuming no change in the institutional structure of agriculture we would expect the net non-farmer buyer proportion of the farm real estate market to slowly decrease in the future. If, however, the institutional structure of asset ownership in agriculture were to change, say toward large corporate farms, this trend may very well reverse and move substantially upward in the future.

Land Investment and Taxes

Investors considering farm real estate as an alternative often mention tax advantages as a reason for favoring land as an investment. Just what they mean is not always clear since ownership of land draws with it several different kinds of tax considerations.

First there is the capital gains tax which applies to land. Capital appreciation of land through time will increase the net worth position of the owner. If he sells the real estate at some future time for more than he paid for it the difference between the price he originally paid and his selling price is a capital gain. Income from capital gains of productive assets is eligible to be taxed at a much lower rate than income derived from normal business operations for profit. While investments in farm real estate are eligible for this capital gain tax rate so are many other investment alternatives, the most notable of which are corporate stocks. So the capital gains tax provisions would neither hinder nor enhance the position of farm real estate as one of many alternative investment sources.

Probably the tax advantages which farm real estate investors are concerned with are those arising through the ability to convert income from production to income from capital gains under present tax laws. Persons in high personal income tax brackets can purchase a farm which can be operated in such a way as to show net losses, thus lowering their income tax bracket. Part of the loss from the farming operation can arise from heavy investment in items which improve the value of the real estate such as fertilizer, drainage, leveling, improvement and modernization of buildings and fences. In effect the

investor can add to net worth in the form of capital appreciation of the real estate investment which will be taxed sometime in the future at the capital gains tax rate while at the same time he can show a net loss from farming operations for which he can receive tax credit allowing him to be taxed in a lower personal income tax bracket. This type of tax advantage associated with farm real estate will make it a more desirable alternative than other sources of investment to some investors. This advantage will continue as long as existing tax laws stay in effect.

Investors, both farmer and non-farmer, must also take into account the property tax when making investment decisions regarding farm real estate. Table 44 shows the movement in the effective farm real estate tax rate and the average per acre tax on farm real estate through time. The effective tax rate is found by dividing the total current value of farm real estate into the total amount of farm real estate tax collected. It is not the rate of the tax assessor which is then applied to the assessed valuation to determine the tax bill but rather the percentage of current market value of farm real estate that is collected as real property taxes for any given year.[9] The average

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[9]The per acre tax figures in Table 44 do not agree with those published in Agricultural Statistics. In computing that per acre tax series the value of public and Indian lands is deducted from the total value of farm real estate. Public and Indian land values are calculated by assuming their value to be comparable to similar privately held land. Since public and Indian lands are generally of poorer quality than privately held land they are likely over valued by this method. For this reason the Agricultural Statistics estimates are upward biased. On the other hand the estimates in Table 44 are downward biased due to not excluding public and Indian land from total value of farm real estate. The two series form the upper and lower boundaries of the estimates of average tax per acre. The absolute spread between the two estimates becomes larger as the tax per acre increases. This is because there is an acreage difference in calculating the two estimates amounting to approximately 8 percent. That is, the Table 44 estimates are approximately 8 percent below the Agricultural Statistics estimates. See Agricultural Statistics (1962, Table 703; and 1963, Table 703).

Table 44 Total Farm Real Estate Taxes, Average Per Acre Farm Real Estate Taxes, and Effective Rate of Taxation 1930-1963

Date	Total Value of Farm Real Estate (Million Dollars) (1)	Total Farm Real Estate Taxes (Million Dollars) (2)	Effective Tax Rate Col (2)/Col (1) (Percent) (3)	Per Acre Value of Farm Real Estate (Dollars) (4)	Average Per Acre Tax on Farm Real Estate Col (3)·Col (4) (Dollars) (5)
1930	47,873	567	1.18	48.52	.50
1931	43,730	526	1.20	43.72	.52
1932	37,180	461	1.24	36.67	.45
1933	30,802	398	1.29	29.98	.39
1934	32,201	383	1.19	30.93	.37
1935	33,264	392	1.18	31.54	.37
1936	34,260	394	1.15	32.45	.37
1937	35,213	405	1.15	33.31	.38
1938	35,170	400	1.14	33.23	.38
1939	34,085	407	1.19	32.17	.38
1940	33,636	401	1.19	31.71	.38
1941	34,400	407	1.18	31.94	.38
1942	37,547	400	1.07	34.35	.37
1943	41,604	400	.96	37.50	.36
1944	48,200	419	.87	42.83	.37
1945	53,884	465	.86	47.20	.41
1946	61,046	519	.85	53.31	.45
1947	68,463	605	.88	59.62	.52
1948	73,664	656	.89	63.96	.57
1949	76,623	706	.92	66.33	.61
1950	75,256	741	.98	64.96	.64
1951	86,586	773	.89	74.74	.67
1952	95,078	805	.85	82.08	.70
1953	96,535	839	.87	83.34	.73
1954	95,038	870	.92	82.06	.75

Table 44--Continued

Date	Total Value of Farm Real Estate (Million Dollars) (1)	Total Farm Real Estate Taxes (Million Dollars) (2)	Effective Tax Rate Col (2)/ Col (1) (Percent) (3)	Per Acre Value of Farm Real Estate (Dollars) (4)	Average Per Acre Tax on Farm Real Estate Col (3) · Col(4) (Dollars) (5)
1955	98,172	928	.95	85.32	.81
1956	102,934	977	.95	90.05	.86
1957	110,421	1,044	.95	97.25	.92
1958	115,934	1,103	.95	102.80	.98
1959	124,393	1,188	.96	111.04	1.07
1960	129,929	1,251	.96	116.48	1.12
1961	131,363	1,330	1.01	118.22	1.19
1962	127,436	1,398	1.02	124.19	1.27
1963	143,638	1,468	1.02	129.79	1.32

Source: Col (1) Farm Real Estate Market Developments (CD-64), August 1963, p. 41.

Col (2) Agricultural Statistics, 1962, Table 704; 1964, Table 700.

Col (4) Farm Real Estate Market Developments (CD-64), August 1963, p. 41.

per acre tax in 1963 of $1.32 represented the twentieth consecutive yearly rise since the lowest per acre tax during the period of $.36 in 1943. The rise has been due to rising land values throughout the 20-year period and since 1952 a slight rising trend in the tax rate.

The per acre tax rose 267 percent between 1943 and 1963 while the per acre value of farm real estate rose 246 percent during the same period. Thus we can see that the tax burden on farm real estate is tending to become greater. In order for the tax burden in percentage terms to be the same as it was in 1943, tax collections would have been $1,384 million instead of $1,468 million in 1963. The combination of increasing tax rates and increasing land values has resulted in an average per acre tax increase per year of 4.8 cents over the 20-year period.

If a buyer of farm real estate in 1943 had been able to look into the future and had determined that the average increase in taxes would be 4.8 cents per year for the next 20 years he could have discounted this increase in his future costs and lowered his valuation of the property accordingly. Suppose for example that our buyer has somehow determined the net annual return he expects this property to yield without assuming any increase in property taxes and has settled upon an acceptable capitalization rate. To determine the present value of the future income streams accruing to the property he divides the net average annual return by the capitalization rate. The result is the price he can afford to pay for the property under his assumptions. But since our 1943 buyer is omnicient with respect to the average annual increase in real estate taxes he can determine the effect of this increasing cost on the present value of his property. By dividing the

average annual increase in the tax by the square of his acceptable capitalization rate and subtracting this figure from the value he calculated previously, he finds the 1943 present value of the property considering the tax increase.[10] This assumes the increase in costs will be maintained at the constant rate in perpetuity. Assuming a constant capitalization rate of 5 percent and the above 4.8 cent yearly incremental increase in cost of ownership due to taxes the decrease in value per acre due to the tax increase is $19.80. (.048/.0025). This takes the inflationary trend of the past 20 years into account. If only the tax rate change is taken into account exclusive of the inflationary trend in land values the change in value due to the tax would be much less and may in this case even be positive since the effective rate for 14 of the 20 years is below the effective rate in 1943. To take a hypothetical example, if we expect the tax rate to increase one cent per acre per year in perpetuity, all other things constant, and we assume a 5 percent capitalization rate the decrease in present value due to the tax increase is $4.00 per acre (.01/.0025).

We can most likely expect real estate tax rates to continue their upward trend in the future. Improvement and maintenance of county roads will continue along with the increased expense of school consolidation, school bus routes, higher classroom education costs, and expanded county services. The rural to urban movement leaves rural counties with narrower personal property tax bases and the urban counties with the added expense of providing services for the rural

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[10] A constant increment of change in the net annual income stream can be accounted for by an addition to the general capitalization formula. The formula then becomes $V = a/r \pm i/r^2$ where i is the annual increment of change in the income stream and can be either positive or negative. R.R. Renne, Land Economics, (New York: Harper λ Bros., 1947), p. 216.

immigrants. The rate of tax increases per acre per year has been very slightly upward since the early 1950's. Five-year averages of increases over the past 20-year period are 1943-1948, 4.2 cents per year; 1948-1953, 3.2 cents per year; 1953-1958, 5 cents per year; and 1958-1963, 6.8 cents per year. We can expect at least the same rate of rise in the future.

Land Values and Government Programs

Any government program is a policy means toward realization of certain values which society deems important and which it otherwise may not be able to achieve. Most government agricultural programs of the past 35 years have had as their goal stabilizing and/or increasing farm incomes. Three general approaches have been used.

First we have the programs affecting the price of agricultural products. In this category fall the commodity price support programs usually with some type of restriction on the quantity of land which can be used or on the quantity of the product which can be marketed, government disposal programs such as school lunch, food stamp, and PL 480, and tariffs or other trade restrictions at the international level. When any of these programs are successful in raising the price of an agricultural product or keeping it above market clearing levels the returns available for distribution to agricultural production factors including land will be larger. Depending on the share of total revenue accruing to land, a portion of the added returns due to the program will be capitalized into land values. Since these programs are commodity oriented they have a differential impact on land values in different areas of the country.

When marketing quotas in the form of acreage allotments are used in conjunction with a price support program ownership of land with an acreage allotment is tantamount to having a license to produce a specific commodity. As with any license which tends to restrict entry the allotment itself gains a value imputed to it by the difference between returns to holders of the allotment and returns to those without it. Since in this case the license is in the form of land with an acreage allotment, in areas where the allotments have value, this value is capitalized into land values. The allotment would have no value in areas where an unrestricted alternative provided returns equal to returns from the restricted crop.

The second category of government programs are those which attempt to increase productivity. Included here are the Agricultural Conservation Programs with cost sharing arrangements for approved practices and improvements, technical assistance provided by the Soil Conservation Service, research and development by agricultural experiment stations and research and dissemination of information by land-grant colleges and the Agricultural Extension Service.

Activities under the Agricultural Conservation Program most directly affect the value of land through practices designed to improve the productive quality of that input. Effects of this program then to a greater extent than effects of others in this category tend to be directly capitalized into land values.

The third category of programs also directly affect land values and the welfare of landholders. Here we are speaking of the Soil Bank Acreage Reserve and conservation reserve type programs which

allow payments to landholders for taking land out of agricultural production and diverting its use through various forms of conservation practices. Control of the land is necessary for participation in this type of program. Thus, at least some of the benefits become attached to the land and are capitalized into market prices.

The acreage reserve portion of the Soil Bank Program operated on a year-to-year basis and was voluntary, so a participant must have decided that his returns would be greater by participating in the program. The effect of the acreage reserve on land prices then would have been much the same as any program designed to raise farm income such as a price support program.

The Conservation Reserve program was a longer run approach where participants contracted with the program for up to 10 years. To the extent that higher and more stable income streams were realized both demand for land and incentive for present owners to retain possession would increase. Higher land prices should have resulted, although Table 40 shows no sharp increase in 1956 in the index of land values.

An important effect of past government programs on land values is the mere fact that even though most were called "temporary" they did persist. The expectations that government programs of some type will continue to exist is an important land market factor due to their general stabilizing influence on farm income. Lower capitalization rates can be used for land values when a smaller allowance can be made for risk and uncertainty arising from instability.

Summary

The non-farmer investor is becoming a smaller part of the farm real estate market. With each succeeding generation fewer and fewer urban investors have strong actual or sentimental ties with agriculture and thus will have fewer non-economic motives for owning farm real estate. Farm real estate investments involve certain costs not associated with other types of investments. The property tax is a direct cost to the farmland investors when his net return is calculated which means that the gross land rental return must be higher than returns from comparable investments in which the property tax has already been deducted or where it doesn't play as important a role as an expense item. And the property tax cost is increasing over time due to both the rate and base increasing. Also farm real estate holdings involve a cost in terms of the investor's time for managing the investment or in terms of money for hiring this management service.

These costs are normally much less in alternative investments such as corporate stocks or securities. The non-farmer investor then is looking more at the economic aspect of farm real estate investment as opposed to alternative forms of investment, and except for the period 1956-1959 when the Soil Bank provided both high returns and investment security, has tended to become a smaller component of the farm real estate market. (See Table 43, col. 3).

This has caused the expansion buyer to become an increasingly dominant force in the farm real estate market. Even though net farm income per farm declined from its 1948 high and fluctuated between 1949 and 1955 at relatively low levels before beginning its present

rising trend in 1956, farm real estate prices rose steadily throughout the entire period with only two minor setbacks occurring in 1950 and 1954. Thus, it appears the expansion buyer has been willing to bid up the price of farm real estate over a rather long period partly on the basis of factors other than his current net farm income. One of these factors is the expectation that some type of government agricultural program will persist. As we shall find and discuss in greater detail in Chapter V the expansion buyer generally appears willing to pay more for farm real estate to add to his existing land base at present than may be warranted by capitalization of expected income flows accruing to that input calculated from the residual return model but less than warranted by the series derived from the production function model.

CHAPTER IV

THEORETICAL FRAMEWORK FOR FARM REAL ESTATE VALUES

Before proceeding to an analysis of the data derived from our two models a conceptual framework from which we may view the results must be developed.

Expected Behavior of Land Marginal Value Products over Time

Land price rises can be rationalized on a purely theoretical basis. Picture a production function analysis, using a Cobb-Douglas type of statistical function on time series data, where the variables are land, labor, and capital measured in physical terms--acres, man-hours, and constant dollars. And for the sake of argument let us assume the coefficients to be one-third for each input so that the function is $Y = 1X_1X_2X_3$ where X_1, X_2, and X_3 are land, capital and labor respectively. Suppose that in time period one the input values are such that the function is $Y = 1(27)^{\frac{1}{3}}(8)^{\frac{1}{3}}(42.9)^{\frac{1}{3}}$ so solving for Y we get $1 \times 3 \times 2 \times 3.5 = 21$.

Now time passes and with it come some very important changes in the inputs. Land substitutes are developed which allow one acre of land to yield almost twice its capability in time period one, but the same amount of land is used as before. Labor substitutes are developed which would allow reduction to about one-third the labor used in the first time period but less labor leaves than would be possible. The use of capital increases by about two and one-half times.

We can enter these changes into the function. The land input remains the same at 27 but added to it is a bundle of land substitutes which increases the effective amount of land by almost twice. We will therefore add 23 units of land substitute giving the land input a value of 50. Capital increases by two and one-half times--from 8 to 20. Labor decreases from 42.9 to 29 but labor substitutes in the magnitude of (say) 96 increase the effective labor input by slightly over two and one-half times its former level of 42.9 to 125.

