FACTORS INFLUENCING FARM REAL ESTATE VALUES IN KANSAS

by

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TABLE OF CONTENTS

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I wish to thank Dr. Frank Orazem, my major professor, not only for his encouragement and assistance in the preparation of this thesis but also for his guidance as my advisor during my undergraduate program.

My thank yous are extended to Dr. Arlo Biere and Dr. Norman Whitehair, as committee members, for their helpful suggestions and instructions that contributed towards the completion of this thesis.

It is hard to express the gratitude for the unselfish attitude and many lonely nights that my wife, Mary, endured during my program of study. So all I can say is thank you.

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Land is one of the most important assets in the United States, or for that matter, the world today. Land in the United States must fulfill increasing demands from a growing population and a continuously developing economy. The supply of agricultural land is subject to increasing pressure from urbanization, public installations, and facilities. Uses such as these are creating greater demands on available land, practically unheard of throughout most of our history.[1]

The most important claimant upon land today is agricultural since large amounts are needed for the production of food and fiber used to feed our domestic population. An additional portion of land put to agricultural use is needed for export. Thus far there have been sufficient quantities of land to meet the demands, and more than enough left over to fill the non-agricultural needs. Aided by the availability, conquest and development of frontier, and technological progress in production techniques, our agriculture has forcefully renounced the predicted Malthusian consequences of population growth.

The question arises - how long can we continue to meet the needs of our population, and more than likely an increased population, with the land available to us for use as an input for the production of agricultural commodities? There is a possibility that new technology will surpass the need to acquire additional land for use in agriculture, making more of it available

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[1]Howard W. Ottoson, Land Use Policy and Problems in the United States (Lincoln: University of Nebraska Press, 1963), p. 203.

for non-agricultural uses. Regardless of future outcomes, land will remain a very important resource for not only agricultural, but many other uses of our society. Therefore, it should be used wisely in order to obtain its optimum capacity, not squandered away as if the supply was unlimited.

The objective of this study is not to formulate a land use policy and therefore state how this resource should be allocated among competing alternative uses. Since land is a very important input not only for agricultural production, but for non-agricultural uses as well, it is useful to study factors that affect its value. Knowing the factors affecting land values would aid those buying or selling farm real estate, lending agencies who lend money for the purchase of farm real estate, and others whose decision-making abilities would be affected by this information.

Trends in Land Values in Kansas

The only published county data on land values in Kansas is provided every five years by the Census of Agriculture, the latest being 1969. This data shows an average value of $159 per acre in Kansas. In addition, the United States Department of Agriculture provides market information on farm real estate on March 1 and November 1 of each year. The Crop and Livestock Reporting Service provides information indicating trends in land values in various parts of the state, and other sources providing unofficial information. There still remains a need for more current and adequate information on farm real estate values as a consequence of the rapid changes that are taking place in the price of land.

With the exception of the three years ending March 1, 1950, 1954 and 1970, land prices in Kansas have increased every year since 1941 (see Figure 1 and Appendix Table 1). The Korean War appears to have raised the value of

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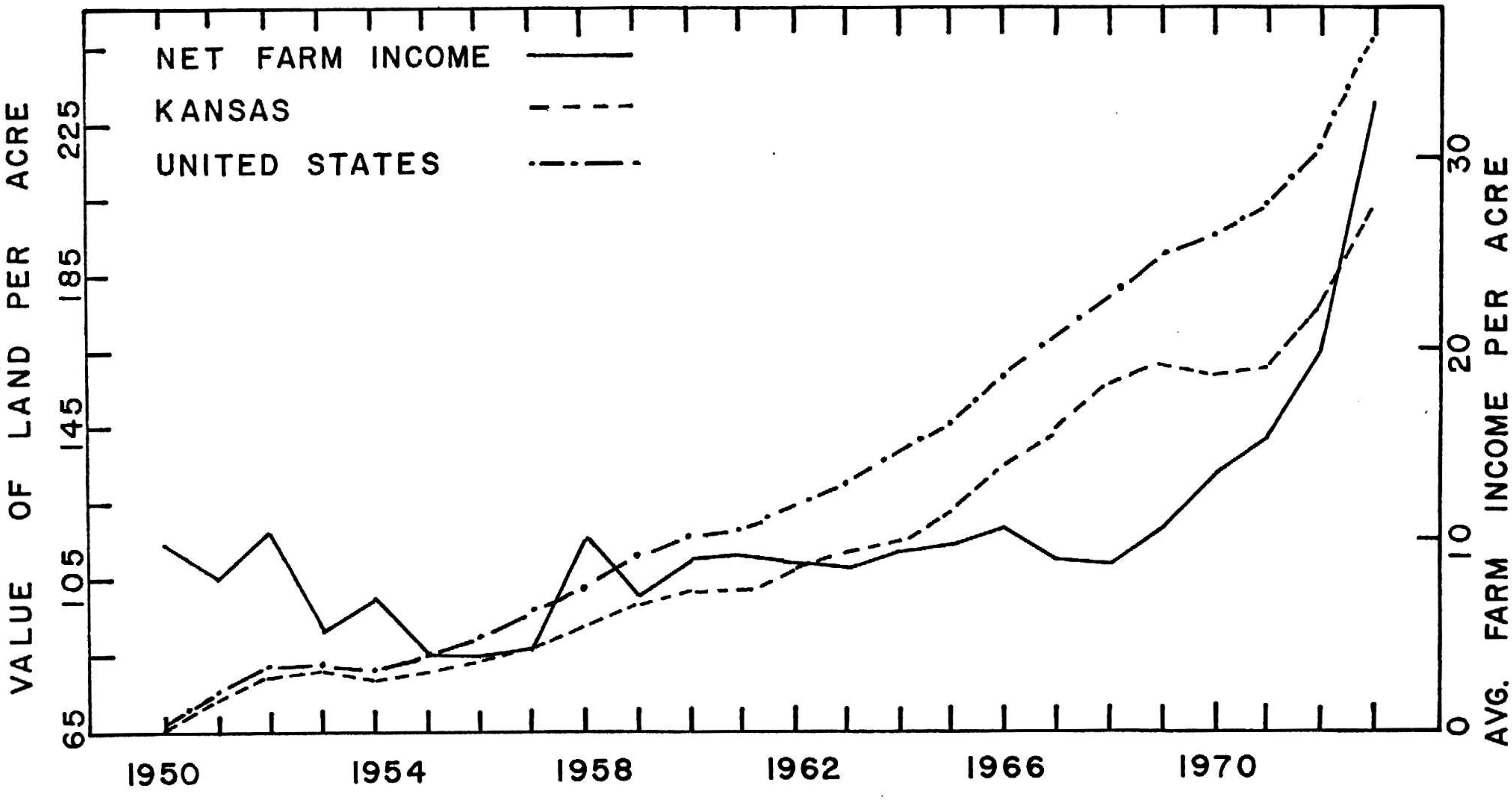
Figure I-1. Average Value of Land and Buildings per Acre for Kansas and U.S., and Average Net Income per Acre for Kansas, 1950-1973



land after a stabilizing period following the second World War. As can be seen in Figure 1 there was a sharp decline in net farm income in 1953, probably causing a slight decline in land prices in 1954. However, land prices in the mid-fifties were, in general, rising despite the fact that net farm income was down. Taxes on farm real estate in Kansas increased 60 per cent during the decade from 1950 to 1960, which may have affected the decrease in land prices during that decade. This study will show that property tax levels do have a regressive effect on land prices.

The decline from $162 in 1969 to $159 in 1970 might have been due to lower wheat and feedgrain prices, although it is doubtful that this was the only cause since farm net income per acre rose during the same period. There may have been a psychological effect present as a result of lower grain prices. However, the main reason for the decline was probably higher interest rates and a tight money policy at the time.

Following World War II there were great drops in the price of land; thus the upward trend after 1940 presented a completely different pattern. The three declining years mentioned above may have resulted from expectations of post-war declines in land prices. Analagous to the general economy as a whole, no depression or major recession occurred in which prices declined greatly.

> The 1974 average value of farmland increased 30.5 per cent from March 1, 1973 to March 1, 1974, which is the largest increase since land value data became available in 1912. The average value was $265, $62 above $203 on March 1, 1973.[2]

A letter published by the Federal Reserve Bank stated that:

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[2]W. H. Pine and R. R. Hancock, Trends in Land Values in Kansas (Unpublished research paper, Kansas State University, 1974), p. 1.

> Farmland values continued to rise sharply during the first quarter of 1974 according to nearly 750 Seventh District agricultural bankers. The average value of good farmland rose 12 per cent during the first quarter and was one-third higher than the year earlier level at the end of the quarter--both record increases. The latest survey results mark the seventh consecutive quarter in which the rate of advance in farmland values has surpassed the previous quarter.[3]

Crop prices, perhaps the most influential factor affecting farmland values, have been rising fairly rapidly during this and the previous period possibly accounting for a majority of the sharp rises in the value of farm real estate.

Regional Trends in Kansas

Accurate land prices for a small geographic area are difficult to obtain since the smallest breakdown is by counties, provided by the Census of Agriculture. Therefore, information on land values on small tracts or a particular kind of land such as irrigated, bottomland, or a particular type of pasture within a county is practically non-existent.

The semiannual information provided by the Crop Reporting Service will show trends in the values of farm real estate for areas of the state or groups of counties in the state. The number of reports from counties is not sufficient to measure a year-to-year land value on a county basis.

The values provided by the Crop Reporting Service are shown by Western, Central, and Eastern sections of the state,[4] Crop Reporting Districts, and type of farming area, Figures I-2 to I-10 and Appendix Tables 2 and 3. The

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[3]Terry Francl, Federal Reserve Bank of Chicago Agricultural Letter, No. 1271, April 26, 1974.

[4]The values shown for the Western, Central, and Eastern sections of the states are average values of the Crop Reporting Districts in that portion of the state.

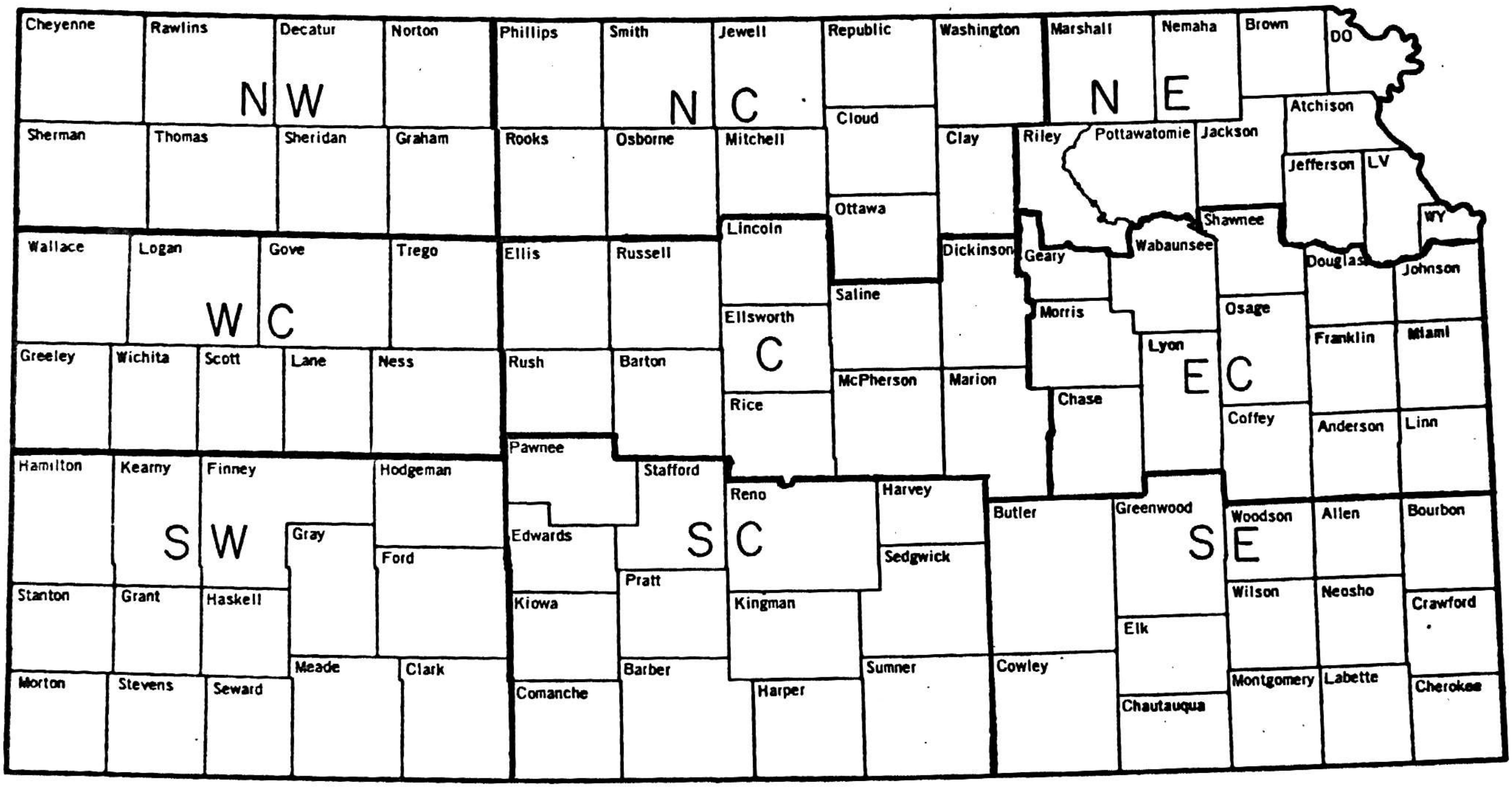


Figure I-2. Crop Reporting Districts of Kansas

Source: Kansas State Board of Agriculture, Report of the Board, Farm Facts, 1971-72. (Topeka, Kansas: Robert R. Sanders, State Printer, 1972), p. 27.

Figure I-3. Index Numbers of Values per Acre of all Land in Farms by Sections in Kansas, 1962-1974

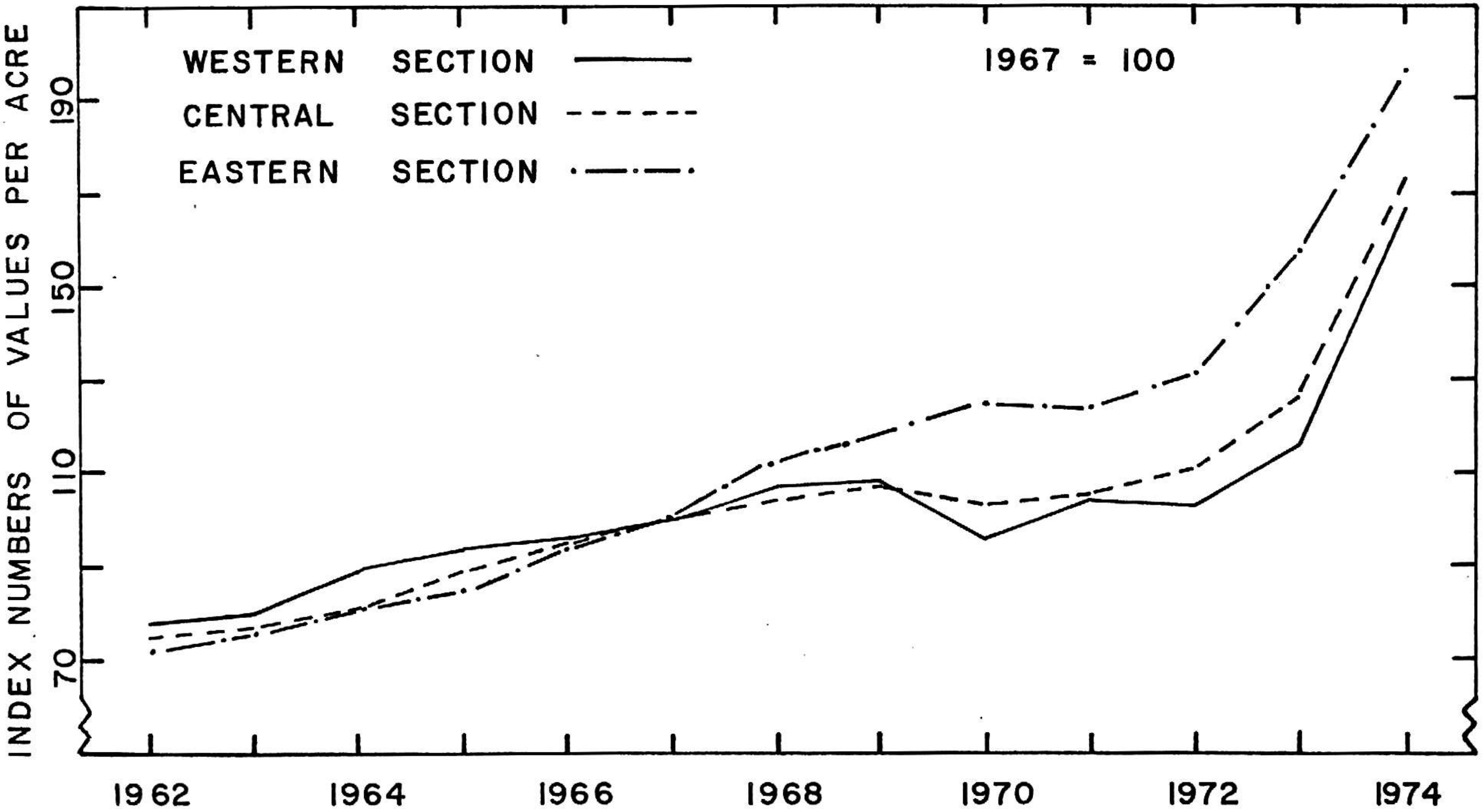


Figure I-4. Index Numbers of Values per Acre of all Land in Farms by Crop Reporting Districts in the Eastern Section of Kansas, 1962-74

