A COMPARISON BETWEEN THE INVESTMENT VALUE AND MARKET VALUE OF KANSAS AGRICULTURAL LAND

By

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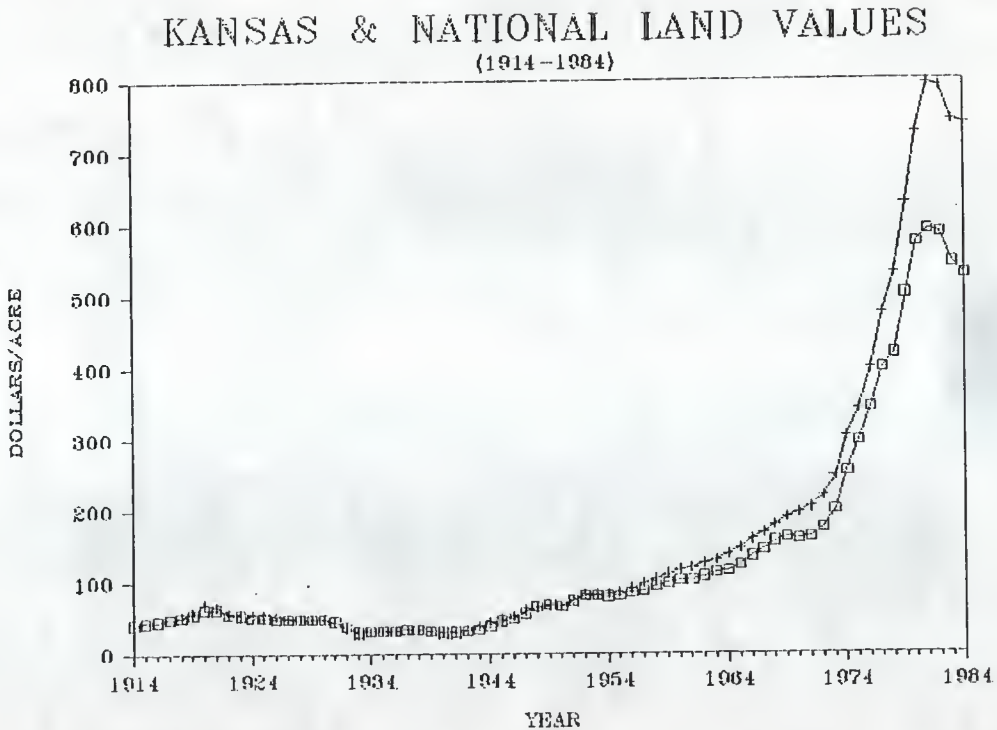
CHAPTER I

INTRODUCTION

The average acre of farmland during the period 1970 to 1979 esclated a dramatic 10 to 20 percent per year depending upon location. During the same interval, the Consumer Price Index rose on average about 10 percent per year. Thus, in most areas land kept pace with inflation and often exceeded it's annual average percent increases. It's no wonder that land was seen as a prime investmest. During the 1970's land was seen not only as a hedge against inflation but maybe the best hedge against inflation.

Figure 1 shows the value of Kansas and national farmland from 1914 through 1984. The land value rose until 1920 and dropped during the 1920's. The depression era saw declining land values, but from the 1940's through 1972 there was moderate and consistent growth. From 1973 through 1979, Kansas farmland value, like farmland nationally, escalated sharply with real capital gains achieved. There was an expanding world market for American agricultural products and a general feeling that "we are going to feed the world." There were high hopes and aspirations about the future of agriculture. But this was short lived, the Russian grain embargo of 1979 and a general shrinking of agricultural exports have hurt agriculture. Farm foreclosures have also increased over the past few years. Interest rates on land mortgages and the general opportunity cost of capital also rose from 1978 through 1982 and have continued to be high relative to the mid 1960's to early 1970's. Land prices nationally and in Kansas,



□ Kansas land values (column 5, appendix table A-8),

+ National land values (column 3, appendix table A-8),

Figure 1. Kansas and national land values.

which have historically followed the same basic pattern, have demonstrated this recent pessimism. Land prices in Kansas reached a peak near the end of 1981 and in 1982 the price fell and continued to fall until 1984. This was the first time land prices fell three years in a row since 1931-1933. This three year drop in land prices has raised questions concerning how the interest rate on land mortgages and opportunity cost of capital increases, as well as, the expectations of future land inflation and residual return growth have affected land values. This study will research these variables and will use these and other variables to find the investment value of Kansas farmland and compare it to the actual market value of Kansas farmland.

The Kansas Board of Agriculture (1981) reports there were 76,000 farms in Kansas with an average size of 638 acres in 1981. These farms produced total cash receipts of nearly $5.8 billion. Of the $5.8 billion, crops accounted for 55.8 percent and livestock accounted for 44.2 percent. Of the total, wheat accounted for 23.4 percent, corn 8.4 percent, sorghum 10.6 percent, cattle 33.3 percent, hogs 6.3 percent, hay 7.1 percent, soybeans 5.5 percent, and 5.4 percent from smaller diversified sources. Farmland may not have contributed directly to all of the $5.8 billion but it did contribute to a large portion of it. (pp. 115-117).

Buying land, either to start a farming operation or to add to an existing farm, is always a hard decision. Many questions must be asked to provide answers to whether buying farmland would be a wise investment. Compared with other production inputs, land is purchased infrequently and usually involves a large, long-term financial obligation. Prospective buyers must evaluate and make decisions based on present conditions with appropriate allowances for expected trends. A capital budgeting model was developed by Lee (1976) for evaluating farm real estate purchases. Lee's model will inform the prospective buyer if the land purchase is a feasible investment given the buyer's unique estimations and expectations. In the model, the potential buyer must adjust each of the 11 variables to fit his unique situation pertaining to his land purchase. The 11 variables in Lee's model give consideration to time, taxes, credit terms, investment rate of return, estimations of income, and expectations for growth in income and land value inflation (or deflation). This model will help the buyer to critically evaluate the maximum bid he can submit in an attempt to buy the land. He then can compare his bid price to the actual price the seller seeks. If the model's maximum bid price is more than the asking price, the parcel will be a good investment if his expectations and estimations occur. If the asking price is more than the maximum bid price, the investment may not be wise. (Lee, pp. 1-3). The buyer can change his estimations of each variable in the model to develop different scenarios of the maximum bid prices. He should consider, though, the likelihood of each scenario coming true when exploring each option.

