ANALYSIS OF FACTORS AFFECTING RURAL REAL ESTATE VALUES IN EASTERN OKLAHOMA

By

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TABLE OF CONTENTS

Chapter Page

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

The rural real estate market in Oklahoma and the United States has generally been characterized by increasing prices in the 1970's. During the 1973 to 1979 period, farm real estate values in the United States increased by 56.0 percent [13]. In Oklahoma over the same period, farm real estate values increased by 50.5 percent [15].

Such increases in rural real estate values have generated interest in identifying the factors that affect real estate prices. According to theory, the value of real estate is determined by the returns that can be generated from the most profitable enterprise that a particular tract of real estate is capable of supporting. Previous studies have established a direct relationship between farm income and rural real estate prices [9, 12]. The increases in rural real estate values appear to be greater than can be justified by farm income. The non-agricultural demand for rural real estate has increased rapidly in certain areas. Special pressures exist on rural real estate that is near highly populated residential and recreational areas. In these areas the non-agricultural demand for rural real estate is extremely high.

The factors that determine the value of rural real estate are of interest to a variety of individuals. These individuals include assessors, appraisers, developers, farmers and non-farmers who wish to live or recreate in a rural setting. Due to the existence of two separate

use demands for rural real estate, agricultural and non-agricultural, there is a need for meaningful methods of estimating values of rural real estate that account for these differences in its use.

Objectives

The general objective of the study is to examine the factors that cause variations in rural real estate values in an area of Oklahoma experiencing substantial non-agricultural as well as agricultural real estate use pressures. The specific objectives are to:

1. Identify rural real estate characteristics in selected counties.
2. Identify and quantify the physical factors associated with inter-tract variation in rural real estate prices in selected counties.
3. Develop and test models to explain rural real estate values in selected counties.

Organization of the Study

Discussion of the study is presented in the four remaining chapters. In Chapter II the study area and the rural real estate market in the study area are described in detail. The economic and demographic aspects of the study area are discussed. The results of a questionnaire distributed to recent purchasers of rural real estate are presented. In Chapter III general factors that affect the rural real estate market are examined. Economic theory is reviewed to determine what factors affect rural real estate values and what the effects should be. The results of previous studies which examined the factors affecting rural real estate

values in Oklahoma and other states are summarized and discussed. In Chapter IV the rural real estate values in the study area are analyzed. The procedure that was employed in the collection of the rural real estate data for this study is explained. The various models employed to estimate rural real estate values are presented. The variables used in this study are discussed individually. Reasons for their selection as well as their expected impacts on rural real estate values are stated. The results of each model are presented and analyzed. The study and its results are summarized in Chapter V.

CHAPTER II

DESCRIPTION OF THE STUDY AREA AND ITS REAL ESTATE MARKET

The purpose of this chapter is to define the study area and examine some characteristics of the rural real estate in the area. In the following section, the study area is defined and some general facts about the counties in the study area are presented [16, 17]. In the next section, responses to a mailed questionnaire sent to rural real estate buyers in the study area are summarized.

Study Area

The study area included Adair, Cherokee and Muskogee counties in eastern Oklahoma. Maps of these counties are shown in Figure 1. The primary reason for selecting these Eastern Oklahoma counties include the availability of accurate soil survey information, availability of rural real estate sales data and the fact that a significant number of rural real estate transactions have occurred in the area in recent years.

The three counties are rather typical of rural Eastern Oklahoma. Considerable rural industry as well as agricultural and recreation related activities exist in the counties.

Adair County

The economy in Adair County is heavily dependent upon agriculture.

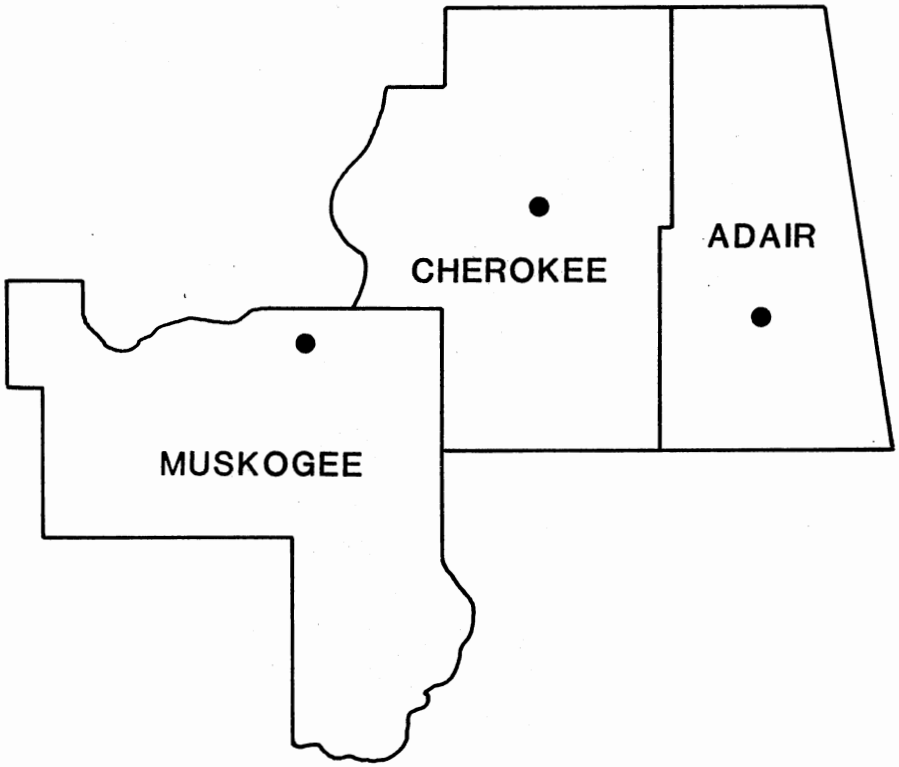

Figure 1. Map of Adair, Cherokee and Muskogee County

The Adair County seat, Stilwell, is a small agriculturally centered community. The other towns in the county are all small farming communities. The farms in Adair County tend to be small in size. In 1976, 17.3 percent of the farms were 49 acres or less, and 51.9 percent of the farms were 139 acres or less [17]. Large commercial farms are uncommon in Adair County. In 1976, 2.4 percent of the county's farms were over 1000 acres in size [17]. The average size farm for the county was 222 acres [17].

Cherokee County

The county seat of Cherokee County is Tahlequah. Recreation is of major economic importance in Cherokee County.

Considerable economic activity in the northern half of the county is related to recreation along the Illinois River. The southern and eastern parts of the county are also influenced by recreational activities. In the southern part of Cherokee County, Tenkiller Reservoir encompasses many square miles and provides for several different types of recreational activities in the area. The eastern border of the county is formed by Fort Gibson Reservoir. This reservoir also provides a multitude of recreational opportunities in the area.

Agriculture is also important in Cherokee County. Farms tend to be small; there were 17.6 percent of the farms under 50 acres and 54.8 percent were under 140 acres in size in 1976 [17].

The income generated by these farms was very low. There were 58.8 percent of the farms in Cherokee County with the gross value of their annual sales under $2,500.00 and 86.3 percent of the farmers had gross sales less than $10,000.00. The majority of the agricultural real

estate was in pasture and hay crops. Animal income was the predominant income for most rural real estate in the county [16].

Muskogee County

Muskogee is the county seat of Muskogee County. Muskogee is one of the larger non-metropolitan cities in the State of Oklahoma. Rural real estate in Muskogee County is affected by activities in Muskogee. A large amount of non-agricultural related businesses and industry exist in rural areas surrounding the city. Many people employed in Muskogee live in the rural area near the city.

Muskogee County is considered a major agricultural county in the state. Animal agriculture, cash field crops and commercial horticultural production is prevalent in the county. A large number of small farms exist in Muskogee County. In 1976, 49.7 percent of Muskogee County farms were less than 140 acres and 19.5 percent were less than 5 acres [17]. A smaller number of very large commercial farms raised the average size of farms in the county to 290 acres.

Study Area Real Estate Market Questionnaire

In order to learn about who was buying rural real estate in the study area and why transactions are taking place, a questionnaire was designed and mailed to 857 purchasers of such property from January, 1976 to December, 1978 based on records from the county clerk's office. A copy of the Eastern Oklahoma Real Estate Market Questionnaire and a cover letter that accompanied the questionnaire are presented in Appendix A. The purpose of the introductory cover letter was to explain the need for the information contained on the questionnaire, detail the

objectives of the study and insure the confidentiality of the responses. The letter also included the personal signatures of those responsible for the study.

Questionnaire Results

Questionnaires were mailed to 857 rural real estate buyers. The final response rate was 19.1 percent. The county breakdown of the response rate is summarized in Table I.

A possible reason for the less than desired response rate was the lack of a follow-up mailing. Due to the confidentiality of the returned survey, it was impossible to identify who had returned the questionnaire and who had not.

Responses to selected questions in the Eastern Oklahoma Real Estate Questionnaire are presented in Table II. These responses are discussed in the following pages of this chapter.

Days Per Year of Off-Farm Employment

Adair County had a greater percentage of the respondents that were full-time farmers than the other counties in the study area. Approximately 30.8 percent of the respondents in Adair County indicated that they were employed off the farm 50 days or less each year.

Muskogee County had the greatest percentage of respondents that were non-farm rural real estate owners. A total of 58.3 percent of the respondents in Muskogee County were employed more than 250 days per year off the farm.

These questionnaire results are consistent with what is known about the economic bases of the study area counties. Muskogee County is

TABLE I

RESPONSE RATES OF EASTERN OKLAHOMA RURAL REAL ESTATE QUESTIONNAIRE BY COUNTY

County	Response Rates (Percent)
Adair County	18.89
Cherokee County	18.76
Muskogee County	20.31
Study Area	19.13

TABLE II

RESPONSES TO EASTERN OKLAHOMA LAND MARKET QUESTIONNAIRE

	Adair	Cherokee	Muskogee	Total
Days per year of off-farm employment				
0-50	30.8	19.1	11.1	17.7
51-100	0	6.4	0	3.1
101-150	7.7	4.3	8.3	6.3
151-200	15.4	14.9	5.6	11.5
201-250	7.7	17.0	16.7	15.6
250-	38.4	38.3	58.3	45.8
Place of residence				
City or Town	29.2	25.7	27.3	26.8
Rural	70.8	74.3	72.7	73.2
Current age				
0-20	0	0	1.5	0.6
21-30	4.2	12.2	19.4	13.9
31-40	50.0	40.5	19.4	33.3
41-50	16.7	14.9	28.4	20.6
51-60	16.7	20.3	17.9	18.8
61-70	4.2	9.5	10.4	9.1
71-	8.2	2.6	3.0	3.7
Education				
Less than High School	20.8	3.9	10.8	8.9
High School	16.7	36.8	33.8	33.3
Some College	25.0	32.9	24.6	28.0
College Graduate	37.5	26.4	30.8	29.8
Sex				
Male	95.8	98.6	95.5	96.6
Female	4.2	1.4	4.5	3.4

TABLE II (Continued)

	Adair	Cherokee	Muskogee	Total
Marital status				
Married	95.8	93.2	92.4	93.8
Unmarried	4.2	6.8	7.6	6.2
Acres owned				
0	0	1.3	1.5	1.2
1-5	4.2	18.7	22.7	18.2
6-10	16.7	17.3	10.6	14.6
11-20	8.3	8.0	15.2	10.9
21-50	12.6	9.3	13.6	11.5
51-100	8.3	26.7	6.1	15.8
101-160	8.3	9.3	6.1	7.9
161-320	20.8	4.0	9.1	8.5
321-480	0	1.3	4.5	2.4
481-640	0	2.8	1.5	1.8
641-	20.8	1.3	9.1	7.2
Acres rented				
0	62.5	92.0	87.7	85.6
1-5	0	0	0	0
6-10	0	0	0	0
11-20	0	1.3	0	0.6
21-50	4.2	0	1.5	1.8
51-100	4.2	0	3.1	1.8
101-160	0	4.0	0	1.8
161-320	16.7	2.7	4.7	5.4
321-480	0	0	1.5	0.6
481-640	4.2	0	0	0.6
641-	8.2	0	1.5	1.8
Type of farming or ranching operation				
Sole Proprietor	25.0	16.2	16.2	16.2
Husband-Wife	68.8	67.6	67.6	67.2
Family Partnership	6.2	5.4	13.5	7.4
Non-Family Partnership	0	2.7	0	1.7
Family Corporation	0	8.1	2.7	7.5

TABLE II (Continued)

	Adair	Cherokee	Muskogee	Total
Years farming				
0-5	20.1	47.8	41.5	41.2
6-10	33.3	10.9	9.8	13.7
11-15	13.3	8.7	9.8	9.8
16-20	0	10.9	7.3	7.8
21-	33.3	21.7	31.6	27.5
Established or intend to establish residence				
Yes	71.4	80.0	79.4	78.6
No	28.6	20.0	20.6	21.4
If No, How Many Miles Away	7.0	30.45	61.0	40.04
Reason for purchasing				
Establish Own Farm	24.1	21.6	17.1	20.2
Expand Farming Operation	20.7	7.2	12.2	11.1
Investment	24.2	18.6	23.2	21.2
Site for Personal Residence	31.0	48.5	41.5	43.3
Industrial Development	0	0	0	0
Residential Development	0	3.1	2.33	2.3
Other	0	1.0	3.7	1.9
Seeking additional land in future				
Yes	54.5	42.9	38.1	42.6
No	31.8	15.6	19.0	19.1
Maybe	13.6	41.6	42.9	38.3
Rate of Return	18.89	18.76	20.31	19.10

economically diversified with many families that choose to live on small tracts of land and work in the city.

In Adair County, the agricultural sector is the major influence on the economy. Cherokee County is influenced by both agricultural and non-agricultural sectors. These factors affect who purchases rural real estate.

Current Age

The majority of the respondents to the Eastern Oklahoma Rural Real Estate Questionnaire were between the ages of 31 and 60 years of age. Less than 15 percent of the respondents in each of the counties in the study area were over the age of 60. This indicates that not much rural real estate in the study area may be changing hands in the future due to estate settlements.

Education

In each of the counties of the study area, over 50 percent of the respondents attended at least some college. In a market of such well educated buyers, prices paid for real estate should accurately reflect its real value based on expected future returns.

Sex-Marital Status

Almost all (93.8 percent) of the respondents to the questionnaire were male and married. The results were similar for all counties in the study area.