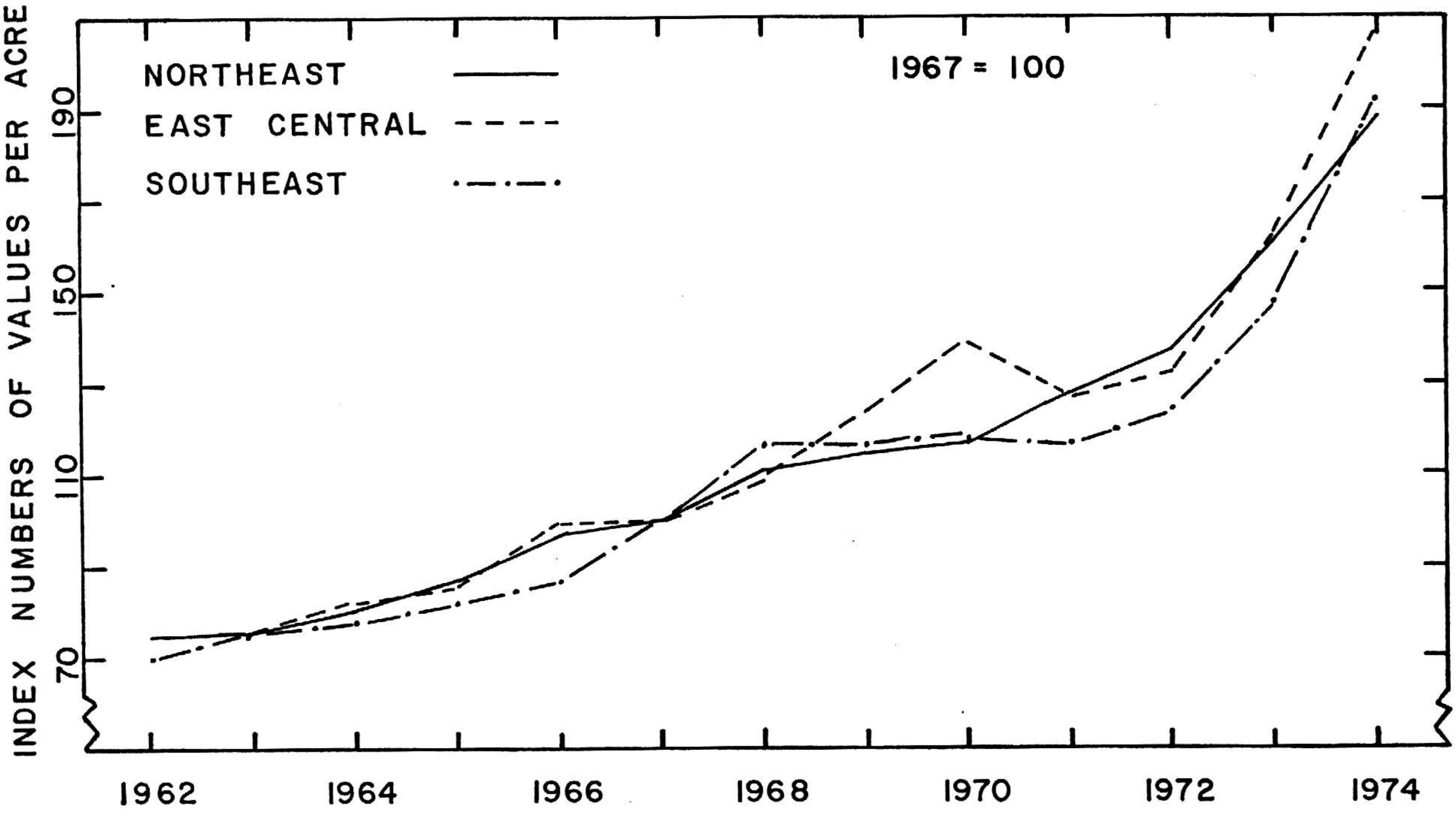


Figure I-5. Index Numbers of Values per Acre in all Land in Farms by Crop Reporting Districts in the Central Section of Kansas, 1962-74

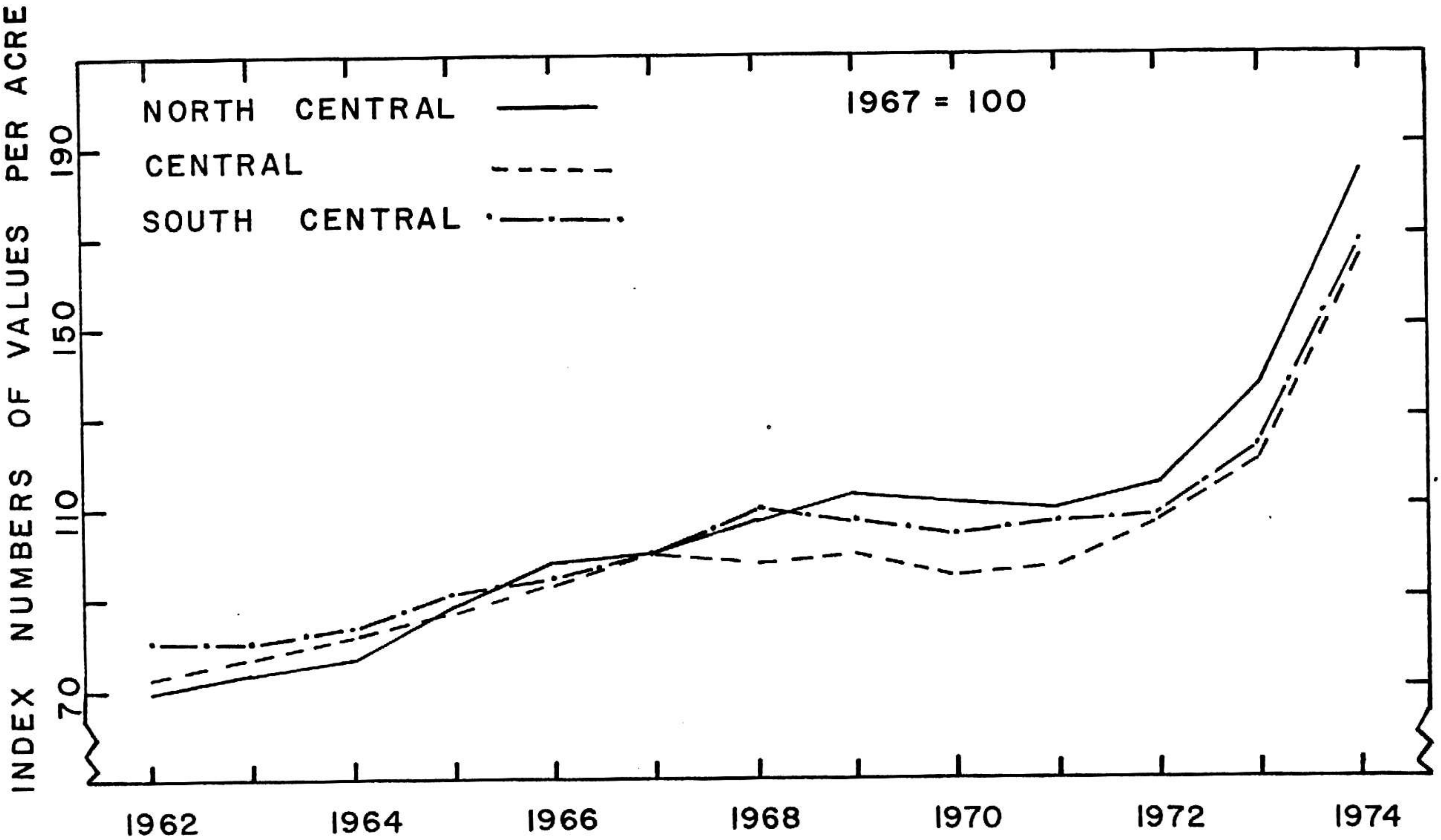


Figure I-6. Index Numbers of Values per Acre of all Land in Farms by Crop Reporting Districts in the Western Section of Kansas, 1962-74

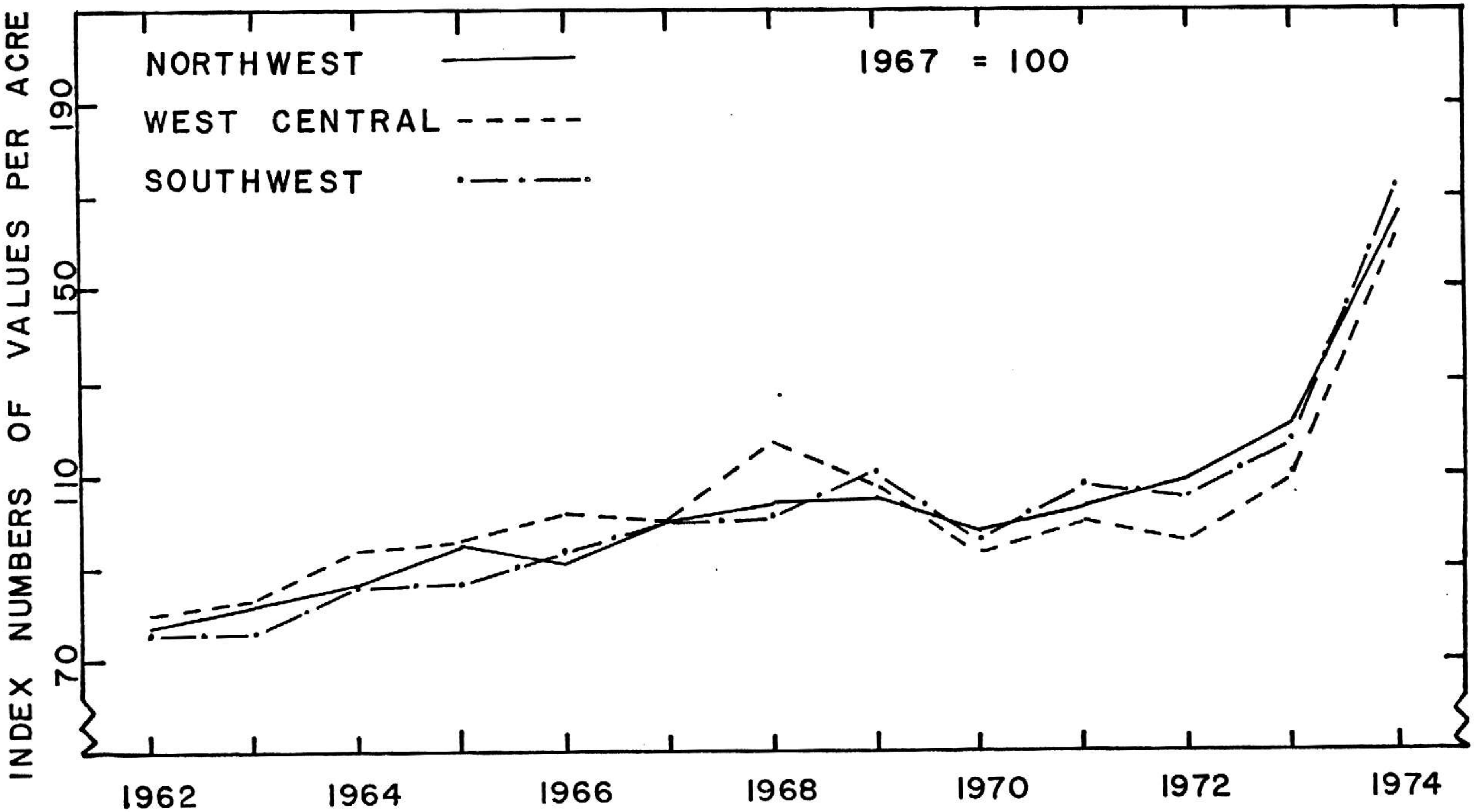


Figure I-7. Index Numbers of Values per Acre of Pastureland by Sections in Kansas, 1962-74

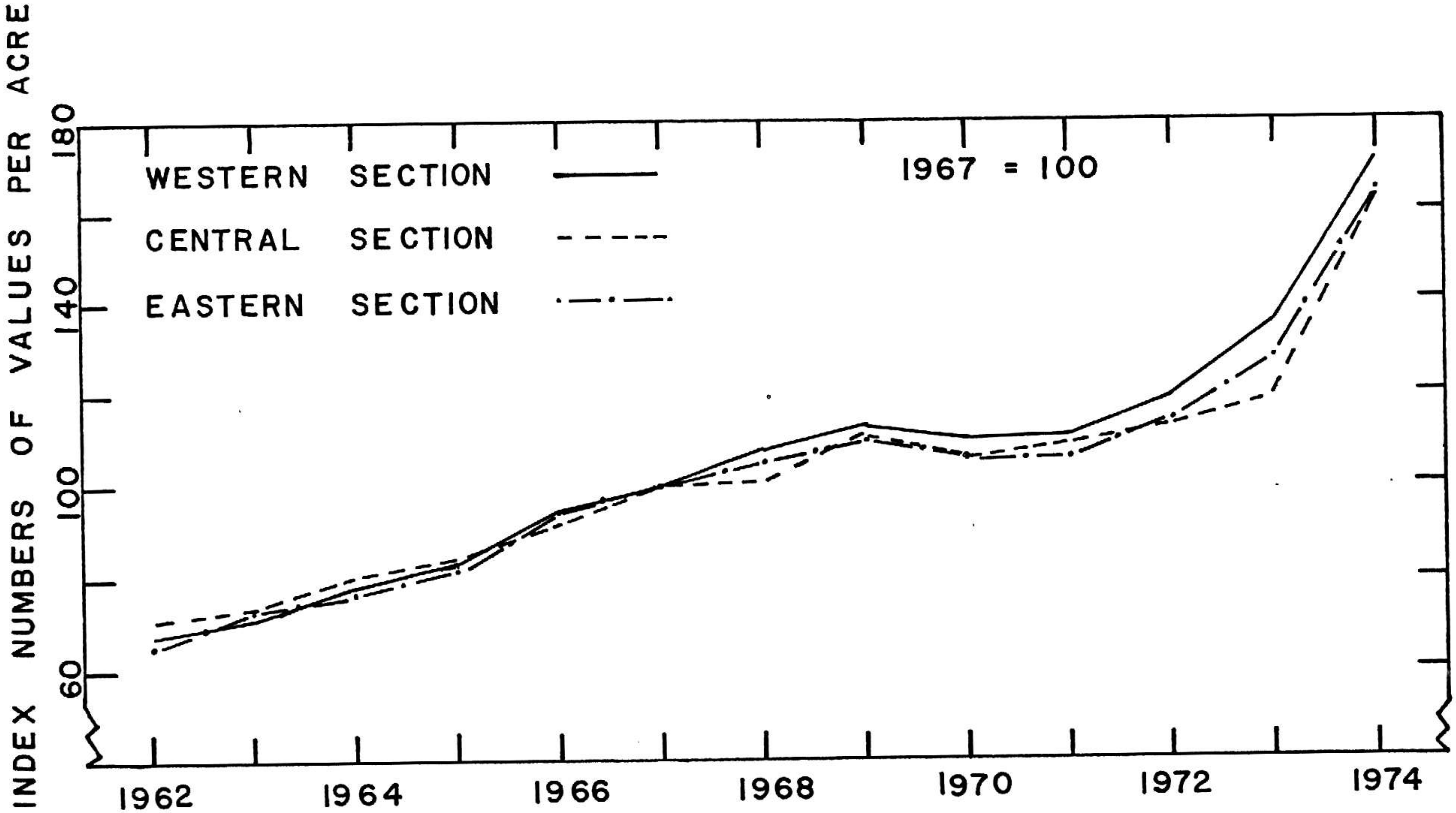


Figure I-8. Index Numbers of Values per Acre of Pastureland by Crop Reporting Districts in the Western Section of Kansas, 1962-74