The model was developed primarily for investment feasibility so it does not provide the potential buyer with cash-flow feasibility on the investment. The cash-flow feasibility will vary depending on the buyer's financial situation.

Kletke and Plaxico (1983) state that there are three basic concepts of value in farmland evaluation. These are market value, investment value, and feasibility value. Market value is the exchange price if the parcel was sold on the open market. The investment value is the price which could be paid with a reasonable expectation that a predetermined rate of return could be obtained. Feasibility value is the price that the purchaser's cash-flow would permit him to pay. It is conceivable that there may be differences between the three values. Nevertheless they have suggested that, "over the long in a perfect market, investment values and market values could be expected to be very similar." (p. 1). We can derive the investment value from Lee's model to compare it to the actual market value. However, the land market is not perfectly competitive. The land market will employ some characteristics of a perfect market but it will also lack others. If we assume that the land market, on the whole, is perfectly competitive we can see if the investment value given by Lee's model will be equal to the actual market value of Kansas agricultural land. In this framework we can also explore the differences between Lee's model and the actual value and also see if there is consistent relationships between the actual value and the value offered by Lee's model.

OBJECTIVES OF THE STUDY

The approach taken in this study is to investigate historical relationships between financial data and land prices in Kansas. This will be accomplished by using Lee's capital budgeting model to calculate land prices based on the model's 11 variables and comparing this to the actual land value at the time.

The specific objectives of the research in this study are:

1. To investigate how closely Lee's model (using Kansas data) traces actual historical land prices.
2. To investigate differences between Lee's model and actual land prices and modify the data so that the model traces actual land values more closely.
3. To explore the relationahip between the most important variables in the model and actual land prices.

JUSTIFICATION OF STUDY

Lee's model is more complex than formulas often used by real estate appraisers to evaluate the value of farmland. Historical data for the 11 variables were assembled to test the ability of the model to follow actual land prices.

There has been a considerable amount of research on such topics as the impact of general inflation and net farm income on land values, predicting and evaluating farmland values, real capital gains, and other topics in land economics. But no research has attempted to calculate the investment value and compare it to the actual value. To date there has been relatively little research on the recent price decline. This research will investigate how the future expectations of net rent growth and land inflation, as well as, interest rates on land mortgages, and opportunity costs of capital used in the model have changed during the recent land price decline. The intent of this study is to provide a better understanding of farmland price fluctuations.

ORGANIZATION OF THE STUDY

This thesis contains six chapters. The first chapter introduces the topic to be researched and gives justification for the study. Three primary objectives of the study are also stated. Chapter two includes a review of the literature related to the study. References are made to previous studies concerning a wide variety of topics including inflation, net farm income, previous predicting and evaluating models, government payments, land ownership, and other issues related to land economics. Chapter three gives an in-depth view of how capital budgeting works and how Lee applies it to his model. The model itself is explained in detail and an example of how it works is offered. The sensitivity of the model to the 11 variables is demonstrated. Theory of land supply and demand is included with a discussion on economic rent and Ricardian rent. Chapter four describes the derivation, description, and usuage of the data in the study. Chapter five discusses the results of the study. Included will be a discussion on changing the four variables so the model's value will be equal to the actual value. Also included will be a discussion of the land value to net rent ratio. The concluding section analyzes five different land values and provides scenarios of the interest rate on land mortgages-opportunity cost of capital combinations and interest rate on land mortgages-net rent combinations that would allow an equilibrium at each of the different land values. Chapter six summarizes the results and conclusions of the study.

CHAPTER II

LITERATURE REVIEW

INTRODUCTION

This chapter reviews the literature relevant to this study. The first sections discuss the impact of net farm income and general inflation on land values, followed by discussions of the the impact of government payment, alternative investment opportunities, and capital gain impact on farmland values. The next sections discuss the factors that have affected the recent price decline, income and capital gains tax, and inter-tract variations of farmland. The next sections will include reviewing several models which predict land prices and evaluate farmland prices. The concluding sections will discuss farmland ownership, land market characteristics, farm size, and other issues related to land economics.

FARM INCOME

One of the biggest factors in determining farm real estate value is farm income. Using an application of causality testing, Phipps (1983) implies that the return to land is found to be a leading indicator of the price of farmland. (pp. 1-3). Scofield (1964) reported that 86 percent of the variatiom in land prices in the U.S. from 1961 to 1963 was associated with differences in net farm income. He also reported that in a regression analysis that a change of 10 percent in net farm income per acre was associated with a change of 7.5 percent in the market value of real estate. (pp. 18-22). Net income per acre is a very sensitive variable in both Lee's (1976), and Kletke and Plaxico's (1983) capital budgeting model. A small change in the net income per acre will have a relatively large impact on the bid price a potential buyer can submit for a tract of farmland. In traditional evaluating formulas, expected residual net returns to land was an extremely important component in estimating land values. (Lee, pp. 14-15), Klemme and Schoney (1984), as well as Miller (1983) further substantiate the importance of net income per acre in evaluating land prices.

Reinsel and Reinsel (1979) state that their data strongly suggest that an individual buying land at any time during the last forty years would have been in error if he had assumed that his earnings would remain constant in the future. They also imply that population growth may be the biggest factor in causing expectations of earnings and land values to vary over time. (pp. 1095-1096). Melichar (1979) also suggests that growth in current returns puts upward pressure on land values. (p. 1085).