Acres Owned

Approximately one-third of the respondents owned 10 acres or less. Among the respondents, small land holders were considerably more common in Cherokee and Muskogee Counties than in Adair County. This suggests that there was a more active non-agricultural real estate market in Cherokee and Muskogee Counties than in Adair County.

Acres Rented

Very few of the respondents in Cherokee and Muskogee Counties stated that they rented additional real estate. In Adair County approximately 37 percent of the respondents rented real estate. This is probably because real estate in Adair County is used more for agricultural uses than the real estate in the other two counties.

Type of Farming or Ranching Operation

A majority of the farmers and ranchers that responded to the questionnaire indicated that they have husband-wife type operations. The next most popular type of operation was the sole proprietor. This is not greatly different from the situation for Oklahoma in general as documented in the Census of Agriculture [16].

Years Farming

A majority of the farmer and rancher respondents indicated that they had been in operation 10 years or less. This was the case in every county of the study area. In Adair and Muskogee Counties over 30 percent of the farmer and rancher respondents indicated that they had been in operation for over 20 years.

Established or Intent to Establish Residence

A substantial majority of the respondents indicated that they have established or intend to establish their residence on rural real estate. Such preference for rural rather than city living seems to be common in the study area, based on the number of rural residences in evidence.

Reason for Purchasing

The major reason for the purchase of the real estate by the respondents was a site for their personal residence. Other important reasons included the establishment of their own farm, expansion of farming operations and as an investment.

Seeking Additional Land in the Future

A majority of the respondents did not rule out the purchase of additional real estate in the future. This indicates that the rural real estate market in the study area will be active in future years.

CHAPTER III

GENERAL FACTORS AFFECTING THE RURAL REAL ESTATE MARKET

The factors affecting rural real estate values are of interest to assessors, rural appraisers, farmers and many other individuals that try to understand the dynamic nature of the rural real estate market. The purpose of this chapter is to examine relevant economic theory that is applicable to rural real estate markets and to review previous studies of rural and agricultural real estate markets to identify factors which influence rural real estate values.

Relevant Theory

General micro-economic theory can be applied to the rural real estate market to help explain its performance. The value of a tract of real estate is determined by the returns that can be generated by the most profitable enterprise that a particular tract of real estate is capable of supporting. The value of real property is generally influenced by the general economic development of the area, quality of the real estate, its location and the proximity and the quality of the nearby public and private developed area. Each of these influences on rural real estate is examined in the following sections.

Impact of Tract Quality

Several factors go together to give each tract of real estate a unique productive capacity. These factors include fertility, underlying structure of subsoil, topography, drainage and climate. The value of a tract of real estate can be considered to be the present value of all of its future earnings. These factors go together to determine the earning capacity of the real estate. The use of a production function can help explain how these factors affect real estate values. A production function defines the physical relationship between a firm's resource inputs and its output of goods and services per unit of time [7].

The production function for a firm defines the total physical product, average physical product and the marginal physical product for the firm. The total physical product of a firm is the total amount of output produced using varying amounts of an input. Functionally the total physical product can be represented as follows:

$$Y = F(X_1\ X_2, \ldots X_n)$$

Where Y is output, X_1 is the variable input and $X_2 \ldots X_n$ represents all of the inputs that are fixed in quantity. Average physical product is the total physical product divided by the amount of input used. The marginal physical product is the change in the total physical product for a one-unit change in the amount of input used. Figure 2 shows the relationships between total physical product, average physical product and the marginal physical product.

To determine the value of the total product for a firm the total physical product is multiplied by the price of the output. The value of the total product shows the total revenue generated at different levels

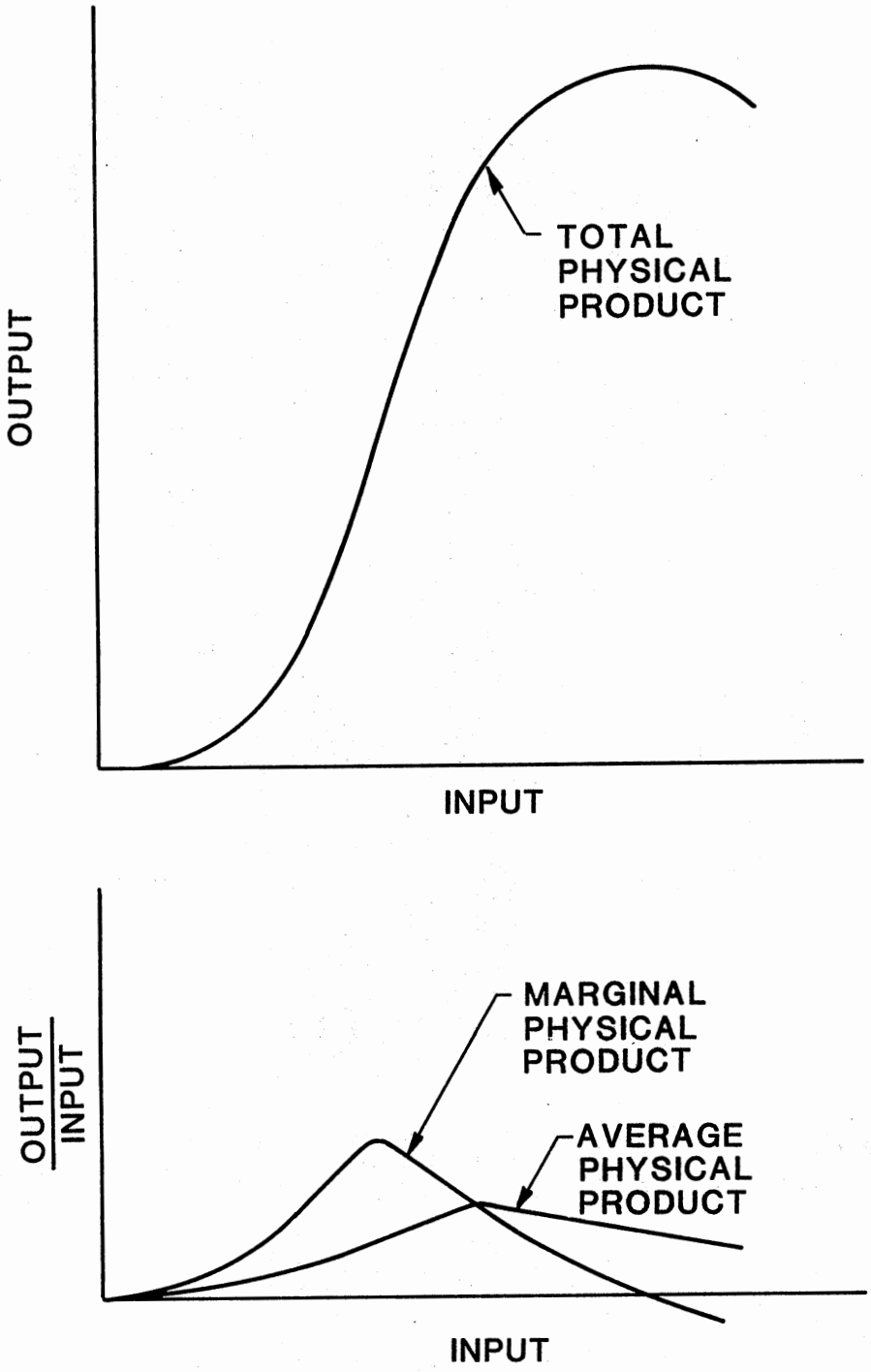

Figure 2. Physical Relationship Between Total Physical Product, Average Physical Product and Marginal Physical Product

of input use. The value of the average product is the average physical product times the price of the output and the value of the marginal product is the marginal physical product times the price of the output. Figure 3 shows the relationship between the value of the total product, value of the average product and the value of the marginal product.

The effect of different tract quality can be examined using this analysis. If the same amounts of inputs are applied to two identical tracts of real estate with the exception that one tract has a higher quality, the value of the total product for the tract of higher quality will be greater than the value of the total product for the lower quality tract. This relationship is shown graphically in Figure 4. The value of the marginal product for the higher quality tract is also greater than the value of the marginal product for the lower quality tract. The relationship between the value of the marginal product curves for the higher and lower quality tracts is shown in Figure 5. If the assumption is made that the producers of the output are operating in a perfectly competitive market, then the price of the input is constant for all levels of input usage. This assumption enables us to establish the profit maximizing position as where VMP = P_x, where VMP is value of the marginal product and P_xM is price of the input. This relationship is shown graphically in Figure 6. A firm will produce a product where VMP = P_x in the rational stage of production. Figure 7 shows the stages of production for a firm.

Stages I and III are not considered to be rational stages of production. In stage I, a firm would improve its position by using more inputs to produce a greater amount of output. In stage III, total output is decreased by using additional units of input. The rational stage

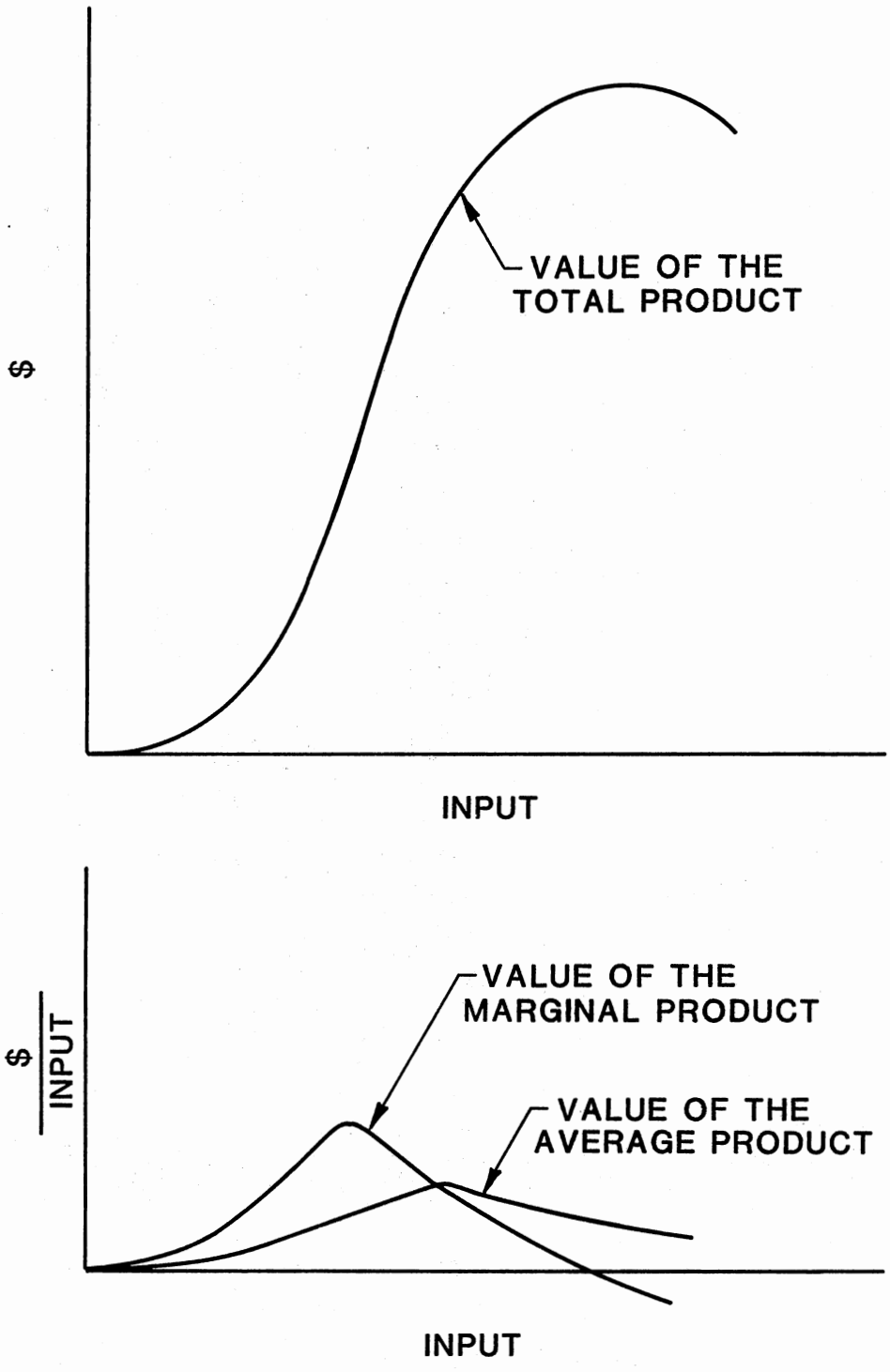

Figure 3. Relationship Between Value of the Total Product, Value of the Average Product and Value of the Marginal Product

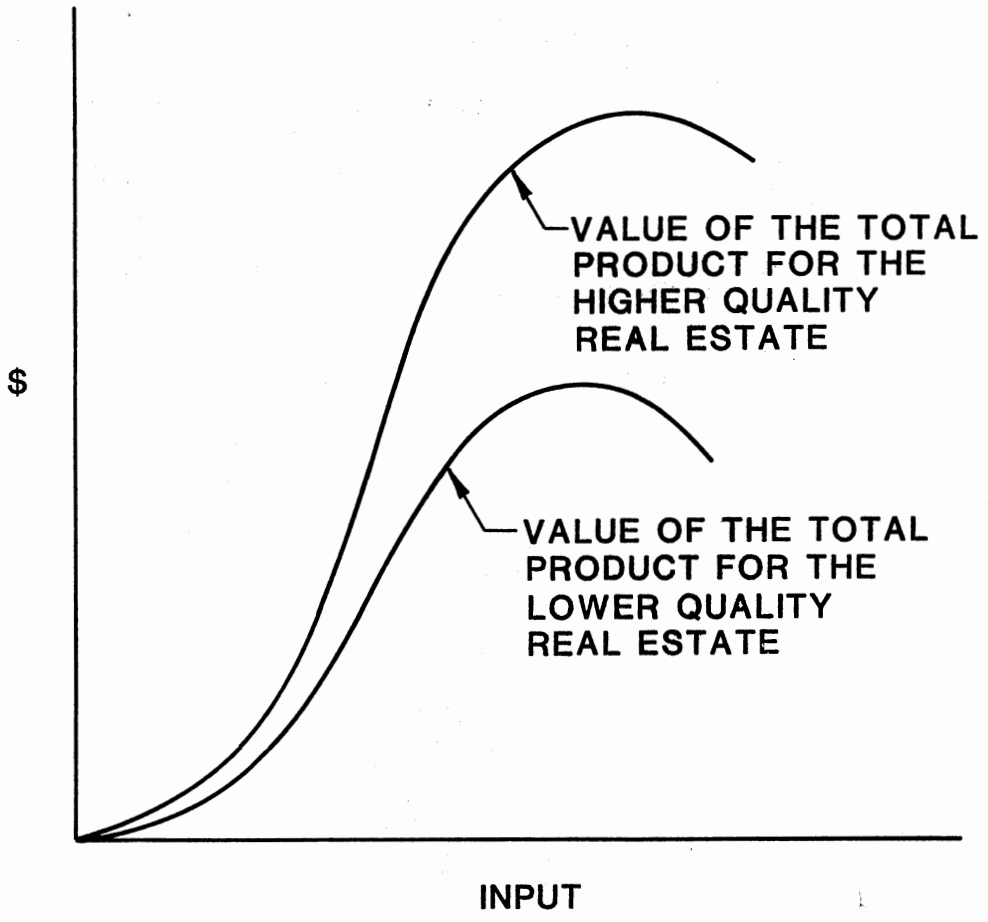

Figure 4. Relationship Between the Value of the Total Product for Two Different Tracts of Real Estate