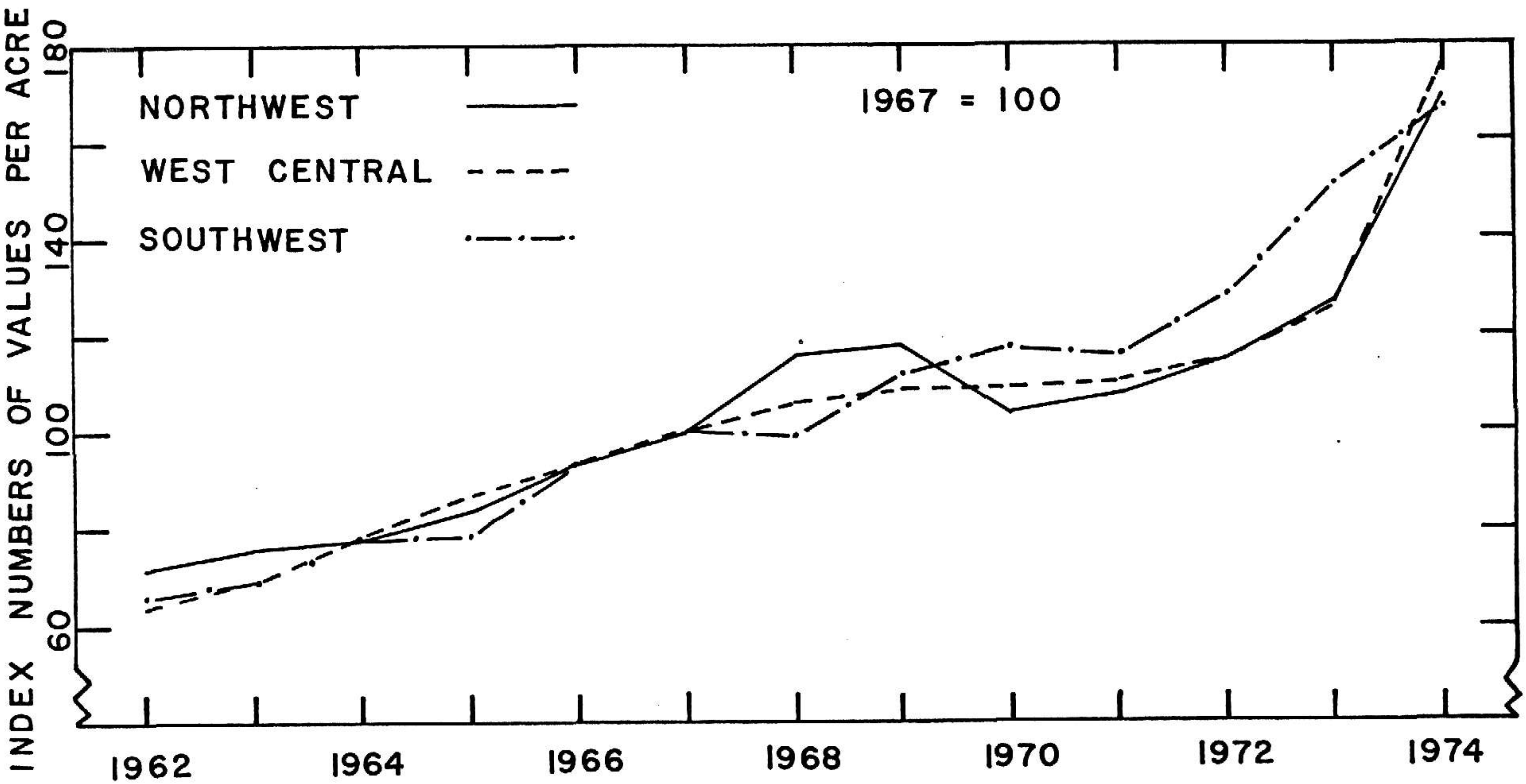


Figure I-9. Index Numbers of Values per Acre of Pastureland by Crop Reporting Districts in the Central Section of Kansas, 1962-74

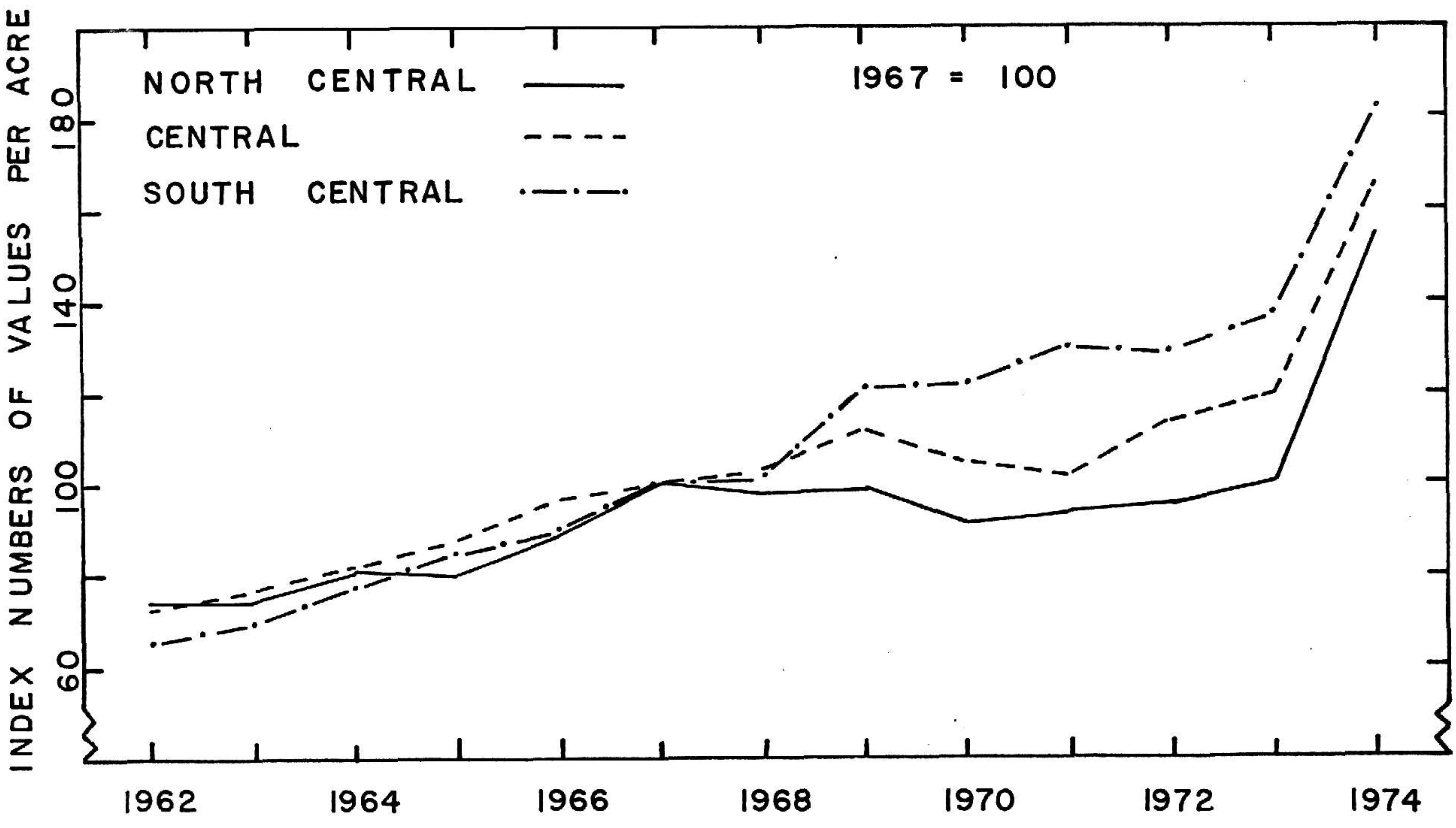
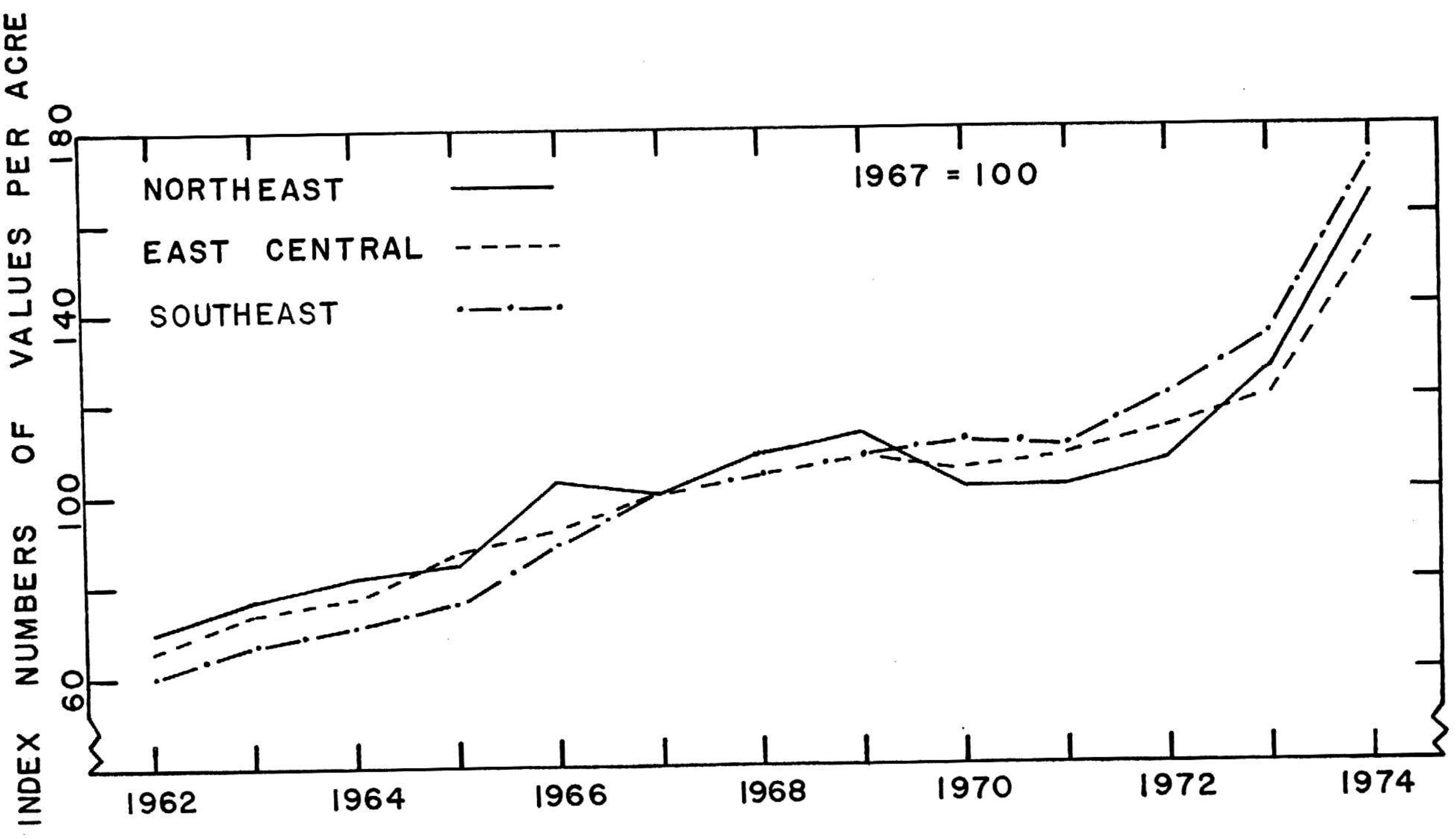


Figure I-10. Index Numbers of Values per Acre of Pastureland by Crop Reporting Districts in the Eastern Section of Kansas, 1962-74



values provided by the Crop Reporters have been converted to index numbers with 1967 as the base period (100) in order to show the respective trends within Kansas (Note Figure I-2 for the division of the state into the nine Crop Reporting Districts).

The approximate land values for 1967 that may be used with the index numbers for the Western, Central and Eastern sections of the state and the Crop Reporting Districts for converting to actual dollars are:

Western Section	$118
Eastern Section	$151
Central Section	$151
Northwest (NW)	$106
West Central (WC)	$111
Southwest (SW)	$137
North Central (NC)	$121
Central (C)	$157
South Central (SC)	$174
Northeast (NE)	$163
East Central (EC)	$151
Southeast (SE)	$138

The 1967 values may be used for computing a value for any of the years shown in the Appendix Table 2 - Index numbers of values per acre of all land in farms by sections and Crop Reporting Districts in Kansas.

Kansas farm real estate values have changed much more rapidly in some areas of the state than others during the last decade. In recent years the land values of the Eastern section of Kansas have undergone the greatest change. These have almost doubled the 1967 values. The East Central Crop Reporting District has more than doubled its land values since 1967. Part of this tremendous increase is due to the rapid expansion of urban areas, especially around the major metropolitan area of Kansas City. The value of farm real estate in the Central section of the state also has shown a rapid increase, although not as large as the Eastern section. This increase is also due to urban influence exerted by the rapid expansion of the Wichita area on neighboring counties. The Western section of Kansas has shown the least increase in farm real estate since 1967, although it is slightly more than one and a half times its 1967 value. Since this is the least populous area of the state, urban influence doesn't contribute the large effect it does in the other sections of the state. The major factor in the increase of farmland values in the Western section can be attributed to increased expansion of irrigation, livestock feeding, and the rise in prices received by farmers for their products.

The 1974 land prices in all areas of the state reflect one of the greatest increases on record for any one year in Kansas. Prior to the last few years, land prices in most areas of the state remained fairly stable from 1968 to 1971, especially in the Western and Central sections of the state.

CHAPTER II

REVIEW OF LITERATURE

Previously there have been only a few studies conducted on the factors that influence farm real estate values, and even fewer that incorporated a combination of both exogenous and endogenous variables. Until recently a majority of the studies were primarily concerned with the endogenous variables. There have been only a few isolated attempts to examine the non-farm determinants of farm real estate values, or to integrate the agricultural land market with the non-farm sector of the economy. The portion of these studies relevant to this paper will be reviewed below.

Schuh and Scharlach Study

The first study to be reviewed was conducted and published in 1966 by G. Edward Schuh and Wesley C. Scharlach of the Department of Agricultural Economics, Purdue University.[1] Their study was a regression model used for a cross-sectional analysis of land values in the state of Indiana.

Aggregate data on the 92 counties of Indiana were taken as individual units of observation. The data was measured as annual averages for the year of 1959, which was the most recent year in which substantial relevant data was available.

The following basic statistical model was used by Schuh and Scharlach:[2]

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[1]G. Edward Schuh and Wesley C. Scharlach, "Quantitative Analysis of Some Farm and Non-farm Determinants of Agricultural Land Values - Impact of Economic Development," Purdue University Agricultural Experiment Station, Purdue Univ., Research Bulletin 821, 1966, p. 7.

[2]Ibid.

$$y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + b_8x_8$$

where: y = Value of land and buildings per acre.

x_1 = Population density (persons per square mile).

x_2 = Specified farm expenditures per acre.

x_3 = Distance from Chicago.

x_4 = Farm wage rate.

x_5 = Property taxes.

x_6 = Land quality or capability.

x_7 = Fertilizer or plant food application per acre.

x_8 = Average size of farms in acres.

Modifications of this basic model were attempts to evaluate alternative measures of the hypothesized determinants of land values. The criterion used to discriminate among the independent variables was to select the data series that resulted in the highest level of significance for the estimated coefficient. When this does not discriminate, the data series yielding the highest coefficient of determination (R^2) was used.[3]

Table II-1 summarizes outcomes of models derived by the use of least squares regression analysis. By comparing the regression coefficients derived for each independent variable in the six different models, the effect a particular variable has on land values in Indiana is derived. For example, when property tax rate per \$100 of assessed valuation (X_5) was used in Model 1 instead of property tax rate per acre (X_6), used in the other five models, the coefficient for population density (X_1) was approximately one-third of that in the other models. This is partly due to the fact that the coefficient for the tax rate variable is not statistically significant in Model 1, while the

[3] Ibid., p. 7.

Table II-1. Schuh and Scharlach Regression Analysis Results on Indiana Agricultural Land.

	Model Number					
	1	2	3	4	5	6
x_1	.212a/	.600	.653	.560	.578	.649
	(.020)b/	(.204)	(.211)	(.200)	(.205)	(.214)
	.548c/	.093	.102	.085	.086	.100
x_2	2.059	1.875	1.868	1.792	1.761	1.987
	(.706)	(.688)	(.713)	(.681)	(.700)	(.701)
	.092	.081	.075	.076	.070	.088
x_3	-.334	-.354	-.338	-.315	-2.75	-.307
	(.060)	(.057)	(.060)	(.062)	(.064)	(.063)
	.271	(.311)	.274	.233	.180	.221
x_4	-5.640	-5.562	-5.399	-5.689	-5.653	-5.610
	(1.393)	(1.342)	(1.386)	(1.327)	(1.360)	(1.327)
	.163	.170	.153	.180	.170	.177
x_5	.019					
	(.059)					
	*					
x_6		-2.318	-2.650	-2.081	-2.202	-2.567
		(1.229)	(1.269)	(1.200)	(1.229)	(1.269)
		.041	.049	.035	.037	.047
x_7	66.094	63.408		62.994		62.579
	(7.477)	(6.693)		(6.140)		(6.140)
	.482	.517		.556		.556
x_8			2.486		2.518	
			(.281)		(.258)	
			.482		.532	
x_9				.072	.119	.058
				(.045)	(.045)	(.046)
				.030	.077	.019
x_{10}	.437	.610	1.152			
	(.580)	(.574)	(.569)			
	*	.013	.046			
x_{11}						.171
						(.150)
						.015
R^2	.878	.883	.874	.885	.879	.887
S	37.82	37.01	38.34	36.74	37.68	36.61

Table II-1 (Cont'd).

*Approximately zero.

a/Line 1 is the estimated net regression coefficient.

b/Line 2 is the standard error of the regression coefficient.

c/Line 3 is the partial correlation coefficients (x vs y)

Source: G. Edward Schuh and Wesley C. Scharlach, "Quantitative Analysis of Some Farm and Non-Farm Determinants of Agricultural Land Values - Impact of Economic Development," Purdue University Agricultural Experiment Station, Purdue University, Research Bulletin 821, 1966, p. 11.

Variable Identification for Table II-1:

y = Value of land and buildings per acre ($0.10)a/.

x_1 = Population density (persons per square mile).

x_2 = Specified farm expenditures per acre ($0.01).

x_3 = Distance from Chicago (millimeters on a standard road map where 1mm equals about .43 miles).

x_4 = Farm wage rate - U.S.D.A. ($0.001).

x_5 = Property tax per $100 of assessed valuation ($0.01).

x_6 = Property tax rate per acre (based on tax collections) ($0.10).

x_7 = Weighted index of land capability (Index figure to two decimal places).

x_8 = Top three land capability classes as a proportion of all eight classes (0.1%).

x_9 = Fertilizer application per acre (0.02 lb).

x_{10} = Plant food (N-P-K) application per acre (0.1 lb).

x_{11} = Average size of farms in acres (0.1 acre).

a/Units of measurement in parentheses.

coefficient for the tax collection variable (X_6) is significant in the other models. For a variable to be considered statistically significant, the estimated net regression coefficient should be at least twice as large as the standard error.