Brown and Brown (1984) examines the effect of different expectations of prospective purchasers about future potential purchases. They examined the "effect on current farm prices of heterogenous farm buyers expectations about the different distributions of offers to buy (the land)." In their model, "each seller optimally has a reservation price in excess of the value he attaches to the stream of income from the land." They conclude that people who have very optimistic views of expectations of farm earnings and land values have a significant impact in determining farmland values. This implies that expectations play an extremely important role in determining land values in the future. (pp. 164-169).

INFLATION

There has been a land value decline from 1982 through 1984. The articles reviewed in this section were written before this occurance and thus, they have made no reference to it.

Except for a few relatively short periods of time, farm real estate price changes have generally moved in the same direction as the GNP Price Deflator since 1925. However, the percentage land price changes have often been greater on both the up and down sides than the percentage changes in the GNP Price Deflator. Duncan (1979) shows, however, that the two indexes have exhibited approximate harmony over the past half century. (pp. 14-16).

Feldstein (1980) focused on the specific question of how changes in expected inflation and in it's uncertainty affect the real price of land and of reproducible capital. He shows that the interaction of taxes and increased inflation cause a rise in the real value of land and a fall in the real value of corporate equities. Feldstein states that "an unanticipated jump in the expected rate of inflation causes an immediate jump in the level of the land price. After this initial jump, the price of land increases at the same rate as the general rate of inflation." (pp.910-911).

Martin and Heady (1982) suggest that if Feldstein's hypothesis is true it could have a dramatic effect on the U.S. farm real estate market. If the inflation rate should fall, some of the real capital gains could disappear. Martin and Heady tested Feldstein's hypothesis by expressing the ratio of real estate value to returns as a function of anticipated inflation and other variables such as the rate of growth and variability of returns. They concluded that inflationary expectations don't appear to have a direct impact on the value of U.S. farm real estate. (pp. 1-2). "Only a highly tentative link has been established between inflation premiums in bond rates and farm real estate value." (p. 36).

Tweeten (1981) elaborated on the relationship between farmland prices and cash-flow in an inflationary ecomony. He concludes by stating that the ratio of land earnings to land price is unaffected by the rate of inflation. He also says that farmland earnings have kept pace with sharply rising land prices in recent years and based on reasonable expectations of future land earnings, "land prices are justified by prospective future earnings from land use for farming alone." With respect to land earnings keeping pace with land price increases in excess of national inflation, Tweeten suggests that this is because of favorable supply-demand balance for farm products, low mortage interest rates in relation to land returns, tax benefits and for other reasons. Tweeten suggests the behavior of farmland in an inflationary economy will cause cash-flow problems because cash-flow patterns under high inflation rates raise immediate cash costs of buying land on credit and defer returns. (pp. 18-21).

Tweeten responds to the cliche' "inflation makes farmland a good investment" by stating:

> "If land values remains a constant multiple of land earnings as in the past, land prices will increase with national inflation only to the extend that land earnings increase with inflation. Because inflation has little impact on land prices other than by way of land earnings, it follows that persons who invest in farmland as a hedge against national inflation are likely to make a costly mistake. The more likely case is that real farmland earnings will rise in the future. The important point, however, is that the attractiveness of farmland investment is better judged by trends in land earnings than by national inflation rates." (p. 21).

Reinsel and Reinsel (1979) suggest that when prices rise rapidly during general inflation, production of most goods can be increased at least partly to satify demand, but new land can't be developed despite strong demand. Thus, land values can be expected to increase more than general inflation. (p. 1096).

GOVERNMENT PAYMENTS

Duncan (1979) points out that government payments to farmers have been a factor in farm income since the mid-1930's. In 1935, these payments accounted for almost 7.5 percent of cash receipts to farmers. These payments then declined in importance, in 1955 the payments accounted for less than 1 percent of cash receipts. The proportion rose again and reached a range of 6 to 7.3 percent of cash receipts in the late 1960's and early 1970's before declining again. (pp. 16-17).

Chryst and Timmons (1961) suggest that farm real estate values have been increased because of lowered risk in farming resulting from the income-maintenance aspects of the government's farm programs. They state that "capitalization of farm programs benefits into land value directly leads to the need for more benefits, resulting in higher land values and again in need for more benefits." (pp. 252-277).

Reinsel and Krenz (1972) note that the proportion of the payments actually capitalized into land values is moderated because of uncertainty over the duration of such payments. Thus, future buyers of farmland shouldn't lose all of the additional income flowing from government payments if an "appropriate discount rate is used in determining the property value." This implies that "buyers should use a somewhat higher discount rate in calculating property value when part of the cash flow to be derived from the property is in the form of government payments." Higher discount rates, they add, results in a lower discounted present value for the property in question, and "at least partially account for the possibility that government payments may cease in some future date."

Harris (1977) developed a theoretical model of land value determination incorporating agricultural support prices. He demonstrated that the "time path of land values can be quite sensitive to policy parameters." If "policy authorities establish a support-price formula that recaptures all nonland operating costs but no return on land, the time path of land values is level or constant." The implication of this is that policy has a "once-and-for-all impact on land values, raising them to new equilibrium levels." If policy makers "allow a portion of the rate of return on land to be included in the support-price formula, land values increase over time and approach an equilibrium value greater than for the situation in which no land costs are included in the support prices." (pp. 493-494).