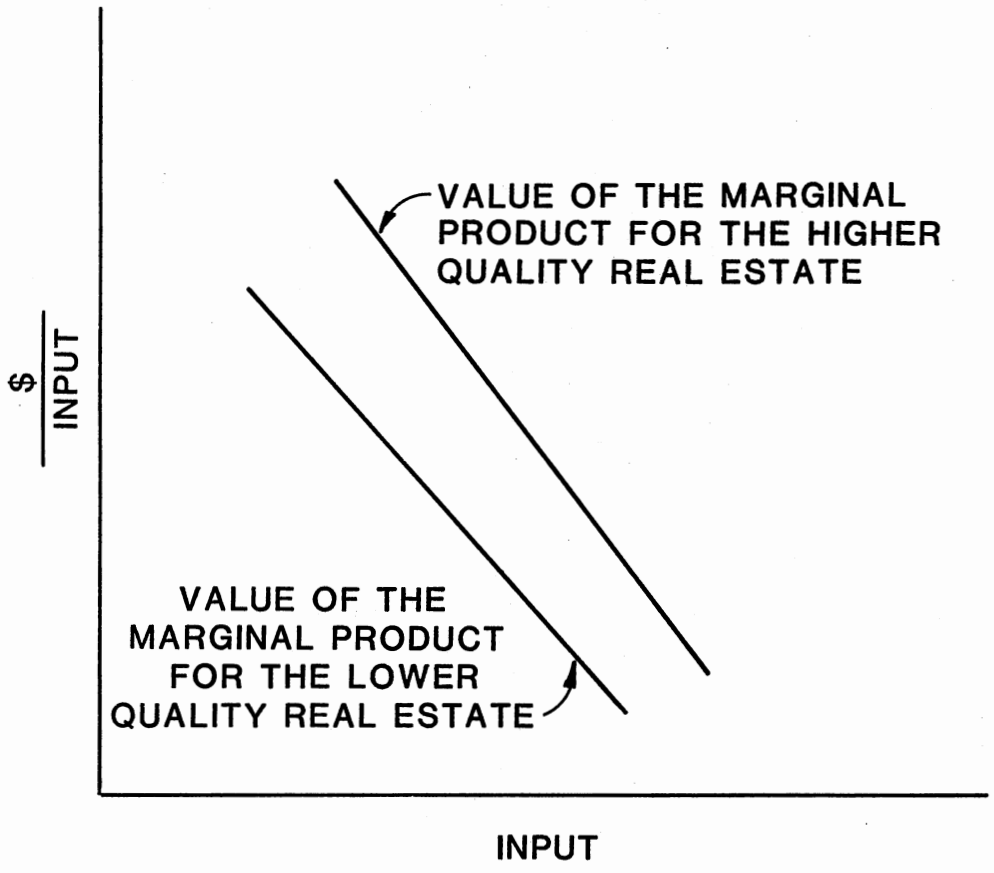

Figure 5. Relationship Between the Value of the Marginal Product for Two Different Tracts of Real Estate

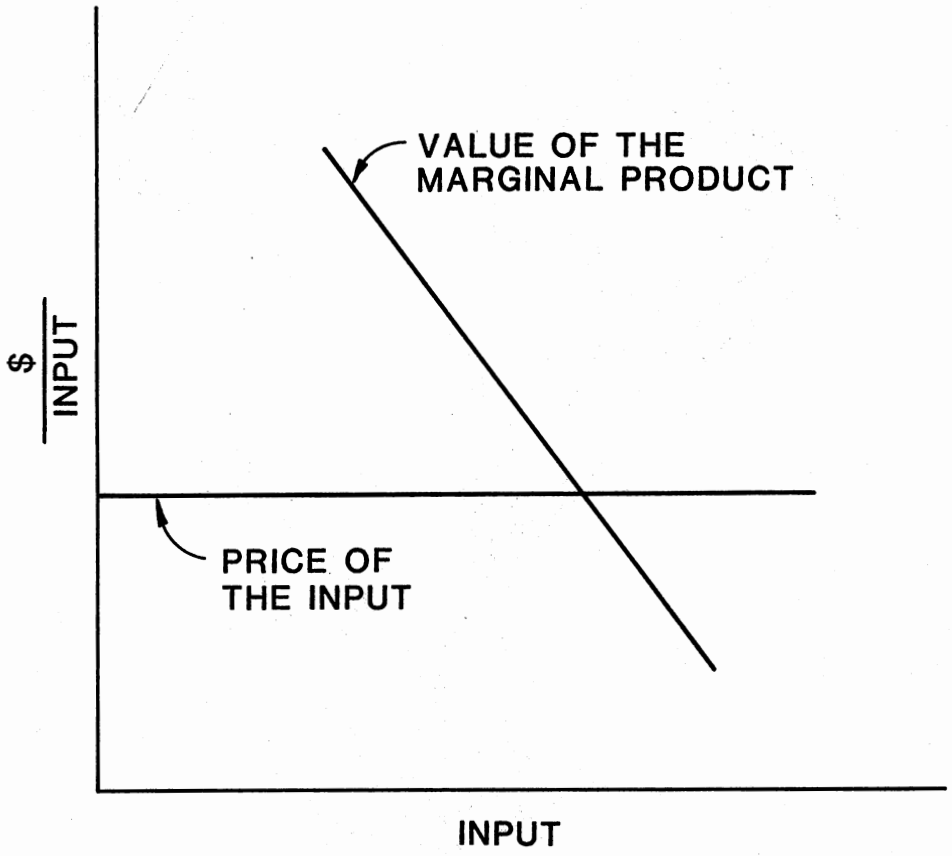

Figure 6. Profit Maximizing Position

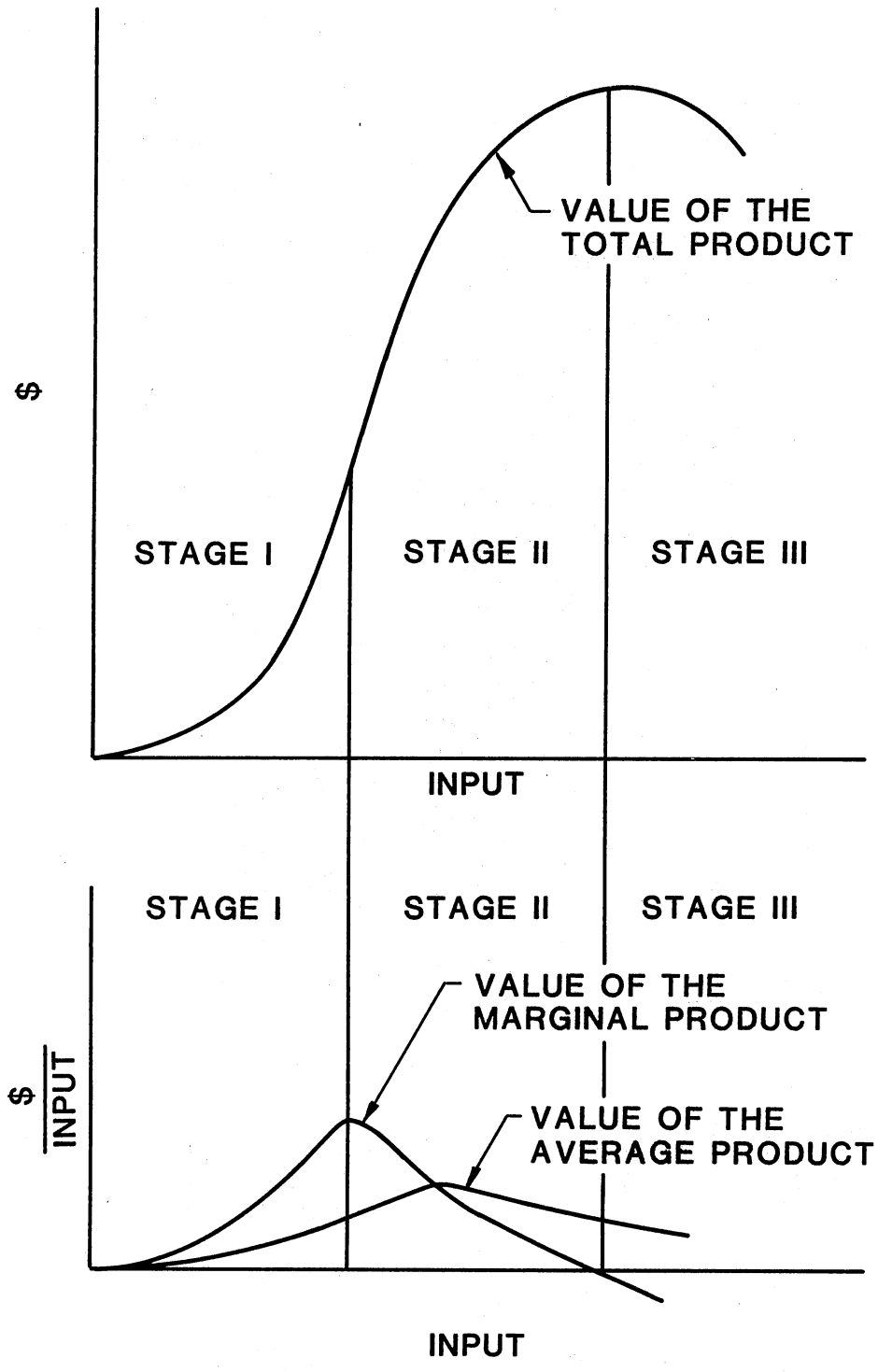

Figure 7. Stages of Production

of production in stage II. A firm will maximize its profits if it equates the value of the marginal product and the price of the input in stage II of production. If there are two tracts of real estate, one with a higher quality than the other, with all other things equal, the higher quality tract will generate a greater total revenue than the lower quality tract. This is translated into higher real estate values for the higher quality tract.

Site or Location Impact

A tract of real estate that is farther away from a central market than another tract of real estate will have a greater cost structure. This relationship can be seen in Figure 8. If the assumption is made that the producers are pure competitors, then it can be stated that producers will receive the same price per unit for their product no matter how many units they sell. This determines the profit maximizing point for the producer to equate marginal cost and the price of the output as:

$$MC = P_y$$

where

MC = Marginal Cost

P_y = Price of the Output

If two producers are using real estate, one located more favorably than the other, when they maximize their profits the producer with the more favorably located real estate will have greater profits exclusive of real estate costs.

For the example shown in Figure 8, such profits are represented by

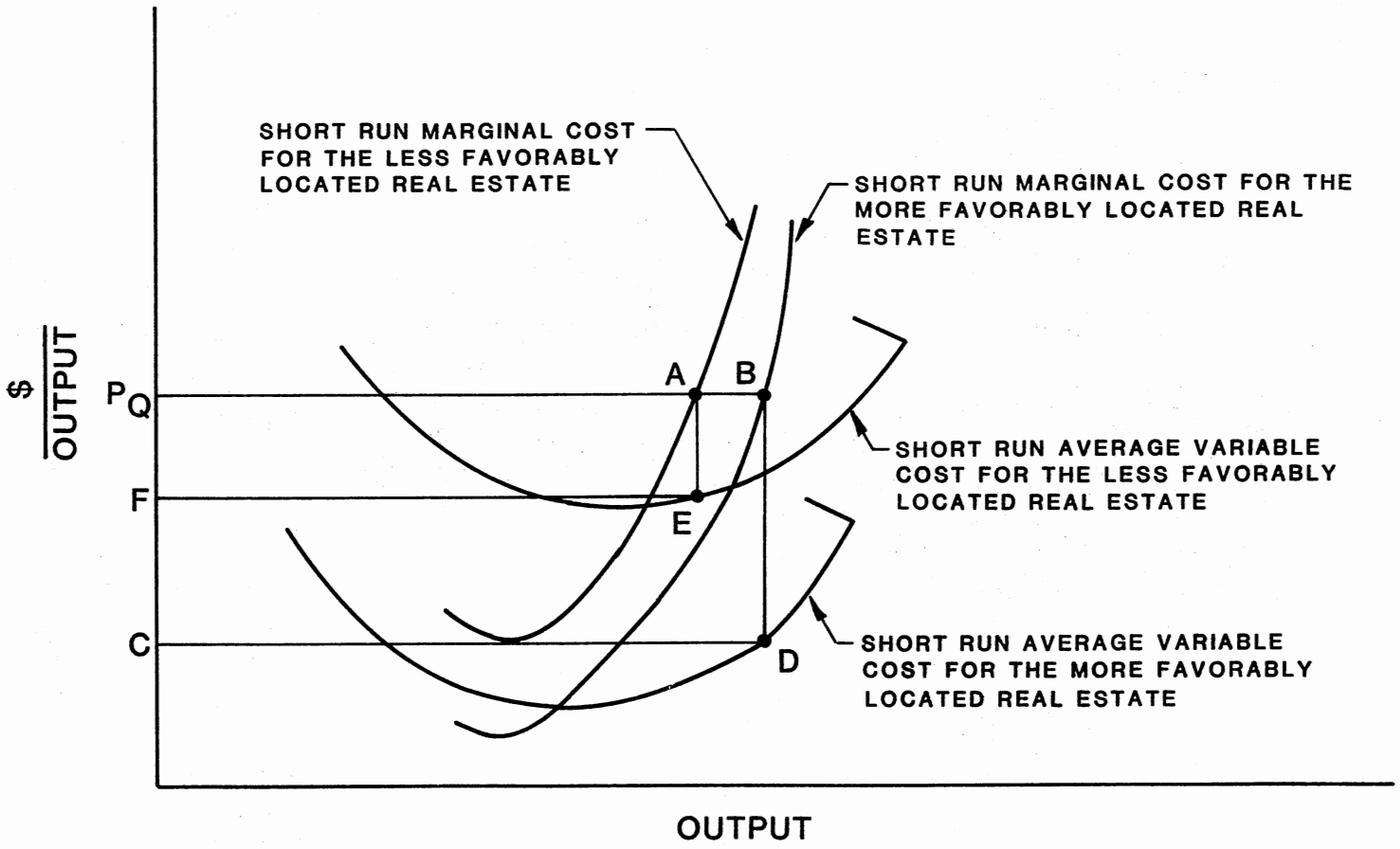

Figure 8. Relationship Between the Average Variable Cost and Marginal Cost for Two Different Tracts of Real Estate

the area defined by P_Q, B, D, C. For the less favorably located firm such profits are represented by the smaller area defined by P_Q, A, E, F. These differences in profits, exclusive of real estate costs, will cause the better located real estate to have a higher market value.