The function for time period two is

$Y = 1(X_1 + X_1 \text{ substitute})^{\frac{1}{3}} X_2^{\frac{1}{3}} (X_3 + X_3 \text{ substitute})^{\frac{1}{3}}$ or

$Y = 1(27 + 23)^{\frac{1}{3}} (20)^{\frac{1}{3}} (29 + 96)^{\frac{1}{3}}$ which reduces to $Y = 1(50)^{\frac{1}{3}}(20)^{\frac{1}{3}}(125)^{\frac{1}{3}}$.

Solving for Y we get $1 \times 3.68 \times 2.72 \times 5 = 50$.

The marginal physical product for land in time period one is $\frac{\frac{1}{3}(21)}{27} = .259$ and for time period two if we can measure the land substitute $\frac{\frac{1}{3}(50)}{50} = .333$. If we cannot measure the substitute in the land variable the land MPP appears to be $\frac{\frac{1}{3}(50)}{27} = .617$. The point is that it is theoretically possible to get increasing marginal physical products through time for land under the situation described above which approximates what has happened in U.S. agriculture over the past 4 decades.[1]

Now since marginal physical product times product price equals marginal value product we can postulate a price of one in the first time period to yield a marginal value product of (.259) (1) or .259.

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[1]This concept and the basis for the example was developed by G. L. Johnson who discussed it with the author.

In the second time period, even if the price decreases as much as to 80 percent of its former level and we can measure the land substitutes the MVP is (.333)(.8) or .266 -- an increase over the MVP in time period one. Thus land MVP's may rise due to productivity increases even though product prices decline.

If we cannot measure the land substitutes in the land input the MVP in the second time period will rise relative to MVP in the first time period even if prices fall to less than half their former levels (MVP = (.617)(.5) = .309).

A problem arises when we attempt to measure these substitutes empirically for inclusion in a production function. First there are the new techniques and cultural practices which increase production without substantially affecting the physical amount of inputs used but which do increase output. In this category are included such items as stubble mulching practices, hybrid seed, more productive breeds of livestock or higher educational levels of farm operators leading to greater management capacity.

In another category are the technical innovations which change the input mix within the aggregated input called capital without changing the amount of constant dollars worth of capital employed. An example is the disinvestment in horses and mules which approximately offset the investment in motor vehicles and tractors at least up to 1948. This was a tremendous labor saving change but was neither picked up as change in the capital input nor as an addition to labor in the form of a labor substitute. Thus, if it is theoretically possible to get increasing MPP's for land by including the land and labor substitutes it is certainly possible and probable that land MPP's will increase

when many of these output increasing substitutes are not measured in the conventional input categories in a production function. Therefore it is possible and highly probable to have increasing marginal value products for land even though product prices fall, if the increase in MPP more than offsets the fall in product prices.

Table 45 presents average yearly rates of change in marginal physical product of real estate in 1947-1949 constant dollars, and marginal value product of real estate in current dollars for the 19 areas studied over selected time periods. With very few exceptions the rate of change in MPP's for all areas in all time spans is positive. Of the exceptions those occurring in the 1940-1949 period are negative because of substantial jumps in MPP in the early part of the period due to generally favorable weather in 1942 and 1943 and dips in 1949.[2]

Any time the table shows a lower rate of increase for MVP than for MPP, it means the average change in prices for the period was negative. This was true with five exceptions for the period 1933-1939. In the five exception areas, Corn Belt beef raising, Northern Plains wheat-corn-livestock and Northern Plains cattle prices did not change, while Intermountain cattle and Northern Plains sheep prices increased during the period.

The 1950-1954 period was characterized by falling product prices which started in late 1948, and even though MPP changes in most areas were positive the effect of the price decline overwhelmed the effect of the rising MPP's, and MVP's trended downward except for the Southern Piedmont cotton and the Washington and Oregon wheat-fallow areas.

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[2]The Stallings weather index shows 1942 and 1943 to have had favorable weather. James Stallings, "Weather Indexes," Journal of Farm Economics, Vol. 42, (1960) pp. 180-186.

Table 45 Average Yearly Rates of Change Within Selected Periods in Real Estate Marginal Physical Products in Constant 1947-1949 dollars and in Real Estate Marginal Value Products in Current Dollars

Area	1933-1939		1940-1949		1950-1954		1955-1962	
	MPP	MVP	MPP	MVP	MPP	MVP	MPP	MVP
Central Northeast Dairy	.73	.44	-.02	1.19	-.12	- .39	.84	.93
Eastern Wisconsin Dairy	.98	.58	.08	1.72	.21	- .34	1.04	1.13
Western Wisconsin Dairy	.54	.35	.08	1.23	.12	- .37	.40	.55
Dairy-Hog Minnesota	.52	.47	.27	1.54	.16	- .19	.96	1.03
Hog-Dairy Corn Belt	.87	.66	.26	1.95	.05	- .05	.89	1.11
Hog-Beef Raising Corn Belt	.30	.30	.12	.98	.12	- .05	.58	.67
Hog-Beef Fattening Corn Belt	1.06	.84	.39	3.14	.65	-1.03	3.16	3.24
Cash-Grain Corn Belt	.85	.30	.25	1.73	.15	- .35	.60	.26
Cotton Southern Piedmont	.40	.08	- .02	.60	.41	.16	.28	.32
Texas Black Prairie Cotton	.48	.10	.31	1.20	.41	- .20	.21	.21
No. Plains Wheat-Small Grain-Livestock	.14	.09	.01	.44	-.04	- .12	.11	.15
Northern Plains Wheat-Corn-Livestock	.15	.15	.10	.55	.03	- .16	.04	.16
No. Plains Wheat-Roughage-Livestock	.07	.06	.03	.30	.05	- .09	-0-	.04
Southern Plains Winter Wheat	.10	.09	.02	.47	-.05	- .16	.23	.25
Southern Plains Wheat-Grain-Sorghums	.07	.06	.07	.43	-.10	- .25	.60	.56
Wheat-Fallow Washington and Oregon	.18	.04	-.04	.40	.07	.06	.11	.11
Northern Plains Cattle	.03	.03	-0-	.08	-.01	- .14	.02	.08
Intermountain Cattle	.02	.07	.01	.22	.13	- .36	.15	.36
Northern Plains Sheep	.01	.02	-0-	.08	-.01	- .17	.04	.03

Source: Computations based on results of the production function model described in Chapter II.

In the 1955-1962 period MPP*s tended to rise in all areas except for the Northern Plains wheat-roughage-livestock area where there was no change. MVP*s are generally somewhat higher than MPP*s indicating a slight upward trend in prices for the period.

The real estate MPP has generally trended upward in all areas in all time periods. Thus the influence of the productivity component of real estate MVP*s is upward and will exert upward pressure on real estate values. If the product price component of MVP is neutral or increases an upward pressure will be exerted on land values. If the price component is negative but not enough to offset the positive MPP component the upward pressure still exists but is weaker. But if the price component is negative and larger than the positive MPP component downward pressure is exerted on land values. We are, of course, assuming that a potential buyer is cognizant of the past behavior of real estate MVP*s.

Empirical evidence indicates that in American agriculture ability to effectively innovate existing and developing technology tends to be highly correlated with size. Census figures reveal a large decline in the number of farms over the studied period and increases in the average size of farms. But the decrease in the number of farms is not uniform over the different size groups.

Table 46 tells most of the story as to what has happened over the studied period using 1950-1959 as representative. The over $10,000 class farms increased by 64 percent while the largest class—those selling less than $2,500--decreased by 50 percent. The $2,500-$10,000

farm category lost 24 percent of its farms in the 10-year period but increased as a percent of total farms from 29.8 in 1954 to 34.3 in 1959.

In terms of value of marketings the over $10,000 class farm increased their share of total farm marketings from 50.7 percent in 1950 to 71.7 percent in 1959 or an increase in actual value of sales of 93 percent. Both lower sales classes lost in share of market and in actual value of sales during the period.

Table 46 Changes in Number and Total Dollar Sales of Farms by Gross Sales Categories 1950-1959

Gross Sales Farm Class	Number of Farms Thousands		Percent Distribution of Farm Nos.		Percent Change in each Class
	1950	1959	1950	1959	1950-1959
Over $10,000	484	794	9.0	21.5	+64
$2,500-$10,000	1603	1270	29.8	34.3	-24
Under $2,500	3291	1637	61.2	44.2	-50

Gross Sales Farm Class	Total Value of Products Sold - Million Dollars		Percent of Total Market	
	1950	1959	1950	1959
Over $10,000	11,303	21,860	50.7	71.7
$2,500-$10,000	8,268	6,989	37.1	23.0
Under $2,500	2,340	1,775	12.2	5.3

Source: Edward Higbee, Farms and Farmers in an Urban Age, (New York: Twentieth Century Fund, 1963), p. 156

Thus we find the already larger than average farms becoming larger and the smaller than average farms disappearing. The explanation for this occurrence lies largely in G. L. Johnson's fixed asset theory.

Real Estate and Fixed Asset theory

In classical economic theory the equilibrium amount to use of any factor is determined by equating marginal factor cost (MFC) or assuming a perfect factor market, its price, with its marginal value product (MVP). If the marginal value product is greater than the

price, it pays to increase the use of the resource; if less, it pays to decrease its use. Now if with classical theory we assume that agricultural inputs are completely divisible and further that they can be bought and sold for the same price we are essentially assuming that there are no fixed factors. Then if output increases faster than demand and product prices fall, the MVP's of the inputs will fall and a movement of resources out of agriculture into other uses will occur. Further, the equilibrium after adjustment will, according to the theory, yield equal returns to the resources left in agriculture with those in the non-farm economy.

Empirical evidence in the form of low returns to factors of production in agriculture in relation to comparable factors in the non-farm economy and the inability of the market mechanism to correct the situation indicates the explanatory power of the classical theory to be less than perfect. G. L. Johnson, in attempting to extend the theory for better explanatory power started by changing the concept of a fixed asset. He defines a fixed asset simply as one that it does not pay to vary. In other words, it does not pay to acquire any more of the asset nor does it pay to dispose of any of the asset presently on hand.

The key to Johnson's theory lies in recognizing two prices for a productive factor: an acquisition price or the price a farmer must pay to acquire additional units of an asset and a salvage price or the price a farmer could receive if he wanted to dispose of some of the factor. If acquisition price and salvage prices diverge with salvage price less than acquisition price the factor is fixed in the productive

range defined by the condition P_x acq, $\geq MVP_x^y \geq P_x$ sal. where P_x acq. is acquisition price of the factor (x), P_x sal. is its salvage price, and MVP_x^y is the marginal value product of the factor (x) in the production of an output (y). The asset is variable upward if MVP_x^y is greater than P_x acq. and variable downward if MVP_x^y is less than P_x sal.[3]

Under the fixed asset theory assumptions, movement of land out of agriculture is accomplished only when the MVP of that land in agricultural uses is below its salvage price. The salvage price for agricultural land is at or near the zero level, so disregarding the relatively small amount of land which is moving or is in the ripening process to move from agriculture to a higher and better use very little land once in, moves out of agriculture.[4]

The acquisition price is the price that would have to be paid in order to draw land into agriculture from its (formerly) higher and better use in the non-farm sector. Some very minor instances of this occur as in the case of old school grounds reverting back to agriculture after a school consolidation or an old highway right-of-way being

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[3]For a more complete exposition of fixed asset theory and its applications see Glenn L. Johnson, "The State of Agricultural Supply Analysis," Journal of Farm Economics, Vol. 42, (1960) pp. 435-452; and Dale E. Hathaway, Government and Agriculture, (New York: Macmillan Co., 1963), pp. 110-126. Also see Bob L. Jones, "Farm-Non-Farm Labor Flows, 1917-1962," (unpublished Ph.D. dissertation, Michigan State University, 1964); and Clark Edwards, "Resource Fixity, Credit Availability and Agricultural Organization," (unpublished Ph.D. dissertation, Michigan State University, 1958).

[4]Barlowe estimates that approximately 10 percent of the total U.S. land area was used for non-agricultural purposes in 1958. Further, he estimates it will take approximately 12 percent of the total U.S. land area in non-farm uses to sustain a population of 300 million. The overall impact of the additional 2 percent taken out of agricultural use during the time which it will take this country's population to reach 300 million will be slight. Raleigh Barlowe, "Our Future Needs for Non-Farm Lands," Land, 1958 Yearbook of Agriculture, (Washington: U.S.

plowed up after a new super highway was built on a nearby site. But in general the value of land moving to the non-farm higher and better use is so high as to preclude the land from ever being bid back into agriculture. Acquisition may also be accomplished through draining, clearing, or otherwise reclaiming land not presently used for agriculture purposes and the cost of these operations is the acquisition price of such land to agriculture. In recent years only a small amount of land has entered agriculture in this manner. Therefore, in general we can say that for land as between agricultural and non-agricultural uses the acquisition price is infinite and the salvage price is zero. Thus, for all practical purposes the supply of agricultural land measured in acres is fixed or in other words the supply curve for agricultural land has an elasticity near zero at any given point in time. Any changes then in the demand for agricultural land in the aggregate will be reflected almost entirely as a change in land prices.

While supply elasticity of land measured in acres is near zero, capital investments in land and land substitutes add to total productivity of land, and supply elasticity is more elastic when land is measured in some type of constant productive units. Since the ability to increase the effective supply of land by these means depends on technological improvement in the various types of reproducible capital or techniques applied to land this concept applies over time as the new methods, techniques and capital improvements become available and are innovated. This does not change the above static supply elasticity argument.

Government Printing Office, 1958), pp. 474-479. Localized impacts around established metropolitan areas will be great but for purposes of this study agricultural land will be valued for agricultural uses and the speculation effect with regard to moving land to a higher and better use will not be considered.

While land is fixed in agricultural uses it is not fixed generally to the specific agricultural enterprise. The type of agricultural use to which any given parcel of land will be put depends upon where its particular comparative advantage lies. Comparative advantage dictates that a given piece of land will be used in the production of that product or combination of products from which it will receive its greatest return.

At any given point in time a specific demand, supply, and price structure exists for agricultural products. This structure, along with the productivity level or state of technology which then exists, determines the marginal value product of each of the productive factors. The acquisition price then for land in producing a specific agricultural commodity or product is the price which must be paid for agricultural land by the producers of that commodity to bid land away from its present agricultural higher and better use. Thus it is the MVP of land in that higher and better use. The salvage value is the price at which the land will change from its present use to its opportunity cost or next best alternative use--that price being the MVP of land in the next best alternative use. The acquisition and salvage prices then define the limits of the range of comparative advantage for land in the production of a specific product. With a differential change in the product price structure or productivity level of land between different types of enterprises, land at the margin of transference, that is, land where MVP in its present productive use shifts outside the comparative advantage range defined by the acquisition and salvage prices, will shift toward the more profitable use whether it be a partial shifting

of some land between enterprises on individual farms or complete shifts of land use on whole farms or what is more likely, a combination of both.

The comparative advantage range can shift through time as various economic and technical characteristics which determine comparative advantage change differentially between areas or between types of production. Contributing to a shift in the comparative advantage range for a given area or type of production are changes in land productivity (MPP) or product prices in other areas while land productivity and product price in the given area remain constant. This is an externally generated change in comparative advantage for the given area.

Shifts in land MVP's within a given area or type of production are caused by changes in land productivity or product prices in that area while land productivity and product prices outside the given area remain constant. This is an internally generated change in comparative advantage for the given area. Thus, land use and land value in a given area will change when its MVP in its present use falls outside the comparative advantage range. This can be caused by (1) movement of the comparative advantage range, (2) movement of the land MVP in that area, or (3) a combination of both movements in opposite directions or at different rates in the same direction. To the extent that both forces move in the same direction land values will change in the same direction but land use patterns will not change (i.e., land will tend to remain fixed in its present agricultural use).