ALTERNATIVE INVESTMENT OPPORTUNITIES

Duncan (1979) suggests that rational investors are expected to make investments to maximize their total net returns over time. This should include both annual rates of return and rate of capital appreciation. When returns are higher in agricultural investments than elsewhere, it is expected that asset prices in the farm sector would increase relative to prices of non-agricultural assets. This would indicate that when rates of return are better in agriculture thsn elsewhere investors would shift funds to agriculture. Therefore, increased profitability on alternative investments should have a depressing effect on farm real estate values as funds that used to bid for land bid for higher returning investment alternatives. Between 1940 and 1977, rates of return on common stock were below the total rates of return on farm resl estate about hslf of the time. (pp. 18-19). Recently outside investments have had a higher rate of return than agriculture. This should indicate that investors would shift out of agriculture to more profitable investments.

In Lee's (1976), as well as Kletke and Plaxico's (1983) capital budgeting models for evaluating the investment feasibility of purchasing farmland, an increase in the opportunity cost of capital will inversely affect the feasible bid price offered. A decrease in the investor's opportunity cost will have the opposite effect on the bid price. This can be explained by stating that as the rate of return on your next best alternative investment goes up you will need to get the same rate of return from the farmland you want to purchase. Because you want a higher rate of return from the land you will need to bid less for that parcel of land to get the higher rate of return.

CAPITAL GAINS

From 1950 to 1981, with the exception of three years, holders of farm real estate, in the aggregate, have enjoyed capital appreciation of land .

Duncan (1979) points out that there has been a growing diverenge between net farm income and land prices that begin during the late 1940's. Till 1981 farmland prices have continued on an almost uninterrupted upward course, while farm income growth was lackluster, broken only by the 1972 to 1975 period. (pp. 17-18). Melichar (1979) suggests that the diverengence between farm income and land prices can be explained thru real capital gains. Melichar implies that comparing farm income and farmland prices is incorrect. Instead, he suggests, one should compare real capital gains from farm assets with current returns to these assets. Real capital gains are computed by "adjusting the nominal gains for the gains or losses resulting from each year's change in the purchasing power of the funds tied up in assets or of the money owed." Over the two decades preceeding 1972, real capital gains averaged about one-third as large as net farm income. From 1972 to 1978, on average, income and real gains have been roughly equal. Melichar suggests that the growth in the current returns has figured prominently in putting upward pressure on land prices and, therefore, in the occurance of real capital gains. Even in real constant dollars, "recent real capital gains are on average significantly larger than in earlier periods." (pp. 1085-1091).

An analysis by Kuhlman (1978) implies that farm income and expected capital gains were major forces in U.S. farmland prices over the 1940 to 1977 period. Plaxico (1979) implies that expected capital gains had a greater impact on land prices than an equal expected increase in net farm income. (pp. 1098-1102).

Castle and Hoch (1982) suggests that capitalized rent explained only about half of real estate values in both the 1970's and in the period 1920 to 1978. The other half could be explained by the capitalization of capital gains, including real gains or losses from price level changes. (p. 8).

FACTORS AFFECTING PRICE DECLINE

Since 1981 the price of farmland has dropped in many states. Scott (1982) lists many factors that may have helped cause the price of land to fall. He says land income has been flat since 1974 and with declining grain prices and large grain carryovers, expectations about income from land have dampened. Higher interest rates and an increasing real rate of interest have adversely affected the ablitiy of most purchasers to finance land. He also implies that the "Tax Recovery Act of 1981" caused disinvestment in land for those who had capital gains as an important factor in holding land. "The reduction of the tax rates makes the value of the current income higher and the present value of capital gains lower relative to current income." Other negative factors that Scott suggest include a change in the exchange rates, the inability of the Soviet Union and the Eastern Block countries to pay for imports, unemployment in the U.S., and decreasing demand for farmland by foreigners. (pp.2-5).

Shalit and Schmitz (1984) developed a model of farmland accumulation which analyzes the impact of credit allocation and the level of debt on farmland prices. Their model stresses the role of real net wealth accumulated by farmers on the lending procedure for farmland purchases. They suggest that "credit allocated on the basis of wealth not only increases farmland prices but also destabilizes them." They imply that any policy attempting to deal with farmland values stabilization must regulate the allocation of credit to individual farmers. They state that the opposite is often done because as farmland prices increase farmers request and obtain more money for land purchases. Loans are available since they expect farmland values to increase. But if prices are expected to fall or are falling, credit terms are strengthened, thus compounding the decline in farmland values. (pp. 303-304). They state that credit allocation that helped increase farmland values in the 1970's has now depressed them because of accumulated debt. This was accomplished because the "accumulation of farm real estate debt accelerates the increase in farmland values up to a level where the amount of debt burdens the farmer and forces him to sell more land. Then, prices fall and credit terms are strengthened to reduce debt size." (p. 312). This would also correspond to the psychology of a land buyer. When land prices are increasing land buyers bid the price of land up which bring about more land inflation. When land prices are falling land buyers wait to buy land which brings about more land deflation.

INCOME TAX AND CAPITAL GAINS TAX

There have been conflicting studies on how income tax brackets affect the land market. Lee and Rask (1976), and Harris and Nehring (1976) claim that higher tax bracket individuals can not bid as much for land because of reduced after-tax earnings. Klemme and Schoney (1984) claim that this disadvantage is outweighed by reduced after-tax real interest rates.

Scott (1981) suggests that higher tax rate bracket investors have an advantage because the growth rate on earnings needed to either continue holding farmland or buy farmland declines as you move to higher tax brackets. Scott adds that the breakeven growth rate is the same across all tax brackets and alternative rates of returns if there is no capital gains or if the capital gains tax is 100 percent. "The higher tax bracket individual can always accept a lower growth rate 'in net income' than the lower tax bracket individual and still break even with an alternative higher current return investment whose asset value remains unchanged." (pp. 15-16).