Economic Development Impacts

Economic development is the process where an economy's real income increases over time. This results from improvements in production techniques coupled with increases in the kinds and quantities of economic or capital resources utilized. Economic development is often accompanied by a general increase in the population. The effect of economic development can be shown through an analysis of the supply and demand for real estate.

The supply and demand of real estate can be represented graphically as in Figure 9. This figure shows the supply and demand for real estate at two different points in time. The supply of real estate is considered to be fixed resulting in the vertical supply schedule, SS. Time period 1 is represented by D_1D_1. In time period 1, R_1 units of real estate are bought at price P_1. After general economic development and growth, the demand for real estate shifts to D_2D_2. This results in a higher price P_2, for the same units of real estate R_1. A positive relationship exists between economic development and the value of real estate.

The demand for rural real estate has increased steadily over time. An increasing proportion of this rise has been due to the non-agricultural sector. Part of the reason for the increase in non-agricultural demand for rural real estate is due to increasing levels

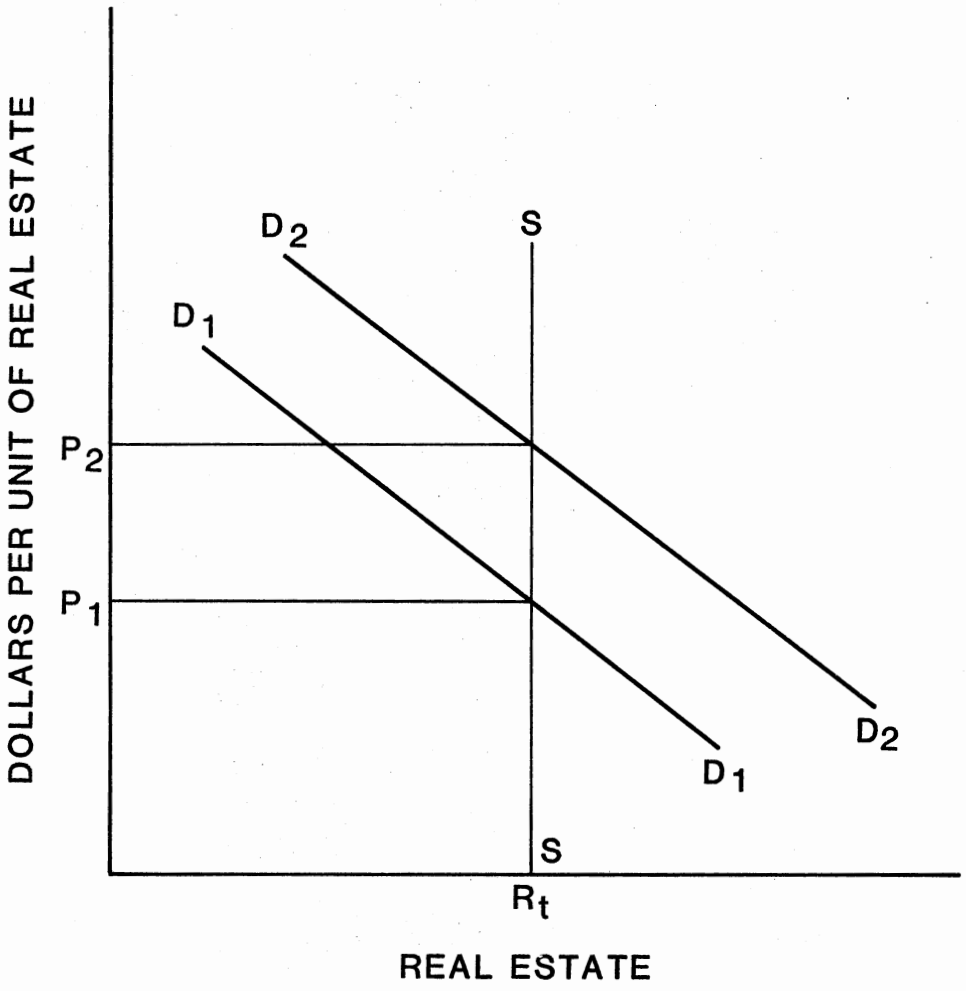

Figure 9. Supply and Demand of Agricultural Real Estate

of population and per capita income. The growth in income and population has increased the demand for real estate for commerical, residential and recreational purposes. This increase in the demand for real estate has spread to the rural areas due in part to improvements in the transportation sector. Better quality highways from rural areas into the metropolitan areas encourage city workers to live in rural areas, some distances from their work. This phenomenon has resulted in increased demand for rural real estate and thus increased rural real estate values.

Review of Literature

Previous research efforts concerning rural real estate markets in Oklahoma and other states have revealed factors that influence real estate values.

VanDeveer [4] examined the factors that influence farm land values in six Western Oklahoma counties. The criteria used for determining which land sales were examined included a restriction that all sales be 20 acres or more. The factors were broken into two categories, physical and non-physical factors. Physical factors considered included number of acres, date of sale, proportion of mineral rights transferred, peanut allotment, road accessibility and tract quality. The non-physical variables included occupational status, type of ownership, farm enlargements and other conditions associated with land transfers, attitudes and personal characteristics.

Regression analysis was applied to fit the models. The results indicated that three factors had the greatest influence on land values. They included the general economic trend, income earning capacities of

farmers and non-agricultural economic development. The study also indicated that inflation, net rent increases and advanced levels of technology are expected to be important in the future.

Jennings [5] conducted a study to evaluate factors affecting farm land values in North Central Oklahoma. Regression analysis was performed on several variables including time, tract size, distance variables, mineral rights, quality and productivity variables. The restriction on the size of the subject tracts in the selection process was 40 acres. The results from this study indicated that the time variable explains much of the variation in agricultural land values in North Central Oklahoma. The time variable encompasses the general influences of inflation, net rent increases, farm enlargement, expanding non-farm use of rural lands and advancing technology.

Tower [11] conducted a study of factors affecting rural land prices in East Central Florida. Through the use of multiple regression analysis, it was determined that the size of tract, value of improvements, ratio of cultivated land and woodland, distance to Orlando, Florida, and the distance to nearest town of population 10,000 to 50,000 had significant impacts on rural land values. The study concluded the size of tract variable and the distance variables exhibited non-linear relationships to the price per acre.

Pine and Hancock [10] determined that income, foreign markets, available capital, farm enlargement, technology and inflation were the factors influencing farm land values in Kansas. The study concluded that high farm income, new technology, general inflation, less attractive alternative investments and consumptive uses would encourage higher land prices. However, a period of dry years, a disease or insect

outbreak without adequate chemicals or lower prices for farm products could reduce farm income and put a brake on land prices.

Vrooman [14] conducted a study to determine whether there were external benefits generated by state owned land in the Adirondack region of New York. The results showed that tracts of land that were adjacent to the state owned land had a higher value than tracts not joining public land.

Other findings of the study indicated that the important factors affecting the value of rural land were accessibility by road, location, adjacency to state owned land, date of sale, land use classification, size of tract, site type, topography and non-local buyers.

CHAPTER IV

ANALYSIS OF REAL ESTATE VALUES

The procedures used in this study to evaluate rural real estate values are examined in this chapter. Also, the models that were used in the analysis are defined. Next, the variables that were used in the models are presented. Finally, the results of the models are presented in detail.

Method of Analysis

The general method of analysis utilized to explain study area real estate values was multiple linear regression. The following section describes the process of multiple linear regression analysis. According to this method of analysis, changes in any one variable can be either partially or totally explained by changes in various other variables. The assumption must be made that a linear relationship exists between a variable Y and K-1 explanatory variables (X_2, X_3, ..., X_k) and a disturbance term U. If there is a data set of n observations on Y and the X's, it can be stated that:

$$Y_i = B_1 + B_2X_{2i} + \ldots + B_kX_{ki} + U_i \qquad i = 1,2, \ldots, n$$

The unknown factors in the equation are the B coefficients and the parameters of the u distribution (6). In order to solve for the B coefficients the u distribution must be determined. A compact method

of writing the n equations above is with matrix notation. Using matrix notation the equations can be written as follows:

$$y = XB+u$$

Where

$$Y = \begin{bmatrix} Y_1 \\ Y_2 \\ \cdot \\ \cdot \\ \cdot \\ Y_n \end{bmatrix} \qquad X = \begin{bmatrix} 1 & X_{21} & \cdots & X_{k1} \\ 1 & X_{22} & \cdots & X_{k2} \\ & \cdot & & \cdot \\ & \cdot & & \cdot \\ & \cdot & & \cdot \\ 1 & X_{2n} & \cdots & X_{kn} \end{bmatrix}$$

$$B = \begin{bmatrix} B_1 \\ B_2 \\ : \\ : \\ B_k \end{bmatrix} \qquad U = \begin{bmatrix} U_1 \\ U_2 \\ : \\ : \\ U_n \end{bmatrix}$$

To account for the intercept, B_1, a column of units must be included in the X matrix. To make further progress on the estimation of the B coefficients vector, some additional assumptions must be made. These assumptions are:

(1) $E(U_i) = 0$ for all i

(2) $E(UU') = 6^2 I_n$

(3) X is a set of fixed numbers

(4) X has a rank $K < n$

The first assumption states that the U_i are variables with zero expectation. Assumption 2 has two important factors that must be considered. First it shows that $E(U^2) = 6^2$ for all i, that is the U_i,

have a constant variance, 6^2. The constant variance is also referred to as homoscedasticity. Second, it shows that E $(U_t U_{t+s}) = 0$ for s o, that is the U_i values are not correlated with each other. Assumption 3 indicates that in repeated sampling the sole source of the variation in the y vector is the variation in the u vector. This assumption also indicates that the properties of the estimators and tests are dependent upon the X matrix. The final assumption states that the number of observations exceeds the number of parameters to be estimated. This assumption also indicates that no exact linear relationship exists between any of the X variables.

The least squares procedure was used to estimate the B coefficients. This procedure results in the following estimated regression equation:

$$\hat{Y}_i = b_o + b_i x_{1j} + b_2 x_{2j} + \ldots + b_k x_{kj}$$

where

$\hat{Y}_i$ = the estimate of y for the i'th observed values of the X's

$b_o, b_1, b_2, \ldots, b_k$ are the estimates of $B_o, B_1, B_2, \ldots, B_k$

Then the observed value for the i'th Y is

$$Y_i = b_o + b_1 x_{1i} + b_2 x_{2i} + \ldots + b_k x_{,i} + e_i$$

where

$e = Y - \hat{Y}_i$ = the unexplained variation to be minimized by the equation.

The Models

The following three basic models were utilized in this research to explain the variation in rural real estate values located within the study area:

1. models of values of all rural real estate,
2. models of values of rural agricultural real estate and
3. models of values of rural non-agricultural real estate.

These general model types are specified in the following paragraphs.

Models of Values of All Rural Real Estate

For the purposes of this research, factors affecting study area rural real estate values aggregated over all uses were specified as follows:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7)$$

where

Y = Value per acre for rural real estate,

X_1 = Date of sale,

X_2 = Size of tract in acres,

X_3 = Location of real estate within a rural water district (binary code),

X_4 = Soil slope,

X_5 = Value of improvements per acre,

X_6 = Real estate use (agricultural or non-agricultural binary code) specified by County Assessors,

X_7 = Distance to nearest county seat.

This general model was applied to the total study area and the individual counties in the study area.

Models of Values of Rural Agricultural Real Estate

The general form of models used to explain variability in values of agricultural real estate in the study area is as follows:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6)$$

where

Y = Value per acre for agricultural real estate,

X_1 = Date of sale,

X_2 = Size of tract in acres,

X_3 = Value of improvements per acre,

X_4 = Improved agricultural real estate (crops and improved pasture or forest and rangeland, binary code),

X_5 = Soil slope,

X_6 = Distance to nearest county seat.

Alternative methods were employed to define agricultural real estate. Sub-models were estimated for each alternative. The first method of defining agricultural real estate was that real estate designated as agricultural by the county assessors in the study area. Using these designations, the model of the value per acre of agricultural real estate was applied to designated agricultural tracts in the study area (Adair, Cherokee and Muskogee Counties). A second alternative for defining agricultural real estate was to make assumptions that all tracts of real estate that are greater than specified sizes are used for agricultural purposes and that smaller tracts are non-agricultural. Value

per acre models were estimated for parcels of real estate greater than 5 acres, greater than 10 acres and greater than 20 acres for the study area taken as a whole and for the individual counties.

Models of Values of Non-Agricultural Real Estate

The general form of models used to explain the value per acre for non-agricultural real estate in the study area was specified as follows:

$$Y = f(X_1, X_2, X_3, X_4, X_5)$$

where

Y = Value per Acre for Non-Agricultural Rural Real Estate,

X_1 = Date of Sale,

X_2 = Size of tract in acres,

X_3 = Value of improvements per acre,

X_4 = Location of real estate within a rural water district (binary code),

X_5 = Distance to nearest county seat.

Alternative designations of non-agricultural real estate were derived in a similar manner as were designations of agricultural real estate. One method used to define non-agricultural real estate was to use the County Assessors' designations. County Assessors' records specify real estate use by three categories--agricultural, residential and commercial. A non-agricultural real estate use variable was developed by aggregating assessors designations of residential and commercial lands. Using this definition of non-agricultural real estate use and the general models specified above, models were estimated for value per acre for non-agricultural real estate tracts in the entire study area

and in each individual county (Adair, Cherokee and Muskogee). Another method used to define non-agricultural real estate was to assume that all tracts of rural real estate less than a specified size were used for non-agricultural purposes. Value per acre models were estimated for parcels of real estate less than or equal to 5 acres, less than or equal to 10 acres and less than or equal to 20 acres for the entire study area taken as a whole and for the individual counties.