Comparative Advantage and Agricultural Production

In order for the comparative advantage concept to apply an interdependence must exist between different agricultural areas. Tolley

and Hartman suggest four characteristics of American agriculture which contribute to this interdependence. First, various agricultural areas compete with each other because they produce for a common aggregate market. Second, different areas produce various common crops so they are competing in the supply of the same product. Third, agricultural areas are different enough from each other to react differently to production or demand changes occurring through time. Fourth, changes in production and demand variables normally occur in such a way that various areas are affected differently.[5]

According to Barlowe, four categories of economic and technical characteristics combine to determine comparative advantage.[6] They are (1) natural advantages, (2) favorable production combinations, (3) transportation advantages, and (4) institutional advantages. Over time the characteristics included in these four categories can change differentially between areas.

These changes may occur sometimes by an act expressly for that purpose such as drainage, fertilizer application, irrigation, or recombination of inputs made possible through technological innovation which may favor one area relatively more than another. In some instances no express act on the part of the agricultural participants is required in an area to change comparative advantage patterns. Non-

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[5] G.S. Tolley and L.M. Hartman, "Inter-Area Relationships in Agricultural Supply," Journal of Farm Economics, Vol. 42, (1960), pp. 453-473.

[6] Raleigh Barlowe, Land Resource Economics, (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1958), pp. 246-248.

farm population and industry shifts give some areas a location advantage and technological improvement in transportation facilities work to the advantage of some areas more than others. Almost any government agricultural program will work to change comparative advantage patterns through favoring some areas relatively more or to the detriment of others. Over time the differential impacts of changes in the economic and technical characteristics of comparative advantage will be reflected in changes in relative marginal value products of the land input between and within the different agricultural areas of the country. Or, in other words, the comparative advantage range and/or the land MVP in a given area may shift to the point where the MVP lies outside the comparative advantage range, causing a disequilibrium situation and pressures for corrective adjustment. The effect of changes in variables constituting shifts in comparative advantage may be very difficult or impossible to pinpoint in the time period in which they occur or even in the next several years since there is usually a lag between shift and adjustment. Or the shift may not be great enough to cause the land MVP to lie outside the comparative advantage range in the short run. However, the net effect of many shifts in variables constituting comparative advantage occurring through time and affecting areas differently will show up in the changing relationships of different area's land marginal value products and hence in land prices.

Labor and Fixed Asset Theory

Labor also has a diverging acquisition and salvage price for the farm sector. According to Jones, the acquisition value for a person entering the farm sector is the present value of his expected future

net income streams from the best non-farm job he could hold given his age, educational background, alternative jobs available and the unemployment rate. The person should enter agriculture only if at that point in time his expected earnings in agriculture are equal to or greater than the expected earnings in the best available non-farm job.

The salvage value of a person already in agriculture and contemplating leaving is the present value of expected future income streams from the best non-farm job he could hold given his age and other factors mentioned above at the time of transferring out. The divergence between acquisition and salvage prices widen as age increases due to the difference in kinds of jobs available and transfer costs. Unlike the case for land the salvage price for agriculture labor is greater than zero and the acquisition price is less than infinity.

Now applying the comparative advantage range concept developed above for land use within agriculture to labor use between agriculture and the non-farm sector we see that labor is fixed in agriculture if its marginal value product in agriculture falls within the borders of the comparative advantage range delineated by the acquisition and salvage prices for farm labor. The comparative advantage range may shift over time as well as the actual MVP of farm labor. The growth rate of the general economy and the changing labor requirements toward higher skill levels has tended to shift the acquisition price upward and the salvage price downward. Any time agricultural labor MVP's do not keep pace with the movement in the acquisition price it means that expectations in an earlier period were wrong and labor in agriculture is receiving lower returns than labor in the non-farmer economy which was comparable labor at the time the expectations were formed. Empirical

evidence indicates that farm labor MVP's have not kept pace with acquisition prices; that the MVP's of a substantial amount of farm labor have dropped below salvage prices and out movements from agriculture have resulted; but a substantial portion of the labor fixed in agriculture is not receiving returns comparable to non-farm counterparts.

Implications of Fixed Asset Theory

Given this situation the labor fixed in agriculture will attempt to push their MVP's toward the labor acquisition price. One way for the individual farmer to increase his MVP is to organize his farm as efficiently as possible and to use all relevant existing technology. The efficient use of much of the new technology available in recent years requires large operating units. Many commercial farms are still too small to efficiently use available labor and new or existing technology. This can take two forms. The new technology may be such that the operating unit can become more efficient only by increasing and re-combining the quantities of all the major factors of production (land, labor, and capital). The payoff in this case is a lower cost per unit of production. Or the farmer may be forced to adopt the new technology in order to survive as Cochrane points out in what he calls the "Agricultural Treadmill" effect.[7] If this new technology is labor or both labor and capital saving it means the farmer on his existing unit will have excess or under-employed resources in the

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[7]Willard W. Cochrane, Farm Prices, Myth or Reality, (Minneapolis: University of Minnesota Press, 1958), chap. 5.

form of labor, capital, or both. Since many commercial farmers have found themselves in this position in recent years--too little land to efficiently use available labor and new or existing technology--they have continued to bid actively for the relatively small proportion of farmland which becomes available for sale each year.[8] Since much of the new technology available is of the labor and land saving type and in light of the earlier discussion about the introduction of input substitutes into the production function we would expect both labor and land MVP's to increase as the farmer attempts to improve his position. The labor MVP even though higher may still be far below the labor acquisition price. But the MVP of land has increased along with that of labor and he can now afford to pay a higher price for additional increments of land on which he can apply his excess labor and capital. Thus it is theoretically possible and empirically quite probable for land prices to rise and for expansion buyers to be willing to pay these higher prices even though labor and/or capital may not be receiving returns comparable to their non-farm counterparts.[9]

Summary and Implications

One reason for the expansion buyer's rationale in bidding up land values is connected with the fixity of labor and capital and the advancement of capital and labor saving technology on the individual

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[8] William H. Scofield, "Dominant Forces and Emerging Trends in the Farm Real Estate Market;" paper presented at the Seminar on Land Prices, North Central Regional Land Economics Committee, Chicago, November 21, 1964.

[9] C. L. Quance is presently working on a Ph.D. dissertation at Michigan State University on Capital flows in U.S. agriculture under the same Resources for the Future, Inc. project of which this study is also a part. He contemplates explaining capital's role in agriculture within the general framework of fixed asset theory.

farm unit. Labor once committed to agriculture tends to become fixed there even though its returns drop below returns to labor in the non-agriculture economy which was comparable to the agricultural labor at the time of commitment to the respective occupations. An agricultural laborer having worked in that industry for say 15 years cannot expect to move to a non-agricultural occupation at the same job or rate of return as the non-agricultural laborer who has been working in his chosen industry for 15 years is presently enjoying. The agricultural laborer must plan on starting in the non-agricultural job at approximately the same job and rate of return as anyone else just starting in that occupation. For this reason, even though the farmer is not earning as much as he expected to be when he choose the agricultural occupation, he stays in agriculture because he is still earning more than he could if he moved to a non-agricultural job after having worked in agriculture for several years.

Capital items can also become fixed to a farm, in that at any point in time they may be earning less than expected when they were purchased but more in their present use than could be realized from their sale. Thus, both capital and labor may be earning less than their non-farm counterparts and yet be fixed in agriculture. With the innovation of labor and/or capital saving technology the available capital and labor becomes under employed. One way out of this dilemma for many farmers is to enter the land market to expand the farm land base and thus use to capacity the fixed labor and capital assets and in doing so attempt to increase net farm income.

These expansion buyers could conceivably bid the price of expansion land purchases up to a maximum where the return on the land

investment plus the out-of-the-pocket costs for operating expenses exhausts the additional total product derived from the expansion unit. The rationale is that labor and capital are fixed and any under employed portions are essentially free goods for use on the expansion purchase. So up to nearly the full net income from the expansion purchase may be capitalized into the purchase price of land bought for expansion purposes.

The expected effect of government programs on the value of farm real estate, under the assumptions of fixity of labor and capital and rapid technological advance resulting in excess capacity with regard to these inputs on individual farms, is quite different than would be expected if agricultural firms were in equilibrium in the classical economic sense. According to traditional theory, programs which hold commodity prices above market clearing levels will cause the marginal value products of all inputs to increase and more of all to be used. The amount of increased use of each would be determined by the relative elasticities of their supply curves and the elasticities of substitution. But where labor and/or capital over capacity already exists, the increase in their MVP's may not be enough to make it profitable to add more of these inputs. That is, the input MVP may not rise enough to equal the cost of additional units of the input. In this case the increase in returns from the government program will be allocated to the land input and capitalized into a higher price for land. As long as labor's MVP in agriculture is equal to or greater than its MVP would be in its non-farm alternative it is fixed in its present use. The farmer then is willing to accept a return to his labor equal to or near the level of returns he could presently receive from a non-farm

source. He is also willing to accept a return from his capital investment approximately equal to the return he could receive by selling this input and investing the money in an alternative use. Thus he is willing to allocate a greater share of net farm income to the land input and any increase in net farm income tends to be totally allocated to land. This means that even though the expansion buyer's labor and capital may not be earning returns comparable to labor and capital elsewhere he will pay a higher price for the expansion land purchase. His actions are justified both by the fixed asset argument and because land MVP's have risen.

CHAPTER V

AN ANALYSIS OF RESULTS IN HISTORICAL PERSPECTIVE

In this chapter the models used are appraised as to their usefulness and relevance and the data is analysed in its historical perspective.

Appraisal of the Residual Return Model

The capitalized ex post and ex ante series from the data yielded results which allow an appraisal of the assumptions and usefulness of the model. The assumption regarding the imputed return to labor was that the current factory worker's wage in the specific area, adjusted by the national non-farm unemployment rate reflected the farm labor salvage value--that is, the minimum farm labor wage below which out movement of labor from the farm would occur. Both the ex post and ex ante series generally show a closer relationship with market value estimates from Costs and Returns data in the pre World War II years than in the post World War II period. While the Costs and Returns estimates trend upward with only an occasional dip since the early 1930's the ex post series generally build to a peak in the early post war years and then decline through 1962, with the series in some areas exhibiting negative land values for some years. Both the Costs and Returns market value estimates and the ex post estimates from the production function model exhibit generally rising land value trends throughout the period. This fact pinpoints the cause for the different

behavior exhibited by the ex post series from the residual return model to our assumption about the imputed salvage value of labor.

By a rather back door route the results indicate that during the 1930's the assumed salvage value was near that which farmers themselves appeared to consider proper since the residual model series generally approximate the Costs and Returns market estimates. Beginning in the mid 1940's factory workers wages began an increase which carried through the remainder of the period. As these higher wages were imputed into the residual calculations lower residuals were left for land with the resulting decrease in the residual series and the wider and wider divergence between them and the Costs and Returns estimates. Thus, it appears that the unemployment rate adjusted factory wage is becoming less and less accurate as a proxy for what farmers themselves believe to be their true salvage value. It is true that out movement of labor from agriculture has been great over the period. For those who moved out the salvage value which they recognized for themselves was obviously higher than the one assumed in our model. But for those farmers still in agriculture and willing to pay the Costs and Returns estimated price for land our assumed labor salvage price is too high.

One explanation for the change in recognized labor salvage values is that those most willing to move out of agriculture are the first to leave. As the farm labor income falls relative to non-farm wages the farmers who are left are probably those who are more the agricultural fundamentalist types who put a greater value on rural life for a variety of reasons and are willing to accept a lower labor income in order to stay on the farm.

Another explanation is that a large proportion of the decline in number of farmers is due to non-entry of young farmers as opposed to out movement of established farmers. It follows then that the average age of active farmers is increasing. Due to the work rules and customs established with regard to employment in the non-farm economy which favor employment of younger initial entrants into this job market, the unemployment rate adjustment applied to the factory wage is not enough to reflect the plight of the older farmer searching for a non-farm job. His age might exclude him from consideration for a non-farm job with wages comparable tothose of a factory worker as we have assumed.

Preliminary results of a Ph.D. thesis presently being completed by Chennareddy support these findings. Chennareddy developed a model for estimating the present value of future income streams for a 25-year old and a 45-year old worker in the farm sector and in four different occupations in the non-farm sector. He found the present value of future income streams for a 25-year old farm worker to be most highly correlated with those of a factory worker while for a 45-year old farm worker the highest correlation was with workers in laundrys and retail trades. Thus when first entering farming the worker's relevant salvage value appears to be a wage comparable to that he could receive as a factory worker but after having been engaged in farming for approximately 20 years, the farm worker's salvage value has declined to a level comparable to what he could receive in the relatively low paying non-farm jobs such as laundry worker or employee in the retail trades.[1]

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[1]Venkareddy Chennareddy, Present Values of the Expected Future

Certain specific areas, however, deviate enough from the general pattern to warrant further comment. The ex post series in the Southern Plains wheat and wheat-grain-sorghums areas and the Washington and Oregon wheat-fallow area exhibit upward trends throughout the period at a higher level than the Costs and Returns market price estimates series. This means that farm labor incomes have surpassed factory workers incomes in these areas. Factory wage rates were consistently lower in these areas than in the Midwest and East accounting for part of the reason for the relatively high farm labor incomes.

A similar though less apparent situation exists in the Northern Plains wheat areas. Here the ex post series generally trends upward although not as fast and the whole trend in each area lies below the trend in the Costs and Returns market price estimate. Since all of the wheat areas exhibit similar trends a plausable explanation is that the price stabilizing influence of the government wheat price support programs plus relatively low factory wages have caused this effect.

Two other areas whose ex post series only level off without any appreciable drop in the post war years are the cash grain and hog-beef fattening areas of the Corn Belt. A main enterprise of these farms is corn. With the combination of mechanization, increased size, and increased use of fertilizer contributing to large productivity increases particularly since 1955 (See Tables 27 and 28) and government supported corn prices, net farm incomes have increased enough that farm labor income has increased at approximately the same rate as

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Income Streams and their Relevance to the Mobility of Farm Workers, Ph.D. dissertation in progress, Michigan State University.

factory workers wages *if* the price of land remained relatively constant. Since the *ex post* series lies below the *Costs and Returns* series land prices have risen and labor income has declined relative to factory workers incomes.

Further analysis along these lines are beyond the scope of this study but the evidence presented becomes very significant with regard to the usefulness of the residual model in light of earlier discussion on fixed asset theory and expected behavior of land marginal value products.

The analysis indicates that farmers may rationally pay higher prices for land if the land MVP's support this action even though they may not be receiving returns for their labor comparable to labor returns in the non-farm economy. In order for the residual model to estimate land values equal to the production function land value estimates, the yearly residual return estimates would need to equal the yearly MVP estimates. Thus, the residual model would estimate land values equal to values estimated from the production function model only if the production function model exhibited constant returns to scale, and the imputed capital and labor returns in the residual model equaled the returns to these inputs yielded by the production function model. This means that farm labor and capital returns would have to equal those in the non-farm occupation chosen as representing the labor and capital salvage values.

Obviously this has not been the case, at least for labor, since farm labor returns have declined relative to labor returns in the non-farm economy. The *Costs and Returns* market price series is generally bracketed by the *ex post* series from the residual model on the

low side and the same series from the production function model on the high side. Thus when there is a spread between the residual and production function series the relative position of the Costs and Returns series to the other two may give some indication as to the relative strengths of declining farm labor income in relation to non-farm labor income on one hand and rising land MVP's on the other as farmers' criteria in evaluating the price to pay for more land.