In the 1976 Tax Reform Act, the proportion of capital gains subject to tax was reduced from 50 percent to 40 percent. This reduction took full effect in 1978. One of the Reagan administration's early proposals was to further reduce the proportion of capital gains tax from 40 to 20 percent. Scott comments that because of the lower capital gains tax rates, it is always more advantageous for persons in higher tax brackets to buy and hold farmland compared to those in the lower tax brackets, assuming they anticipate selling the land with a price gain. Scott speculates that the effects of even lower capital gains tax rates would make it "more and more advantageous for high income taxpayers to invest in farmland and for low income taxpayera to disinvest in farmland." (pp. 16-17).

INTER-TRACT VARIATIONS

Value of agricultural land can vary from tract to tract depending upon the buyer's preference. Tracta of similar soil type and productuve capacity may be viewed differently becauae of a variety of reasons. Pine (1978) studied the factors affecting inter-tract variations in value of farmland in Kansas. He reported that amall tracts generally sold for more per acre than large tracts. He noted, however, that may have been due to the fact there may have been more improvements or the land was closer to a town or road. He reports that better type of land, not suprisingly, sold for more per acre. He also reports that land with higher quality of roads, land with improvements, and land closer to towns sold for more per acre. (pp. 1-19). Schuh and Scharlsch (1966) also studied some farm and non-farm determinants of agricultursl land value. They also report a positive relstionship between land quality and value. There is also a positive relationhip between local population density and land values. They also reported that property taxes have a depressing effect on farmland values. They agree with Pine in stating that, other things equal, land value decreases as the distance from a major metropolitan ares increases. Schuh and Scharlach also suggest that increased use of non-land inputs lead to higher values for agricultural land. They also suggest that ecomonies of size are cspitalized into higher land vslues. (pp. 1-3). Burton and Nelson (1982) did a similar study with farmland values in Eastern Oklahoma. They used a regression equation to check the relationship between each varisble and rural land value. They reported many of the same results as the previous studies. Date of sale (each month), land improvements, and nonagricultural land use were all positively correlated to rural land vslue. Size of tract was negatively correlated to rural land value, while soil type did not significantly affect the value of the land. (pp. 7-10).

PREVIOUS PREDICTING MODELS

Researchers have used a variety of approsches in formulating econometric models of farm resl estate values ranging from very simple single-equations models with few variables to complex multi-equation models using advanced statistical techniques to reach their solutions.

Tweeten and Nelson (1966) explained 95 percent of the changes in land prices during the 1923 to 1963 period using a five-equation model that placed land price as a function of land in farms, farm transfers, the number of farms, last year'a net farm income, rate of return on nonfarm inveatment, and laat year's land price. They concluded that farm enlargement preasure was tha most important cause of increase in farmland valuea during the 1950 to 1963 period. The model has fairly good predictive qualities. When using a simplified one-equation veraion of the model and 1925 to 1975 data, the model explained 98.8 percent of the changes in land prices during that period. (pp.29-40).

Herdt and Cochrane (1966) developed a simultaneous equation model of the farm real estate market to try to explain rising farmland values when keeping income per acre constant. They thought that advances in technology played an important role in the land price increasea. Their study concluded that technology (USDA Productivity Index), the ratio of prices paid to prices received, and the general price level were primary determinants of farmland prices. (pp. 243-263).

Reinsel (1973) predicted land price was a function of U.S. population and the money supply. Hia model explained 99.8 percent of the variation in land prices betweem 1947 and 1970. He sug-geated that inflationary pressure in the economy and increased population pressures were the main factors affecting farmland valuea. The model won't, however, explain the impact of other important variables in determining land values. (pp. 107-136).

Duncan (1979) applied a regressive equation with equally impressive results. He placed land value as a function of farm operator's realized net farm income per acre, expected personal income of the farm population from nonfarm sources per acre, government payments per acre, expected returns (earnings plus capital gains) on farm real estate, voluntary transfers of farmland per 1,000 farms, expected returns on common stock, and average farm size. Using data from 1929 to 1975, the model explained 98.8 percent of the land price variation. When he used data from 1939 to 1975, 99.1 percent of land price variation was explained. He states that the most important variables of farmland values are found to be farm expansion pressure and expected realized net farm income per acre. Capital gains expectations were significantly higher between 1960 and 1975 than years previously. (pp. 21-25).

Reynolds and Timmons (1969) used a two-equation recursive model for identifying the principal determinants for agricultural land prices for the period 1933 to 1965. They found that much of the variation in land prices could be explained by expected capital gains, tranfers of farmland, government payments for land diversion, conservation payments, farm enlargement pressures, and the rate of return on common stock.

Klinefelter (1973) found 97 percent of the variation in Illinois land prices between 1951 and 1970 could be explained by net returns, average farm size, number of transfers, and expected capital gains. (pp. 27-33).

Pope et al. (1979) reviews the models presented by Reynolds and Timmons, Tweeten and Nelson, and Herdt and Cochrane. All of the models did a reasonably good job explaining variations in land prices during the period for which they were originally estimated. Pope re-estimated the models using more recent data and found there was an abundance of sign changes and lack of statistical significance of many variables in the regression results. Pope suggests that the "model specifications do not reflect accurately enough the relevant structural changes and other characteristics of the farmland market." (pp. 107-115). Shalit and Schmitz (1982) reviews Pope's conclusions by stating that "the econometric models of the 1960's for the behavior of farmland prices were inappropriate to explain the recent growing diverengence between farm income and land values." (p. 710).

Shalit and Schmitz (1982) showed that savings (the difference between farm income and consumption) and accumulated real estate debt are the main determinants of high farm land prices. They also showed that as the banking system increased the supply of credit to farmers with land as collacteral, land values rise at a faster rate than if no credit was available. Therefore, "the expansion and contraction of credit importantly affects the pace at which land prices increase or decrease." (p. 718).

ADDITIONAL EVALUATING MODELS

There have been many models for evaluating farmland real estate. Perhaps the simplest model would be the traditional income capitalization model. (Suter, 1974). This model defines the value of a tract of farmland as the value of the anticipated stream of net revenues coming from the land into perpetuity, discounted to the present. In formula terms:

$$V=I/D$$

Where:

V= The estimated present value of a specific farmland property.