Description of Variables and Data Collection

Data utilized in this study to analyze rural real estate values in the study area consisted of information describing real estate transactions for the years 1976, 1977 and 1978.

Legal records for all study area rural real estate transactions, which were recorded during this time period and which involved parcels greater than one acre in size, were examined. Those transactions that were clearly not market transactions were eliminated. Data were collected on the remaining transactions. These data were collected from several sources including legal records in county offices, state and federal agency data banks and general public information sources as specified below.

Value Per Acre of Real Estate

The value per acre for tracts of rural real estate that changed ownership in the study area during the time period of the study was estimated from revenue stamps on the warranty deeds filed in the county clerk's office. Market values for such tracts were estimated by using the following formula:

$$TMV = (RS/TR)\ 1000$$

where

TMV = Tract Market Value,

RS = Value of Revenue Stamps,

TR = Tax Rate per $1,000 of value.

The tax rate was determined at the time the sale took place. A tax rate of $1.10 for every $1,000.00 of the sale value was used to estimate market value for rural real estate sales that took place before August, 1978. For sales that took place after July, 1978 a tax rate of $1.50 for every $1,000.00 of the sale value was used.

The value of rural real estate was adjusted for general inflation by using the consumer price index (2) to convert all real estate market value data to 1976 dollars. To determine the value per acre for the real estate the total value was divided by the size of the tract in acres.

Date of Sale

The date of sale associated with the transaction of a tract of real estate was obtained by month and year from the warranty deed in the county clerk's office. Each month in the time period considered in the study (January, 1976 through December, 1978) was chronologically assigned a number from 1 to 36. For example, January, 1976 was assigned the number 1, February, 1976 was assigned the number 2, etc. The date of sale variable was included in all models of the value per acre for rural real estate estimated in this study. Special factors particularly related to the fact that real estate is an absolutely limited resource

should cause real estate prices to increase at a rate greater than the general economy inflation rate. Therefore, date of sale was expected to be positively related to value per acre of real estate.

Size of Tract

The sizes of the tracts of real estate considered in this analysis were entered into appropriate models in acres. Such information was obtained from record books in county assessors' offices using owners' names and legal descriptions from the warranty deeds in the county clerks' offices. The size of tract variable was included in all of the models estimated in this study.

The amount of credit that is required for the purchase of larger tracts of real estate is difficult for most people to finance. Due to this the value per acre for the large tracts of real estate tend to be lower than the value per acre for the smaller tracts of real estate. The expected relationship between the size of the track and the value per acre of real estate is negative.

Rural Water District

The variable that signified that a tract of real estate was located inside a rural water district was determined by data available from the Oklahoma Conservation Commission. The Oklahoma Conservation Commission has prepared county based maps of rural water districts in Oklahoma, including those in the study area counties. This variable only designates the tracts of real estate that were inside a rural water district and not the tracts of real estate on which water taps were located. A variable to identify tracts of real estate on which water taps were

located would be more appropriate for the analysis of rural real estate values. However, such specific data were not available.

The rural water district variable was specified by a one (1) if a tract of real estate was in a rural water district and a zero (0) if the tract of real estate was not in a rural water district. The rural water district variable was included only in the non-agricultural real estate value models estimated in this study.

When non-agricultural tracts of real estate were located inside a rural water district the potential of being connected into the water line, was expected to increase the value per acre of the tract of real estate. Therefore, the location of a tract of real estate inside a rural water district was expected to have a positive influence on the value per acre for real estate.

Soil Slope

Data on soil slope in the study were obtained from the Oklahoma Foundation for Research and Development Utilization, Inc. This organization provided county maps of soil slopes in 40 acre cells as determined by the Soil Conservation Service of the United States Department of Agriculture. The slope of the soil on a 40 acre tract as reported was an average over the area and reported as one slope. The percent of slope was broken down into three different groups as follows:

1. zero to three percent,
2. three to eight percent and
3. greater than eight percent.

The slope of real estate parcels considered in this study were assumed to be the midpoints of the range reported for that parcel except

a slope of 8.5 percent was assumed for parcels which had indicated slopes of greater than eight percent. The soil slope variable was included only in models of agricultural real estate.

On rural real estate utilized for agricultural purposes the value per acre of the real estate was expected to decrease as the percent of soil slope increased. The usefulness of agricultural real estate is decreased with a steeper slope. As the usefulness of agricultural real estate declines, the value of such real estate decreases.

Value of Improvements per Acre

The value of the improvements that were present on tracts of real estate sold in the study area were estimated from information in the county assessors' offices. To estimate the market value of the improvements, assessment rates for improvements were applied to the assessed values of the improvements as indicated below:

$$MVI = AVI/AR$$

where

MVI = Market Value of Improvements,

AVI = Assessed Value of Improvements,

AR = Assessment Rate.

The assessment rates utilized in these calculations were mean assessment rates by property classes as reported by the Oklahoma Tax Commission [8]. These rates are presented in Table III. The value of improvements on a tract of land was divided by the size of the tract in acres to calculate the value of improvements per acre. The value of improvements per acre variable was included in each of the models

TABLE III

MEAN ASSESSMENT RATES BY PROPERTY CLASSES BY YEAR[1]

	Residential	Commercial	Agricultural
Adair			
1976	12.86	13.92	4.71
1977	12.70	14.89	8.67
1978	10.86	14.03	8.67
Cherokee			
1976	13.13	13.02	4.65
1977	11.98	12.28	6.59
1978	11.73	13.52	6.63
Muskogee			
1976	14.94	14.32	5.04
1977	13.82	14.16	5.48
1978	12.21	13.94	5.48

[1]Taken from [8].

estimated.

The relationship between the value of improvements per acre and the value of real estate was expected to be positive. The value of improvements on a tract of real estate was expected to be included in the value of the sale of the property.

Improved Agricultural Real Estate

Data on the variable, improved agricultural real estate was obtained from the Oklahoma Foundation for Research and Development Utilization, Inc. This organization has compiled in a computerized data system, Soil Conservation Service information on agricultural land use patterns for counties throughout Oklahoma, including the study area counties. The land use patterns are reported for 40 acre cells. The land use classifications are forest land, rangeland, pastureland and cropland. For this study, forest and rangeland were grouped together. If a tract of real estate was classified as forest or rangeland, then the value of the improved agricultural real estate variable was zero. Pasture and cropland were also grouped together. If a tract of real estate was pasture or cropland, the value of the improved agricultural real estate variable was one. The improved agricultural real estate variable was included only in the models of agricultural real estate estimated in this study. Cropland and improved pasture produce higher yields and greater cattle gains than forest or rangeland. This will result in a higher income from the real estate. Therefore, the relationship between improved agriculture real estate and the value per acre of real estate was expected to be positive.

Non-Agricultural Real Estate

The non-agricultural real estate use variable was determined by data in study area county assessors' offices. In the record books in the county assessors' offices, the assessed values of real estate and improvements and the size in acres for the rural tracts of real estate are specified by real estate use categories. These categories are agricultural, residential and commercial. The reason for the breakdown of the assessed values was that different assessment rates were used for agricultural, residential and commercial property. If a tract of real estate was determined to be residential or commercial by the county assessors, a value of one was assigned to the non-agricultural real estate use variable. The non-agricultural real estate use variable was included only in the models of values of all rural real estate. The pressure placed on rural real estate for non-agricultural uses is great. This pushes the value of real estate that is used for non-agricultural uses above the value for agricultural real estate. Therefore, positive relationships were expected between the non-agricultural real estate use variable and the value per acre for rural real estate.

Distance to the Nearest County Seat

For each parcel of real estate considered in this study, the distance to the nearest county seat was measured in highway miles. A map from the Oklahoma Highway Department was used to determine the measurement. The distance from the real estate tract to the nearest county seat was measured. It was possible for a tract of real estate located in one county to be closer to the county seat of another county. This variable was included in all models of rural real estate values. The

greater the distance that must be traveled from a tract of real estate to reach the major market in the area the greater the operating expense required for the operation of the real estate. This translates into a lower value per acre for the real estate. Therefore, a negative relationship was expected between the distance to the nearest county seat and the value per acre for rural real estate.

Results

The estimation procedure selected to analyze the data collected was the Statistical Analysis System (SAS). SAS is a computer routine developed by Barr and Goodnight [1] that is extremely flexible in data organization and manipulation. SAS also lends itself particularly well to multiple regression analysis. The general forms of the models specified earlier in this chapter were applied to the data and evaluated on the basis of certain criteria. These criteria were (1) the amount of variation in the dependent variable explained by the equation as measured by the coefficient of determination (R^2), (2) the significance of the equation and each variable in it and (3) the consistency of the sign of each variable's coefficient with economic theory.

Models of Value of All Rural Real Estate

The general model of values of all rural real estate was estimated for the study area as a whole and for the individual counties of the study area. The specific form for the model is as follows:

$$VPA = a + b_1\ DOS + b_2\ SIZ + b_3\ SRS + b_4\ RWD + b_5\ SSL + b_6\ IPA + b_7\ NAG + b_8\ DNC + b_9\ SRD$$

where

VPA = Value per acre,

DOS = Date of sale,

SIZ = Size of tract,

SRS = Square root of size of tract,

RWD = Rural water district,

SSL = Soil slope,

IPA = Value of improvements per acre,

NAG = Non-agricultural real estate,

DNC = Distance to the nearest county seat,

SRD = Square root of the distance to the nearest county seat,

The results are shown in Table IV and the means of the variables are shown in Table V. The F-tests indicated that the models were significant at the .0001 level.

Date of Sale. Date of sale had a significant impact on the value per acre for all rural real estate in the study area as well as on the individual county models. Its impact on the value per acre in Cherokee County was not as significant as it was for the other counties but worth considering. Based on the value of the coefficient for the date of sale it can be said that the value of real estate in the study area adjusted for normal inflation, increased by an estimated $44.93 per acre per month due to the impact of time related factors such as increasing demand for rural real estate for recreational and investment purposes. The range of this variable's estimated impact was from $22.96 per acre per month in Cherokee County to $79.22 per acre per month in Muskogee County. In preliminary runs, square root of date of sale was examined as an independent variable, however, the coefficients of the date of sale

TABLE IV

MODELS OF VALUE OF ALL RURAL REAL ESTATE[a]

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
Intercept	1068.3254	1398.0609	254.4697	3129.9609
	(.2405)	(.3174)	(.8354)	(.0920)
DOS	44.9273	44.0080	22.9646	79.2230
	(.0012)	(.0420)	(.1449)	(.0054)
SIZ	8.6603	6.8783	25.6826	9.5601
	(.1367)	(.2331)	(.0591)	(.4596)
SRS	-175.6568	-223.4772	-456.3412	-165.8084
	(.1359)	(.1537)	(.0326)	(.5093)
RWD	755.0358	-403.7762	101.8301	817.4678
	(.0126)	(.6834)	(.7640)	(.2048)
SSL	50.8775	-84.0370	-328.3499	48.1956
	(.3279)	(.3055)	(.4547)	(.6556)
IPA	0.4920	0.3510	0.4187	0.4840
	(.0001)	(.0001)	(.0001)	(.0001)
NAG	4413.2468	1662.1618	2741.0952	8250.9029
	(.0001)	(.0201)	(.0001)	(.0001)
DNC	33.2077	24.4135	-216.3474	290.1349
	(.7028)	(.8566)	(.1254)	(.0722)
SRD	-511.44417	-120.2092	1140.8883	-2353.1559
	(.3170)	(.8744)	(.1231)	(.0207)
R^2	.4440	.3947	.3902	.5262
N	1116	168	427	421

TABLE IV (Continued)

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
F	98.16	11.45	36.75	50.71
PR > F	.0001	.0001	.0001	.0001

[a]Numbers appearing in parentheses represent the observed significance level of the variable as determined by the "student-t" values.

TABLE V

MEANS OF THE VARIABLES IN THE MODELS OF VALUE
OF ALL RURAL REAL ESTATE

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
VPA	2887.8108	2028.3988	2022.6277	4313.7791
DOS	19.1146	17.5773	19.9430	18.6912
SIZ	32.3834	43.2791	31.4569	29.1953
SRS	4.5968	5.0004	4.7287	4.2706
IPA	2732.8509	2204.0248	1855.2139	4042.4887
SSL	4.0954	5.0536	3.6345	3.5178
DNC	10.2765	12.0657	8.8624	11.3325
SRD	3.0153	3.3103	2.8158	3.1473

and the square root of the date of sale variable were not significant.

Size of Tract. To examine the impact of the size variable on each of these models both the size in acres and the square root of the size must be considered together. Table VI shows the total estimated impacts of size based on the four models.

The size of the tract of real estate in acres had a varying impact on the value per acre for rural real estate, but in general, size of tract appears to be inversely related to real estate value per acre. For the Cherokee County model, the size variables are quite significant and for the Muskogee County model the variables are not significant. In the total model and the Adair County model, size of tract variables are only marginally significant.

Rural Water District. The dummy variable stating that a tract of land is in the boundaries of a rural water district was significant in the general study area model. It was not significant, however, in the county models. Based on this analysis, the value per acre for rural study area real estate increases by an estimated $775.04 if the tract is located inside a rural water district.

Soil Slope. Soil Slope did not significantly affect the value of real estate in the total model or any of the county models as reported in Table IV. This was probably due to the fact that much of the real estate considered in this study was utilized for either forests, cattle, residential or recreational purposes. Soil slopes are seldom deterrents to any of these uses.

TABLE VI

IMPACT OF SIZE OF TRACT IN ACRES VARIABLES ON VALUE PER ACRE FOR ALL RURAL REAL ESTATE

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
5	-30.6178	-43.0927	-76.3584	-27.5158
20	-16.1813	-24.7261	-38.8538	-13.887
100	-8.9054	-15.4694	-19.9515	-7.0207
200	-3.7605	-8.9239	-6.4056	-2.1643

Value of Improvements per Acre. As was expected, the value of improvements per acre is an important variable in these models. In the total study area, this variable had a coefficient of 0.4920. From this it can be said that, in general, for rural study area real estate, for every dollar of improvements per acre the value of the real estate per acre increased by $0.4920. The range of the coefficient for the study area counties was from 0.3510 in Adair County to 0.4840 in Muskogee County.