The residual model is useful as a tool for analysis and comparison. But due to the problems in arriving at a salvage value for farm labor and capital it should be used with extreme care in estimating market values of land and then only on a case by case basis. Individual farmers who have their own criteria with regard to their specific labor salvage value and the minimum return they will accept on non-land capital may use the model to estimate what they could afford to pay for additional land. But these imputed values certainly cannot be generalized when using the model for this purpose.

Appraisal of the Production Function Model

Reder states that since it is not a "production function" in the economic theory sense and since the difference is one of theoretical importance the Cobb-Douglas function is useless in making empirical estimates of input marginal physical products and in determining the demand curve for these inputs.[2] Bronfenbrenner answers Reder's criticism and the following draws heavily on his comments.[3] The

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[2]Melvin W. Reder, "An Alternative Interpretation of the Cobb-Douglas Function," Econometrica, Vol. 11, (1943), pp. 259-264.

[3]Martin Bronfenbrenner, "Production Functions: Cobb-Douglas, Interfirm, Intrafirm" Econometrica, Vol. 12, (1944), pp. 35-44.

theoretical function is an intrafirm function which holds at one moment in time for a specific firm. The Cobb-Douglas function is fit to different observations on the same firm over time (time-series), to observations on different firms at one moment in time (cross-section), or in our case both simultaneously. Thus according to the argument it is an interfirm function fit to observations where each observation lies at one point on different intrafirm functions. At any one point in time for any single firm its actual location on its intrafirm function is the only one which is relevant--all other points are hypothetical. The interfirm (Cobb-Douglas) function is a locus of all these "actual" locations of each firm on its intrafirm function.

If we assume a long run competitive equilibrium the interfirm function must be a straight line running through the origin or a number of parallel straight lines running through their respective origins and tangent to each of the relevant intrafirm functions at its point of maximum average product. This means that the sum of the coefficients for the physical inputs must equal one, thus yielding constant returns to scale. At the points of tangency between the inter-and intrafirm functions the slopes of the two must be equal and since they are at the same coordinates, beyond which the intrafirm function lies below the interfirm function and declines with respect to the interfirm function the elasticity of production computed for the intrafirm function where the other inputs are fixed will be less than one while the elasticity computed for the interfirm function where all inputs are varied in proportion will be one by definition. This yields decreasing marginal physical products for the variable factor with

the others fixed and constant returns to scale when all are varied in proportion.

Due to imperfections in the factor markets or to long run disequilibrium, the interfirm production function may not be tangential to the intrafirm curves but rather cut them from above or below. The sum of the elasticities of the physical inputs then may be either greater or less than one and the resulting marginal physical products for the individual inputs will allocate either more or less than the total product in returns to the factors.

Bronfenbrenner indicates an impressive list of some 15 studies, both time series and cross sectional, in which the Cobb-Douglas technique was used and for which it presented results bearing out the marginal productivity theory which it was designed to verify. Unsatisfactory results, where they have occurred, have been due to statistical instability of the data according to Bronfenbrenner. One which yielded partially unsatisfactory results was a time series study by Leonard Felsenthal, "Studies in the Cobb-Douglas Production Function for Mining and Manufacturing in Germany, 1925-1936," (unpublished M.A. thesis, University of Chicago, 1940). The sum of the coefficients significantly exceeded one but the ratio of the labor coefficient to the sum of the coefficients corresponded closely to the actual proportionate share of labor in German national income during the studied period.[4]

Since 1944 when Bronfenbrenner wrote his article, the Cobb-Douglas technique has been adapted for use in numerous production

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[4] Ibid. pp. 42-43.

function studies and a great deal more has been learned about its properties. The "statistical instabilities" which he alludes to as the reason for unsatisfactory results have been more clearly defined. When the sum of the coefficients is less than one the most probable cause is omission or under estimation of relevant inputs. Sums of coefficients greater than one usually occur because the unit of measurement and mode of within category aggregation used in entering the inputs does not properly reflect the effective quantities of inputs actually used. It comes back to the fact that acres, man-hours, and constant dollars do not in many cases do an adequate job of reflecting the actual changes which take place in the input categories over time or between firms. The within input category mix changes, both in terms of relative quantities of individual items and in terms of quality, cannot be reflected by the commonly employed methods of measurement.

An alternative interpretation--the one used in this study--is that the sum of the coefficients is not an indication of returns to scale but rather of returns to size, in which the within input category mix changes as the size of the firm increases allowing the use of certain available technology not readily adaptable to the smaller size firms.

If we choose to assume, contrary to the argument presented in Appendix B for the use of a restricted function that no relevant input variables have been left out of the function, and that the sum of the elasticities is an indication of returns to scale, and we further believe constant returns to scale to hold, then according to Bronfenbrenner an adjustment of the coefficients scaling them down in proportion till their sum equals one (that is $\frac{b_i}{\Sigma b_i}$ for each b_i) is a

reasonable method of determining proportionate shares of total product to allocate to each factor.

Incorporating this technique for the original unrestricted function where the land coefficient was .519 and the sum of coefficients was 1.62 we find the share of total product allocated to land to be $\frac{(.519)}{(1.62)}$ or .320. This would scale down the MPP^{a}s derived from the original function to about 62 percent of their non-adjusted levels, which were not calculated in this study.

Using this technique on the land coefficient from the restricted function, the scaled down coefficient would be $\frac{(.358)}{(1.34)}$ or .267. Thus the MPP^{a}s derived from the restricted function but using the adjusted coefficient would be about 75 percent of the level at which they were in fact estimated and presented in Tables 21-39. This would also fix a lower limit on the two land value series derived from the production function model at 75 percent of their tabled values in Tables 2-20 (columns 2 and 3). Reduction of these series to a constant 75 percent of their present levels would not change either the within series or between production function derived series relationships. It would, of course, change the within year relationships of these two series with the other three in the table.

Decreasing the magnitude of the production function derived ex ante series will decrease the pressure for increases in land prices. The areas where this adjustment will reverse the pressure, that is, where before the adjustment the ex ante series lay above the Costs and Returns market estimates but lay below after the adjustment include Eastern Wisconsin Dairy, 1935-1940; Western Wisconsin Dairy, 1935-1936;

Hog-Beef Raising, Corn Belt, 1935-1937; Cash Grain Corn Belt, 1939-1941 and 1959-1962; Texas Black Prairie Cotton, 1935-1938; all wheat areas, 1935-1937 or 1938; and in addition, Southern Plains Winter Wheat, 1960-1962; Wheat-Grain-Sorghums, 1954-1962; and Wheat-Fallow, 1961-1962. Adjustment affecting the relationship between the ex post series and market estimates series in the same way includes Southern Plains Winter Wheat, 1948-1961; Wheat-Grain-Sorghums, 1945-1962; and Wheat-Fallow, 1951-1962; and Cash Grain, Corn Belt, 1949-1962. These adjustments should be kept in mind with a view toward possible alternative interpretations of the data throughout the latter analysis sections of this chapter.

Proposed use of the Production Function as a basis for Allocation of Net Farm Income.

The coefficient scaling technique allows the production function model to be used in determining proportionate shares for distribution of net farm income to the unpaid factors--land, operator and family labor, and capital. In a sense then, used in this way, the production function becomes a simultaneously determining residual return allocation model.

The problem with most residual return models, including the one used in this study, is the necessity of assuming a rate of return for all factors except the one to which the residual is to be allocated. Then when net income fluctuates widely from one period to another, the residual factor assumes the total of either the windfall gain or loss from these fluctuations. A more reasonable approach would be for all factors to share these windfall gains or losses in proportion to the contribution of each to net farm income.

Hurd has developed a simultaneous net farm income allocation procedure in which he converts physical quantities of land, labor, and capital to a common denominator using current market prices of each in a base period in order to determine the proportionate share of net farm income to allocate to each factor.[5] Iden extended the Hurd procedure to using current market prices in each year for the factors thus allowing the proportionate shares to change from year to year.[6]

The difficulty with both procedures is that an implicit assumption must be made that the market is pricing the factors perfectly in accordance with their actual relative worths in producing net farm income. Thus to the extent that the factor markets deviate from perfection due to institutional barriers and/or imperfect knowledge and foresight, the proportionate shares calculated for allocative purposes will be biased.

Use of the scaled coefficients from a production function yields a proportionate share for each input which can be used to allocate net farm income without the necessity of introducing current market prices of the inputs in the process. This will allow the results from the production function simultaneous allocation model to be analyzed in terms of current market prices for the inputs to answer questions of over or under investment in specific factors and the appropriateness of the given combination of factors in view of their current market prices. Although the technique was not employed in

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[5]Edgar B. Hurd, "Allocation of Net Farm Income," Agricultural Economics Research, Vol. 9, (1957), pp. 10-19.

[6]George Iden, "Farmland Values Re-explored," Agricultural Economics Research, Vol. 16, (1964), pp. 41-50.

this study it has promise for proving a useful tool in future investigations of this general type.

Analysis of the Land MVP Series over the Studied Period

Across all areas we find both price and productivity declining in the early 1930's. The Depression coupled with widespread drought conditions were primarily responsible. The first New Deal agricultural legislation, the Agricultural Adjustment Act of 1933, appears to have slightly reversed the downward trend during 1933 but its greatest impact came in 1934 and 1935 when generally larger price increases were evident. This coupled with more favorable weather in 1935 caused large jumps in land MVP's in these years. In 1936 parts of the 1933 Agricultural Adjustment Act were declared unconstitutional while other emergency provisions had run their course. Thus prices generally slowed their advance in the wheat, cattle, and sheep areas, and declined in the dairy and Corn Belt areas in 1936. Productivity increases in the dairy and Corn Belt areas generally increased thus softening the effect of price declines on land MVP's.

In 1937 the Agricultural Marketing Agreement Act was passed. It was designed to boost milk producers incomes through establishing minimum prices which processors could pay producers for milk in local market areas where producers agreed to the production control terms of the marketing agreement. Prices still declined in 1937 and 1938 although productivity increases caused land MVP's to decline only slightly in the dairy areas.

The most important New Deal legislation in agriculture was the Agricultural Adjustment Act of 1938. It established the basic

price support and production control provisions for the storable agricultural commodities and the basic provisions in this act with amendments are still in effect today. When it appeared that a crop covered by the act was going to be in surplus causing severe price declines the Secretary of Agriculture could use price support and marketing quotas to keep the price above the market clearing levels and/or bring production in line with consumption. This legislation did not receive a realistic test of effectiveness until much later in the period due to the beginning of World War II.

From the beginning of the studied period till 1940 agriculture was in a depressed state. During this period so was the rest of the economy, so relatively the farmer was about as well off as his urban neighbor. With World War II came sharply increased demand for agricultural products across the board. These increases were due to great demand by the armed forces where consumption levels per capita were generally higher than in civilian occupations, need for agricultural products by allied nations, wastes and losses due to the war, and increased domestic demand due to higher income levels and low unemployment rates. To cope with the increased demand the government agricultural policy changed from production restriction to encouragement to expand production. Acreage allotments were dropped and price support levels increased in an effort to decrease some of the uncertainty about future demand for expanded output. Both the basic crops and the Steagall Commodities were to be supported at or above 90 percent of parity for at least two years after the end of hostilities.[7]

[7]The basic crops include cotton, corn, wheat, tobacco, rice and peanuts. The Steagall commodities are hogs, eggs, chickens, turkeys, milk, butterfat, dry peas, dry edible beans, soybeans, flax seed and

As anticipated, prices increased enough during the war that price support provisions were not actually used. In fact, shortages of many commodities persisted throughout the war and demand remained high after the war due partly to the needs of both allies and former enemies in the war's aftermath and beginning of reconstruction. The price break came in the wheat and cotton areas in 1947 and carried through 1948 while for all other areas it arrived a year later in 1948.

Land productivity increased throughout the war years up to 1948 or 1949 in all areas but in general the increase was at a faster rate in the earlier years of the war than in the latter part of the period. This was probably due partly to pressing into production more and more land resources which under ordinary circumstances would have been considered sub marginal for these uses. Also many improved capital inputs were difficult if not impossible to obtain due to the war effort. Finally Stallings weather index shows very favorable weather for wheat, corn and cotton in the early 1940's.

The net effect was a tremendous increase in land marginal value products between 1940 and 1948 in all areas. In both the dairy and cotton areas MVP's increased on the average 255 percent, in the wheat areas they averaged a 248 percent increase, in the Corn Belt areas they averaged an increase of 241 percent and in the Western cattle and sheep areas the increase averaged 203 percent. Thus, wartime demands were relatively more favorable to marginal value products of land in the dairy, cotton, and wheat areas than in the Corn Belt and Western livestock areas.

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peanuts for oil, potatoes, sweet potatoes, and American-Egyptian cotton (upland cotton is a basic crop).

The mandatory supports at 90 percent of parity for the basic crops and the Steagall Commodities ended December 31, 1948--two years after the end of World War II. Congress decided to extend support for the basic commodities and the Steagall Commodities, hogs, chickens, eggs and milk at 90 percent of parity and for the other Steagall commodities and all other crops at 60-90 percent of parity the exact level to be based on a formula which considered carryover, estimated production, and estimated disappearance. Thereafter a sliding support scale was to go into effect but this provision was superseded by a series of amendments preventing the formula from operating until 1955 for the basics. Price declines to support levels coupled with declines in productivity in the wheat, cotton, and corn areas due to relatively unfavorable weather caused declines in land MVP^{a}s in this year.

After a particularly heavy battle over the Brannan Plan, Congress decided instead in favor of frozen supports for basics at 90 percent of parity in 1950. The Steagall commodities and all other crops started on the sliding scale support in 1950. Marketing quotas in the form of acreage allotments were put into effect. Slight productivity and price increases in 1950 caused land MVP^{a}s to increase in most areas.

Then with the outbreak of the Korean war government policy again turned toward encouraging production and the price support levels were maintained for the basic crops at 90 percent of parity through 1954. Prices during 1951 and 1952 held firm due to increased war demands but fell back to support levels in 1953 and 1954. Productivity increases were not great enough to offset the price declines and land MVP^{a}s generally declined.

The Eisenhower administration was characterized by a determination to end rigid, high price supports which tended to encourage continued over production of crops already in surplus. The 1954 Agricultural Act provided for sliding support levels which finally were put into effect causing prices to be generally lower and again land MVP's declined because productivity increases were not enough to offset price declines.

Price support levels were raised slightly in April 1956 from levels at the beginning of the year for corn, wheat, rice, dairy products, oats, barley, rye, and grain sorghums in response to the forthcoming presidential election and the dip in net farm income in 1955, but Eisenhower still resisted Democratic pressures to return to high, rigid price supports. A bill passed by Congress returning the basic crops to rigid price supports at 90 percent of parity was vetoed by the President. Eisenhower then proposed the Soil Bank Acreage and Conservation Reserve Program, which was passed by Congress. The Acreage Reserve provision lasted four years while the Conservation Reserve portion was in effect for five years. Stable to moderately higher prices in the 1955-1958 period coupled with substantial increases in productivity, particularly in the Corn Belt areas, caused land MVP's to increase considerably during the period. No specific change in land MVP's or productivity can be attributed to the Soil Bank program on the basis of the data in this study.

In the 1960 election campaigns the Republican farm program stressed movement toward the free market and fewer governmental restrictions on the farmer's freedom of action, while the Democrat farm proposal was to increase farm incomes by strict government administered production control programs. The change of administrations

did in fact change the emphasis toward stricter production control and included direct payments and two price systems.