I= The annual net return to land. If the average income can be estimated with accuracy, you can then assume a fixed income over an infinite planning period.

D= The discount rate or the capitalization rate. The discount rate may be the market rate of interest adjusted for risk and uncertainty or the necessary internal rate of return or opportunity cost.

The formula is a relatively simple one. For example, if the average return to land is $40 per acre and the appropriate discount rate is 9%, then the formula suggests a value of $444.44 per acre. The computation is as follows:

$$V=\$40/.09=\$444.44$$

Obviously, the model is highly sensitive to net income and the discount rate. An assumed higher income results in a higher estimated value and a higher discount rate results in a lower value estimate. (Lee and Rask, 1976, p.2).

Lee and Rask state that this provides an accurate estimate only if three conditions are met: (1) the investment produces the same net income over time; (2) the capitalization rate used to discount future net rent remains constant; and (3) an infinite or very long planning period is used. (pp. 2-3). Crowley (1974) shows these conditions are rarely met and that the apparent rate of return generally underestimates the actual rate of return. (pp. 52-57).

More complex models have been developed in recent years. Capital budgeting techniques have come into general use in many business areas and are being used increasingly as a basis for agricultural finance evaluations.

Kletke and Plaxico (1983) developed a capital budgeting model where the investment value of farmland is considered to be made up of five additive components: (1) the stream of annual revenues coming from using the land in agricultural production and/or other activities; (2) the opportunity cost of land ownership coming from alternative means of controlling the land resource; (3) the anticipated capital gains (losses) ocurring over the planning period; (4) the present value of the purchase price at the end of the planning period; and (5) the finance costs. (pp. 1-5).

Klemme and Schoney (1984) developed a model for prospective land buyers that results in a bid price for land based on joint considerations of (1) the land's economic value and (2) the maximum loan supportable by the land's cash returns. The after-tax economic value of the land is based on both it's earning ability and increased value over time. The maximum feasible after-tax loan size for both the short-run and long-run is calulated to determine the amount of equity necessary to complete the financial deal. (pp. 117-118).

Lee's capital budgeting model, which is used in this study will be explained in detail in the theory section.

FARM SIZE

Previous research has shown that the average farm size is increasing (McDonald and Coffman, 1980; Gustagson, 1983). We will now investigate which size of farm can bid the most for a tract of land. A theoretical model was constructed by Harris and Nehring (1976) to test the impact of farm size for bidding potential for agricultural land. The model was constructed to determine the maximum bid price that would be made for an acre of land by a decision-maker with a given set of characteristics, capabilities and expectations. The variables in the study that have an impact on the maximum bid price were net income, income variability, wealth, degree of risk aversion, marginal income tax rate, rate of pure time preference, and expected rate of growth in land income and prices. Size was classified (according to the Cencus of Agriculture) from 0 to IV, where 0 was the largest farm size and IV was the smallest. Harris and Nehring reported that the largest farm size (Cencus class 0) may not have the greatest bidding advantage after all. A combination of higher marginal tax rates and diseconomies of size may cause Class 0 farmers to have a lower maximum bid price that either Class I or II farmers. (pp. 161-169).

Lee and Rask (1976) conclusions were similar to those of Harris and Nehring. Harris and Nehring point out that the largest farms had lower net income per acre because of diseconomies and their larger overall income pushed them into higher marginal income tax brackets, thus enabling smaller, more efficient farms to potentially outbid the larger (Class O) farms. But the largest farms were still able to potentially outbid the two smallest size farms (Class III and IV). (pp. 168-169).

Klemme and Schoney (1984) contradict these studies by saying that farmers in higher income tax brackets can bid more for land based on economic reasons. These reasons were that higher marginal tax rates reduces both real (after-tax) interest rates and after-tax net returns to land. The impact of lower interest rates outweighs the impact of reduced net returns. (pp. 117-126). These results were also suggested by Boehjie and Reinders (1983, pp. 37-42), and Scott (1981, p. 15-16). Farmers in high tax brackets, notes Klemme and Schoney, may have cash-flow problems particurally if their planning period is short. (p. 126).

WHO OWNS THE LAND AND WHO IS BUYING IT

Duncan (1979) reports for the year ended March 1, 1977, 23 million acres of farm real estate changed hands. This was up 15 percent from the 20 million acres in 1971, but down from the recent peak of 42 million acres transferred during 1974. The number of transfers for 1977 dropped 2.5 percent from the 1971 figures. This may reflect the fact that larger tracts of land are being transferred. Of the total number of transfers in 1977, 64 percent went to active farmers, about the same proportion as over the past three decades. Approximately 12 percent of transfers went to part-time farmers. This figure has stayed quite stable over the past few years. In 1977, 91 percent of the acres transferred representing farmland expected to be used for agricultural purposes for at least five years after the transfer. (pp. 27-28).

In an extensive research report Gustafson (1983) found that 39.3 percent of farm and ranchland in Kansas was owned by a husband and wife, while 38.6 percent was owned by a sole proprietor. Family partnerships accounted for 12.5 percent and non-family partnerships owned 1.3 percent. Family corporations owned 3.0 percent, and only 1.2 percent of farm and ranchland in Kansas was owned by non-family corporations. (p. 19).

Gustafson also reported that 52.1 percent of the occupation of farm and ranchland owners in Kansas were farmers. Retired individuals owned 19.5 percent and 14 percent was owned by white collar workers. (p. 15).

Gustafson also stated that 49.5 percent of farm and ranchland in Kansas was acquired by purchasing the parcel from a non-relative, while 12.3 percent purchased the land from relatives. He also notes that 25.7 percent of farm and ranchland owners inherited the land they presently own. (p. 23).