The failure of the tax rate per $100 assessed valuation ($X_5$), to yield statistically significant results may be attributed to two related factors: First, assessment procedures were highly arbitrary. The effective tax rate may be changed by altering the assessed valuation. Therefore, the tax rate per $100 assessed valuation provides very little information which can be determined as a measurement error. Secondly, the tax rate per $100 assessed valuation may be the wrong theoretical concept. When dealing with the price of land per acre, tax collections per acre may be the more relevant concept to apply.[4]

By noting the sign of all the regression coefficients, the effects that variable has on Indiana agricultural land values may be determined. For all the variables except distance from Chicago (X_3), farm wage rate (X_4), and property tax per acre (X_6), the coefficients maintain positive signs. Therefore, as the size of all except these three variables increases, the value of agricultural land also increases. Additionally, the larger the net regression coefficient, the larger will be the effect on agricultural land values.

The six models presented by Schuh and Scharlach produced very similar prediction patterns. Therefore, on the basis of the highest R^2 and the lowest standard error of estimate, Model 6 has the greatest power of explaining cross-sectional variation of land prices (Table II-1).

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[4]Ibid., p. 11.

Computed residuals, which are defined as the actual values minus the estimated values, will often show systematic patterns that suggest the addition of another variable. It was found in this study that the model tended to under-value poor land. Several reasons were presented for this tendency. First, the quality measure may not have included all of the dimensions of land quality for agriculture. It was based on capability of the soil to support agricultural crops. Therefore, other measurements such as actual agricultural productivity per acre might provide a more relevant indication of soil quality. Possibly certain classes of land should have been given higher weights.[5]

Thirdly, the pattern of residuals may reflect the way in which the variable was introduced into the model. The land quality variable was used linearly and the true relationship may have been curvilinear. Lastly, the values of the dependent variable - value of agricultural land - represented what farm residents considered land in their area to be worth, not the actual price obtained when ownership changed.[6]

Also in their analysis, the county with the largest under-prediction possesses unusually attractive scenic resources and is the site of a state park. Therefore, it would not be unreasonable to expect heavy demand for land as sites for motels, and various recreational facilities. Thus, these factors were not captured by other variables used in the model.

Hammill Study

Another study conducted by Ann E. Hammill uses two separate models, the first employing 1959 data and the second, 1964 data. This made it possible to

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[5]Ibid., p. 14.

[6]Ibid., p. 15.

estimate how well the model and variables used in 1959 would determined 1964 farm land values in Minnesota.[7]

The variables used in this study can be grouped into three categories: soil quality, local development, and location. Soil quality refers to the characteristics of soil that influence productivity. For this particular study they used a crop production value index in hopes of achieving closer approximation to soil quality as it influences productivity. Although they noted that a crop production index may have inherent weaknesses due to the degree of accuracy and dependability of that data included.

The crop production index was derived from data on acres, production and the prices for crops that were grown on 80 per cent of the county's acreage in 1959 and 1964. Production for each crop was multiplied by average prices for the specific years, then divided by total acres, thus obtaining a value figure per acre per county. This crop production value index was expected to represent the cropping pattern that would yield the highest profits for each county. Thus, management considerations are included implicitly, as are weather conditions that influence crop production.[8]

As a second soil quality variable, cropland as a percentage of all lands in farms, was used to ascertain the influence on farm real estate values of the amounts of farmland suitable for crops as opposed to farmland in forests or other uses.

The variable used for local development was local growth, defined as

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[7]Ann E. Hammill, "Variables Related to Farm Real Estate Values in Minnesota Counties," Agricultural Economics Research, Vol. 21, No. 2, USDA, April 1969, p. 45.

[8]Ibid., p. 46.

local economic activity indicating purchasing power, local pressures for land, and population densities. This variable was expected to indicate concentrations of non-farm people with the largest percentage representative of the most business development, greatest pressures for rural land and the highest incomes.[9]

The variable used for location was the distance from the center of the county to a standard metropolitan statistical area divided by the population of this area. Their purpose in doing this was to account for the size of the city plus the distance from it.

To evaluate the relationship among farm real estate values, soil equality, local growth, and location in Minnesota, all counties where the rural farm population accounted for at least 25 per cent of the total population were studied. The resulting count was 77 out of the 96 counties in Minnesota.

The following multiple linear regression was used for the 1959 data:[10]

$$y = a + bX_1 + bX_2 + bX_3 + bX_4$$

where:

y = Farm real estate values per acre in dollars.

x_1 = Population/distance.

x_2 = Crop production value index.

x_3 = Percent cropland of total land in farms.

x_4 = Percent rural non-farm, plus urban.

The results of this multiple linear regression model are presented in Table II-2. By noting the table it can be seen that the signs of all the

[9]Ibid., p. 47.

[10]Ibid., p. 46.

coefficients are positive, which means that any increase in the size of the variables will increase farm real estate values in Minnesota. The most important variable affecting farm real estate values was the percentage cropland in the total land in farms. The population/distance variable was the next in importance, while the crop production value was third. The per cent rural non-farm plus urban was of little significance in explaining farm real estate values. When all the variables, except percent rural non-farm plus urban were used, the R^2 only decreased one percent from 71 per cent to 70. Therefore, the per cent rural non-farm plus urban variable was not significant in explaining the variance of farm real estate values.

Table II-2. Results of Regression Relating Four Variables to Farm Real Estate Values in Minnesota Counties, 1959.

Variable	Regression Coefficient	Standard error	t value	Partial correlation coefficient
Population/distance	.0227	.0051	4.48[a]	.49
Crop Production Value Index	.0150	.0073	2.06[b]	.25
Percent cropland of total land in farms	2.7726	.3504	7.91[a]	.71
Percent rural non-farm plus urban	.0077	.0072	1.08	.13

R^2 = .71

a/Significant within .05 limit
b/Significant within .01 limit

Source: Anne E. Hammill. "Variable Related to Farm Real Estate Value in Minnesota Counties," Agricultural Economics Research, Vol. 21, No. 2, April, 1969, p. 46.

Hammill then tested to see if the three variables - population/distance, crop production value index and percent cropland of total land in farms would explain 1964 farm real estate values as well as they did the 1959 values.

The results obtained from the 1964 regression model are presented in Table II-3. In the 1964 model the population/distance variable remained constant and the remaining two variables were reconstructed to represent 1964 values. The same procedure was followed concerning the counties studied: only those in which rural farm population of 25 percent or more were included. This totaled eight less counties than in the 1959 model.

Table II-3. Results of Regression Relating Three Variables to Farm Real Estate Values in Minnesota Counties, 1964.

Variable	Regression Coefficient	Standard error	t value	Partial correlation coefficient
Population/distance	.0263	.0035	7.25[a/]	.71
Crop production value index	.0200	.0029	6.91[a/]	.68
Percent cropland of total lands in farms	2.2612	.2530	8.94	.77

R^2 = .898

[a/]Significant within .01 limit.

Source: Anne E. Hammill, "Variables Related to Farm Real Estate Values in Minnesota Counties," Agricultural Economics Research, Vol. 21, No. 2, April 1969, p. 49.

Results of the 1964 model with an R^2 of .898 indicate that this equation explains more of the variation in farm real estate values than did the 1959 model. The coefficients of the two models are very similar (see Tables II-2 and II-3).

They hypothesized the higher R^2 in 1964 was a result of the reduction in the number of counties in the study. The counties studied were believed to be similar in characteristics and therefore subject to a higher degree of explanation provided by the independent variables. However, when the validity of their hypothesis was checked by running a regression employing the 1959 data, the same variables and counties used for the 1964 data, and an R^2 of .69 were obtained. Therefore, those additional eight counties excluded in 1964 probably had little effect on increasing the R^2.[11]

It is evident that between 1959 and 1964 the importance of the population/distance variable and the crop prodictuion value index relative to farm real estate values increased substantially as indicated by the respective "t" values and the partial correlation coefficient. The regression coefficient for the crop production value index increased slightly in 1964 and became significant at a higher level of .01.[12]

In this cross sectional study no attempt was made to consider changes in prices, technology, or other factors that would influence farm real estate values over time.

Pasour Study

A study conducted by E. C. Pasour, using a regression model emphasizes the impact that property tax levels may have on farm real estate values in North Carolina.[13]

There is a general agreement among economists that increases in property tax levels on farm real estate are capitalized into lower property values. To what extent this may be true is not known. Therefore, it was Pasour's main purpose to provide information concerning the relationship between changes in the level of property taxes and the value of farm real estate in North Carolina.

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[11]Ibid., p. 49.

[12]Ibid.

[13]E. C. Pasour, Jr., "Real Property Taxes and Farm Real Estate Values: Incidence and Implications," American Journal of Agricultural Economics, Vol. 55, No. 4, (November, 1973), p. 549.

The value of farm real estate was regressed on the tax rate and a group of other variables that was expected to influence farm real estate values in North Carolina. Four categories of independent variables were used that were related to urban influence, agricultural productivity, farm size and recreational demands.

Observations for this study were on a county basis for North Carolina. The dependent variable was the average value per acre of farm real estate per county.

The following model was formulated by Pasour:[14]

$$y = f\ (x_1,\ x_2,\ x_3,\ x_4,\ x_5,\ x_6,\ x_7,\ x_8,\ x_9)$$

where:

y = Average county value of farm real estate in North Carolina, per acre, 1969.

x_1 = Effective property tax rate in dollars per hundred dollars assessed value on an annual basis by county, 1969.

x_2 = Percentage change in population from 1960-70 by county in North Carolina.

x_3 = Population per square mile by county in North Carolina, 1970.

x_4 = Cropland as a percent of total farmland by county in North Carolina, 1969.

x_5 = Average market value of crops and forestry per acre of land in farms by county in North Carolina, 1969.

x_6 = Average market value of all other agricultural products sold per acre of land in farm land for each county in North Carolina.

x_7 = Average size farm by county in North Carolina, in acres, 1969.

x_8 = Dummy variable for counties located in Western North Carolina.

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[14]Ibid., p. 551.

x_9 = Dummy variable for coastal counties in North Carolina.

All variables except x_1 and x_7 (tax rate and average farm size) were in linear form. Variables x_1 and x_7 were expressed in log form, which increased the explanatory power.

The economic model just presented was estimated by ordinary least squares regression using cross sectional data. There were 83 observations.

The following equation was estimated:[15]

$$y = 293.51 - \underset{(-2.61)}{74.02 \log x_1} + \underset{(2.81)}{1.97x_2} + \underset{(2.22)}{0.34x_3}$$

$$+ \underset{(2.87)}{1.97x_4} + \underset{(8.87)}{1.99x_5} + \underset{(3.27)}{0.50x_6} \underset{(-2.36)}{-47.91 \log x_7}$$

$$+ \underset{(5.55)}{109.10x_8} + \underset{(1.07)}{17.47x_9}$$

The "t" values for each regression coefficient are shown below the coefficient. All variables except x_3 and x_9 are significant at the .01 level. Whereas x_3 is significant at the .02 level, x_9 is not significant at a generally acceptable probability level. With an R^2 of .72 the variables explain almost three-fourths of the variation in the per acre values of farm real estate between the various counties of North Carolina.

The coefficients of the effective property tax rate (x_1), shows that a 10 percent increase in the effective property tax rate is associated with a \$7.40 per acre decrease in the average value of farm real estate. This means farm real estate values will decrease by about \$7.40 per acre when the effective local property tax is increased from \$1.00 to \$1.10 per \$100 assessed valuation. This result shows that long-run capitalization of property tax

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[15]Ibid., p. 552.

differentials on farm real estate in North Carolina does occur.[16]

The coefficient for each of the urban influence variables, x_2 and x_3, was positive. This indicates that any increase in these variables will result in an increase in the value of farm real estate in North Carolina.

All of the productivity variables, x_4, x_5 and x_6, had positive signs. Therefore any increase in them will be associated with an increase in farm real estate values in North Carolina as well.

The variable for average size farm (x_7) was inversely related to the average value of farm real estate. Thus, as the average farm size of a county increases, the average value of farm real estate in that county will decrease. The explanation for this may lie in the fact that as farm size increases, the ratio of the value of improvements to land and dwellings rises for smaller farms.

The dummy variables, x_8 and x_9, were included to compensate for the intangible factors related to recreational opportunities which were believed to cause farm real estate values to be higher in coastal and mountainous areas of North Carolina. The coefficient for the dummy variable for counties located in Western North Carolina (x_8) indicates that average farm real estate values are about \$110 higher per acre in Western North Carolina after adjusting for farm size, economic productivity, agricultural tax rates and other variables included in the equation. The coefficient of the dummy variable for the coastal counties in North Carolina (x_9) was not significantly different from zero. This was to be expected, according to Pasour, because much of the agricultural land in the coastal counties is not well situated for recreational

[16]Ibid., p. 553.

uses.[17]

The results of this study are consistent with the belief that property taxes levied on land are largely capitalized into lower land prices. The results also indicate that the effect of property tax relief for farmers will vary depending on the farm size and the extent of capitalization of property taxes levied on farm real estate in relation to other forms of real estate.[18]

Property taxes are not as important in financing local government in North Carolina as in some other states. Therefore, the effect of property tax relief elsewhere may have more impact. Property taxes represent an important production cost to farmers, thus the relationship between property taxes and farm real estate becomes important. Information regarding this relationship is required to assess the effects of specific policy alternatives such as substitution of income or sales taxes for real property taxes or preferential taxation of agricultural land.[19]

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[17]Ibid., p. 553.

[18]Ibid., p. 556.

[19]Ibid.

CHAPTER III

FACTORS AFFECTING LAND VALUES

Farmland may be bought or sold for a number of reasons. A few are directly related to farm income, but many factors come from outside agriculture. For a complete picture of all the factors affecting farmland values, both of these areas must be considered. If only those factors within agriculture (endogenous factors) or only those factors outside agriculture (exogenous factors) are considered, the picture is only partially complete.

Endogenous factors affecting land values.

Farm Enlargement: Four of five farm real estate transfers in the Northern Plains states, Kansas being one, were purchased for farm enlargement. This percentage has remained relatively constant since 1960. If a farmer has labor and machinery which are not being fully utilized, he can then acquire additional land with the added costs being seed, fuel, fertilizer, taxes and a few other minor variable costs. The net income per acre for the added acquired land is greater than for the farm as a whole. Thus, he can justify paying more per acre for expansion land than for an entire farm because fixed costs are spread over more acres.

Also the increasing value of farm buildings tends to shift the advantage in favor of the prospective buyer, who already owns a farmstead. He can bid more for the land because his purchase price for additional land is his total cost, whereas a competing buyer who desires to live on the farm as an owner-operator must reckon with the fact of a substantial additional investment in buildings. The purchase price is not his total cost of acquiring the farm.

This suggests that farm-expansion buyers can pay more for supplemental land, not necessarily because the land will increase the scale of operation, but because they need not reckon with building costs. For they are not only spreading their labor and machinery over additional acres, but also their buildings.

During the last ten years, 1963-1973, the average farm in Kansas has increased from 500 to 600 acres.[1]

Farm Technology: Farm technology has a tendency,or at least has in the past years, to inflect opposing effects on land prices. Mechanical innovations such as specialized expensive machines often require large farming units to achieve scale economies, which reduce cost per unit of output resulting in an increase in net returns. Effort to secure sufficient acreages to achieve size economies tend to raise the value of farm real estate.

Biological innovations on the other hand probably cause a secular decline in land prices, providing other things are equal. Direct and indirect population pressures for more farmland and higher land prices are offset by substitution of fertilizer, better hybrids, chemicals, irrigation and other capital inputs for land. In 1963 it was believed that application of 9.5 million tons of fertilizer nutrients had the same results as an added 142 million cropland acres.[2]

The effect on land prices of decreasing production costs through innovation or scale can be quite different at the micro (firm) and macro (national)

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[1] W. H. Pine and R. R. Hancock, "Trends in Land Values in Kansas," (Unpublished Research Paper, Kansas State University, 1974), p. 6.

[2] Luther G. Tweeten and Ted R. Nelson, "Sources and Repercussions of Changing U.S. Farm Real Estate Values," Oklahoma State University Experiment Station, Oklahoma State University, Technical Bulletin, T-120, April, 1966, p. 23.

levels. The buyer, concerned only with the short-run micro level of an impact of increased farming efficiency, can easily be misled into overpricing land.

The macro effects become increasingly important as technology becomes generally adopted. The problem is that farmers acting as individuals view increasing productivity as justification for considerably higher land prices. Thus, as many farmers follow this pattern, improved technology results in lower rather than higher farm real estate prices, other factors held equal. Farmers who do not recognize this macro relationship, and especially the late adopters who are unable to reap income gains before the macro effects come into being, can quite easily endanger their equity by paying too much for additional farmland. It is believed that last year (1973) this macro effect was cushioned to a good degree by the increased demand for agricultural products and resulting higher prices for farm products. Therefore, as long as demand continues to be high, land prices will not suffer from increases in technology.

Property Taxes: In the last few years property taxes on farm real estate have become a central issue. There has been a great deal of pressure coming from both the agricultural sector and the non-agricultural sector for property tax relief especially in rapid urbanizing areas. Little information is available, however, concerning the potential impact of property tax relief for farmers in relation to other property owners.

The extent, if any, to which property tax changes are capitalized into land values for the owner of any form of real estate will depend upon the amount of real property he holds. Sometimes the effect will be on the value of the property owned or, in other cases, the major effect will be on rents charged. Among economists there is general belief that increases in farm real estate property taxes are capitalized into lower property values. To what extent is uncertain because only a few isolated studies have been done to determine the actual effect.[3]

Since property taxes are very important in Kansas for the financing of both schools and local governments, little attention has been paid to the incidence of property taxes levied on farm real estate. Results are very limited and inconclusive.