Non-Agricultural Land Use. A major factor in the value per acre of rural study area real estate was the dummy variable stating whether or not the property was used for non-agricultural purposes. The impact of this factor was expected to be positive, and in the models, this was determined to be significantly true. The coefficient for the study area model was $4,413.25 per acre. The range of the county coefficients was from $1,662.16 in Adair County to $8,250.90 in Muskogee County.

Distance to the Nearest County Seat. The distance to the nearest county seat was measured by the miles to the county seat from the property along the highways. The impact of this factor was significant only in the model of Muskogee County rural real estate. The relationship between distance to the nearest county seat and value of rural real estate appeared to be slightly significant for Cherokee County. However, this relationship was estimated as being positive (Table VII) which was difficult to explain from a theoretical standpoint.

Models of Values of Agricultural Real Estate

The general model of values of agricultural real estate was

TABLE VII

IMPACT OF DISTANCE TO NEAREST COUNTY SEAT IN MILES ON VALUE PER ACRE FOR ALL RURAL REAL ESTATE

Miles	Cherokee County Model	Muskogee County Model
5	293.8733	-762.2284
20	38.7630	-236.0467
25	11.8303	-180.4963

estimated for the study area as a whole and for the individual counties of the study area. The specific form for the model is as follows:

$$VPA = a + b_1\ DOS + b_2\ SIZ + b_3\ SRS + b_4\ IPA + b_5\ SSL + b_6\ IAG + b_7\ DNC + b_8\ SRD$$

where

VPA = Value per acre,

DOS = Date of sale,

SIZ = Size of tract,

SRS = Square root of size of tract,

IPA = Value of improvements per acre,

SSL = Soil slope,

IAG = Improved agricultural land,

DNC = Distance to the nearest county seat,

SRD = Square root of distance to the nearest county seat.

There were two different definitions used to determine agricultural real estate in the study area. The first definition used was the county assessors definition of agricultural real estate. The second definition of agricultural real estate was a size of tract method. The specific agricultural real estate value model was applied using both definitions of agricultural real estate.

Agricultural Real Estate as Designated by County Assessors

The county assessors in the study area determined what was agricultural real estate. Using this definition of agricultural real estate, the agricultural model was applied to the study area as a whole and the

individual counties in the study area. The results are shown for the study area as a whole and for individual counties in Table VIII. The means of the variables are presented in Table IX. The F-test indicates that all of the models were significant at the .0001 level.

Date of Sale. Date of sale had a significant impact on the values of assessor defined agricultural real estate in the three study area counties individually as well as in the study area as a whole. Study area agricultural real estate values adjusted for normal inflation, increased by an estimated $40.37 per acre per month over the time period of the study due to time related factors. The range of coefficients for the individual counties was from $15.16 in Cherokee County to $47.84 in Adair County.

Size of Tract. The size of the tract of assessor defined agricultural real estate in acres had a significant influence in the entire study area. The models of the individual counties' agricultural real estate were also significantly influenced by the size of tract. To examine the impact of the size of tract on each of these models, both the size in acres and the square root of the size must be considered together. Table X shows the total impacts of size of tract in each of the four models.

Value of Improvements Per Acre. The value of improvements per acre was a very significant variable in the models of value per acre for assessor defined agricultural real estate. In the entire study area, for every dollar of improvements per acre, the value per acre for agricultural real estate increased by an estimated $0.2660. This relationship also was identified in the individual county models. The range of

TABLE VIII

MODELS OF VALUE OF ALL RURAL AGRICULTURAL REAL ESTATE BASED ON ASSESSORS DEFINITION OF AGRICULTURAL REAL ESTATE[a]

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
Intercept	4108.8731	1839.9293	2826.4722	6162.8895
	(.0001)	(.1849)	(.0001)	(.0001)
DOS	30.3679	47.8437	15.1644	35.9658
	(.0001)	(.0024)	(.0358)	(.0099)
SIZ	7.0616	3.3511	21.2253	7.6763
	(.0092)	(.3167)	(.0008)	(.1787)
SRS	-210.8707	-99.1806	-420.3880	-214.0973
	(.0003)	(.3035)	(.0001)	(.0570)
IPA	0.2660	0.5209	0.1598	0.2652
	(.0001)	(.0001)	(.0001)	(.0001)
SSL	35.7517	-42.2369	-25.6029	-3.4535
	(.2202)	(.4656)	(.6360)	(.9470)
IAG	104.1883	48.2986	131.8703	-102.9723
	(.5444)	(.8848)	(.7450)	(.7624)
DNC	202.5409	76.6383	93.8741	319.9526
	(.0001)	(.5356)	(.1192)	(.0001)
SRD	-1665.3030	-711.4865	-612.3783	-2635.8509
	(.0001)	(.3689)	(.0590)	(.0001)
R^2	.4408	.4317	.3521	.4703
N	663	101	227	335
F	64.45	8.73	17.01	36.19

TABLE VIII (Continued)

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
P > F	0.0001	0.0001	0.0001	0.0001

[a]Numbers appearing in parentheses represent the observed significance level of the variable as determined by the "student-t" values.

TABLE IX

MEANS OF THE VARIABLES IN THE MODELS OF VALUE OF AGRICULTURAL REAL ESTATE BASED ON ASSESSORS DEFINITION OF AGRICULTURAL REAL ESTATE

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
VPA	1463.7021	1047.1944	917.4862	1959.3985
DOS	18.7662	17.2079	19.8502	18.5014
SIZ	40.1532	60.9281	37.4726	35.7061
SRS	5.3066	6.3469	5.3682	4.9513
SSL	3.5492	3.6861	3.6588	4.2329
IPA	2000.7075	993.7435	1011.3851	2974.6763
DNC	11.8198	13.6882	10.2358	12.3298
SRD	3.2707	3.6025	3.0639	3.3107

TABLE X

IMPACT OF SIZE OF TRACT IN ACRES VARIABLES ON VALUE PER ACRE FOR AGRICULTURAL REAL ESTATE DETERMINED BY ASSESSORS DEFINITION OF AGRICULTURAL REAL ESTATE

Acres	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
5	-87.2426	-41.0038	-166.7779	-88.0709
20	-40.0905	-18.8264	-72.7765	-40.1973
50	-22.7600	-10.6752	-38.2265	-22.6016
100	-14.0255	-6.5669	-20.8135	-13.7334
200	-7.8492	-3.6620	-8.5006	-7.4627

the coefficient of the value of improvements per acre variable on the county models was from 0.1598 in Cherokee County to 0.5209 in Adair County.

Soil Slope. The soil slope did not have a significant impact on the value of assessor defined agricultural real estate for the study area as a whole or for any of the three counties considered individually.

Improved Agricultural Real Estate. The improved agricultural real estate variable did not have a significant impact on the value per acre of assessor defined agricultural land in the study area as a whole or for any of the individual counties in the study area.

Distance to the Nearest County Seat. The distance to the nearest county seat in miles had a significant impact on the value of assessor defined agricultural real estate in the study area. The distance in miles was also significant in the individual county models with the exception of the Adair County model. The total effect of the distance to the nearest county seat in the entire study area and Cherokee and Muskogee Counties is presented in Table XI.

Agricultural Real Estate as Designated by Size of Tract

When the size of tract was used to estimate the value of agricultural real estate several different acreage breakdowns were used. These included greater than 5 acres, greater than 10 acres and greater than 20 acres. The models of all rural real estate greater than 5 acres were determined to contain the best results and were chosen to be discussed

TABLE XI

IMPACT OF THE DISTANCE TO THE NEAREST COUNTY SEAT ON THE VALUE PER ACRE OF AGRICULTURAL REAL ESTATE BASED ON THE ASSESSORS DEFINITION OF AGRICULTURAL REAL ESTATE

Miles	Study Area Model	Cherokee County Model	Muskogee County Model
5	-542.2052	-179.9898	-858.8357
20	-169.8322	-43.0578	-269.4416
25	-130.5197	-28.6016	-207.2176

in the following pages. The results of the 10 and 20 acre breakdown models are reported in Appendix B. Table XII presents the results of the models of values of rural real estate greater than 5 acres. The means of the variables in the models are presented in Table XIII. The F-test indicated that all of the models were significant at the .0001 level.

Date of Sale. Date of sale had a significant impact on the values of agricultural real estate defined by tract size in the three study area counties individually as well as in the study area as a whole. Study area values of agricultural real estate, as defined by tract size, adjusted for normal inflation, increased by an estimated $15.61 per acre per month over the time period of the study due to time related factors. The range of coefficients for the individual counties was from 8.9148 in Cherokee County to 41.8337 in Adair County.

Size of Tract. The size of the tract of greater than 5 acre tracts had a significant influence in the study area model. The individual county models were not as significantly affected by the size of tract as the model for the study area as a whole. The size of tract did not significantly affect agricultural real estate in Adair County. The total effect of the size of tract variables on the Cherokee and Muskogee County models as well as for the study area model are presented in Table XIV.

Value of Improvements per Acre. The value of improvements per acre was a very significant variable in the value per acre for agricultural real estate as defined by tract size. For the entire study area, it can be stated that for every dollar of improvements per acre the value of

TABLE XII

RESULTS OF MODELS OF VALUES OF RURAL REAL ESTATE GREATER THAN 5 ACRES[a]

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
Intercept	1704.9945	127.3083	1434.4201	2912.8171
	(.0001)	(.8829)	(.0001)	(.0001)
DOS	15.6109	41.8337	8.9148	15.4642
	(.0001)	(.0017)	(.0343)	(.0431)
SIZ	3.1624	2.2761	4.6315	3.9999
	(.0314)	(.4458)	(.2060)	(.1912)
SRS	-101.3964	-59.9439	-97.3541	-138.2086
	(.0014)	(.4763)	(.1055)	(.0352)
IPA	0.3515	0.6047	0.4265	0.2786
	(.0001)	(.0001)	(.0001)	(.0001)
SSL	1.9321	-39.7064	20.6405	-19.3156
	(.9020)	(.4129)	(.6737)	(.4864)
IAG	157.5491	182.0184	133.9601	-62.2068
	(.0974)	(.5306)	(.6721)	(.7271)
DNC	64.6091	0.9866	41.7444	100.5836
	(.0051)	(.9905)	(.2743)	(.0119)
SRD	-523.9871	-32.1741	-375.6683	-838.6040
	(.0001)	(.9466)	(.0660)	(.0023)
R^2	.3969	.3378	.4596	.4216
N	789	120	405	264
F	64.16	7.08	48.23	23.24

TABLE XII (Continued)

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
PR > F	0.0001	0.0001	0.0001	0.0001

[a]Numbers appearing in parentheses represent the observed significance level of the variable as determined by the "student-t" value.

TABLE XIII

MEANS OF VARIABLES IN RURAL REAL ESTATE GREATER THAN 5 ACRES IN SIZE MODELS

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
VPA	1018.5919	833.7332	884.8962	1307.7202
DOS	18.4461	17.4333	19.1827	17.7765
SIZ	44.5623	59.6910	39.9932	44.6967
SRS	5.8185	6.4311	5.6459	5.8049
IPA	1015.5719	762.8758	798.9057	1462.8197
SSL	4.3929	4.7747	4.6039	5.0447
DNC	10.9576	12.3726	9.1852	13.0322
SRD	3.1332	3.3726	2.8825	3.4092

TABLE XIV

IMPACT OF SIZE OF TRACT IN ACRES VARIABLES ON VALUE PER ACRE FOR AGRICULTURAL REAL ESTATE DETERMINED BY TRACTS GREATER THAN 5 ACRES

Acres	Study Area Model	Cherokee County Model	Muskogee County Model
5	-42.1834	-38.9066	-57.8089
20	-19.5105	-17.1375	-26.9045
50	-11.1772	-9.1364	-15.5457
100	-6.9772	-5.1039	-9.8210
200	-4.0074	-2.2525	-5.7729

agricultural real estate per acre increased by only $0.3515. The range of the coefficients of the value of improvements per acre in the individual county models was from 0.2786 in Muskogee County to 0.6047 in Adair County.

Soil Slope. The soil slope did not have a significant impact on the value of agricultural real estate as defined by tract size for the study area as a whole or for any of the three counties considered individually.

Improved Agricultural Real Estate. The improved agricultural real estate variable had a significant impact on the value of agricultural real estate in the entire study area. If a tract of real estate in the study area was cropland or improved pastureland, the value per acre increased by an estimated $157.54. The improved agricultural real estate variable did not have a significant impact on the value of agricultural real estate in the individual counties of the study area.

Distance to the Nearest County Seat. The distance to the nearest county seat in miles had a significant impact on the value of study area agricultural real estate as defined by tract size. The distance in miles was also significant in Muskogee County and marginally significant in Cherokee County. The distance in miles was not significant in Adair County. The total effect of distance to the nearest county seat in the entire study area as well as Cherokee and Muskogee Counties is presented in Table XV.

Models of Values of Non-Agricultural Real Estate

The general model of values of non-agricultural real estate was

TABLE XV

IMPACT OF THE DISTANCE TO THE NEAREST COUNTY SEAT ON THE VALUE PER ACRE OF AGRICULTURAL REAL ESTATE BASED ON TRACTS GREATER THAN 5 ACRES

Miles	Study Area Model	Cherokee County Model	Muskogee County Model
5	-169.7250	-126.2596	-274.4515
20	-52.5580	-42.2576	-86.9340
25	-40.1883	-33.3893	-67.1372

estimated for the study area as a whole and for the individual counties of the study area. The specific form for the model is as follows:

$$VPA = a + b\ DOS + b\ SIZ + b\ SRS + b\ RWD + b\ IPA + b\ DNC + b\ SRD$$

where

VPA = Value per acre,

DOS = Date of sale,

SIZ = Size of tract,

SRS = Square root of size of tract,

IPA = Value of improvements per acre,

DNC = Distance to the nearest county seat,

SRD = Square root of distance to the nearest county seat.

Two different definitions were used to designate non-agricultural real estate in the study area. The first definition used was the county assessors' definition of non-agricultural real estate. The county assessors' definition of non-agricultural real estate used was explained in the discussion of the agricultural real estate use variable earlier in this chapter. The second definition of non-agricultural real estate was based on size of tract. The specific non-agricultural real estate value model was applied using both definitions of non-agricultural real estate.

Non-Agricultural Real Estate as Designated by County Assessors

The county assessors in the study area have designated non-agricultural real estate for assessment purposes. Using this definition of non-agricultural real estate, the non-agricultural model was applied

to the study area as a whole and to the individual counties in the study area. The results are shown in Table XVI and the means of the variables that are in the model are presented in Table XVII. The F-test indicates that all of the models are significant at the .0001 level with the exception of the Adair County model.