Duncan states that credit financing continues to play a big role for farmland purchases. During 1977 most transfers involved credit financing. The Federal Land Bank provided financing for 28 percent of the farm and ranchland purchases, while seller contracts accounted for 29 percent. Insurance companies provided financing for 13 percent, while seller mortages and commercial banks each provided financing for 10 percent of the purchases. Other lenders provided the remaining 10 percent. (pp. 32-36).

Duncan points out that farmers planning to enlarge their operations probably account for the bulk of farmland purchases. Data developed by the USDA indicate that most real estate transfers in 1977 become part of another farm, rather than being used as a complete farm unit after the transfer. In 1977, 63 percent of all transfers were for use as part of an existing farm. This has dramatically increased since 1956 when only 33 percent of the total transfers of farmland were used as part of another farm, while the other 60 percent were used as a whole farm. He suggests that "over the past 20 yeara, the farmer seeking to enlarge his farm has emerged as the major participant in the land market." (p. 29).

McDonald and Coffman (1980) suggests that 63 percent of all farmland transfers were added to an existing farm and helps explain why the average size of farms has been increasing and the number of farms declining. Another reason for the increase in farm size and declining farm numbers is a steep drop in the number of small farms. Those farms with less than 100 acres are projected to drop by "more than a half million by the turn of the century." (p. 5).

The Kansas State Board of Agriculture (1981) reports that in 1900 there were 173,000 farms in Kansas with an average size of 241 acres. By 1950 the number of farms had dropped to 135,000 and the average farm size increased to 374 acres. By 1982 the number of farms had dropped to 76,000 and the average size of farms increased to 638 acres. (p. 40).

Gustafson also reported that 6.9 percent of farm and ranchland owners in Kansas owned less than 100 acres, while 43.8 percent owned between 100 and 499 acres. He also reported that 45.6 percent owned between 500 and 4,999 acres, whereas only 3.7 percent owned more than 5,000 acres. (p. 40).

McDonald and Coffman imply that large farms will continue to be the growth sector of U.S. agriculture. While the total number of farms will decline by a third, the number of large farms (sales of $100,000 and more) will nearly quadruple, from 150,000 (5 percent of all farms) in 1974 to 560,000 (32 percent of all farms) in the year 2000. (p. 7).

Gustafson reported that the largest 5 percent of landowners own 31 percent of the farm and ranchland, while the largest 1 percent of the landowners own 14 percent of the farmland in Kansas. (p. 37).

McDonald and Coffman imply that as farms become larger and require more machinery to operate, fewer young people will be able to get started in farming. Only those who inherit a farm will have a good chance of acquiring one. Those who do not inherit a farm will probably have difficulty getting started in farming and may be limited to small or part-time farming operations. (p. 10).

McDonald and Coffman predict that the number of young farmers entering farming will probably have declined by 40 percent by the end of the century. That decline will be due both to the larger capital requirements for a standard of living comparable to nonfarm alternatives and to fewer farming opportunities. McDonald also suggests that smaller farms affordable to young operators to form an expansion base will be purchased or rented by larger farmers seeking to expand. (p. 11).

Gustafson reports that only 0.2 percent of farm and ranchland in Kansas is owned by people under the age of 25, while 5.2 percent is owned by people between the age of 25 to 34. People over the age 65 own the largest amount of land. They own 34.1 percent, whereas people between 55 and 64 own 24.8 percent of the land. People between the age 45 and 54 own 21.9 percent, as compared to people between the age of 35 and 44, who own 7.8 percent of the land. (p. 31).

McDonald and Coffman suggest because nonfarmers own about 44 percent of U.S. farmland many farmers have to rent at least some of the land in their operation. By the end of the century, McDonald and Coffman predict that 63 percent of the farmers will own all the land they operate, 30 percent will lease some of the land they operate, while the remaining 7 percent will be tenant farmers, leasing all the land they operate. (p. 15).

McDonald and Coffman also explain how farm growth and expansion is encouraged by economies of scale and new technology. (p. 15). "Economies of scale" means that farmers can lower their production costs per unit of output by increasing, up tp a point, the size of their operation. (Kay, 1981, p. 55). Some technologies that have been recently introduced further lowered the costs of production on large farms. Duncan also suggests that technology has generally reduced the per unit cost of production, but it has frequently been available only in large, discreet units such as four-wheel drive tractors. (p. 19).

LAND MARKET CHARACTERISTISTICS

Duncan pointa out that agriculture is often characterized aa the best current example of a perfectly competitive industry. But it doea not follow that all aubmarketa within the industry are competitive. The land market has aome characteristics of a perfectly competitive market but lacks others. (p. 4).

The competiteve requirement of many sellers and buyera and the inability of any one buyer or aeller to influence price is valid only for land at the atate or national market level. Within a small community, however, there are usually few sellera and depending on the demand for land, relatively few to potentially many buyers. Although the quantity of land offered for sale at a given time may vary according to market conditiona, it typically repreaenta a relatively low proportion of total acres of land in the defined area. Therefore, a few more tracta of land offered for aale may affect the current supply of land for aale in that area. The additional tracts of land could also affect the price of the land. (p. 4).

The competitive asaumption of perfect knowledge of both buyera and aellera in the marketplace is typically not true in the caae of the land market. The typical land buyer doea not have complete knowledge of the characteristica contributing to the value of all tracts of land nationally or even within a amall market area. Land buyers and sellera uaually only enter the market occaaionally and have limited knowledge of the market.

Therefore, land will, and occasionally has sold for more or less than it's value. (p. 3).

The competitive market requirement of homogeneous goods will not hold true for land even within a small area. Over a wide area, market prices will vary widely. Kansas Flint Hills land is far different from river bottomland in Northeastern Kansas and the market price will reflect this difference. Even within a small area, tracts of similar soil type and productive capacity may be viewed differently because of location or distance to a town, for example. These inter-tract variations can potentially have a big impact on the selling price for a parcel of land. (p.3).