Prices remained approximately the same in the early 1960's as they were in the late 1950's. But during the decade of the 1950's large increases in productivity took place which showed no sign of abating in the 1960's. The productivity gains were large enough to more than compensate for price declines in the latter part of the 1950's and land MVP's trended upward throughout the period and into the 1960's. These trends were different in different areas. Between 1955, generally the low point for land MVP's in most areas during the 1950's and 1962, land MVP's in the Western livestock areas increased on the average 64 percent, in the Corn Belt areas the increases averaged 55 percent, in the dairy areas the average increase was 42 percent, in the wheat areas the increase averaged 37 percent with the Southern Plains wheat areas increasing more substantially than the Northern Plains and Washington-Oregon wheat areas, and in the cotton areas the increases averaged 21 percent. Part of the reason for the almost complete reversal of gains in land MVP's during this period as compared to the war period is that consumer demand has shifted away from cereal grain products and toward meat and livestock products while synthetics have replaced cotton to a large extent in the consumer's market basket.

Nevertheless, land marginal value products have trended steadily upward over the period. While it is difficult to attribute specific changes in land MVP's to specific government programs we can be certain from the above analysis that the land MVP's most directly

and strongly affected are those in the areas most heavily dependent on government price support programs. If productivity increases continue at a rate similar to that in evidence in the study, drops in prices of farm products of politically acceptable magnitudes, assuming some type of farm program will be with us into the future, will probably not be great enough to overwhelm the productivity trend and land MVP's will continue their rising trend into the future. This means that the question is not whether landowners will gain or lose from small changes in government programs but rather how much will they gain when we assume that land prices are based totally on capitalized marginal value products.

Analysis of the Land Value Series

The ex ante land value estimates by both the residual returns model and the production function model indicate that in the wheat areas, the Western livestock areas, the Central Northeast dairy area, the Minnesota dairy-hog area, and all Corn Belt areas except the hog-beef raising area, great pressure for land price increases should have been built up during the war years. While land values as estimated in the Costs and Returns series did in fact increase during the war in these areas, their rise was much less spectacular than appears to have been warranted by these estimates. The most obvious reasons for the slow reaction of the land market during this period are that farmers had their hands full during the early war years attempting to pay off debts incurred during the Depression; that the Depression had made buyers cautious about making long-term investments which may be very difficult to pay off if another depression were to

occur after the war; and that regardless of whether another Depression occurred or not, the heavy demand for farm products would no doubt slacken at war's end as had happened after World War I and the government programs gave no guarantees beyond two years after the end of hostilities so the expected lower income streams would not support large land price increases.[8]

The residual model ex post series for these same areas also indicate that even with the adjusted factory workers yearly wage imputed as the salvage value for farm labor much higher prices for land could in fact have been paid while leaving the farmer relatively as well off as his factory worker cousin.

In the post war period, however, the residual return ex post series declines rapidly in all areas except the Southern Plains wheat areas, the Washington-Oregon wheat area, the Intermountain cattle area, and the Northern Plains sheep area. This indicates that farm incomes did not keep pace with non-farm incomes and in order for farm labor income to be equal to factory workers incomes the residual return to land had to drop severely--and in some cases become negative.

In the exception areas the residual model ex post series indicates that residual returns to land even in the post war period would have supported higher land prices than were actually paid according to the Costs and Returns estimates. In the exception wheat areas this can be partly explained by the fact that under the

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[8]Lerohl found 10-year average expected prices of 13 farm commodities to be below actual prices for the 1942-1951. Since price expectations play a particularly heavy role in determining land prices this is significant in explaining a slow reaction of land price during the war. Milburn L. Lerohl, "Expected Prices for U.S. Agricultural Commodities, 1917-1962," (unpublished Ph.D. dissertation, Michigan State University, 1965), p. 69.

assumptions of the residual model the full amount of any government program payments are added to the land residual and capitalized into land values. The wheat program supporting wheat prices at high levels coupled with relatively large payments for conservation practices through the Agricultural Conservation Program increased the residual to land substantially in these areas. In part, however, the high residual values can be explained by the relatively low factory wages imputed in these areas.

The wool program no doubt contributed to the high residuals in the Northern Plains sheep area. No further explanation is evident for the high residuals in the Intermountain cattle area.

In the remaining areas the residual model shows that if farm labor returns are to be comparable to factory workers wages the return to land had to be low or negative throughout the entire studied period.

The relationship between the production function ex post series and the Costs and Returns market value estimates appears to depend somewhat on the level of the residual return ex post series particularly in the latter years. Generally, the nearer the residual ex post series comes to equaling the Costs and Returns market estimates the nearer the market estimates come to the price which the production function model estimates can be paid for land on the basis of its marginal value product. This relationship shows that farmers purchasing land evidently consider some minimal return to their labor which they are willing to accept and this figure is influenced by the level of non-farm wages in their respective areas.

The production function ex post series indicate that in all areas except the Southern Plains wheat areas and Washington and Oregon wheat area the market price is below--some places substantially below--the price which could be paid for land based on the actual future income streams accruing to land under the assumptions of the production function model. Admittedly the ex post estimates for the latter years are based on the assumption that the income streams in the last 5 years of the study are a reasonable basis for expectations of the level of future income streams. And the ex ante series which is the predicted price which the potential buyer thinks he can afford to pay for land based on the past 5 years throughout the time period is consistently higher than the ex post series. But the difference in value levels between the ex post and Costs and Returns series is large enough in most areas to warrant the conclusion that the trend in land prices in the future will be generally upward.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The primary objective of this study was to delineate the factors in the farm real estate market which have affected the price of farm real estate between 1930 and 1962. As an aid in analysis of these factors, a production function model and a residual return model were postulated to estimate the income streams accruing to farm real estate over the period under two different sets of assumptions for 19 different type-of-farming areas in the United States. The estimated annual income streams from both models were capitalized to yield for each area and each year an ex ante or expected price which could be paid for real estate based on the income streams of the past five years and an ex post or actual price which could have been paid based on actual income streams accruing to farm real estate under the assumptions of the models. Further the year-to-year changes in the estimated marginal value products or yearly income streams from the production function model were partitioned into price and productivity components to further aid in the analysis.

Theoretical arguments are employed which indicate that over the period the marginal physical product of farm real estate should have increased primarily due to the technological revolution going on in agriculture during the period which has allowed large increases in agricultural production without the use of increased quantities of land and with the use of much less labor. Fixed asset theory was

employed to argue that it is economically sound for farmers to bid up the price of farm real estate even though the returns to their labor may not be comparable to labor returns in the non-farm economy. Both of these arguments were verified by the data although it was found that farmers are influenced by the non-farm wage rate in determining what price they are willing to pay for farm real estate.

The net percentage of non-farmer buyers over sellers in the farm real estate market is decreasing due to urbanization and time breaking many of the strong ties a multitude of urban people once had with the rural sector and the increased costs of property taxes and management services involved in farm real estate investments.

While non-farmer investor interest is declining the farmer expansion buyer is rapidly becoming more dominant in the farm real estate market. As labor and capital saving technology becomes innovated excess capacity in these inputs develops and the answer for many farmers is to expand the size of the existing farm unit to make efficient use of the available capital and labor. Many farms are too small to make use of available technology and we find these farm units disappearing and being absorbed in the form of expansion purchases by the already larger than average farms.

Government programs are found, as expected, to have a greater impact in those areas where farm income levels depend directly and heavily on these programs. Although specific changes in land values were not traceable to specific programs, in general the impact of government programs appeared to be twofold. First, the reduction in uncertainty in the post war period due to price support programs

appeared to have some influence in raising land prices in the wheat areas but no influence was detectable elsewhere. Second, through raising farm incomes either by price support or various direct payments farmers' incomes are higher relative to non-farm incomes and they seem more willing to bid land prices up if their labor incomes are more comparable to non-farm wages in their area. Further, the data indicate that the productivity component of income streams to land is rising at a rate which suggests that changes in government programs within the limits of political acceptability in the immediate future will probably not cause land MVP's to fall but rather will only affect the rate of increase.

Finally, the data suggests that current land prices are below what expansion buyers could afford to pay for farm real estate to add to their existing units. Thus the cautious conclusion that farm real estate market prices will continue their upward trend is advanced.

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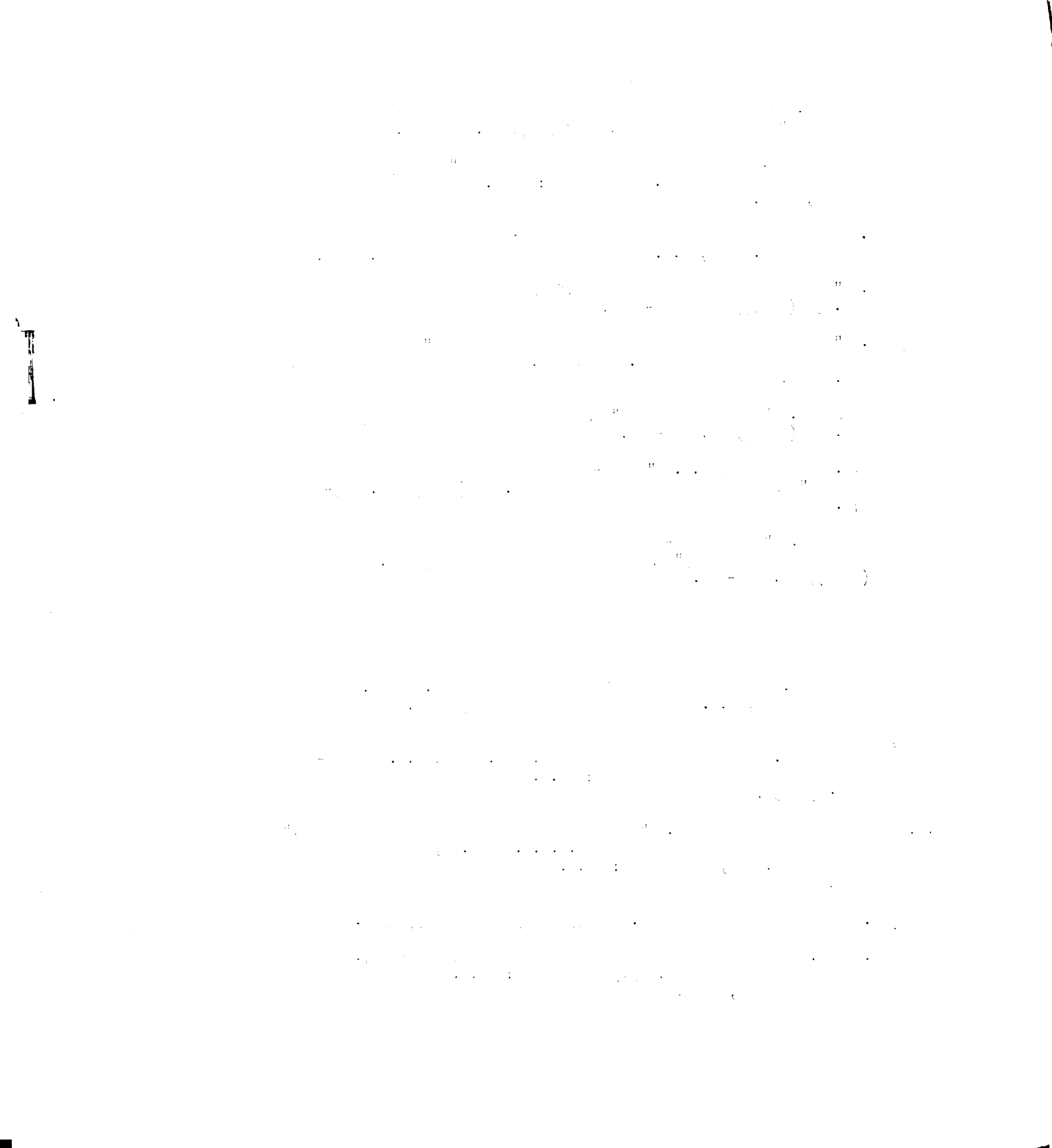

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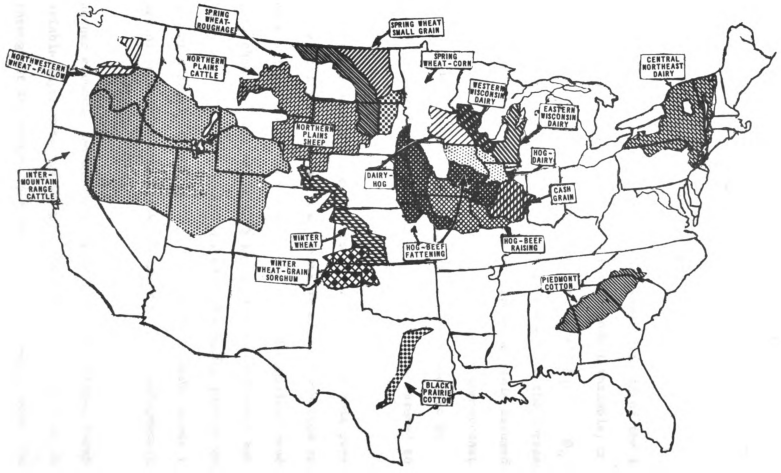
APPENDIX A

Location of the 19 Type-of-Farming Areas in the Study



APPENDIX B

The Production Function Model

The statistical function fit to the sample data is of the form $Y = \alpha X_1^{\beta 1} X_2^{\beta 2} \ldots X_n^{\beta n} \epsilon_i$ where Y is the dependent variable, α is a constant, $X_1 \ldots X_n$ are the independent variables, $\beta_1 \ldots \beta_n$ are parameters measuring the elasticity of Y with respect to the corresponding X_i, and the log of ϵ_i is an independent random variable assumed to have a normal distribution with a mean of zero and a homoscedastic variance for all observations. Further the X_i are assumed to be independent and measured without error. The function is assumed to be linear in logs.

The first economic assumption required for use of this particular statistical model is that the elasticities of production are constant over all ranges of output while the marginal physical products of the inputs change. This assumption may or may not hold true but it is probably a more logical assumption than that which must be made with the use of a straight multiple linear regression model where the elasticities of production change but the marginal physical products are constant.

Another economic assumption is that the total product curve for any one variable input with the others fixed at a given level is in Stage II throughout its range, increasing at a decreasing rate, thus

marginal physical product declines throughout but cannot be negative since total product never reaches a maximum.

A third assumption is that all inputs are complimentary in some combination; that is, some of each input must be present in order for any production to take place.

A rather strong additional economic assumption is necessary in order to fit this type of function and test hypotheses beyond the normal statistical and economic assumptions commonly required of a production function. Combining cross-sectional and time-series data in the production function requires the assumption that the elasticities of production with respect to each of the inputs remain constant over both areas and time.[1]

In a time-series production function of the Cobb-Douglas type for a given area constant elasticities of production must be assumed through time. In a cross-sectional function of the same type for a given time period constant elasticities must be assumed across observations or areas. When cross-sectional and time series data are combined both assumptions must be made simultaneously. This means that for a <u>one percent</u> change in the input magnitude (X_1), output will change by a <u>percentage</u> equal to the corresponding regression coefficient (b_1) regardless of time period or area. Admittedly this assumption may be difficult to defend for the length of time and the heterogeneity of the areas involved but if the model yields reasonable results the assumption is justified. Separate

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[1]For another application of the model see Irving Hock, "Estimation of Production Function Parameters Combining Time-Series and Cross-Section Data," <u>Econometrica</u>, Vol. 30, (1962), pp. 34-53.

time series equations for each area were considered and rejected because of the very high intercorrelations found between the independent variables. Separate cross-sectional functions for each year were also considered and rejected both for high intercorrelation and low explanatory power reasons. The combined model then was adopted because it yields a reasonably good fit to the data while at the same time it holds the intercorrelation problem to a very low level.

The Variables in the Production Function

The function was fitted to the data using the following variables.