The theory of tax incidence suggests that taxes on land cannot be shifted. Under competitive conditions the tax can only be shifted when the quantity of land supplied is decreased when the tax is imposed. If the supply of land is inelastic as typically assumed, the property tax will be capitalized and the value of land decreased. But if the supply of improved land is not completely inelastic, which is the present opinion of some land economists, a tax on land will not be fully capitalized into lower land values. If existing land owners attempt to maintain the pre-tax price of land (this is assuming the supply of land is perfectly inelastic), the result will be excess land supplied and there will be downward pressure on land prices until the tax is fully capitalized. Although the tax is fully capitalized, an increase in property taxes will not necessarily decrease land values. For example, the proceeds of the tax may be used for public services, which may increase land values and offset the tax capitalization.[4]

From prior studies in Kansas the incidence of property taxes levied on farm real estate cannot be determined. Although it appears that property taxes

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[3]E. C. Pasour, Jr., "Real Property Taxes and Farm Real Estate Values: Incidence and Implications," American Journal of Agricultural Economics, Vol. 55, No. 4 (Nov. 1973), p. 549.

[4]David H. Hyman and E. C. Pasour, "Real Property Taxes, Local Public Services, and Residential Property Values," Southern Economic Journal, Vol. XXXIX, No. 4 (April 1973), p. 601-611.

levied in Kansas are to some extent capitalized into lower property values. Due to the structure of the market for agricultural products, prices being determined mainly by conditions of national and international markets increase property taxes which cannot be passed on by producers in the form of higher prices for products produced by them.

Land Quality and Farm Income: These two interrelated factors are included under one heading because income from an acre of farm real estate is dependent on the quality of the land. Also, land quality will dictate the type of production that can be successfully conducted on that particular type of ground. Major problems of classification of land arise because of the difficulty of developing an autonomous measure of land quality. Therefore, it is much easier to classify land by the income generated from it.

Since land is a resource, it has worth in the value of goods or services it produces or is expected to produce. Usually land is capable of producing an income year after year and perhaps forever, if utilized correctly. The present value of land is the sum of future incomes discounted back to the present. Buyers and sellers must estimate what they consider to be the value, differing among them according to how they discount it.

In Kansas land prices followed income per acre only approximately (note Figure I-1). From 1950 to 1957 land prices moved up slowly while income was generally on a downward trend. From 1958 to 1968 land prices rose significantly while income fluctuated but did show an upward trend. Since 1968 income appeared to lead the increase in land prices. The drop in land prices in 1969-70 followed two relatively low income years of 1967 and 1968. The influence of current and past income on expected income and land prices is not easily determined.[5]

Generally, it can be stated that when income is on an upward trend, land prices will also tend to increase, although lags between the two do often occur. Also, since production goes hand in hand with income, increased production per acre (which could be due to many variables, i.e., fertilizers, irrigation, or other capital intensive investments) will increase farm real estate values.

In summary, variables associated directly with agricultural endeavors depend a great deal on production, costs, and the demand of those presently engaged in agricultural production for more farmland to expand. Increases in demand for agricultural products will lead to higher farmland values as long as production costs do not increase as rapidly.

Exogenous factors affecting land values.

Population: A growing population expands demand for land indirectly through increased food requirements and directly through conversion of farmland to urban housing, roads, airports, industry expansion, etc. Improvements in diets, and changes in tastes and preferences, which include a desire for more animal products, will require more land resources per capita unless offset by higher yields. Other things being equal, greater food requirements would be expected to increase land demand and therefore farm real estate values.

A comprehensive study conducted by the U.S. Department of Agriculture, of land resources and the predicted needs, estimates that 15.8 million acres will be shifted to urban and built-up uses between 1958-1975. This is equal to more than the combined area of Rhode Island, Delaware, Hawaii, Maryland

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[5] W. H. Pine and R. R. Hancock, "Trends in Land Values in Kansas," (Unpublished research paper, Kansas State University, 1974), p. 4.

and New Jersey. But the long-run urban requirements are more impressive. Assuming an annual growth rate of 1.6 percent and direct urban land requirements of .1 acres per person, all U.S. land would be utilized in 300 years.[6]

It is a proven fact that farm real estate located close to large population centers has a higher value than farm real estate in areas where the population densities are not as great. Near major metropolitan areas the influence of speculation for future non-agricultural uses may extend to 100 miles, having a definite effect upon farmland values. Also, land in the approximate location of good recreational areas commands a higher value because of the attraction it offers the general public. Examples of these areas are lake fronts, national or state parks, coastal areas, mountainous areas or any other place that attracts the attention of people looking for places for homes or just places to visit.

In recent years there has been a yearning by John Q. Public for a place to live in the open country with fresh air, sunshine and recreation, or a few acres to hobby farm. Thus this idea of owning a few acres appears to influence many buyers, affecting an increase in land prices in some areas. Although this is a known fact, the influence is hard to measure and it will vary from area to area.

As a generalization it can be said that the urban population has a large effect on farm real estate values, especially those areas located near metropolitan areas.

Foreign Markets: Recent increased foreign demand for U.S. farm products can

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[6] Luther G. Tweeten and Ted R. Nelson, "Sources and Repercussions of Changing U.S. Farm Real Estate Values," Oklahoma State University Experiment Station, Oklahoma State University, Technical Bulletin, T-120, April, 1966, p. 22.

be partially credited for the rising price of farm products. Agricultural exports have more than doubled from 1969 to 1973. The large purchase by the Soviet Union of grain and the large increase of purchases by Japan and other countries nearly eliminated the large surpluses, exerting an upward pressure on farm product prices. Thus, foreign trade is responsible in some part for the recent increase in farm real estate values.[7]

Inflation: Although farm real estate values and the indicators of inflation in the U.S. economy have not always moved in the same direction, inflation is believed to be a major determinant of the increase in farm real estate values. Since the value of farmland is expressed in monetary terms, the value of farm real estate is embodied in the dollar value of the asset. If, for instance, the dollar value of farmland were to remain constant while inflation occurred for the rest of the economy, it would mean the dollar value of farm real estate had decreased.[8]

During inflation periods, farm real estate is one commodity that attracts monetary interest. The reason being that people seek investment opportunities that hopefully will grow as rapidly or more rapidly than the rate of inflation in order to hedge against the decrease in the value of the dollar. In recent years land has served well for this type of investment. Thus, some hold the view that farm real estate is a tax haven and a store of value against the effects of inflation.

Due to the fixed nature and diminishing quantity of available farm

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[7]W. H. Pine and R. R. Hancock, "Trends in Land Values in Kansas," (Unpublished research paper, Kansas State University, 1974), p. 5.

[8]Danny A. Klinefelter, "Factors Affecting Farmland Values in Illinois," Illinois Agricultural Economics, Vol. 13, No. 1 (January, 1973), p. 27.

real estate, coupled with increasing demand for alternative uses, it may be assumed that the real value of farm real estate has not declined. Thus, it can be hypothesized that inflation has a positive effect on farm real estate values.

Other Factors: Some non-farm people view farm real estate as a desirable long term investment often causing them to pay such higher prices that returns in alternative investments would be greater. But increases in the value of farm real estate have made these very attractive investments.

All the factors mentioned in this chapter contribute to the changes and trends in farm real estate values. Some have more influence than others which is to be expected. The effects of some factors are easily measured, while the effects of others are almost impossible to measure.

In general, farmland values are the sum of expected income that may be obtained through ownership and control of the resource, properly adjusting for their distance in the future, and for the possibility they might never occur, or may occur in some weakened form. Therefore, it holds that the higher the expectations of returns from farm real estate by buyers and sellers, the higher will be the value of this resource. Also, the more confidence in these returns, the higher will be the asking and reservation price.

CHAPTER IV

THE MODEL

An ordinary least squares regression model was set up to examine the cross sectional variations in farm real estate values in Kansas at a particular point in time.

Aggregate data on the 105 counties of Kansas were collected and used as individual units of observation. The 1969 value of farm real estate and buildings per acre was used as the dependent variable, since it is the latest published county data available. The Census of Agriculture, which is taken every five years, provides the only county data that is published. The statewide average was $158.78 per acre and ranged from a low of $85.44 per acre in Logan county to a high of $701.86 per acre in Wyandotte county.

Data for the independent variables was drawn up and placed in categories to represent the factors believed to influence farm real estate values described in Chapter III. The five original categories or areas were urban influence, agricultural productivity, farm size, property taxes, and recreational demand.

Two variables, percentage change in population from 1960 to 1970 by county and population per square mile by county, were used to describe the urban influence on population affecting farm real estate values. It was hoped that these two variables would adequately represent economic growth or development in the respective counties of Kansas. In an aggregate model it is difficult to quantify the various factors associated with economic development into meaningful variables for statistical analysis. Other variables are also likely to be relevant, such as the amount of industrialization and the level of income.

To keep the problem manageable, it is necessary to summarize these factors in as few variables as possible. As a result, it was decided that population density and the percentage change in the population of the county from 1960 to 1970 would be sufficient to characterize the urban influence factor.

The population density was obtained by dividing the 1972 county population by the total square miles of the county. Population per square mile is a good indicator of the non-farm demand for farm real estate for all purposes, including sites for industry, businesses, residences, public utility installations, and transportation. Also it is a good indicator of the level of economic activity in that area. Thus, within the model there is a variable that will present a good estimate of the current level of development. The second variable of percentage change in the population (1960-1970) was included because it should be a good indication of the rate of economic growth. The hypothesized sign for both of these variables is positive.

Three different variables were originally used to relate to agricultural productivity. The data source for each of these variables was the 1969 Census of Agriculture. The first, productivity of cropland as a percent of total farmland, was included because it was believed that farm real estate with a higher percent of cropland would have a higher value than other farm real estate with a lower percentage of cropland.

In any model used to show the cross sectional variations in farm real estate values there must be a variable to describe land quality or capabilities because there are a number of characteristics that will distinguish one tract of farmland from another. Thus, the variable chosen must be able to distinguish such characteristics as topsoil fertility, underlying structure, topography, drainage, and climate which will distinguish the productivity capabalities of one tract of farm real estate from another.

One way of accomplishign this would be to classify land according to its quality. This is difficult to accomplish, as pointed out in Chapter III, because classes as such are difficult to develop. Thus, chances for a large margin of error are great as shown by previous studies.

Alternatively, land values may be analyzed through the production function. A tract of land can be treated as a precise unit, which could be one acre, to which variable inputs are applied. In a sense this defines a production function in which a particular product is being produced. Thus, it can be said that a production function for higher quality farmland will be greater than a production function for a lower quality of farmland. It will indicate that the same quantity of inputs applied to both qualities of farmland will bring about a greater total production for the higher quality farmland.

The production function for the higher quality of farmland means that the Marginal Physical Product curve[1] (MPP) for the non-land factors will be above the MPP for the lower quality farmland (see Figure IV-1).

The value of farmland used for production is determined by the capitalized value of the net rents presently and in the future from that tract of land. This net rent can be shown graphically with the MPP curves. A price line for these non-land inputs used for production graphically shows what proportion of them to use in the production process. The quantity used of the

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[1]MPP is defined as the change in output resulting for a unit increment in variable input and is computed by dividing the change in output by the increment in input that caused the change in output. Algebraically expressed as:

$$MPP_{(input)} = \frac{\text{Change in Output}}{\text{Change in Input}}$$

variable non-land inputs would be O-A in low quality farmland. The area in rectangle OACD defines the expenditures on the non-land variable inputs and the rent to the farmland would be triangle DCF.

Where competitive markets exist, all farmers face the same factor-prices. As a result the higher Marginal Value Product curve[2] (MVP) resulting from the higher quality farmland, leads to increased use of the non-land inputs, where the OB amount would be used compared to OA amount for the lower quality land. (Figure IV-1). Also the rent to the higher quality land is greater (Triangle DGE). Therefore, the capitalization of this larger rent under the same market conditions leads to a higher value for the higher quality farmland.

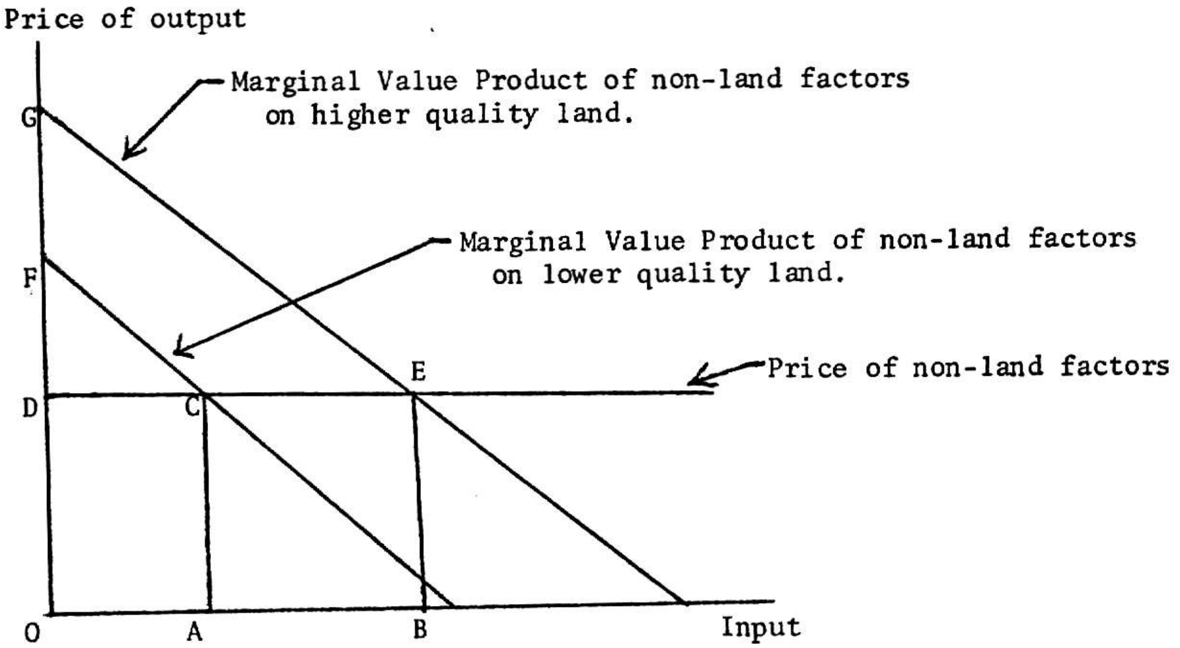

Figure IV-1. The Marginal Value Products of non-land factors applied to land of two different qualities.

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[2]MVP is defined as the MPP multiplied by the unit price of the output.

Two economic measures for productivity were used as variables in the model. The first variable, the market value of crops and forestry per acre, will not only indicate the just described relationship of land quality and production capabilities, but also will show where new technology such as advanced hybrids and irrigation practices are being used. It also indicates the extent that fertilization is being applied and agricultural chemical use. All these factors are known to increase production, thus the market value of crops and forestry per acre will be larger in these respective areas.

The second productivity variable was used to include all other agricultural products sold per acre not included in the first variable. This variable was included because differences in farm real estate values might also exist due to the amount of livestock from area to area. The only problem or fallacy of these two variables would be due to a wide variation in the prices for a particular product received by different farmers. It is believed that these variations will average out comparatively among the counties in the state, eliminating the problem, and not affecting the accuracy of the two productivity variables. The hypothesized sign of the coefficient of both of these variables is positive.

The average size of farm in each county was included because previous studies have shown that the average value of farm real estate tends to decrease as the farm size increases. Therefore, farm size is believed to be inversely related to farm real estate values. The hypothesized sign for the coefficient of the average farm size is negative.

The variable used to indicate the level of property taxes was the effective mill levy of that respective county. The average mill levy for the state of Kansas for the tax year 1972 was 87.8, which means the tax per $100 assessed values would be $8.78. The mill levy over the state ranged from a high of 150.9 in Wyandotte county to a low of 31.6 in Stevens county. The effective property tax level is believed to be inversely related to farm real estate values, therefore the hypothesized sign for the coefficient is negative.

Finally a variable used to describe the recreational demand for Kansas farm real estate was introduced because it has proven to be a significant factor in other studies.

In summary, the following economic model was formulated:

$$y = f(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8)$$

where:

y = The average county value of farm real estate in Kansas per acre, 1969.

x_1 = Percentage change in population from 1960 to 1970 by county in Kansas.

x_2 = Population per square mile by county in Kansas, 1972.

x_3 = Average market value of crops and forestry per acre of farmland in farms by county in Kansas, 1969.

x_4 = Average size of farms by county in Kansas, in acres, 1969.

x_5 = Effective property tax mill levy by county in Kansas, 1972.

x_6 = Average market value of all other agricultural products sold per acre of farm real estate for each county in Kansas, 1969.

x_7 = Cropland as a percent of total farmland, by county in Kansas, 1969.

x_8 = Recreational services offered per acre of farm real estate.

All variables except x_4, x_5, and x_6 were employed in linear form. Variables x_4, x_5, and x_6 were employed in log form which increased their explanatory power.[3]

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[3]This semi-log form means that one expects a given percentage change in an independent variable to have the same effect on the dependent variable regardless of the absolute level of the independent variable.

CHAPTER V

ANALYSIS AND RESULTS

The economic model presented in the previous chapter was estimated by ordinary least squares regression procedure using cross sectional data, with 105 observations - one for each county. Four regression equations were determined using this economic model, the first being a statewide model. The other three models were sectional models of the state of Kansas. The first of the three models applies to the Western section of the state which includes the Northwest, West Central and Southwest Crop Reporting Districts. The second applies to the Central Section of the state including the North Central, Central and South Central Crop Reporting Districts; and the third model represents the Eastern Section of the state which includes the Northeast, East Central and Southeast Crop Reporting Districts (see Figure I-2 for a map showing the Crop Reporting Districts). Three sectional models were formulated for the purpose of showing how different factors (variables) may have different impact levels on land values in different sections of the state. It was hypothesized, for instance, that farm real estate values in the Eastern Section would be subject to more influence from the urban influence variables and less influence from the agricultural productivity variables than in the other two sectors of the state.