Date of Sale. Date of sale did not have a significant impact on the values of assessor defined non-agricultural real estate in the study area model. The date of sale variable also did not have a significant impact on the individual county models with the exception of Muskogee County. In Muskogee County, assessor defined non-agricultural real estate values increased by an estimated $183.06 per acre per month over the time period of the study due to time related factors.

Size of Tract. The size of the tract of assessor defined non-agricultural real estate had a significant influence in the study area model. The individual county models were also significantly influenced by the size of tract with the exception of Adair County. The impact of the size of tract on the entire study area model and the Cherokee and Muskogee County models are presented in Table XVIII.

Rural Water District. The dummy variable signifying that a tract of real estate is located inside a rural water district had a significant impact on assessor defined non-agricultural real estate in the study area as a whole but not on the individual county models. If an assessor defined non-agricultural tract of real estate in the study area was located inside a rural water district, the value per acre increased by an estimated $2,738.23 per acre.

TABLE XVI

RESULTS OF MODELS OF VALUES OF RURAL NON-AGRICULTURAL REAL ESTATE BASED ON ASSESSORS DEFINITION OF NON-AGRICULTURAL REAL ESTATE[a]

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
Intercept	5503.2678	5540.4706	-2279.9916	24047.2021
	(.1144)	(.3559)	(.6340)	(.0046)
DOS	63.1136	68.3075	18.5078	183.0602
	(.2246)	(.3510)	(.7870)	(.0894)
SIZ	511.5229	415.4161	408.4609	2464.5985
	(.0101)	(.6938)	(.0413)	(.0025)
SRS	-5129.8731	-3550.2529	-4204.5635	-18134.9696
	(.0012)	(.4852)	(.0235)	(.0008)
RWD	2738.2269	-513.4920	1769.3913	617.9025
	(.0176)	(.8992)	(.1823)	(.8330)
IPA	0.8119	0.1901	0.7919	0.7275
	(.0001)	(.2859)	(.0001)	(.0001)
DNC	-477.0166	-14.9961	-1291.3223	-607.2300
	(.2760)	(.9731)	(.0464)	(.5902)
SRD	2334.8096	476.3567	7538.2086	1585.8195
	(.2958)	(.8425)	(.0175)	(.7797)
R^2	.4642	.1691	.5027	.5201
N	238	46	107	85
F	28.46	1.10	14.30	11.92
PR > F	.0001	.3801	.0001	.0001

[a]Numbers appearing in parentheses represent the observed significance level of the variable as determined by the "student-t" value.

TABLE XVII

MEANS OF VARIABLES IN RURAL NON-AGRICULTURAL MODELS BASED ON ASSESSORS DEFINITION OF NON-AGRICULTURAL REAL ESTATE

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
VPA	8504.9773	4912.3074	5969.7445	13640.6565
DOS	20.4789	17.8913	22.5140	12.3176
SIZ	3.9986	2.9776	4.9067	3.4081
SRS	3.7186	3.5438	3.9167	3.5639
IPA	6070.2727	5595.1581	4524.7476	8272.9369
DNC	7.9117	11.5109	6.9813	7.1353
SRD	2.6055	3.2018	2.4554	2.4716

TABLE XVIII

IMPACT OF SIZE OF TRACT IN ACRES VARIABLES ON VALUE PER ACRE FOR NON-AGRICULTURAL REAL ESTATE DETERMINED BY ASSESSORS DEFINITION OF NON-AGRICULTURAL REAL ESTATE

Acres	Study Area Model	Cherokee County Model	Muskogee County Model
5	-4003.9966	-1471.8796	-5645.6060
10	-1110.6853	-921.1387	-3270.1789
20	-635.5516	-531.7081	-1590.5037
50	-213.9507	-183.1541	-100.0734

Value of Improvements per Acre. The value of improvements per acre was a very significant variable in explaining the value per acre for assessor defined non-agricultural real estate in the study area. In the individual county models, the value of improvements per acre had a significant impact with the exception of the Adair County model. In the entire study area, for every dollar of improvements per acre the value of assessor defined non-agricultural real estate increased by an estimated $0.8119 per acre. In the Cherokee County model, the coefficient on the value of improvements per acre variable was 0.7919 and in the Muskogee County model it was 0.7275.

Distance to the Nearest County Seat. The distance to the nearest county seat in miles did not significantly affect the value per acre of assessor defined non-agricultural real estate in the study area. In the individual county models, only the Cherokee County model was significantly affected by the distance to the nearest county seat. The relationship between the distance variables and the value of assessor defined non-agricultural real estate in Cherokee County was positive. This was not as expected based on economic theory. Due to this and the fact that the other models were not significantly affected by this variable, the effect of the distance to the nearest county seat on the value of assessor defined non-agricultural real estate in Cherokee County is not clear.

Non-Agricultural Real Estate as Designated by Size of Tract

When the size of tract was used to estimate the value of non-agricultural real estate, three different acreage breakdowns were used.

These different breakdowns included less than or equal to 5 acres, less than or equal to 10 acres and less than or equal to 20 acres. The models of all rural real estate less than or equal to 5 acres were determined to contain the most meaningful results and were chosen to be analyzed in the following pages. The results of the 10 and 20 acre breakdowns are reported in Appendix B. The results of the models of values of rural real estate less than or equal to 5 acres are presented in Table XIX. The means of the variables in the less than 5 acre models are presented in Table XX. The F-test indicated that all of the models were significant at the .0001 level.

Date of Sale. Date of sale had a significant impact on the value of less than 5 acre tract real estate in the study area as a whole and on the Muskogee County model. The Adair and Cherokee County models were not significantly affected by the date of sale variable. The value of less than 5 acre tract real estate in the study area as a whole increased by an estimated $88.89 per acre per month due to time related factors. An increase of $150.75 per acre per month was estimated for Muskogee County.

Size of Tract. The size of the tract of less than 5 acre real estate had a significant effect on the entire study area model. Of the individual county models, only the Muskogee County model was significantly influenced by the size of tract. Estimated impacts of the size of tract on the entire study area and on Muskogee County are presented in Table XXI.

Rural Water District. The dummy variable signifying that a tract of real estate was located inside a rural water district had a

TABLE XIX

RESULTS OF MODELS OF VALUES OF REAL ESTATE LESS THAN OR EQUAL TO 5 ACRES IN SIZE[a]

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
Intercept	29408.8551	7436.6614	14932.4157	62845.2734
	(.0001)	(.5550)	(.2094)	(.0001)
DOS	88.8901	66.0043	35.6433	150.7505
	(.0188)	(.3508)	(.5986)	(.0255)
SIZ	6761.1976	1070.2093	3786.2776	16022.6769
	(.0093)	(.8354)	(.3855)	(.0007)
SRS	-27902.3169	-5510.7884	-17716.0904	-63035.5849
	(.0011)	(.7361)	(.2199)	(.0001)
RWD	2391.7942	-251.8873	404.8913	-318.7999
	(.0047)	(.9494)	(.7643)	(.8525)
IPA	0.1425	0.2022	0.2525	0.3118
	(.0004)	(.2328)	(.0047)	(.0001)
DNC	-139.2945	14.6354	-1392.3376	-450.5761
	(.6464)	(.9715)	(.0209)	(.4713)
SRD	-263.9295	159.7504	6702.7945	486.4779
	(.8684)	(.9432)	(.0259)	(.8827)
R^2	.2980	.1549	.3135	.5100
N	327	48	122	157
F	18.43	1.05	7.44	22.15
PR > F	0.0001	0.0001	0.0001	0.0001

[a]Numbers appearing in parentheses represent the observed significance level of the varible as determined by the "student-t" value.

TABLE XX

MEANS OF VARIABLES IN THE MODELS OF VALUES OF TRACTS LESS THAN OR EQUAL TO 5 ACRES IN SIZE

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
VPA	5674.4494	5015.0627	5799.5234	9368.5533
DOS	20.7647	17.9375	22.4672	20.2293
SIZ	3.0209	2.2493	3.1226	3.1295
SRS	3.6564	3.4237	3.6841	3.6908
IPA	6796.4552	5806.8973	5361.8110	8380.2760
DNC	8.6657	11.2917	7.7911	8.4745
SRD	2.7358	3.1547	2.5943	2.7070

TABLE XXI

IMPACT OF SIZE OF TRACT IN ACRES VARIABLES ON VALUE PER ACRE FOR NON-AGRICULTURAL REAL ESTATE DETERMINED BY TRACTS LESS THAN OR EQUAL TO 5 ACRES IN SIZE

Acres	Study Area Model	Muskogee County Model
2	-12968.7180	-28550.2100
3	-9348.2126	-20370.9360
5	-5717.0970	-12167.6920

significant impact on less than 5 acre real estate in the study area as a whole but not on the individual county models. If a less than 5 acre tract of land in the study area was in a rural water district, the value per acre increased by an estimated $2,391.79 per acre.

Value of Improvements per Acre. The value of improvements per acre was a significant factor determining value per acre for less than 5 acre non-agricultural real estate in the study area. The value of improvements per acre had a significant impact on the individual county models with the exception of Adair County. In the entire study area, for every dollar of improvements per acre the value of non-agricultural real estate increased by an estimated $0.1425. In the Cherokee County model, the coefficient on the value of improvements per acre variable was 0.2525 and in the Muskogee County model it was 0.3118.

Distance to the Nearest County Seat. The distance to the nearest county seat in miles did not significantly affect the value per acre of less than 5 acre real estate in the study area. The coefficient for distance to nearest county seat appears to be significant for the Cherokee County model; however, it is positive, which is difficult to explain theoretically.

CHAPTER V

SUMMARY, CONCLUSIONS AND LIMITATIONS

The general objective of this study was to examine the factors that cause variations in rural real estate values in Eastern Oklahoma. The specific objectives were to:

1. Identify rural real estate characteristics in eastern Oklahoma.
2. Identify and quantify the physical factors associated with inter-tract variation in rural real estate prices in eastern Oklahoma.
3. Develop and test models to explain rural real estate prices in eastern Oklahoma.

A rural real estate market questionnaire was sent to real estate buyers in the study area (Adair, Cherokee and Muskogee Counties) to determine the characteristics of the buyers of rural real estate in eastern Oklahoma. Almost one out of every two respondents to the questionnaire worked 250 days or more a year off the farm. This and other characteristics indicated that approximately one-half of the purchasers of rural real estate in the study area were non-agriculturally oriented. People that work in non-agricultural jobs in the cities and towns of the study area purchase rural land for residential and other nonagricultural purposes.

Econometric models were developed to evaluate the influence of

various factors on rural real estate values. Models were estimated for all rural real estate, for agricultural real estate and for non-agricultural rural real estate. Each of these were estimated for the study area as a whole and for each of the individual counties in the study area. Multiple linear regression analysis was the statistical method utilized for the estimation of the models.

The independent variables in the rural real estate models were chosen on the basis of economic theory and previous studies of rural real estate markets. The independent variables that were included in all of the models were (1) date of sale, (2) size of tract in acres, (3) value of improvements per acre and (4) distance to the nearest county seat. The size of tract in acres and distance to nearest county seat variables were expected to be nonlinearly related to the value of rural real estate, and the square root of the variables were added to the model to compensate for the nonlinear relationship.

Other variables in the models of all rural real estate were (1) location within a rural water district, (2) soil slope and (3) non-agricultural real estate use. Variables included in the models of agricultural real estate were (1) date of sale, (2) size of tract in acres, (3) square root of size of tract in acres, (4) value of improvements per acre, (5) soil slope, (6) improved agricultural real estate and (7) distance to nearest county seat and square root of distance to the nearest county seat. The variables included in the models of non-agricultural real estate values were (1) date of sale, (2) size of tract, (3) square root of the size of tract, (4) value of improvements per acre, (5) location within a rural water district, (6) distance to the nearest county seat and (7) square root of distance to the nearest county seat.

Significant factors affecting general rural real estate values in the study area were: date of sale, rural water district, value of improvements per acre and non-agricultural real estate use. The factors that did not have significant effects on general rural real estate values were size of tract in acres, soil slope and distance to the nearest county seat.

Significant factors affecting agricultural real estate values were date of sale, size of tract in acres, value of improvements per acre and distance to nearest county seat. The factors that did not have significant effects on agricultural real estate values were soil slope and improved agricultural real estate.

Significant factors affecting the rural non-agricultural real estate values were size of tract in acres, rural water district and value of improvements per acre. The factors that did not have significant effects on rural non-agricultural real estate values were date of sale and distance to the nearest county seat.

Conclusions

Several factors were found to be particularly important in explaining rural real estate values in the study area. These are date of sale, size of tract, value of improvements per acre, distance to nearest county seat and definitions of agricultural and non-agricultural real estate.

The inflation rate in the local real estate market being higher than the inflation rate for the general economy was the important factor measured by the date of sale variable. This phenomenon may be a result of buyers expectations of continuing inflation and their view of real

estate as a store of real value.

The greater capital outlays required for the purchase of large tracts of agricultural real estate reduces the number of potential buyers, making size of tract an important variable in determining rural real estate values. Most small tracts of non-agricultural real estate have a higher than average value per acre. The capital required for larger tracts limits the number of potential buyers when large tracts of non-agricultural real estate are placed on the market.

The value of improvements per acre is an important variable in explaining the values of all rural real estate, agricultural real estate and non-agricultural real estate. However, the coefficients for this variable were consistently less than one. There are two plausible explanations for less than unitary coefficients. The first is that the sellers of rural real estate did not know the real market value of the improvements and sold for less than full value. The second is that the county assessors' value of improvements may be based on depreciated replacement cost which is greater than actual market value of the improvements as sited. The depreciation of improvements may not have been correctly estimated by the county assessors' offices.

The total relationship between the distance to the nearest county seat and value of rural real estate was generally significant and negative as expected. As the distance from the primary market increased the value of real estate decreased at a decreasing rate. The definitions of agricultural and non-agricultural real estate were of importance in this study. The two definitions resulted in different values of coefficients in the models. The definition of agricultural real estate that appeared to be most effective was the greater than 5 acres definition. The

county assessor's definition appeared to contain some non-agricultural real estate resulting in confusion when comparisons were made with this approach. If a tract of real estate that is less than 5 acres in size is intended for a non-agricultural purpose, the county assessor's office might not recognize this change. Therefore, the models of agricultural real estate based on the greater than 5 acre definition was considered the most useful when applied to the objectives of this study.