Y. The dependent variable--total output of each representative area-type farm in each year--is defined as total cash receipts from sale of crops, livestock, and livestock products, government program payments plus value of perquisites, and change in inventory of crops and livestock during the year valued at current prices, all deflated by the specific area's prices received for products sold index to convert total output to constant dollar values. The prices received index is a Paasche type which uses current year quantities of products sold as weights. That is, the indes is $\frac{\Sigma P_1 Q_1}{\Sigma P_o Q_1}$ where Q_1 is current year quantities, P_1 is current year prices, and P_o is 1947-1949 base year prices.

The independent variables in the production function for the representative farm in each area are as follows.

X_1. Real Estate--defined as total acres of land in the farm unit including crop, idle, fallow, failure, abandoned, pasture, woodland, wasteland, farmstead yards, barnyards, feed lots, roads, lanes, fences, and land in Soil Bank or other government programs. Also included are

buildings and structures, wells, irrigation systems, tile or other drainage systems, and any other permanent fixtures and improvements generally classified under the heading real estate.

The rationale for including these capital improvements in real estate even though the variable is measured in acres is found in the income capitalization approach to valuation of farm real estate. The income capitalization approach in farmland appraisal determines a net return accruing to the farm real estate, and then assuming this return to represent the flow of income streams from the real estate input capitalizes it by an appropriate interest rate to determine the present value of the real estate. The capitalized value is then adjusted up or down if the capital improvements are better or not as good as typically found on other farms in the surrounding area. So assuming the representative farms in the respective areas to have a typical set of capital improvements for the area and further that the productive contribution of these improvements will appear in total product no adjustment is made for capital improvements in the real estate variable.[2]

X_2. Labor--in man-hour units. The man-hours of labor input estimated for the area-type farms includes total hours of operator and family labor including management plus hours of hired labor. It is an artificial series built from estimates of man-hours required under average rates of performance with existing technology levels and with the types of power and equipment normally used in crop and livestock

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[2]For a further discussion of the income approach in farm real estate appraisal and valuation of buildings and improvements see William G. Murray, Farm Appraisal, Iowa State College Press, Second Edition 1947, particularily pages 181-184.

production, maintenance and repairs and management on the number of acres and size of enterprises found on the given area-type farm.[3] No attempt is made to separate out management.

The labor input for the area-type farms appears to be over estimated from two sources. The distribution of farms of a given area type tends to be skewed toward the right thus causing the arithmetic mean to be greater than the mode. To the extent that use of the geometric mean does not correct for the skewness, more small farms fall into the omitted extremes than do large farms when the extremes are defined as beyond plus or minus three standard deviations from the geometric mean. Now if the larger farms are able to use labor saving capital and techniques to a greater extent than the smaller farms, basing labor requirements per acre of crop or unit of livestock on the average of all farms will tend to over estimate the labor requirement on the farms used in the sample of area-type farms to build the representative farm unit. No attempt has been made here to correct for this possible source of bias in the labor input data but we must recognize that it exists and may affect the production function coefficient for labor.

The other source of bias which increases the labor requirement portion in the Costs and Returns series is found in the estimates of labor used for repair and maintenance of machinery and buildings and in management of the operating unit. Impossible to divorce in the estimates for these items is labor time spent in certain endeavors which in the

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[3]For a fuller discussion of derivation of labor requirements see "Agricultural Production and Efficiency," Major Statistical Series of the U.S.D.A., Vol. 2, Agricultural Handbook No. 118, (Washington: U.S. Government Printing Office, 1957).

non-farm economy would be considered personal business. For example, repair and maintenance on that portion of the family car used for personal rather than farm business, repair and maintenance of the family dwelling, and that portion of trips to town or time spent on records which are personal rather than farm business. To at least partially correct for this bias a constant number of labor hours is subtracted from the family and operator hours series in the Cost and Returns data for each year and each area type farm amounting to approximately one and one-half hours per day or 550 hours per year.

X_3. Operating Expenses--in constant dollar values. Included is the total cash paid for goods and services and personal and real estate property taxes during the year excluding hired labor expense, land purchase, and purchase of depreciable capital items. A capital item depreciation figure is included for machinery improvements and other depreciable capital representing the flow of services in a given year from the capital stock. Operating expenses are deflated to constant dollars by the prices paid index for each area. This is a current weighted, Paasche type index of the form $\frac{\Sigma P_1 Q_1}{\Sigma P_o Q_1}$ where Q_1 is current year quantities, P_1 is current year prices and P_o is base 1947-1949 year prices.

Dummy Variables

Two sets of dummy variables are used in the function for area and time. Zero-one dummy variables can be used in a regression model if the data can logically be divided into mutually exclusive groups and the effect of differences in these groups is to change the level of

the function without changing its slope.[4] The first condition in this case is met for both areas and time because each area has a different set of characteristics which contribute to different levels of technical efficiency in production while production conditions as influenced by weather, technology, and size of the farm unit change from year to year.

The second condition is not so easily rationalized. Under the general assumption, which had to be made in order to use the model, production elasticities of the inputs are assumed constant through time and over areas. If the fit can be improved by introducing the time and area dummy variables without significantly changing the coefficients of the physical input variables in which we are interested they are a valuable addition to the function. A statistical test for a significant difference between the regression coefficients for the physical inputs in separate cross-sectional functions for each year and separate time-series functions for each area without dummy variables and the combined function with the dummy variables included would determine if they should be included. Due to the high intercorrelation in the separate functions between the independent variables the estimated standard errors would be very large and the likelihood of detecting significant differences would be greatly reduced. Therefore, the dummies are included in the function on the assumption that they are appropriate as follows:

$X_4 \ldots X_{21}$ Area dummies. Data from 19 areas are included in the function. Thus 18 variables are added to the function, for each

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[4] See William G. Tomek, "Using Zero-One Variables with Time Series Data in Regression Equations," Journal of Farm Economics, Vol. 45, (1963), pp. 814-822.

area except one which is used as the base from which the 18 others deviate. The variables are entered as 1 in logs (10 in natural numbers) if the observation came from the area represented by X_i and 0 in logs (1 in natural numbers) otherwise.

$X_{22} \cdots X_{53}$ Time dummies. Data for 33 years are included in the function. Therefore, using the same procedure as for the area dummies, 32 time dummy variables are entered in the function. Thus for the base year and base area all time and area dummy variables take on the value of zero.

Table 47 presents the results of the production function. The multiple coefficient of determination adjusted by the degrees of freedom ($\bar{R}^2$) is .8096. That is, approximately 81 percent of the variance in output is "explained" by the variance of the independent variables. The sum of the elasticities of production of the physical inputs is 1.62 and is significantly different from 1 at the .01 level of significance. According to classical economic theory increasing returns to scale are thus indicated. In this case if all physical inputs included in the function were increased by 1 percent, output would increase by 1.62 percent.

If we hold strictly to the economic theory assumptions about returns to scale only constant returns to scale are possible. The theory assumes strictly homogeneous inputs and states that if all inputs are increased proportionately, in order to have constant returns to scale, output must also increase proportionately. For increasing or decreasing returns to scale output must increase more than or less than proportionately

Table 47 Regression Coefficients, Estimated Standard Errors, and Coefficient Significance Levels from the Unrestricted Cobb-Douglas Production Function

Variable	Regression Coefficient	Estimated Std. Error
Constant	.041	
Physical Inputs[1]		
Real Estate	.519***	.169
Labor	.473***	.138
Operating Expenses	.671***	.078
Area Dummies[2]		
Central N.E. Dairy-Base for Area Dummies	-0-	
Eastern Wisconsin Dairy	.123***	.040
Western Wisconsin Dairy	.085**	.036
Dairy-Hog Minnesota	.162***	.037
Hog-Dairy, Corn Belt	.174***	.029
Hog-Beef Raising, Corn Belt	.098***	.037
Hog-Beef Fattening, Corn Belt	.187***	.034
Cash Grain, Corn Belt	.200***	.031
Southern Piedmont Cotton	-.080*	.043
Texas Black Prairie Cotton	.081*	.042
No. Plains Wheat-Small Grain-Livestock	-.168*	.088
No. Plains Wheat-Corn-Livestock	-.081	.073
No. Plains Wheat-Roughage-Livestock	.268***	.099
Southern Plains, Winter Wheat	-.090	.095
Southern Plains Wheat-Grain-Sorghums	-.144	.098
Wheat-Fallow, Washington and Oregon	-.184	.134
Northern Plains Cattle	-.545***	.218
Intermountain Cattle	-.168	.159
Northern Plains Sheep	-.675***	.243

Variable	Regression Coefficient	Estimated Std. Error
Time Dummies[2]		
1930 (Base for Time Dummies)	-0-	
1931	-.013	.034
1932	-.012	.034
1933	-.101***	.034
1934	-.108***	.034
1935	-.038	.034
1936	-.164***	.034
1937	-.049	.034
1938	-.001	.035
1939	.122	.035
1940	.018	.035
1941	.037	.035
1942	.076**	.036
1943	.050	.036
1944	.065	.036
1945	.069*	.037
1946	.048	.037
1947	.036	.038
1948	.033	.038
1949	.002	.039
1950	-.002	.040
1951	.014	.041
1952	.009	.041
1953	.003	.041
1954	-.003	.042
1955	.018	.043
1956	.024	.044
1957	.060	.044
1958	.099**	.045
1959	.040	.047
1960	.077	.049
1961	.036	.051
1962	.084	.052

1/ Since negative coefficients for physical inputs are meaningless one-tailed tests of significance were used.

2/ Since area and time coefficients can logically deviate either way from their respective bases, two-tailed tests of significance were used.

*** Denotes significance at the .01 level.

** Denotes Significance at the .05 level.

* Denotes Significance at the .10 level.

respectively. But if all inputs are homogeneous within categories and proportional increases are accomplished also with homogeneous inputs then no recombination of inputs is possible and only proportional increases in output can result.

Then one or more of the theoretical assumptions was not met in order for the function to yield a sum of the input coefficients different from one. Several discrepancies are possible. The function may not contain all the relevant inputs. But if this were the case we would expect the sum of the coefficients to be less than one if the omitted input were limiting and unaffected if not. If the omitted input were limiting and did not increase proportionally with the included inputs decreasing returns to size may result.[5]

The large sum may be attributed to changes in the quality of the inputs or changes in the input mix within a category. In this case the theoretical assumption of input homogeneity is not met. One of the main criticisms of measuring the inputs in acres, man-hours, and constant dollars is that it is impossible to account for quality differences and changes. For example, operating expenses are measured in constant dollar values. The addition of a constant dollars worth of operating expenses today may contribute more output than a constant dollars worth which was on hand due to quality changes resulting from a technological innovation or due to changes in the within category input mix.

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[5]The word "size" is used here in preference to "scale" since scale is reserved for the theoretical situation described above where only constant returns can result.

D. Gale Johnson observed in 1948 that in the period 1913 to 1948 investments made in tractors and other motor vehicles were more than offset by declines in investment in horses and mules while the investment in other machinery remained about the same.[6] Thus, increasing returns to size may occur through a more productive recombination of inputs the magnitude of which is not totally reflected in the method of measurement of the variables in the function.

The dummy variables for area are intended to at least partially account for differences in the quality of inputs between areas, and the time dummies are intended to account for changes in quality through time. To the extent that they fail to account for the total differences and changes we would expect a sum of the coefficients different from one. We could further expect this sum to be larger than one instead of smaller because the rate of technological innovation has proceeded at an accelerating pace through the studied period.

If along with Heady and Dillon[7] we assume that at least part of the reason for the high sum of the coefficients is due to irregularities in the method of aggregation and measurement within input categories; if we further assume that these irregularities affect all categories equally (the irregularities are randomly distributed between categories); and finally if we believe constant returns to scale to hold at any one place and time, then the closer this sum is to one the more economically

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[6]D. Gale Johnson, "Allocation of Agricultural Income," Journal of Farm Economics, Vol. 30, (1948), p. 729.

[7]Earl O. Heady and John L. Dillon, Agricultural Production Functions, (Ames: Iowa State University Press, 1961), p. 589.

reliable we can consider the results from the model provided the explanatory power of the model does not significantly deteriorate.

With this in mind a restriction was placed on the sum of the coefficients of the physical inputs--real estate, labor, and operating expenses--to bring the sum down to a minimum level without significantly changing the explanatory power of the model at the .01 level of significance. In other words, the restricted model minimizes the sum of squares subject to the restriction and an F test on the error sum of squares between the restricted and unrestricted models was used to determine the level of restriction which was possible without significantly changing the error sum of squares at the .01 level of significance.[8]

The restricted sum of the coefficients fulfilling the criteria is 1.34 which is still significantly different from 1 at the .01 level. The $\bar{R}^2$ for the restricted function is .8093 only .0003 less than for the unrestricted function. The restricted function yields results which are not significantly different from the original in a statistical sense but at the same time yields physical input coefficients which are more reasonable in terms of economic theory.

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[8]The form of the hypothesis is that $\beta_1 + \beta_2 + \beta_3 = X$ where β_1, β_2 and β_3 are the real estate, labor and operating expenses coefficients respectively and X is to be determined such that

$$F_{.01(P,N-K-1\ df)} = \frac{(ESS_r - ESS_u)/P}{ESS_u/N-K-1}$$ where ESS_u is the error sum of squares in the unrestricted function, ESS_r is the error sum of squares in the restricted model, P is the number of degrees of freedom for the numerator and is equal to the number of restrictions (in this case 1), N-K-1 is the denominator degrees of freedom with N the number of observations, and K the number of independent variables, and F is the tabled F statistic for the .01 level of significance with P and N-K-1 degrees of freedom.

The restriction partially corrects for some of the aggregation and measurement problems in the independent variables but the restricted sum is still high enough that further analysis is warranted. Empirical evidence indicates that average farm size is increasing primarily via the smaller than average farms being absorbed by the larger than average farm units. As farm units increase in size they become more flexible with regard to recombination of productive factors and the ability to innovate new and existing technology which the smaller size farms are unable to use efficiently. The sum of the coefficients in this case can be interpreted as an indicator of returns to size where the term "size" rather than "scale" denotes a relaxing of the assumption of proportional increases and homogeneity of all inputs.

To sum up, the functional form chosen as the model from which to derive real estate marginal value products is a restricted Cobb-Douglas linear in logarithms production function. In using this model several strong assumptions must be made which necessarily abstract from reality. After weighing the consequences of these abstractions and possible alternative interpretations the conclusion was reached that the model would yield results approximating reality closely enough to be useful.

APPENDIX C

Capitalization Rate

One of the big questions arising when attempting to determine the present value of future income streams accruing to any productive input is what capitalization rate should be used. Even in an ex post sense the decision is difficult because of the wide array of rates of return on different types of investment and the subjectiveness in evaluating the factors determining the interest rate. Since we live in a world of differential risks and uncertainties attached to different types of investment the interest rate chosen for any given type of investment reflects the subjective evaluation of investors of the relative risk involved in the initial investment and uncertainty about the stability and magnitude of the future income streams accruing to it.

Crouse and Everett indicate three factors beyond the general money market which influence capitalization rates for farm real estate. They are physical and economic risk as it affects regularity of income streams, marketability or liquidity of investment, and competition with other forms of investment.[1]

Although the capitalization rate for farm real estate has tended to be greatly influenced by the current farm mortgage rate many rural appraisers and others connected with farm real estate argue that

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[1]Earl F. Crouse and Charles H. Everett, Rural Appraisals, (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1956), pp. 35-36.

ownership is a higher risk venture than mortgage lending and should assume a higher rate of return.[2] Larsen argues the inappropriateness of the farm mortgage rate for use in capitalization on the basis that the former reflects trends in returns from riskless investments while the latter should take into account the opportunity cost of alternative investments with risk features similar to land. He finally comes to the position that since the mortgage rate reflects actual interest paid by farm buyers for their long-term credit, this rate plus an additional risk of ownership factor should approximate a reasonable capitalization rate.