Estimated equation for the statewide model.[1]

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[1]The coefficient of log x_4 (b_1), log x_5 (b_5), or log x_6 (b_6) is $b_i = \partial Y / \partial x_i / x_i$. Equivalently, $\partial Y = b_i(2x_i/x_i)$. If the percentage change in x_i is 1 percent, then the change in Y is $.01(b_i)$. That is, the coefficient of log x_i, when divided by 100, may then be interpreted as the change in the absolute value of Y associated with a 1 percent change in x_i.

$$y = 469.0346 + \underset{(4.1729)}{.9733x_1} + \underset{(10.7806)}{.3181x_2} + \underset{(5.2311)}{2.8271x_3}$$

$$- \underset{(-7.4824)}{48.7509\log x_4} - \underset{(-1.2306)}{12.4840\log x_5} + \underset{(1.4801)}{8.0058\log x_6}$$

$$R^2 = .90$$

The "t" values for each regression coefficient are shown directly below the regression coefficient. All variables, except x_5, property tax mill levy, and x_6, average market value of all other agricultural products sold per acre, are significant at the .001 probability level. Average market value of all other agricultural products sold per acre (x_6) is significant at the 0.15 level and property tax mill levy (x_5) at the .20 level. Although variables x_5 and x_6 were significant at a lower level it was felt that they do contribute to the explanation of the variation of farm real estate values in Kansas, therefore they were retained in the equation. The R^2 of .90 means that 90 percent of all the variation of farm real estate values in Kansas is explained by the six independent variables.

Table V-1 shows the simple correlation matrix for all the variables used in the model. There are not any alarming simple correlation coefficients (r), which would indicate a high degree of multicollinearity among any of the independent variables. Therefore, it can be concluded that for the most part all of the independent variables are non-correlated. The effect on a farm real estate value of each independent variable can be determined without any influence from the other independent variables.

Table V-1. Matrix of Simple Correlation Coefficients for the Variables in the Kansas Farm Real Estate Value Study (Statewide Model)

Variable	y	x_1	x_2	x_3	x_4	x_5	x_6
Value of Farm Real Estate (y)	1.00	.451	.845	.759	-.673	.470	.444
Percentage change in Population 1960-70 (x_1)		1.00	.294	.352	-.196	.246	.307
Population per square mile (x_2)			1.00	.677	-.437	.379	.259
Average market value of crops and forestry per acre (x_3)				1.00	-.379	.224	.305
Average Size of Farm (x_4)					1.00	.623	-.453
Effective Property Tax Mill Levy (x_5)						1.00	.275
Average market value of all other agricultural production per acre (x_6)							1.00

Relationship of Non-Tax Variables to Farm Real Estate Values

The coefficients for both the urban influence variables, percentage change in population from 1960 to 1970 (x_1), and population per square mile by county (x_2), were positive as hypothesized. The coefficient of x_1 shows that an increase of ten percent in the county population was associated with an increase of $9.73 in average farm real estate per acre, with other factors held constant. Table V-2 shows how the various changes in the independent variables will affect farm real estate values. The coefficient for population per square mile (x_2) was the most significant variable affecting farm real estate values in Kansas because it possessed the largest "t" value (10.7806) of any of the independent variables. Also, the correlation x_2 versus y, (r_{yx2} = .845), is the highest of all the independent variables. The larger the correlation coefficient between an independent variable and a dependent variable, the more influence an independent variable will have on the dependent variable, which in this case is farm real estate value per acre. An increase in x_2 of ten persons per square mile will increase farm real estate

Table V-2. The Effect that Changes in the Average Values of the Independent Variables have on Farm Real Estate Values for the Statewide, Western Section, Central Section, and Eastern Section Models.

Independent Variable	Column I	Column II	Column III	Column IV
Statewide Model				
Y = \$158.78[a]	$y = 469.0346 + .9733(x_1) + .3181(x_2) + 2.8271(x_3) - 48.7509\log(x_4) - 12.4840\log(x_5) + 8.0058\log(x_6)$ [b]			
x_1 (%)	\$168.51	\$178.25		\$149.05
x_2 (10 persons)	161.96	165.14		155.60
x_3 (%)	187.05	215.32	\$300.14	130.51
x_4 (%)	153.90	149.03		163.66
x_5 (%)	157.53	156.28	152.54	160.03
x_6 (%)	159.58	157.18	162.78	157.98
Western Section Model				
Y = \$122.46[a]	$y = 14.1109 - .38151(x_1) + .6280(x_2) + 4.9643(x_3) - 2.6385\log(x_4) + 9.6461\log(x_5) + 9.0321\log(x_6)$ [c]			
x_1	\$118.64	\$114.83		\$126.28
x_2	128.74	135.02		116.18
x_3	172.10	221.75	\$370.68	72.82
x_4	122.20	121.93		122.72
x_5	123.42	124.39	127.28	121.50
x_6	123.36	124.27	126.98	121.57
Central Section Model				
Y = \$167.74[a]	$y = 38.3709 + .2689(x_1) + .2336(x_2) + 8.0718(x_3) - 11.7523\log(x_4) + 18.2021\log(x_5) + 8.5526\log(x_6)$ [d]			
x_1	\$170.43	\$173.12		\$165.05
x_2	170.08	172.41		165.40
x_3	248.46	329.18	\$571.33	87.02
x_4	166.56	165.39		168.92
x_5	169.56	171.38	176.84	165.92
x_6	168.60	169.45	172.02	166.88
Eastern Section Model				
Y = \$213.89[a]	$y = 494.7767 + 1.5905(x_1) + .3205(x_2) + 2.0710(x_3) - 56.0765\log(x_4) - 20.9062\log(x_5) + 26.2379\log(x_6)$ [e]			
x_1	\$229.80	\$245.70		\$197.99
x_2	217.10	220.30		210.69
x_3	234.60	255.31	\$317.44	193.18
x_4	208.28	202.67		219.50
x_5	211.50	209.71	203.44	215.98
x_6	216.51	219.14	227.01	211.27

[a]The actual 1969 average market value of farm real estate for that model

[b]Estimated equation for Statewide model

[c]Estimated equation for the Western section model, composed of N.W., W.C., and S.W. Crop Reporting Districts

[d]Estimated equation for the Central section model, composed of N.C., C., and S.C. Crop Reporting Districts

[e]Estimated equation for the Eastern section model, composed of N.E., E.C., and S.E. Crop Reporting Districts

[f]Column I - shows the value of farm real estate (y) when the respective independent variable (x) is increased by 10%. (Except x_2 which represents an increase of 10 persons per square mile)

[g]Column II - shows the value of farm real estate (y) when the respective independent variable (x) is increased by 20%. (Except x_2 which represents an increase of 20 persons per square mile)

[h]Column III - shows the value of farm real estate (y) when the respective independent variable (x) is increased by 50%

[i]Column IV - shows the value of farm real estate (y) when the respective independent variable (x) is decreased by 10%. (Except x_2 which represents a decrease of 10 persons per square mile)

Variable Identification for Table V-2

x_1 = Percentage change in population from 1960 to 1970 by county in Kansas

x_2 = Population per square mile by county in Kansas, 1972

x_3 = Average market value of crops and forestry per acre of farmland in farms by county in Kansas, 1969

x_4 = Average size of farms by county in Kansas, in acres, 1969

x_5 = Effective property tax mill levy by county in Kansas, 1972

x_6 = Average market value of all other agricultural products sold per acre of farm real estate for each county in Kansas, 1969

All variables except x_4, x_5, and x_6 were employed in linear form. Variables x_4, x_5, and x_6 were employed in log form which increased their explanatory power.

values on an average of \$3.18, with other factors held constant.

Both of the productivity variables, average market value of crops and forestry per acre (x_3), and average market value of all other agricultural products sold per acre (x_6), have the hypothesized positive sign. An increase of 10 percent in the average market value of crops and forestry per acre (x_3) was associated with an increase of \$28.27 in the average market value of farm real estate, other factors held constant. A 10 percent increase in the average market value of all other agricultural production per acre (x_6) is associated with an \$0.80 increase per acre in the average market value of farm real estate. The greater influence exerted on farm real estate values by the average market values of crops and forestry (x_3) over the average market value of all other agricultural production per acre (x_6) is to be expected. Agricultural production is more closely related to land productivity than in the production of products which are more capital intensive like livestock. Initially, an observer might be inclined to believe that these two independent variables are highly correlated, thus causing multicollinearity in the model. However, the results do not verify this because the correlation x_3 versus x_6 ($r_{x3x6} = .305$) shows they are not correlated.

Since agricultural productivity was a major influence on farm real estate values, especially market value of crops and forestry per acre (x_3), it can be concluded that the higher prices received by farmers for their products has contributed to an immense rise in farm real estate prices in recent years.

Average size of farms by county (x_4) was inversely related to farm real estate values as hypothesized. A 10 percent increase in farm size, other variables held constant, results in a \$4.88 decrease in farm real estate values per acre. The ratio of improvement to farm real estate, including buildings, is higher for the smaller farms which may explain why farm size is inversely related to farm real estate values. The demand for farm real estate for the purpose of residential property and acreage for the addition to larger farms could also contribute to the inverse relationship, since, as mentioned in the previous chapter, demand can cause land prices to be bid up.

Two variables mentioned in Chapter IV as possible contributors to farm real estate values, were discarded because they were not statistically significant. First, cropland as a percent of total farmland, is believed to be non-significant in Kansas because there was not enough cross sectional variation statewide to influence farm real estate values.

The second variable describing recreational demand for farm real estate was non-significant, the likely reason being recreational facilities are somewhat scattered in Kansas. The few recreational facilities that do exist are located, for the most part, close to large urban centers. Therefore, it is believed that the independent variable, population per square mile (x_2), adequately shows the non-farm demand for farm real estate including that for recreational purposes.

Property Tax Capitalization

The coefficient for the effective property tax mill levy variable (x_5) has the hypothesized negative sign, thus it is inversely related to farm real estate values. The effective property tax mill levy is not as significant in this study as it has been in previous studies.[2] Regardless of this fact, the property tax mill levy did show enough significance to show that it does have some effect on farm real estate values, and thus should be included in the model. An increase in the mill levy from 100 to 110, increases the

[2] E. C. Pasour, Jr., "Real Property Taxes and Farm Real Estate Values: Incidence and Implications," American Journal of Agricultural Economics, Vol. 55, No. 4 (November, 1973).

property taxes paid from \$1.00 to \$1.10 per \$100 assessed value, will decrease farm real estate values by \$1.25 per acre. This result suggests that long-run capitalization of different property tax levels do occur on farm real estate in Kansas. However, this result only partially shows the extent of capitalization.

Consider, for example, what the capitalization of increase in the effective tax rate from \$1.00 to \$1.10 per \$100 assessed valuation would be, using a discount rate for land of ten percent and \$159 per acre as the average value of farm real estate.

At an interest rate of 10 percent and a tax rate of one percent, farm real estate must yield an annual return (R) of \$17.49 per acre to be consistent with a market value of \$159.

That is:

$$\$159 = \frac{R}{.10 + .01}$$

$$R = \$17.49$$

Considering the effect of a tax increase to 1.1 percent (raised from \$1.00 to \$1.10 per \$100 assessed valuation) and the annual return of \$17.49 per acre, market value (V) is reduced to:

$$V = \frac{\$17.49}{.10 + .011}$$

$$V = \$157.57$$

Full capitalization of a property tax increase reduces the market value of farm real estate to \$157.57 or a decrease of \$1.43 per acre. This would suggest that property tax values are fully capitalized.

The discount rate used in the capitalization formula is an important variable in determining the extent of capitalization on property values. The higher the discount rate, the smaller the capitalization effect will be from a given change in the property tax rate. For example, a discount rate of twelve percent, instead of ten percent, is used with the example of a one percent increase in the tax rate:

$$\$159 = \frac{R}{.12 + .01}$$

$$R = 20.67$$

$$V = \frac{20.67}{.12 + .011}$$

$$V = 157.79$$

Thus full capitalization of the property tax increase reduced market value of farm real estate to 157.79 or a decrease of $1.11 per acre compared to the reduction of $1.43 using a discount rate of ten percent.

Farm real estate has continued to appreciate in value particularly since the mid-1950's. For this reason the appreciation value should be reflected in the value of farm real estate. The capitalization formula for estimating farm real estate values should reflect the annual rent or return, the tax rate, and the rate of appreciation. Modifying the capitalization formula to reflect the rate of appreciation in farm real estate values, we now have:[3]

$$V = \frac{R - tV + AV}{i}$$

where:

V = Market value of farm real estate.

R = Annual rent on farm real estate per acre.

t = Effective property tax rate (on a percentage basis).

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[3]Ibid., p. 554.

i = Discount rate.

A = The expected annual appreciation on farm real estate values (on a percentage basis).

Now solving the equation for V we have:

$$V = \frac{R}{i + t - A}$$

Consider the effective property tax rate to be zero. If the market rate of interest is ten percent and the rate of appreciation of farm real estate values is five percent, the appropriate discount rate would be five instead of ten percent, for capitalizing the annual rent on farm real estate.

To determine the full capitalization of the increase in effective property tax rate from \$1.00 to \$1.10, when the discount rate is five percent on the average value of farm real estate in Kansas of \$1.59 per acre:

$$\$159 = \frac{R}{.10 + .01 - .05}$$

$$R = \$9.54$$

$$V = \frac{\$9.54}{.10 + .011 - .05}$$

$$V = \$156.39$$

In this case full capitalization of the increase in the effective property reduced farm real estate value to \$156.39 or a decrease of \$2.61. As another example, if the estimated value of farm real estate presented in Appendix Table 1 for 1973 (\$203) was employed, full capitalization reduced it by \$3.33.

Results presented here indicate that an increase in the effective property taxes on farm real estate in Kansas are capitalized in the form of depressed farm real estate values.

Residual Analysis

Residuals, which are the estimated farm real estate values computed by the regression model minus the actual farm real estate values, often will show systematic patterns that suggest the possible addition of another variable. At times when the residuals suggest the addition of another variable, practical statistical problems may preclude doing this. In some cases measurement problems make it difficult to introduce a new variable. Also, the addition of new variables will often lead to multicollinearity, decreasing the statistical significance of the variables involved.

Figure V-1 shows the actual and estimated values of farm real estate for each county, and Figure V-2 shows the residual values per county in Kansas. The residual values may be analyzed in two steps. First, systematic groupings of residuals will be examined, then an attempt will be made to explain large individual deviations.

Overall, Figure V-2 shows no outstanding systematic groupings of either positive or negative residuals. There are two areas worthy of attention: the Northwest corner and the South Central area of the state. In the Northwest there is an area of overestimation of farm real estate values by the model. This situation possibly is due to a slight overestimation by the land quality variables, since this area has the lowest farm real estate values in Kansas. It should be noted that no problem within the model is indicated as the overestimations are small.

The South Central part of the state represents a group of counties that are underestimated by the model with respect to the actual 1969 value of farm real estate. This underestimation may be due to the fact that this area has large oil deposits and no independent variable in the model represented areas of high mineral or oil deposits. The overall map of residuals indicates that the model's estimation was relatively accurate. Overestimations and underestimations of farm real estate values are scattered randomly among the counties throughout the state.

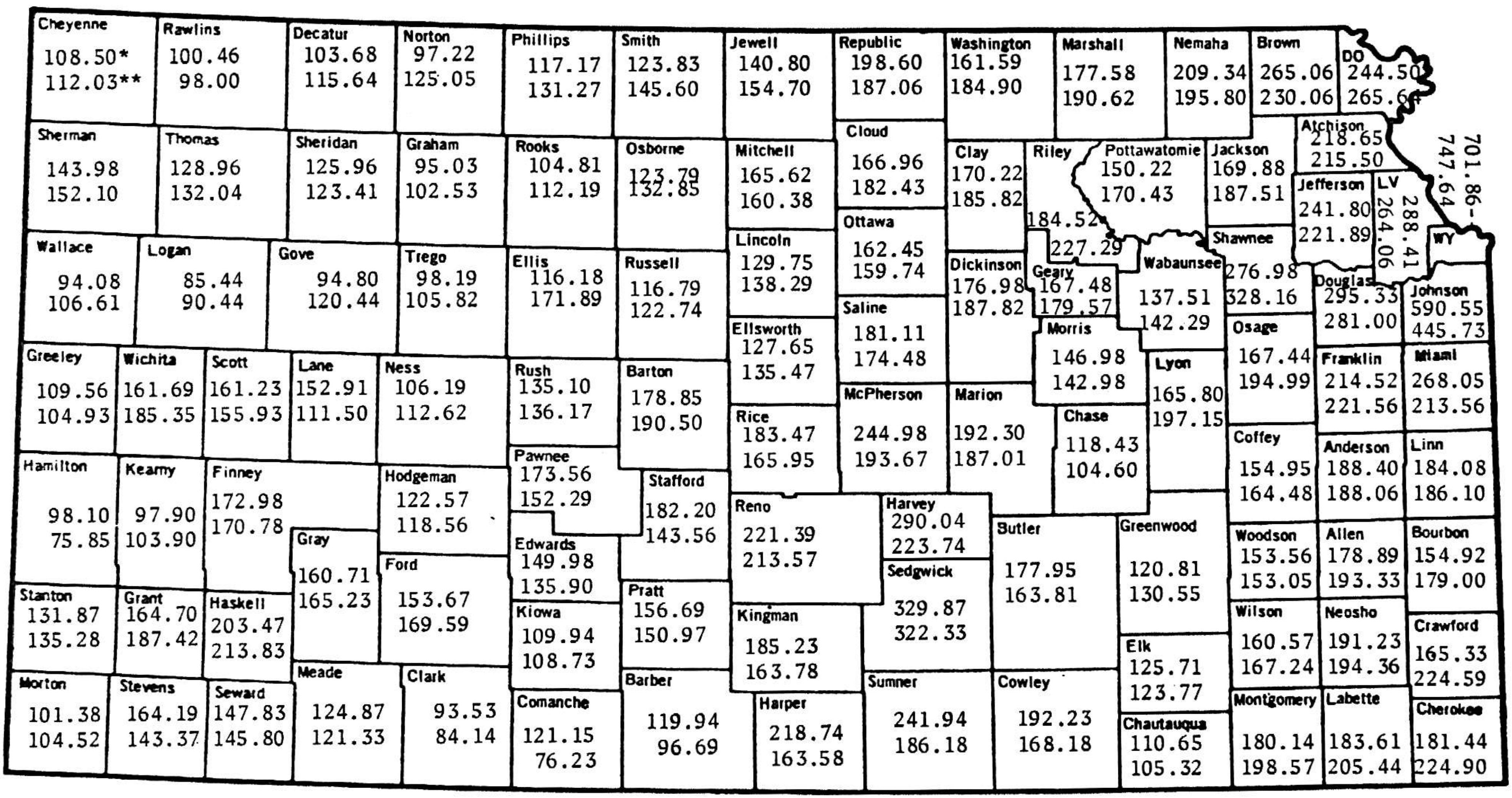
Sizeable deviations of estimated farm real estate values were present in a few counties in Kansas. The largest deviation was an underestimation of $144.82 for Johnson County. Since Kansas City is located in this county, the large error may be due to the fact that farm real estate is subject to much wild speculation, and thus a rapid rate of appreciation, which cannot be measured accurately. South Central Kansas has a high degree of underestimation which was explained previously by the oil production in that area.