The non-agricultural real estate market presented a different aspect to the problem. The county assessors definition of non-agricultural real estate was probably the most accurate. This was due to the fact that real estate that the county assessor's office has identified as non-agricultural real estate, most likely is non-agricultural real estate regardless of size of tract.

Limitations

There were some weaknesses in the study. The weaknesses were related to the specification and availability of the data, particularly the lack of consistent reliable data to differentiate agricultural and non-agricultural land uses. A more exact method of separating agricultural and non-agricultural real estate would benefit the analysis of rural real estate values.

Another weakness in the study was the inaccuracy inherent in the method of determining the value of improvements per acre on rural real estate. A study of rural real estate values using a more accurate method of determining the value of improvements per acre would be useful.

An additional weakness in the study relates to the necessity of

using tax stamps from warranty deeds to determine the sale price of real estate. A more accurate method of determining real estate values would have strengthened the analysis herein.

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APPENDICES

APPENDIX A

SAMPLE OF EASTERN OKLAHOMA LAND MARKET QUESTIONNAIRE AND COVER LETTER

Oklahoma State University

DEPARTMENT OF AGRICULTURAL ECONOMICS

STILLWATER, OKLAHOMA 74074
AGRICULTURAL HALL, ROOM 308
(405) 624-6157, 6154, 6081, 6086

January 7, 1980

Dear

The price of rural land in Oklahoma continues to increase at a rapid rate. These increases are of concern to many people throughout the state of Oklahoma. As part of a research project in the Department of Agricultural Economics at Oklahoma State University, we are attempting to gather information about how the ownership of rural land in Eastern Oklahoma is changing and the implications of such changes for the future.

In an effort to accomplish this objective, information on rural land sales from 1976 through 1978 was gathered from the county courthouses in Adair, Cherokee and Muskogee counties in Oklahoma. According to our information, you purchased rural land in the study area during the time period considered. If this is not correct, please disregard these materials and accept our apologies for the inconvenience. If you did make such a purchase, it would be helpful if you would fill out the enclosed questionnaire and return it in the enclosed stamped envelope. No postage is required.

In order to insure the confidentiality of the responses, please feel free to return the questionnaire without enclosing your address or putting a return address on the envelope. It is not our intention to report the specific information that you send in, but instead to aggregate the returned questionnaires into summary tables.

Your cooperation is very much appreciated.

Sincerely,

James R. Nelson
Associate Professor

William E. Burton
Research Assistant

EASTERN OKLAHOMA LAND MARKET QUESTIONNAIRE

Department of Agricultural Economics

Oklahoma State University

Listed below are several questions related to a land value study in Adair, Cherokee and Muskogee counties in Oklahoma. Please answer these questions as accurately as possible by checking the blank that best describes your situation.

I. General Information

A. Occupation _____

If you are a part-time farmer or rancher, how many days per year do you work off the farm?

0 - 50 days _____

51 - 100 days _____

101 - 150 days _____

151 - 200 days _____

201 - 250 days _____

more than 250 days _____

B. Place of residence.

City or Town _____

Rural _____

C. Current Age

Less than 20 years _____

20 - 30 years _____

31 - 40 years _____

41 - 50 years _____

51 - 60 years _____

61 - 70 years _____

+ 70 years _____

D. Education

Less than High School _____

High School _____

Some College _____

College Graduate _____

E. Sex

Male _____

Female _____

F. Marital Status

Married _____

Unmarried _____

G. How many acres of land do you own?

0 acres _____ 101-160 acres _____

1 - 5 acres _____ 161-320 acres _____

6 -10 acres _____ 321-480 acres _____

11-20 acres _____ 481-640 acres _____

21-50 acres _____ + 640 acres _____

51-100 acres_____

H. How many acres of land do you rent?

0 acres _____ 101-160 acres _____

1 - 5 acres _____ 161-320 acres _____

6 -10 acres _____ 321-480 acres _____

11-20 acres _____ 481-640 acres _____

21-50 acres _____ + 640 acres _____

51-100 acres_____

I. If you were given a gift of $50,000 on the condition that you invest the money in stocks, bonds or agricultural land, how would you invest the money?

Stocks $_____

Bonds $_____

Agricultural Land $_____

J. Do you own non-farm investments such as stocks and bonds?

Yes _____

No _____

II. If you are a farmer or rancher, please answer the following questions:

A. Type of farming or ranching operation

Sole proprietor _____

Husband-Wife _____

Family Partnership _____

Non-Family Partnership _____

Family Corporation _____

B. How many years have you been farming or ranching?

0 - 5 years _____

6 -10 years _____

11-15 years _____

16-20 years _____

+ 20 years _____

C. Did you get your start in farming from your parents or some other relative?

Yes _____

No _____

If yes, how was the farm acquired?

Purchased _____

Inherited _____

Other _____

D. Would you like to see your children continue to farm the land?

Yes _____

No _____

III. Please answer the following questions considering only land purchased from 1976 through 1978.

A. Have you established or do you intend to establish a permanent residence on some of this land?

Yes _____

No _____

If your answer to the above is no, what is the approximate distance of the property to your permanent place of residence?_____

B. What was your primary reason for purchasing the land?

Establish own farm _____

Expand farming operations _____

Investment _____

As a site for your personal residence _____

Industrial development _____

Residential development _____

Other (comment) _____

C. What was the seller's primary reason for selling the land?

Estate settlement _____

Off-farm employment _____

Financial difficulties _____

Retirement _____

Unknown _____

D. Did you rent the property prior to the purchase?

Yes _____

No _____

E. Did the purchase of the land require the purchase of additional machinery?

Yes _____

No _____

F. Are you actively seeking to purchase rural land in the future?

Yes _____

No _____

Maybe _____

APPENDIX B

RESULTS OF THE 10 AND 20 ACRE CRITERIA IN THE DETERMINATION OF AGRICULTURAL AND NON-AGRICULTURAL REAL ESTATE

TABLE XXII

RESULTS OF MODELS OF VALUE OF RURAL REAL ESTATE GREATER THAN 10 ACRES IN SIZE[a]

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
Intercept	1178.2429	-84.0585	1174.4358	1975.6453
	(.0001)	(.9171)	(.0001)	(.0001)
DOS	10.0739	26.7114	7.0971	9.3838
	(.0012)	(.0374)	(.0089)	(.1105)
SIZ	2.1480	0.6393	0.3203	6.0333
	(.0631)	(.8262)	(.8983)	(.0082)
SRS	-74.3616	-12.7785	-16.7219	-197.2885
	(.0072)	(.8854)	(.7113)	(.0003)
IPA	0.2969	0.7451	0.3134	0.2763
	(.0001)	(.0001)	(.0001)	(.0001)
SSL	10.8849	3.8322	5.4392	0.2946
	(.3812)	(.9348)	(.8542)	(.9889)
IAG	162.7603	-163.7122	308.3192	-35.6050
	(.0342)	(.5818)	(.1252)	(.7825)
DNC	30.3714	-1.5962	48.6882	3.7665
	(.0907)	(.9830)	(.0468)	(.8970)
SRD	-259.9923	-9.0088	-397.2007	-98.1351
	(.0211)	(.9832)	(.0033)	(.6297)
R^2	.2910	.3325	.3041	.3294
N	566	91	287	189
F	28.57	5.10	17.42	11.05
PR F	0.0001	0.0001	0.0001	0.0001

[a]Numbers appearing in parentheses represent the observed significance level of the variable as determined by the "student-t" value.

TABLE XXIII

MEANS OF THE VARIABLES IN THE MODELS OF VALUE OF RURAL REAL ESTATE GREATER THAN 10 ACRES IN SIZE

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
VPA	730.6881	599.1089	648.0333	984.7302
DOS	18.7831	17.0220	19.6202	18.3598
SIZ	58.3479	75.8064	52.5378	58.7648
SRS	6.9022	7.5210	6.7037	6.9058
IPA	485.0974	479.2661	415.8448	593.0679
SSL	4.2782	3.6115	4.0027	3.7603
DNC	11.5389	12.4345	9.5802	14.0820
SRD	3.2199	3.3662	2.9547	3.5523

TABLE XXIV

RESULTS OF MODELS OF VALUE OF RURAL REAL ESTATE GREATER THAN 20 ACRES IN SIZE[a]

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
Intercept	1179.0548 (.0001)	225.1488 (.2205)	1611.9857 (.0001)	1126.7647 (.0206)
DOS	7.5477 (.0024)	5.6584 (.0643)	8.4882 (.0087)	5.8979 (.2813)
SIZ	1.4278 (.1192)	-0.0776 (.9035)	2.6203 (.4319)	3.2485 (.1428)
SRS	-50.5232 (.0410)	4.0315 (.8464)	-64.3664 (.3393)	-114.0251 (.0532)
IPA	0.2726 (.0001)	0.2935 (.0001)	0.3637 (.0001)	0.1372 (.0001)
SSL	-10.5087 (.2779)	-5.7566 (.5788)	-7.0230 (.6723)	12.9873 (.5091)
IAG	206.7897 (.0006)	197.7636 (.0061)	373.0524 (.1823)	60.8141 (.6089)
DNC	28.3150 (.0485)	20.0736 (.2041)	73.3640 (.0108)	-22.2556 (.4554)
SRD	-267.1347 (.0035)	-102.3903 (.2763)	-559.1537 (.0004)	95.9736 (.6589)
R^2	.2033	.3922	.3321	.1311
N	388	66	192	130
F	12.12	4.60	13.07	2.30
PR F	0.0001	0.0001	0.0001	0.0248

[a]Numbers appearing in parentheses represent the observed significance level of the variable as determined by the "student-t" value.

TABLE XXV

MEANS OF THE VARIABLES IN THE MODELS OF RURAL REAL ESTATE GREATER THAN 20 ACRES IN SIZE

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
VPA	603.7575	357.7423	609.1164	719.8499
DOS	18.1568	16.8485	18.8594	17.7863
SIZ	76.9971	98.0227	69.5364	77.3393
SRS	8.1497	8.8089	7.9172	8.1584
IPA	330.9683	236.0734	336.0008	371.4020
SSL	1.9770	1.4210	1.7203	1.9320
DNC	11.9538	13.2580	9.7891	14.4695
SRD	3.2903	3.4725	2.9902	3.6383

TABLE XXVI

RESULTS OF MODELS OF VALUE OF RURAL REAL ESTATE
LESS THAN OR EQUAL TO 10 ACRES IN SIZE[a]

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
Intercept	20559.6217	4319.5863	13099.4398	42022.5494
	(.0001)	(.3686)	(.0010)	(.0001)
DOS	72.0550	73.2374	30.3634	114.1644
	(.0021)	(.1107)	(.3793)	(.0151)
SIZ	2691.9245	-45.1091	1894.4945	5961.7137
	(.0001)	(.9649)	(.0091)	(.0001)
SRS	-14634.7409	-1560.4084	-11118.6907	-30725.5733
	(.0001)	(.7219)	(.0006)	(.0001)
RWD	1709.9687	-587.0399	301.4741	460.8991
	(.0008)	(.7639)	(.6766)	(.6953)
IPA	0.1636	0.2213	0.2823	0.3153
	(.0001)	(.0788)	(.0001)	(.0001)
DNC	24.9334	-36.7618	-752.5772	141.6276
	(.8871)	(.9005)	(.0187)	(.6936)
SRD	-839.8319	296.5538	3521.9582	-2162.9144
	(.3780)	(.8589)	(.0276)	(.2792)
R^2	.3804	.2854	.3760	.5344
N	549	77	240	232
F	46.13	3.94	19.97	36.73
PR F	0.0001	0.0012	0.0001	0.0001

[a]Numbers appearing in parentheses represent the observed significance level of the variable as determined by the "student-t" value.

TABLE XXVII

MEANS OF THE VARIABLES IN THE MODELS OF RURAL REAL ESTATE LESS THAN OR EQUAL TO 10 ACRES IN SIZE

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
VPA	4021.4959	3717.5596	3666.4135	7025.8060
DOS	19.4697	18.2338	20.3292	18.9612
SIZ	5.6003	4.8378	6.2477	5.1065
SRS	2.2243	2.0215	2.3670	2.1240
IPA	4993.5616	4242.3795	3576.4595	6852.5772
DNC	8.9945	11.6299	8.0043	9.0927
SRD	2.8075	3.2442	2.6498	2.8173

TABLE XXVIII

RESULTS OF MODELS OF VALUE OF RURAL REAL ESTATE LESS THAN OR EQUAL TO 20 ACRES IN SIZE[a]

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
Intercept	15546.5621 (.0001)	5850.5571 (.0382)	10649.4893 (.0001)	30109.7280 (.0001)
DOS	54.6704 (.0024)	75.7746 (.0356)	19.6810 (.3905)	79.8902 (.0412)
SIZ	1258.0098 (.0001)	515.3755 (.1100)	981.7445 (.0001)	2644.0266 (.0001)
SRS	-8744.6049 (.0001)	-3787.6291 (.0370)	-7266.6718 (.0001)	-17340.5302 (.0001)
RWD	1296.2672 (.0008)	-669.1621 (.6784)	155.3853 (.7592)	1310.5800 (.1697)
IPA	0.1724 (.0001)	0.2463 (.0001)	0.2980 (.0001)	0.3401 (.0001)
DNC	53.2409 (.6615)	-12.3312 (.9580)	-543.7850 (.0160)	286.2843 (.2617)
SRD	-804.0860 (.2398)	240.1578 (.8536)	2604.5732 (.0242)	-2525.1427 (.0900)
R^2	.4044	.3255	.3991	.5222
N	727	102	335	290
F	68.28	6.48	31.02	44.03
PR F	0.0001	0.0001	0.0001	0.0001

[a]Numbers appearing in parentheses represent the observed significance level of the variable as determined by the "student-t" value.

TABLE XXIX

MEANS OF THE VARIABLES IN THE MODELS OF RURAL REAL ESTATE LESS THAN OR EQUAL TO 20 ACRES IN SIZE

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
VPA	3285.4432	3109.4119	2832.7595	5937.2437
DOS	19.6376	18.0490	20.5642	19.1000
SIZ	8.5526	7.8571	9.6323	7.4477
SRS	2.7049	2.5361	2.9013	2.5145
IPA	3966.5210	3477.4051	2725.9271	5700.8072
DNC	9.3977	11.2942	8.3314	9.9155
SRD	2.8712	3.2054	2.7159	2.9255

VITA

William Elbrege Burton

Candidate for the Degree of

Master of Science

Thesis: ANALYSIS OF FACTORS AFFECTING RURAL REAL ESTATE VALUES IN EASTERN OKLAHOMA

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Biographical:

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