The ownership risk factor must be adjusted through time because ownership risk has decreased. Technology has increased efficiency, allowed greater timeliness of operations, introduced more hardy varieties of crops and livestock and allowed soil and water conserving practices and techniques thus causing supply to be more stable. Price stabilizing government programs have cut the risk factor on the demand side. Thus both production and income risks have been declining, leading to the position that the ownership risk factor should also decline through time.[3]

But how much of the risk from price fluctuations is simply transferred to risk from legislative change in government programs? And how much has technology allowed use of land which would formerly have been sub-marginal thus possibly even increasing the production risk in certain areas?

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[2]Raleigh Barlowe, Land Resource Economics, (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1958), pp. 191-194.

[3]Harald C. Larsen, "Relationship of Land Values to Warranted Values, 1910-1948," Journal of Farm Economics, Vol.30 (1948), pp. 579-588.

Another factor which may have tended to increase the risk of ownership factor through time is the institutionalization and impersonalization of sources of credit. As credit facilities have become larger and many have become affiliated nationally, more hard and fast rules have replaced discretionary authority at the local level where the loans are serviced. This has meant less liberal treatment as far as the credit source "riding along" with even the better managers when they have found themselves in trouble due to unforeseen difficulties such as several years of unfavorable weather.

Finally, Murray points out that farm real estate ownership is for not only production but also consumption ends in that it provides a home for the operator and his family. Since the consumption portion should not be expected to yield a monetary return the expected rate of return on the total investment should be adjusted downward.[4]

The amount to add to the capitalization rate for the risk of ownership factor then appears to be impossible to establish empirically and at best could only be a subjective estimate.

Another way to approach the problem is to look at the market for farm real estate in terms of the interest rate. According to Chambers in a land value and income study done in 1924, . . . "it is difficult to see how the anticipated rate of return on farm land, that is, the rate of capitalization, can get very far away from the mortgage rate of interest when farm mortgages are readily available to a large class of potential sellers of land. If buyers bid up the price of land because

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[4]William G. Murray, Farm Appraisal, Second Edition, (Ames: Iowa State College Press, 1947), p. 162.

they are willing to accept a low rate of return on their investments, some of these retired or retiring farmers will decide to sell rather than lease their farms. This will increase the supply of land for sale and thus hold down its price. If, on the other hand, farm land tends to offer a better return than farm mortgages, fewer farms will be offered for sale, which will increase the price.[5]

Of course, the land market is highly imperfect in that only a very small portion of the land in any one area is for sale at any one time and then the interested buyers come from a limited surrounding area. And the capitalization rate is only one of several factors which determine price. While a wide gap between the mortgage rate and capitalization rate will motivate buyers and sellers to act to narrow the gap, slight discrepancies may not provide this motivation so the two rates will not always coincide. The important thing, however, is that there is a tendency for the capitalization rate to move toward the mortgage rate.

Thus the best objective indication of the capitalization rate without any subjective adjustments is the farm mortgage rate. In obtaining the capitalized land value series from both the production function and the residual calculations, the farm mortgage rate on new loans charged by the Federal Land Bank in the respective areas is used.

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[5]Clyde R. Chambers, Relation of Land Income to Land Value, U.S.D.A. Dept. Bulletin 1224, (Washington: U.S. Government Printing Office, 1924), p. 44.

APPENDIX D

Supplemental Data

The following table presents for each of the 19 areas in the study, (1) the imputed salvage value for farm labor based on factory workers wages weighted by the non-farm unemployment rate used in the residual return model, (2) the interest rate charged for new loans on January 1 by the Federal Land Bank and used to compute the imputed salvage return for capital in the residual model and for derivation of the ex post and ex ante land value series from both the residual return and production function models, and (3) the per acre return to land calculated from the residual return model and used in deriving the residual return ex post and ex ante land value series.

Table 48 Farm Labor Salvage Value, Interest Rate, and Per Acre Residual Return Series for 19 Farming Areas in the United States 1930-1962

Year	Labor Salvage Value (Dollars)	Interest Rate (Percent)	Per Acre Residual Return (Dollars)
Central Northeast Dairy			
1930	682.40	5.5	1.23
1931	214.87	5.5	2.09
1932	-0-	5.5	.99
1933	-0-	5.0	1.68
1934	-0-	5.0	1.61
1935	-0-	5.0	3.90
1936	179.56	4.0	2.26
1937	347.16	4.0	2.11
1938	57.44	4.0	3.15
1939	172.27	4.0	1.52
1940	350.79	4.0	3.09
1941	767.25	4.0	1.66
1942	1451.05	4.0	2.66

Table 48--Continued

Year	Labor Salvage Value (Dollars)	Interest Rate (Percent)	Per Acre Residual Return (Dollars)
1943	2017.69	4.0	.06
1944	2236.05	4.0	.11
1945	2070.63	4.0	4.46
1946	1803.91	4.0	9.09
1947	2047.52	4.0	6.43
1948	2239.65	4.0	10.70
1949	2012.56	4.5	3.23
1950	2241.84	4.5	3.42
1951	2812.56	4.5	5.14
1952	2926.12	4.5	1.26
1953	3170.20	4.5	- 3.57
1954	2640.27	4.5	.79
1955	3044.43	4.5	1.39
1956	3260.11	4.5	- .11
1957	3330.38	5.0	1.22
1958	2838.61	6.0	2.35
1959	3294.35	5.5	- .32
1960	3353.88	6.0	- 1.26
1961	3151.26	6.0	.84
1962	3572.15	5.8	- 5.33
Eastern Wisconsin Dairy			
1930	725.35	5.5	.40
1931	228.39	5.5	- .53
1932	-0-	5.5	1.05
1933	-0-	5.5	3.00
1934	-0-	5.0	2.00
1935	-0-	5.0	8.16
1936	190.86	4.0	2.99
1937	369.01	4.0	4.41
1938	61.05	4.0	5.67
1939	183.11	4.0	.95
1940	372.87	4.0	2.41
1941	815.54	4.0	1.40
1942	1542.37	4.0	.03
1943	2144.68	4.0	- 1.66
1944	2376.78	4.0	- 4.76
1945	2200.95	4.0	1.61
1946	1917.45	4.0	6.85
1947	2150.30	4.0	5.02
1948	2371.78	4.0	2.79
1949	2052.60	4.0	- .92
1950	2374.60	4.0	- 6.00
1951	3003.87	4.0	1.39
1952	3134.91	4.0	- 3.14
1953	3341.93	4.0	- 9.80
1954	2800.14	4.0	- 6.34
1955	3269.54	4.0	-12.53
1956	3460.99	4.0	-11.52

Table 48--Continued

Year	Labor Salvage Value (Dollars)	Interest Rate (Percent)	Per Acre Residual Return (Dollars)
1957	3492.22	4.5	-10.37
1958	3004.03	5.5	- 8.69
1959	3539.95	5.0	- 9.00
1960	3606.22	6.0	4.28
1961	3351.69	5.5	11.14
1962	3888.52	5.5	5.23
Western Wisconsin Dairy			
1930	725.35	5.5	- 1.10
1931	228.39	5.5	- 1.06
1932	-0-	5.5	.82
1933	-0-	5.5	1.43
1934	-0-	5.0	.55
1935	-0-	5.0	5.76
1936	190.86	4.0	2.49
1937	369.01	4.0	3.28
1938	61.05	4.0	3.62
1939	183.11	4.0	2.19
1940	372.87	4.0	.96
1941	815.54	4.0	2.11
1942	1542.37	4.0	- .04
1943	2144.68	4.0	- 1.64
1944	2376.78	4.0	- 5.36
1945	2200.95	4.0	- 1.54
1946	1917.45	4.0	2.79
1947	2150.30	4.0	.83
1948	2371.78	4.0	3.75
1949	2052.60	4.0	.33
1950	2374.60	4.0	- 2.11
1951	3003.87	4.0	2.94
1952	3134.91	4.0	.34
1953	3341.93	4.0	- 6.38
1954	2800.14	4.0	- 5.17
1955	3269.54	4.0	- 8.95
1956	3460.99	4.0	- 5.85
1957	3492.22	4.5	- 4.41
1958	3004.03	5.5	.46
1959	3539.95	5.0	- 4.95
1960	3606.22	6.0	-4.52
1961	3351.69	5.5	1.04
1962	3888.52	5.5	- 1.35
Dairy-Hog, Minnesota			
1930	707.63	5.5	1.42
1931	222.81	5.5	.57
1932	-0-	5.5	1.72
1933	-0-	5.5	1.83
1934	-0-	5.0	- .36

Table 48--Continued

Year	Labor Salvage Value (Dollars)	Interest Rate (Percent)	Per Acre Residual Return (Dollars)
1935	-0-	5.0	7.69
1936	186.20	4.0	4.80
1937	352.44	4.0	5.82
1938	59.56	4.0	6.29
1939	178.64	4.0	5.76
1940	363.75	4.0	4.08
1941	795.61	4.0	5.36
1942	1504.68	4.0	5.90
1943	2092.28	4.0	3.35
1944	2318.70	4.0	.48
1945	2147.17	4.0	5.17
1946	1870.59	4.0	12.18
1947	2022.18	4.0	10.43
1948	2247.10	4.0	13.77
1949	2007.46	4.0	5.66
1950	2272.63	4.0	2.21
1951	2821.29	4.0	8.09
1952	3029.21	4.0	5.39
1953	3244.88	4.0	1.32
1954	2771.68	4.0	.94
1955	3175.85	4.0	- 1.19
1956	3327.89	4.0	.53
1957	2408.26	4.5	5.37
1958	3000.94	5.5	3.38
1959	3444.85	5.0	- 4.20
1960	3559.42	6.0	- 6.10
1961	3413.47	5.5	3.19
1962	3831.98	5.5	- 2.47
Hog-Dairy, Corn Belt			
1930	737.58	5.6	1.55
1931	232.26	5.5	.99
1932	-0-	5.5	.67
1933	-0-	5.5	.18
1934	-0-	5.0	- 1.29
1935	-0-	5.0	9.38
1936	194.09	4.0	4.76
1937	375.26	4.0	7.91
1938	62.09	4.0	7.87
1939	186.21	4.0	6.13
1940	379.17	4.0	4.33
1941	829.33	4.0	6.03
1942	1568.46	4.0	10.92
1943	2180.96	4.0	9.96
1944	2416.98	4.0	5.03
1945	2238.18	4.0	8.75
1946	1949.89	4.0	18.25
1947	2213.20	4.0	13.30
1948	2420.88	4.0	22.49

Table 48--Continued

Year	Labor Salvage Value (Dollars)	Interest Rate (Percent)	Per Acre Residual Return (Dollars)
1949	2113.02	4.0	12.95
1950	2388.07	4.0	9.57
1951	2996.45	4.0	13.16
1952	3128.36	4.0	10.44
1953	3369.65	4.0	8.18
1954	2826.35	4.0	12.18
1955	3296.72	4.0	- 1.07
1956	3492.21	4.0	2.10
1957	3549.00	4.6	8.23
1958	3259.71	5.5	15.99
1959	3587.13	5.0	1.67
1960	3630.56	6.0	.72
1961	3426.51	5.8	8.13
1962	3912.48	5.5	3.05
Hog-Beef Raising, Corn Belt			
1930	719.21	5.8	- 1.68
1931	226.46	5.5	.16
1932	-0-	5.5	.70
1933	-0-	5.5	- .40
1934	-0-	5.0	- 2.24
1935	-0-	5.0	4.56
1936	189.24	4.0	- .75
1937	365.90	4.0	3.13
1938	60.54	4.0	3.00
1939	181.56	4.0	3.19
1940	369.71	4.0	1.81
1941	808.64	4.0	2.04
1942	1529.32	4.0	3.44
1943	2126.54	4.0	2.10
1944	2356.67	4.0	- 2.88
1945	2182.33	4.0	- 2.02
1946	1802.11	4.0	7.79
1947	2157.98	4.0	.08
1948	2360.47	4.0	8.80
1949	2069.10	4.0	5.62
1950	2367.59	4.0	5.86
1951	2915.64	4.0	4.70
1952	3057.16	4.0	2.44
1953	3300.78	4.0	- 4.20
1954	2768.69	4.0	- 1.92
1955	3217.22	4.0	- 4.81
1956	3417.86	4.0	- 4.32
1957	3481.26	4.8	- 1.70
1958	3004.72	5.5	5.11
1959	3511.87	5.0	- 5.08
1960	3559.42	6.0	- 5.13
1961	3372.28	5.8	- 1.24
1962	3836.85	5.5	- 3.58

Table 48--Continued

Year	Labor Salvage Value (Dollars)	Interest Rate (Percent)	Per Acre Residual Return (Dollars)
Hog-Beef Fattening Corn Belt			
1930	717.85	5.8	4.94
1931	226.03	5.5	3.91
1932	-0-	5.5	3.68
1933	-0-	5.5	.51
1934	-0-	5.0	- 2.36
1935	-0-	5.0	12.47
1936	188.89	4.0	2.39
1937	365.20	4.0	13.11
1938	60.42	4.0	10.39
1939	181.22	4.0	8.02
1940	369.01	4.0	8.68
1941	807.11	4.0	9.24
1942	1526.42	4.0	20.72
1943	2122.51	4.0	19.07
1944	2352.21	4.0	15.35
1945	2178.20	4.0	15.83
1946	1897.62	4.0	42.87
1947	2153.88	4.0	34.11
1948	2356.00	4.0	50.73
1949	2065.18	4.0	29.05
1950	2363.09	4.0	35.07
1951	2906.46	4.0	32.30
1952	3047.99	4.0	20.83
1953	3288.26	4.0	11.43
1954	2771.31	4.0	22.85
1955	3210.32	4.0	- 1.01
1956	3409.64	4.0	8.20
1957	3476.80	4.8	15.54
1958	3004.03	5.5	27.14
1959	3500.27	5.0	7.82
1960	3550.06	6.0	3.05
1961	3365.76	5.8	11.00
1962	3831.61	5.5	22.12
Cash Grain, Corn Belt			
1930	745.80	6.0	.61
1931	234.83	5.5	- .03
1932	-0-	5.5	1.84
1933	-0-	5.5	2.15
1934	-0-	5.0	3.26
1935	-0-	5.0	12.06
1936	196.24	4.0	10.99
1937	379.42	4.0	9.96
1938	62.78	4.0	7.86
1939	188.28	4.0	10.31
1940	383.38	4.0	7.03
1941	838.53	4.0	15.75
1942	1585.85	4.0	17.22