It can be concluded that the statistical model presented did a respectable job of estimating farm real estate values because a majority of the estimated values resemble closely the actual values.

Sectional models

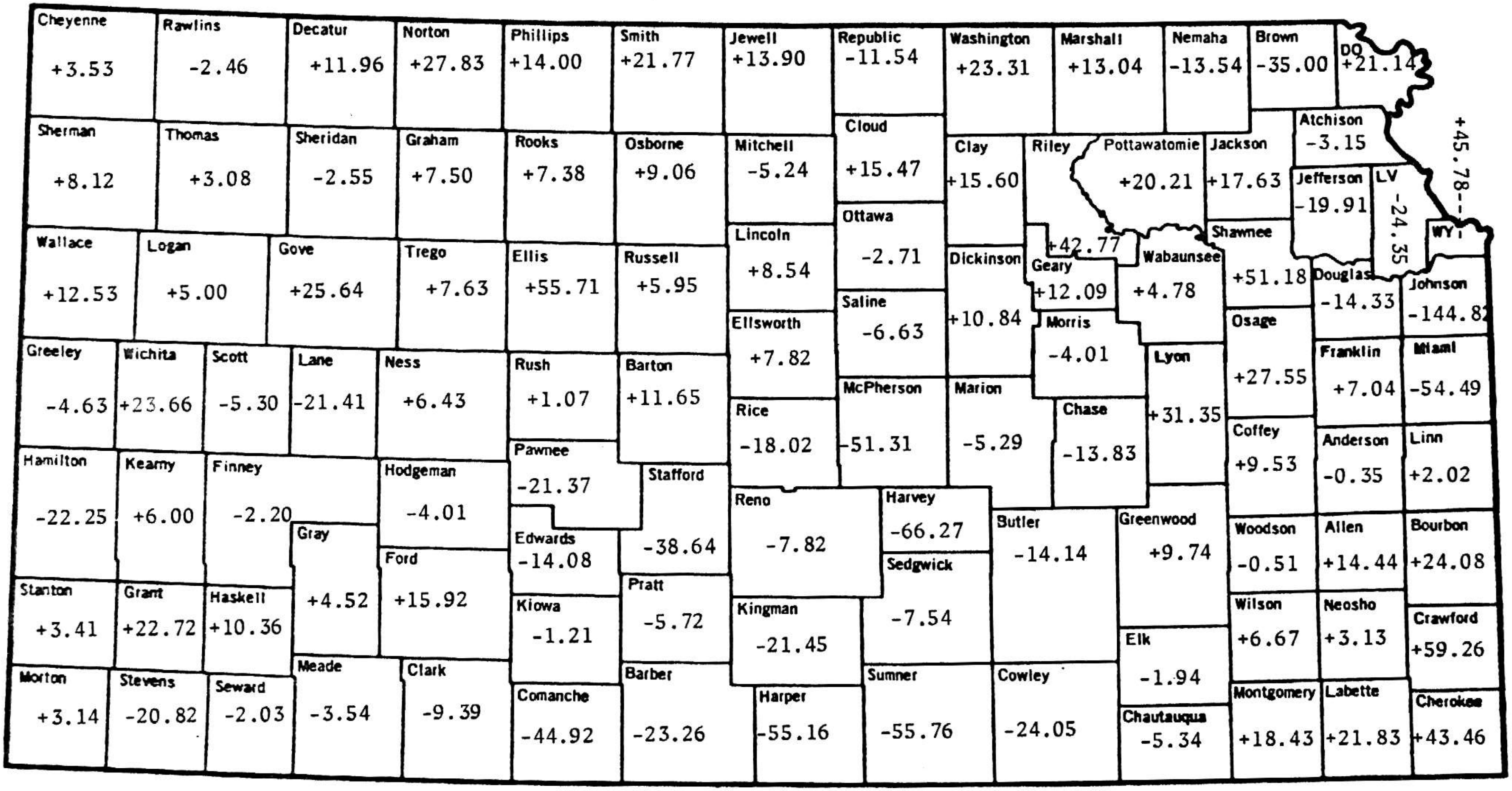
The three sectional models, as mentioned earlier in the chapter, were formulated to give an indication of the different levels of influence exerted by the independent variables in various sections of the state. Table V-3 is a summary of the regression analysis of these models and that of the state model. The state model has greater statistical reliability simply because the three sectional models include only a third of the observations. This fact is shown by the "t" values which, for a majority of the coefficients of the sectional models, are lower than the "t" values of the state model. Some of the "t" values are at such a low level as to indicate the variable is insignificant for that particular model.

Table V-2 indicates the change in farm real estate values when one variable is either increased or decreased by a certain percentage, and the



*Actual ($) Value of Farm Real Estate
**Estimated ($) Value of Farm Real Estate

Figure V-1. Actual and Estimated Farm Real Estate Values per County in Kansas, 1969.



+ = overestimation
- = underestimation

Figure V-2. Residual Values per County for the Regression Model used to Estimate Farm Real Estate Values in Kansas.

remainder of the independent variables are held constant. For example, an increase of 10 percent in population per square mile per county (x_2) in model 2 results in an increase of $6.28 in farm real estate values; from $122.46 to $128.74. The $6.28 increase is compared to only a $3.18 in Model 1, the statewide model.

By a comparison of the coefficients presented in Table V-3, influential differences exerted by the independent variables are evident among the Western, Central and Eastern sections of the state. The most pronounced difference existing between the state model and the three sectional models is that the signs on three of the coefficients differ from the signs hypothesized on the statewide model. The Western section model, (Model 2), has two contradictive coefficient signs. There is a negative sign on the percentage change in population from 1960 to 1970 variable (x_1), therefore it is inversely related to farm real estate values. Perhaps this is due to an average decrease of 4.9 percent in the average population per county in the Western section (see Appendix Table H). This is the least populous area of the state, and this large decrease could have a detrimental effect on farm real estate values.

The second contradictive coefficient sign is on the property tax mill levy variable (x_5), which has a positive sign. Technically, this variable is non-significant and should be discarded due to the low"t" value of 0.8061. Perhaps the positive sign is due to a lower property tax mill levy in this section of the state. The Central section model (Model 3), also has a positive coefficient for the property tax mill levy of variable. The same conclusions explaining the Western section model can also apply for this model.

There are some large variations in the effects of the independent variable on farm real estate values among the sectional models. For instance, the average market value of crops and forestry per acre of farmland in farms (x_3) varies considerably among the models. A ten percent increase results in an $80.72 increase in farm real estate values in the Central section, (Model 3), to a low of a $20.71 increase in the Eastern section (Model 4). The level of significances is much higher for the Central section, ("t" = 5.0698), than for the Eastern section ("t" = 1.7467). All of the variables can be compared for these differences by examining Tables V-2 and V-3.

Although some of the variables are not statistically significant at a high enough level to be considered reliable estimators of land values, they do provide a means of comparing their influences in different sections of the state. The variables show the areas in which agricultural variables outweigh the non-agricultural variables and vice versa in determining farm real estate values.

Table V-3. Regression Analysis Results on Kansas Farm Real Estate Values

Variable	Model Number 1[a]	2[b]	3[c]	4[d]
x_1	.9733[e] (4.1729)[f]	-.3815 (-1.2430)	.2689 (0.4590)	1.5905 (3.4740)
x_2	.3181 (10.7806)	.6280 (1.5489)	.2336 (2.4572)	.3205 (6.7002)
x_3	2.8271 (5.2311)	4.9643 (7.0918)	8.0718 (5.0698)	2.0710 (1.7467)
x_4	-48.7509 (-7.4824)	-2.6385 (-0.2295)	-11.7523 (-0.6493)	-56.0756 (-2.2697)
x_5	-12.4840 (-1.2306)	-9.6461 (0.8061)	18.2021 (0.6557)	-20.9062 (-1.2660)
x_6	8.0058 (1.4801)	9.0321 (3.1442)	8.5526 (0.9241)	26.2379 (1.5347)
R^2	.90	.92	.83	.92

[a] Model 1 is the statewide model

[b] Model 2 is the Western section of the state which includes the N.W., W.C., and S.W. Crop Reporting Districts (Note Figure I-2)

[c] Model 3 is the Central section of the state, which includes the N.C., C., and S.C. Crop Reporting Districts

[d] Model 4 is the Eastern section of the state, which includes the N.E., E.C., and S.E. Crop Reporting Districts

[e] Line 1 is the estimated net regression coefficient

[f] Line 2 is the "t" value for each regression coefficient

For variable identification, see Table V-2.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The value of farm real estate has tripled since 1950. Until the early 1950's, changes in the value of farm real estate had been closely related to changes in farm product prices and net farm income. Since that time the value of farm real estate has increased substantially and there is a belief that much of this increase resulted from factors existing outside the agricultural sector. During this period (1950-1972), no great increase in net farm income or product prices was observed. The large increase in farm product prices recently is believed to be closely related to the recent increase in farm real estate values.

This study attempted to identify some of the major variables affecting farm real estate values in Kansas, and estimated the effect of these variables. To accomplish this, an hypothesis was developed to explain the factors believed to be associated with cross sectional variations of farm real estate values. The hypothesis contained five areas supposedly associated with farm real estate values: urban influence, agricultural productivity, farm size, property taxes and recreational demand.

Cross sectional data on the 105 counties of Kansas were collected and used as individual units of observation for the independent variables. The dependent variable used was the 1969 value of farm real estate and buildings per acre, as it is the most recently published county data available.

The urban influence area was shown by the use of two variables in the model, percentage change in population from 1960 to 1970 by county, and the population per square mile by county. Agricultural productivity was also shown by two variables, average market value of crops and forestry per acre of farmland in farms by county, and average market value of all other agricultural products sold per acre of farm real estate by county. The other areas: farm size, property taxes and recreational demand were represented with one variable each. Farm size and property tax level were hypothesized to be inversely related to farm real estate values while the other variables were considered to be positively related to farm real estate values.

The results of this study indicate that all the independent variables used were statistically significant, except recreational demand which appeared to be non-influential to farm real estate values in Kansas. The results did show that farm size and property tax mill levy were inversely related to farm real estate values and the others have positive influence on land values. The independent variables used explained 90 percent of the variation in farm real estate values in Kansas for 1969.

A corollary objective of this study was to determine the effect higher property tax mill levies would have on farm real estate values. The results indicated that increases in mill levies negatively affect farm real estate values: however, the extent of capitalization was not as great as hypothesized.

Another objective of the study was to determine whether the factors affecting farm real estate values in Kansas have different levels of influence within the state. To determine this, the state was divided into three sections and a regression equation was derived for each section. Results showed that the urban influence variables were large factors in determining farm real estate values in the eastern section of the state. This was as expected, the agricultural productivity variables had the greatest impact on the Western two-thirds of the state, since this area is predominantly agriculture oriented.

In general, the model derived by least-squares regression did an accurate job of estimating farm real estate values in Kansas for 1969. Hence, the model should aid those buying or selling farm real estate, the lending agencies dealing in the purchase of farm real estate, and others whose decision-making abilities would be affected by this information. For additional verification of the model, recent data should be used to determine if the model will continue to be an accurate indicator of farm real estate values.

Recent trends in land values have shown that the availability of credit and interest rates on borrowed capital have a major effect on potential buyers of farm real estate. Therefore, one of the shortcomings of this study may have been the failure to include the interest rate on borrowed money as an explanatory (independent) variable. It is recommended that further research in this area include the interest rate.

APPENDIX

Appendix Table A-1. Average Value of Land and Buildings Per Acre for Kansas and U.S. and Average Net Farm Income Per Acre for Kansas, 1950-1973.

Year	Value of land per acre		Average net farm Income per acre[a]
	Kansas	U.S.[b]	
1950	$ 66	$ 65	$ 9.81
1951	73	75	8.13
1952	80	82	10.66
1953	81	83	5.15
1954	79	82	7.10
1955	81	85	4.04
1956	84	90	4.00
1957	87	97	4.39
1958	93	103	10.25
1959	98	111	7.08
1960	101	116	8.95
1961	102	118	9.35
1962	107	124	8.77
1963	112	130	8.31
1964	115	138	9.39
1965	123	146	9.75
1966	135	158	10.53
1967	144	168	8.95
1968	156	179	8.73
1969	162	190	10.78
1970	159	195	13.49
1971	161	203	15.41
1972	176	219	20.00[c]
1973	203	247	33.00[c]

[a] Includes inventory changes, rent to nonfarm landlords, and interest on farm mortgage debt.

[b] 48 states.

[c] Estimated from realized net farm income.

Source: Pine, W. H. and Hancock, R. R., Trends in Land Values (Unpublished research paper, Kansas State University, 1974), p. 21.

Appendix Table A-2. Index Numbers of Values Per Acre of all Land in Farms by Sections and Crop Reporting Districts in Kansas 1962-1974 (1967 = 100)

	Sections			Crop Reporting Districts									
Year	Western[a/]	Central[b/]	Eastern[c/]	NW	WC	SW	NC	C	SC	NE	EC	SE	State
1962	78	75	72	77	80	76	70	73	81	75	70	70	75
1963	80	77	76	82	83	76	74	77	81	76	76	76	78
1964	89	81	81	87	94	86	77	82	84	81	84	78	83
1965	93	89	85	95	96	87	89	87	91	87	86	82	88
1966	96	95	94	91	102	94	98	93	95	97	99	87	95
1967	100	100	100	100	100	100	100	100	100	100	100	100	100
1968	107	104	112	104	117	101	107	98	108	111	110	116	107
1969	108	107	118	105	108	111	113	100	107	115	123	116	111
1970	96	103	125	98	93	96	111	95	104	117	139	118	108
1971	104	105	124	103	100	108	110	97	107	128	127	117	110
1972	103	111	131	109	96	105	115	107	108	137	132	124	114
1973	116	127	157	121	109	117	137	120	123	161	162	147	132
1974	166	173	196	167	160	170	184	165	169	188	208	192	177

[a/] Western Section value is an average of the NW, WC, and SW crop reporting districts.

[b/] Central Section value is an average of the NC, C, and SC crop reporting districts.

[c/] Eastern Section value is an average of the NE, EC, and SE crop reporting districts.

Source: W. H. Pine and R. R. Hancock, Trends in Land Values in Kansas (Unpublished research paper, Kansas State University, 1974), p. 22.

Appendix Table A-3. Index Numbers of Values Per Acre of Pastureland by Sections and Crop Reporting Districts in Kansas, 1962-1974. (1967 = 100)

	Sections			Crop Reporting Districts									
Year	Western[a]	Central[b]	Eastern[c]	NW	WC	SW	NC	C	SC	NE	EC	SE	State
1962	67	71	65	72	64	66	75	73	66	70	66	60	67
1963	71	74	73	76	69	69	75	77	70	77	74	67	72
1964	78	80	77	78	79	78	81	82	78	82	77	71	77
1965	83	84	82	84	87	79	80	88	85	84	87	76	83
1966	94	92	94	94	94	94	89	97	90	102	92	89	92
1967	100	100	100	100	100	100	100	100	100	100	100	100	100
1968	107	101	105	116	106	99	98	103	102	108	104	104	103
1969	113	111	110	118	109	112	99	112	121	113	108	108	111
1970	110	106	106	104	109	118	91	105	122	101	105	111	109
1971	111	109	106	108	110	116	94	102	130	101	108	110	110
1972	119	113	114	115	115	128	95	114	129	107	114	121	116
1973	135	119	127	127	126	151	100	119	137	126	120	134	126
1974	171	162	164	169	176	167	154	165	182	165	154	172	166

a/ Western Section value is an average of the NW, WC, and SW crop reporting districts.

b/ Central Section value is an average of the NC, C, and SC crop reporting districts.

c/ Eastern Section value is an average of the NE, EC, and SE crop reporting districts.

Source: W. H. Pine and R. R. Hancock, Trends in Land Values in Kansas (Unpublished research paper, Kansas State University, 1974), p. 22.

Appendix Table A-4. Average Values for the Crop Reporting Districts and Sections of the Variables Used in the Regression Model.