Table 48--Continued

Year	Labor Salvage Value (Dollars)	Interest Rate (Percent)	Per Acre Residual Return (Dollars)
1943	2205.15	4.0	18.13
1944	2443.19	4.0	14.01
1945	2263.01	4.0	20.10
1946	1971.51	4.0	34.48
1947	2237.74	4.0	33.29
1948	2457.70	4.0	27.29
1949	2150.15	4.0	22.28
1950	2433.09	4.0	23.10
1951	3031.83	4.0	28.74
1952	3158.94	4.0	21.96
1953	3424.66	4.0	19.42
1954	2855.92	4.0	20.77
1955	3353.10	4.0	14.99
1956	3545.61	4.0	22.60
1957	3621.20	5.0	11.55
1958	3107.33	5.5	15.51
1959	3663.50	5.0	5.81
1960	3692.33	6.0	13.15
1961	3486.23	5.5	19.11
1962	3978.75	5.5	20.74
Southern Plains Cotton			
1930	511.29	6.0	- 1.87
1931	160.99	6.0	- .43
1932	-0-	6.0	.38
1933	-0-	5.0	2.11
1934	-0-	5.0	2.80
1935	-0-	5.0	2.91
1936	134.53	4.0	2.46
1937	260.11	4.0	.55
1938	43.04	4.0	2.06
1939	129.07	4.0	2.33
1940	262.83	4.0	1.68
1941	574.86	4.0	- .35
1942	1087.20	4.0	- .73
1943	1511.76	4.0	- 3.71
1944	1675.36	4.0	- 3.93
1945	1551.42	4.0	- 2.22
1946	1351.58	4.0	2.31
1947	1534.10	4.0	.31
1948	1678.06	4.0	.43
1949	1475.66	4.5	- 2.45
1950	1730.06	4.5	- 2.48
1951	2097.08	4.5	1.43
1952	2152.11	5.0	- 1.02
1953	2307.10	5.0	- 3.18
1954	1928.91	5.0	- 3.37
1955	2257.57	5.0	- .15
1956	2415.09	5.0	- 5.19

Table 48--Continued

Year	Labor Salvage Value (Dollars)	Interest Rate (Percent)	Per Acre Residual Return (Dollars)
1957	2503.77	5.0	- 5.24
1958	2134.36	6.0	2.72
1959	2495.38	5.5	- 2.94
1960	2535.44	6.0	- 3.99
1961	2401.03	6.0	.25
1962	2760.45	6.0	- 1.97
Texas Black Prairie Cotton			
1930	686.49	6.0	- .11
1931	216.16	5.5	.31
1932	-0-	5.5	2.43
1933	-0-	5.5	6.04
1934	-0-	5.0	6.62
1935	-0-	5.0	6.95
1936	180.64	4.0	6.51
1937	349.25	4.0	4.72
1938	57.78	4.0	5.32
1939	173.30	4.0	4.86
1940	352.89	4.0	4.09
1941	771.85	4.0	3.02
1942	1459.74	4.0	- 1.33
1943	2029.79	4.0	- .99
1944	2249.45	4.0	- 4.51
1945	2083.04	4.0	- 3.40
1946	1814.73	4.0	2.58
1947	2059,79	4.0	8.30
1948	2253.08	4.0	2.83
1949	1941.58	4.0	5.28
1950	2197.21	4.0	5.06
1951	2740.92	4.0	- 3.65
1952	2907.78	4.0	.16
1953	3129.95	4.0	1.20
1954	2697.18	4.0	- 6.07
1955	3073.64	4.0	- 3.78
1956	3299.55	4.0	-14.30
1957	3425.70	5.0	-10.04
1958	2919.26	5.5	- .96
1959	3332.91	5.0	- 6.91
1960	3339.27	6.0	- 3.74
1961	3173.91	5.5	- 1.23
1962	3596.11	5.5	- .87
Northern Plains, Wheat-Small Grain-Livestock			
1930	640.82	5.5	- .89
1931	201.78	5.5	- 1.40
1932	-0-	5.5	- .77
1933	-0-	5.5	- .09
1934	-0-	5.0	- 1.17
1935	-0-	5.0	.16

Table 48--Continued

Year	Labor Salvage Value (Dollars)	Interest Rate (Percent)	Per Acre Residual Return (Dollars)
1936	168.62	4.0	- 1.23
1937	326.01	4.0	- .08
1938	53.94	4.0	.06
1939	161.77	4.0	.70
1940	329.41	4.0	.84
1941	720.49	4.0	2.78
1942	1362.62	4.0	3.16
1943	1894.73	4.0	5.53
1944	2099.79	4.0	3.55
1945	1944.45	4.0	5.65
1946	1693.98	4.0	7.18
1947	1922.74	4.0	10.99
1948	2103.17	4.0	5.73
1949	1843.56	4.0	1.73
1950	2109.50	4.0	4.33
1951	2600.69	4.0	5.54
1952	2757.54	4.0	.78
1953	2962.33	4.0	.33
1954	2480.80	4.0	- 1.23
1955	2886.17	4.0	3.64
1956	3102.77	4.0	4.78
1957	3193.69	4.5	.25
1958	2733.93	5.5	3.98
1959	3056.98	5.0	- 1.54
1960	3064.46	6.0	1.45
1961	3002.31	5.5	- 5.25
1962	3301.46	5.5	9.71
Northern Plains Wheat-Corn-Livestock			
1930	669.45	5.5	.76
1931	210.79	5.5	- .45
1932	-0-	5.5	- .08
1933	-0-	5.5	- 1.54
1934	-0-	5.0	- 1.40
1935	-0-	5.0	1.27
1936	176.15	4.0	- 1.81
1937	340.58	4.0	.11
1938	56.35	4.0	.99
1939	169.00	4.0	2.18
1940	344.13	4.0	1.68
1941	752.69	4.0	3.03
1942	1423.50	4.0	5.58
1943	1979.40	4.0	3.63
1944	2193.60	4.0	3.65
1945	2031.33	4.0	6.80
1946	1769.67	4.0	8.48
1947	2008.66	4.0	12.35
1948	2197.14	4.0	8.47

Table 48--Continued

Year	Labor Salvage Value (Dollars)	Interest Rate (Percent)	Per Acre Residual Return (Dollars)
1949	1925.93	4.0	1.39
1950	2203.76	4.0	3.31
1951	2716.89	4.0	7.66
1952	2880.75	4.0	1.79
1953	3094.69	4.0	.99
1954	2591.64	4.0	.48
1955	3015.12	4.0	- 3.01
1956	3113.86	4.0	- .94
1957	3189.64	4.5	3.02
1958	2806.72	5.5	7.08
1959	3271.51	5.0	- 3.87
1960	3290.98	6.0	2.41
1961	3183.87	5.9	1.56
1962	3549.31	5.5	2.64
Northern Plains, Wheat-Roughage-Livestock			
1930	686.33	5.5	- 1.15
1931	222.81	5.5	- 1.50
1932	-0-	5.5	- .50
1933	-0-	5.5	- 1.13
1934	-0-	5.0	- 1.46
1935	-0-	5.0	.01
1936	186.20	4.0	- 2.08
1937	360.00	4.0	- 1.46
1938	59.56	4.0	- .30
1939	178.64	4.0	.45
1940	363.75	4.0	.37
1941	795.61	4.0	2.13
1942	1504.68	4.0	2.72
1943	2092.28	4.0	3.16
1944	2318.70	4.0	2.59
1945	2147.17	4.0	2.84
1946	1870.59	4.0	4.56
1947	2123.20	4.0	6.98
1948	2322.44	4.0	4.02
1949	2035.76	4.0	.62
1950	2329.43	4.0	2.01
1951	2871.83	4.0	3.03
1952	3045.03	4.0	- 1.60
1953	3271.17	4.0	.27
1954	2739.43	4.0	- .70
1955	3187.06	4.0	.47
1956	3448.67	4.0	- 1.40
1957	3353.10	4.5	.80
1958	2970.74	5.5	1.38
1959	3403.67	5.0	- 3.51
1960	3446.35	6.0	1.37
1961	3356.84	5.6	- 3.60
1962	3713.30	5.5	6.39

Table 48--Continued

Year	Labor Salvage Value (Dollars)	Interest Rate (Percent)	Per Acre Residual Return (Dollars)
Southern Plains Winter Wheat			
1930	715.81	5.5	1.46
1931	225.39	5.5	.91
1932	-0-	5.5	- .48
1933	-0-	5.5	- 1.10
1934	-0-	5.0	.19
1935	-0-	5.0	.55
1936	188.35	4.0	1.76
1937	364.16	4.0	.35
1938	60.25	4.0	.98
1939	180.70	4.0	.21
1940	367.96	4.0	.38
1941	804.81	4.0	4.50
1942	1522.07	4.0	6.87
1943	2116.46	4.0	5.61
1944	2345.51	4.0	5.02
1945	2171.99	4.0	6.56
1946	1892.22	4.0	10.76
1947	2147.74	4.0	19.63
1948	2349.28	4.0	8.16
1949	2059.30	4.0	5.02
1950	2356.36	4.0	8.67
1951	2881.56	4.0	5.38
1952	3035.32	4.0	16.40
1953	3203.74	4.0	2.40
1954	2800.51	4.0	6.16
1955	3155.16	4.0	1.86
1956	3362.40	4.0	- .13
1957	3480.05	4.5	3.11
1958	3042.12	5.5	12.78
1959	3453.09	5.0	4.52
1960	3539.95	6.0	7.85
1961	3391.50	5.5	7.99
1962	3856.32	5.5	8.85
Southern Plains, Wheat-Grain-Sorghums			
1930	696.04	5.8	- .84
1931	219.16	5.5	- .69
1932	-0-	5.5	- 1.56
1933	-0-	5.5	- 1.17
1934	-0-	5.0	- .07
1935	-0-	5.0	- .45
1936	183.15	4.0	.52
1937	354.10	4.0	.71
1938	58.59	4.0	.71
1939	175.71	4.0	.95
1940	357.80	4.0	.83
1941	782.58	4.0	2.31
1942	1480.03	4.0	3.38

Table 48--Continued

Year	Labor Salvage Value (Dollars)	Interest Rate (Percent)	Per Acre Residual Return (Dollars)
1943	2058.00	4.0	1.06
1944	2280.72	4.0	6.80
1945	2112.00	4.0	4.07
1946	1839.96	4.0	6.35
1947	2088.42	4.0	16.02
1948	2284.40	4.0	6.09
1949	2002.42	4.0	7.15
1950	1535.74	4.0	2.99
1951	2786.35	4.0	2.22
1952	2947.09	4.0	4.53
1953	3172.44	4.0	- 3.34
1954	2746.22	4.0	- 1.53
1955	3104.46	4.0	- 2.82
1956	3326.66	4.0	- 2.03
1957	3443.95	4.8	1.38
1958	2960.44	5.5	10.22
1959	3372.22	5.0	8.19
1960	3398.80	6.0	10.65
1961	3236.03	5.5	9.35
1962	3669.87	5.5	5.46
Wheat-Fallow Washington and Oregon			
1930	773.07	6.0	- 1.61
1931	243.42	5.5	- 1.98
1932	-0-	5.5	- 1.14
1933	-0-	5.5	- .08
1934	-0-	5.0	.21
1935	-0-	5.0	1.07
1936	203.42	4.0	2.27
1937	393.29	4.0	1.34
1938	65.07	4.0	.45
1939	195.16	4.0	.84
1940	397.40	4.0	.28
1941	869.19	4.0	2.50
1942	1643.83	4.0	3.17
1943	2285.78	4.0	4.45
1944	2533.15	4.0	4.20
1945	2345.75	4.0	4.01
1946	2043.49	4.0	9.99
1947	2319.57	4.0	8.19
1948	2537.23	4.0	10.84
1949	2224.04	4.0	5.22
1950	2642.04	4.0	7.03
1951	3224.46	4.0	8.39
1952	3390.44	4.0	7.43
1953	3590.12	4.0	7.93
1954	3083.18	4.0	7.08
1955	3494.65	4.0	1.33
1956	3667.21	4.0	2.90
1957	3644.32	5.0	8.13

Table 48--Continued

Year	Labor Salvage Value (Dollars)	Interest Rate (Percent)	Per Acre Residual Return (Dollars)
1958	3212.35	5.5	6.20
1959	3663.50	5.0	5.63
1960	3739.51	6.0	4.94
1961	3564.13	6.0	4.66
1962	4038.65	5.5	7.19
Northern Plains Cattle			
1930	680.36	5.7	.23
1931	214.22	5.5	- .23
1932	-0-	5.5	- .03
1933	-0-	5.5	.10
1934	-0-	5.0	- .39
1935	-0-	5.0	- .23
1936	179.02	4.0	- .43
1937	346.12	4.0	- .51
1938	57.27	4.0	.07
1939	171.75	4.0	.13
1940	349.74	4.0	.19
1941	764.95	4.0	.39
1942	1446.70	4.0	.81
1943	2011.64	4.0	.45
1944	2229.35	4.0	.35
1945	2064.42	4.0	.44
1946	1798.50	4.0	.73
1947	2041.38	4.0	1.28
1948	2232.94	4.0	1.18
1949	1957.31	4.0	- .04
1950	2194.90	4.0	.47
1951	2722.14	4.0	1.48
1952	2848.37	4.0	.47
1953	3081.66	4.0	- .03
1954	2653.75	4.0	.00
1955	3062.28	4.0	- .32
1956	3271.61	4.0	- .52
1957	3278.46	4.7	- .07
1958	2876.36	5.5	.49
1959	3293.60	5.0	.03
1960	3371.85	6.0	- .08
1961	3232.94	6.0	.23
1962	3616.70	5.5	- .27
Intermountain Region Cattle			
1930	747.17	5.9	.91
1931	235.26	5.5	.38
1932	-0-	5.5	.45
1933	-0-	5.5	.36
1934	-0-	5.0	- .65
1935	-0-	5.0	.82
1936	196.60	4.0	.98

Table 48--Continued

Year	Labor Salvage Value (Dollars)	Interest Rate (Percent)	Per Acre Residual Return (Dollars)
1937	380.11	4.0	1.08
1938	62.89	4.0	1.20
1939	188.62	4.2	.86
1940	384.08	4.0	1.15
1941	840.06	4.0	1.74
1942	1588.76	4.0	1.59
1943	2209.19	4.0	1.18
1944	2448.26	4.0	.92
1945	2267.16	4.0	1.44
1946	1975.08	4.0	2.11
1947	2241.84	4.0	3.06
1948	2452.21	4.0	3.84
1949	2149.51	4.0	1.83
1950	2459.59	4.0	3.03
1951	3092.98	4.0	5.69
1952	3251.98	4.0	3.17
1953	3472.51	4.0	.06
1954	2968.62	4.0	.10
1955	3379.46	4.0	- .13
1956	3555.88	4.0	.47
1957	3575.77	4.6	1.85
1958	3133.07	5.5	4.35
1959	3576.66	5.0	3.50
1960	3639.54	6.0	1.21
1961	3467.69	6.0	2.04
1962	3891.51	5.5	2.95
Northern Plains Sheep			
1930	680.36	5.7	.32
1931	214.22	5.5	- .03
1932	-0-	5.5	.09
1933	-0-	5.5	.47
1934	-0-	5.0	.11
1935	-0-	5.0	.20
1936	179.02	4.0	.04
1937	346.12	4.0	.23
1938	57.27	4.0	.21
1939	171.75	4.0	.44
1940	349.74	4.0	.40
1941	764.95	4.0	.72
1942	1446.70	4.0	.90
1943	2011.64	4.0	.71
1944	2229.35	4.0	.51
1945	2064.42	4.0	.73
1946	1798.50	4.0	.92
1947	2041.38	4.0	1.08
1948	2232.94	4.0	.98
1949	1957.31	4.0	.04
1950	2194.90	4.0	1.21

Table 48--Continued

Year	Labor Salvage Value (Dollars)	Interest Rate (Percent)	Per Acre Residual Return (Dollars)
1951	2722.14	4.0	2.84
1952	2848.37	4.0	.20
1953	3081.66	4.0	.16
1954	2653.75	4.0	.11
1955	3062.28	4.0	.02
1956	3271.61	4.0	.25
1957	3278.46	4.7	1.02
1958	2876.36	5.5	1.35
1959	3293.60	5.0	.47
1960	3371.85	6.0	.37
1961	3232.94	6.0	.21
1962	3616.70	5.5	.78