District	Average Farm Value (1969)	% Change Population (1960-70)	Population per Square Mile (1972)	Average Size Farm (1972)	Average Value of Crops & Forestry Per Acre (1969)	Value of Other Ag. Prod. Per Acre (1969)	Property Tax (Mills) (1970)
Northwest (NW)	$112.97	-8.4	5.96	978.0	9.49	11.39	72.2
West Central (WC)	116.01	-5.8	4.43	1,236.7	10.55	24.40	57.3
Southwest (SW)	138.41	-0.59	8.54	1,328.8	15.12	26.33	50.8
Western Section[a]	122.46	-4.9	6.31	1,181.2	11.72	20.71	60.1
North Central (NC)	148.71	-13.6	10.70	559.8	12.58	22.44	68.3
Central (C)	162.15	-10.9	22.39	537.8	11.27	23.59	66.4
South Central (SC)	192.36	-12.2	40.96	745.9	13.76	22.54	68.4
Central Section[a]	167.74	-12.2	24.68	614.5	12.54	22.86	67.7
Northeast (NE)	259.26	-0.04	139.39	307.6	19.74	38.00	96.5
East Central (EC)	219.75	3.0	82.97	422.8	11.45	30.79	80.3
Southeast (SE)	162.65	-10.4	28.80	447.4	9.34	28.98	79.6
Eastern Section[a]	213.89	-2.5	83.72	392.6	13.51	32.59	85.5

[a] Section values are the averages of the three Crop Reporting Districts in their respective sections.

Appendix Table A-5. Variables Used for Regression Model for Land Values by County in Kansas.

County	Avg. Farm Value per Acre 1969 a/	Property Tax Mill Levy 1970 b/	% Change Population 1960-70 c/	Pop. Square Mile 1972 c/	Value Crops and Forestry 1969 a/	Value of All Other Agricultural Production 1969 a/	Average Farm Size 1969 a/
Allen	178.89	79.7	-9.4	30.38	13.17	23.36	339.0
Anderson	188.40	66.3	-7.0	14.99	14.48	22.24	402.1
Atchison	218.65	95.2	-10.2	44.53	16.57	35.04	288.8
Barber	119.94	63.5	-21.2	6.32	6.49	20.11	1,166.8
Barton	178.85	62.9	-6.4	38.33	13.72	52.89	504.0
Bourbon	154.92	83.7	-7.2	24.09	7.81	27.52	339.1
Brown	265.06	80.2	-12.9	22.30	26.56	39.80	334.4
Butler	177.95	83.1	- .9	26.24	5.30	51.36	511.0
Chase	118.43	55.6	-14.8	4.83	3.12	49.62	1,101.7
Chautauqua	110.65	70.5	-23.5	7.92	3.64	16.41	753.0
Cherokee	181.44	77.4	-4.6	37.52	21.14	11.52	291.3
Cheyenne	108.50	63.1	-12.2	4.07	9.50	11.24	1,088.9
Clark	93.53	42.1	-17.0	2.99	14.52	21.06	1,603.7
Clay	170.22	70.4	-8.8	15.55	14.86	31.09	433.5
Cloud	166.96	73.5	-8.0	19.57	16.90	15.00	478.8
Coffey	154.95	68.4	-13.6	12.79	9.59	26.81	434.1
Comanche	121.15	62.7	-19.6	3.62	5.06	24.09	1,712.7
Cowley	192.23	85.0	-8.7	30.27	9.40	31.85	478.6
Crawford	165.33	97.7	1.1	64.58	14.98	20.68	284.4
Decatur	103.68	69.7	-15.7	5.86	7.48	14.00	857.5
Dickinson	176.98	77.8	-7.5	27.29	12.71	37.45	409.0
Doniphan	244.50	95.3	-5.0	25.03	-33.79	41.33	281.3
Douglas	295.33	88.5	30.7	115.57	14.74	36.67	250.2
Edwards	149.98	54.6	-11.2	7.39	11.93	13.92	860.9
Elk	125.71	62.7	-23.3	6.45	4.19	21.64	570.9
Ellis	116.18	69.4	14.3	26.20	7.84	24.26	629.1
Ellsworth	127.65	48.3	-16.2	9.88	8.16	11.98	646.3
Finney	172.98	61.6	17.2	15.90	16.92	55.26	1,273.9
Ford	153.67	79.6	5.4	21.71	12.34	59.79	779.2
Franklin	214.52	91.1	2.0	35.17	15.09	31.96	279.9
Geary	167.48	85.4	-4.0	60.50	10.11	18.52	482.6
Gove	94.80	62.2	-5.9	3.82	7.68	35.71	1,132.9

Appendix Table A-5. (Cont'd).

County	Avg. Farm Value Per Acre 1969[a/]	Property Tax Mill Levy 1970[b/]	% Change Population 1960-70[c/]	Pop. Square Mile 1972[c/]	Value Crops and Forestry 1969[a/]	Value of All Other Agricultural Production 1969[a/]	Average Farm Size 1969[a/]
Graham	95.03	66.3	-15.5	5.46	6.42	7.34	962.6
Grant	164.70	39.2	11.4	11.59	23.41	32.19	1,173.9
Gray	160.71	61.8	1.8	5.27	17.87	36.12	964.3
Greeley	109.56	45.9	-10.9	2.71	10.03	22.49	1,606.3
Greenwood	120.81	67.3	-20.7	8.24	2.05	22.27	832.0
Hamilton	98.10	62.9	-14.9	3.09	7.68	6.05	1,751.6
Harper	218.73	62.9	-18.6	10.47	16.08	20.10	559.7
Harvey	290.04	96.0	4.1	50.41	16.65	34.76	337.4
Haskell	203.47	38.6	20.9	6.76	28.68	44.33	1,149.0
Hodgeman	122.57	54.8	-16.6	3.19	8.54	25.61	973.7
Jackson	169.88	101.8	-0.4	17.55	8.56	23.33	302.2
Jefferson	241.80	93.3	5.0	22.48	14.19	36.89	262.4
Jewell	140.80	76.7	-18.4	6.73	12.55	23.65	523.4
Johnson	590.55	107.9	51.0	485.23	22.54	33.51	210.0
Kearny	97.90	38.0	-3.8	31.83	8.82	19.06	1,813.5
Kingman	185.23	54.9	-12.4	11.65	13.70	17.31	559.5
Kiowa	109.94	43.5	-14.4	5.74	8.01	13.91	1,177.8
Labette	183.61	89.0	-4.4	37.88	11.72	45.97	306.5
Lane	132.91	65.8	-14.6	4.03	9.93	26.82	1,227.3
Leavenworth	288.41	113.9	9.4	100.50	13.49	35.81	199.9
Lincoln	129.75	52.8	-18.9	6.70	9.60	15.55	627.9
Linn	184.08	63.9	-8.1	13.49	9.40	25.46	311.7
Logan	85.44	59.4	-7.8	3.50	7.07	6.96	1,503.7
Lyon	165.80	83.6	18.3	35.46	7.11	43.89	434.3
Marion	192.30	67.6	-0.1	15.80	10.06	30.68	384.8
Marshall	177.58	70.1	-9.3	15.54	16.30	21.76	399.2
McPherson	244.98	67.8	-17.5	23.55	15.22	33.03	340.3
Meade	124.87	52.6	-13.1	5.20	10.08	26.06	1,107.5
Miami	268.05	83.6	-4.5	34.74	12.32	28.67	247.0
Mitchell	165.62	67.2	-9.2	11.28	13.78	15.15	595.4
Montgomery	180.14	97.1	-12.3	70.31	9.41	26.79	291.5
Morris	146.98	73.1	-15.3	9.82	5.84	31.02	518.3

Appendix Table A-5. (Cont'd).

County	Avg. Farm Value Per Acre 1969[a/]	Property Tax Mill Levy 1970[b/]	% Change Population 1960-70[c/]	Pop. Square Mile 1972[c/]	Value Crops and Forestry 1969[a/]	Value of All Other Agricultural Production 1969[a/]	Average Farm Size 1969[a/]
Morton	101.38	38.6	5.8	5.07	10.43	5.55	1,952.1
Nemaha	209.34	84.3	-9.9	17.76	13.02	46.09	321.0
Neosho	191.23	77.1	-5.8	26.13	10.93	31.39	322.5
Ness	106.19	56.6	-18.3	4.60	8.35	11.22	919.0
Norton	97.22	85.0	-10.3	8.69	7.74	11.90	753.7
Osage	167.44	71.9	2.6	18.81	11.04	28.37	361.7
Osborne	123.79	63.5	-16.3	7.41	9.26	15.63	695.3
Ottawa	162.45	55.8	-10.5	8.82	12.62	19.22	589.7
Pawnee	173.56	54.7	-19.0	10.86	15.03	29.58	730.5
Phillips	117.17	69.2	-11.0	9.25	6.88	14.08	676.9
Pottawatomie	150.22	78.2	-1.7	14.54	8.02	34.65	453.5
Pratt	156.69	62.1	-19.1	13.63	13.41	44.81	718.2
Rawlins	100.46	68.3	-18.3	4.23	6.91	8.44	1,035.2
Reno	221.39	84.8	1.5	53.75	17.62	20.16	403.0
Republic	198.60	70.9	-15.6	11.87	14.97	38.13	374.2
Rice	183.97	59.0	-12.8	16.95	15.16	17.09	585.9
Riley	184.52	91.2	34.8	61.26	9.72	31.61	415.0
Rooks	104.81	62.9	-20.4	8.69	7.36	10.31	827.7
Rush	135.10	54.0	-19.5	7.46	10.53	7.89	611.3
Russell	116.79	73.9	-18.6	11.03	8.47	8.21	691.7
Saline	181.11	96.6	-16.1	63.08	12.54	20.44	485.2
Scott	161.23	54.5	6.5	8.44	15.10	50.59	1,216.4
Sedgwick	329.87	104.7	1.4	331.12	21.28	29.32	328.8
Seward	147.83	68.5	-1.9	25.36	15.64	20.77	1,188.6
Shawnee	276.98	111.4	8.8	311.59	19.29	25.03	254.4
Sheridan	125.96	80.8	-11.3	4.43	9.42	19.20	897.7
Sherman	143.98	80.1	15.4	7.56	16.11	9.80	1,146.5
Smith	123.83	77.7	-15.1	7.68	9.93	23.24	578.8
Stafford	182.20	55.4	-21.7	7.78	14.63	12.03	680.4
Stanton	131.87	41.3	5.9	3.55	17.64	10.23	1,701.3
Stevens	164.19	31.3	-9.3	6.02	19.07	6.52	1,171.1

Appendix Table A-5. (Cont'd).

County	Avg. Farm Value Per Acre 1969[a/]	Property Tax Mill Levy 1970[b/]	% Change Population 1960-70[c/]	Pop. Square Mile 1972[c/]	Value Crops and Forestry 1969[a/]	Value of All Other Agricultural Production 1969[a/]	Average Farm Size 1969[a/]
Sumner	241.94	89.7	-8.5	19.75	19.00	12.98	460.6
Thomas	128.96	64.1	0.6	7.41	12.31	9.22	1,081.7
Trego	98.19	64.1	-20.9	5.22	6.69	8.88	852.7
Wabaunsee	137.51	73.6	-4.4	8.61	5.58	29.26	631.4
Wallace	94.08	57.4	4.6	2.49	8.50	7.66	1,529.3
Washington	161.59	63.9	-16.3	10.95	14.31	41.39	384.1
Wichita	161.69	49.7	14.8	5.02	21.63	49.26	1,142.9
Wilson	160.57	69.5	-13.4	23.19	9.82	18.78	419.6
Woodson	153.56	74.0	-12.9	9.97	7.13	56.14	524.2
Wyandotte	701.86	150.9	-0.2	1,191.76	57.97	71.74	125.9

Sources: [a/]U.S. Bureau of Census, Census of Agriculture, 1969, Vol. 1, Part 21 - Kansas (Washington, D. C.: U.S. Government Printing Office.)

[b/]Kansas Department of Revenue, Division of Property Valuation, Statistical Report of Property Assessment and Taxation for Tax Year 1972 (Topeka, Kansas, 1973).

[c/]M. J. Emerson, Tenth Annual Report of the Governor in Kansas (Topeka, Kansas: Robert Sanders, State Printer, 1973), p. 65.

SELECTED BIBLIOGRAPHY

Books

Ottoson, Howard W. Land Use Policy and Problems in the United States. Lincoln, Nebraska: University of Nebraska Press, 1963.

Rao, Potluri, and Miller, Roger L. Applied Econometrics. Belmont, California: Wadsworth Printing Company, 1971.

Self, Huber. Geography of Kansas Syllabus and Atlas. Manhattan, Kansas: Ag. Press, 1967.

Journals

Chryst, Walter E. "Land Values and Agricultural Income: A Paradox?" Journal of Farm Economics, Vol. 47, No. 5. (December, 1965).

Hyman, David N., and Pasour, E. C. Jr. "Real Property Taxes, Local Public Services, and Residential Property Values." Southern Economic Journal, Vol. XXXIX, No. 4. (April, 1973).

Pasour, E. C., Jr. "Real Property Taxes and Farm Real Estate Values: Incidence and Implications." American Journal of Agricultural Economics, Vol. 55, No. 4. (November, 1973).

Bulletins and Government Publications

Emerson, M. J. Tenth Annual Economic Report of the Governor. Topeka, Kansas: State Printing Office. January, 1973.

Kansas Department of Revenue, Division of Property Valuation. Statistical Report of Property Assessment and Taxation for Tax Year 1972. Topeka, Kansas: State Printing Office. 1973.

Flinchbaugh, B. L. Financing State and Local Government in Kansas. Department of Economics, Cooperative Extension Service, Kansas State University. Manhattan, Kansas. 1971.

Francl, Terry. Federal Reserve Bank of Chicago Agricultural Letter. No. 1271. April 26, 1974.

Hammill, Anne E. "Variables Related to Farm Real Estate Values in Minnesota Counties." Agricultural Economics Research. Vol. 21, No. 2. April, 1969.

Kansas State Board of Agriculture, Statistical Division. Farm Facts. Topeka, Kansas: State Printing Office, 1971-72.

Klinefelter, Danny A. "Factors Affecting Farmland Values in Illinois." Illinois Agricultural Economics. Department of Agricultural Economics, Agricultural Experiment Station, University of Illinois. Urbana-Champaign, Illinois, January, 1973.

Marsh, Charles F., and Pine, Wilfred H. The Value of Farm Real Estate. Bulletin 389. Agricultural Experiment Station, Kansas State College of Agriculture and Applied Science. Manhattan, Kansas, April, 1957.

Otto, Merton L., and Pallesen, J. E. Trends in Land Values in Kansas. Bulletin 521 Agricultural Experiment Station, Kansas State University, Manhattan, Kansas, January, 1969.

Otto, Merton L.; Pine, Wilfred H.; Collins, Hubert L. Trends in Land Values in Kansas. Circular 341. Agricultural Experiment Station, Kansas State College of Agricultural and Applied Science. Manhattan, Kansas, August, 1956.

Schuh, G. Edward, and Scharlach, Wesley C. Quantitative Analysis of Some Farm and Non-Farm Determinants of Agricultural Land Values - Impact of Economic Development. Bulletin 821. Agricultural Experiment Station, Purdue University. Lafayette, Indiana, November, 1966.

Tweeten, Luther G., and Nelson, Ted R. Sources and Repercussions of Changing U. S. Farm Real Estate Values. Bulletin T-120. Agricultural Experiment Station, Oklahoma State University. Stillwater, Oklahoma, April, 1966.

U. S. Department of Commerce, Bureau of the Census. United States Census of Agriculture: 1969. Vol. I, Kansas Pt. 21. Washington, D. C.: Government Printing Office. 1972.

Unpublished Material

Pine, Wilfred H., and Hancock, R. R. Trends in Land Value in Kansas. Unpublished Research Paper, Kansas State University. 1974.

FACTORS INFLUENCING FARM REAL ESTATE VALUES IN KANSAS

by

ROBERT EARL DAWSON

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AN ABSTRACT OF A MASTER'S THESIS

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MASTER OF SCIENCE

Agricultural Economics

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ABSTRACT

The value of farm real estate has tripled since 1950 in Kansas. This study was directed towards identifying some of the major variables affecting farm real estate values and measuring their effect. To accomplish this, an hypothesis was developed to explain the factors believed to be associated with the cross sectional variations in farm real estate values. The hypothesis contained five areas supposedly associated with farm real estate values: urban influence, agricultural productivity, farm size, property taxes and recreational demand.

Cross sectional data on the 105 counties of Kansas were collected and used as individual units of observation for the independent variables. The dependent variable was the 1969 value of farm real estate and buildings per acre, as it is the most recently published county data available.

The urban influence area was shown by two variables in the model, percentage change in population from 1960 to 1970 by county, and the population per square mile per county. Agricultural productivity was also shown by two variables, average market value of crops and forestry per acre of farmland in farms by county, and average market value of all other agricultural products sold per acre of farm real estate by county. The areas: farm size, property taxes and recreational demand were represented with one variable each.

The results of this study indicate that all the independent variables used were statistically significant, except recreational demand which appeared to be non-influential to farm real estate values in Kansas. The results showed that farm size and property tax mill levy were inversely related to farm real estate values and the others have a positive influence on land

values. The independent variables used were able to explain 90 percent of the variation in farm real estate values in Kansas for 1969.

A corollary objective of this study was to determine whether the factors affecting farm real estate values in Kansas have different levels of influence within the state. To determine this, the state was divided into three sections and a least squares regression equation was derived for each section. Results showed that urban influence variables were important factors in determining farm real estate values in Eastern Kansas. This was as expected since this portion of the state is the most populous. As expected the agricultural productivity variables had the greatest impact on the Western two-thirds of Kansas since this area is predominantly agriculture-oriented.

In general the model derived by least-squares regression did an accurate job of estimating farm real estate values in Kansas for 1969. Hence, it should aid those buying or selling farm real estate, the lending agencies dealing in the purchase of farm real estate and others whose decision-making abilities would be affected by this information.