There is, however, relatively free entry to persons wishing to purchase land, providing they have the required capital and there is free exit for those wanting to sell land.

FUTURE STRUCTURE OF THE RURAL REAL ESTATE SECTOR

Several of the studies reviewed offered some of their views on the future structure of the rural real estate sector. It should be noted that these articles were written before land prices begin to decline. Therefore, no reference were made to the implications of this happening in these studies.

McDonald and Coffman (1980) suggest the likelihood of larger farms, fewer number of farms and more farms becoming corporations. They also state that more farms will specialize in the commodities they produce and some commodities will be produced by only a few large farms. Farmland and farm wealth be will concentrated among fewer and larger farms. Farmers will rent more farmland. Inheritance will be the chief means of acquiring a farm. They also predict new farmers will be fewer and will need more capital to get started. (pp. 1-2).

Tweeten (1981) suggests that in response to the cash-flow problems created by an inflationary economy there will be more: (1) part- time owner-operators with considerable off-farm income; (2) large, diversified, perhaps nonfarm based corporations engaged in farming with access to national debt and equity capital and not subject to life cycle financial problems of family farms; and (3) established family farms which have survived the liquidity crisis to build a large cash-flow surplus. (p.21).

Reinsel and Reinsel (1979) imply that the implications of continuously rising land values for the structure of the agricultural sector are that land owners will benefit from the wealth changes at the expense of future generations of farmers. Fewer tenants will be able to obtain enough capital to become owners. Land ownership and wealth will tend to become concentrated into fewer hands as current land owners expand their existing operation. (p. 1097).

SOCIOECONOMIC PERSPECTIVE OF LAND OWNERSHIP

Raup (1972) discusses that the widespread ownership of farm and ranchland has been a goal of U.S. government policy since the early 1800's. Legislation provided for small tract size and for preferential treatment for squatters in the sale of public land. (p. 1). Benedict (1953) points out that the Homestead Act of 1862, and later legislation, made large areas of U.S. land available for settlement to those who otherwise might not have been able to own land. (p. 1).

Benedict says that the availability of inexpensive land was an added attraction for both U.S. citizens and for immigrants, who were also motivated by a desire for personal freedom. Duncan states that "this background may help explain why American farmers and ranchers have held tenaciously to their property during periods when the returns to their labor and management, as well as, income returns attributable to land, ranged substantially below those offered by other investment opportunities." (p. 4).

Farmer's and rancher's attachment to their land is strong. The farm or ranch may be viewed as producing not only products, but a stream of other tangible and intangible benefits. Cattle ranchers, suggest Smith and Martin (1972), may not be profit maximizers. They points out that "once a certain level of monetary income has been achieved, the rancher is satisfied to forego additional income, preferring to continue his ranch enterprise as a home and way of life." "The strength of ranchers' attitude toward land was the key to understanding why some ranchers did not act as 'economic men'." (p. 4).

CHAPTER III

THEORY AND METHODOLOGY

LEE'S MODEL AND CAPITAL BUDGETING

Real eatate accounta for nearly three-fourtha of all farm asaeta. (Reinael and Reinsel, 1979, p. 1094). And for farmers, purchaaing real eatate for entrance into farming or farm expansion can be one of the most difficult investment decisions confronting them. Farmera muat be able to evaluate each tract of land and derive a bid price if he wants to buy the tract. If hia bid price is not reasonably cloae to the seller's asking price, another buyer could outbid him. Every potential buyer has their own way of evaluating a parcel of farmland. Kletke and Plaxico (1983) sum the different aspects of farmland evaluation by aaaerting:

> "In farmland evaluation, there are three relevant basic concepts of value. Theae are market value, investment value, and feasibility value. Market value, defined as the expected exchange price if the property were exchanged on the open market, is estimated by examining the market pricea of recently sold comparable pieces of property. The investment value of a property is the price which could be paid with reasonable expectationa that a predetermined, deaired rate of return could be attained. Feaaibility value is the price that a purchaaer's caah-flow would permit him to pay. A profitable investment may prove infeasible if available caah-flowa are inaufficient to meet debt service and other caah requirementa. The feasibility value will vary depending on a potential buyer'a financial situation. The feasibility value may be very large for a potential buyer who is adding to an existing unit or who haa a large non-farm income. A rational and prudent buyer would pay no more for a property than the leaat of the market, inveatment and feaaibility values." (p. 1).

On any given parcel of farmland you have the potential for a diverse set of buyers. Every prospective buyer could have different alternatives, different opportunity costs, different discount rates, different tax situations, and different expectations.

Lee's model allows for all these differences. Thus, each prospective buyer could, and probably would, have a unique bid price. Therefore, it is very important for each buyer to determine what his maximum bid price would be.

Lee presumes that land buyers have s limited plsnning period and they do consider their opportunity cost of capital (rate of return on slternstive investments). Land purchasers sre ususlly finsnced with borrowed money; thus, finance terms such as interest rates, down psyment, and length of loan repayment period must be considered. Lee also implemented income tax effects on expected costs and returns, as well as, implementing capital gains taxation when the parcel is sold at the end of the planning period. (p. 2).

Lee suggests that the land purchase decision can be evaluated using capital budgeting. (p. 2). Capital budgeting is a widely accepted method of evaluating investments in short and intermediate term depreciable assets (i.e. machinery). Hopkin et al. (1973) show the potential use of capital budgeting for evaluating real estate investments ss well.

Capital budgeting has been defined as:

> "... a many-sided activity that includes searching for new and more profitable investment proposals, investigating engineering and marketing considerations to predict the consequences of accepting the investment,

and making economic analysis to determine the profit potential of each investment proposal." (Bierman and Smidt, 1975, p. 4).

Therefore, using capital budgeting, purchasing a parcel of land is an acceptable investment alternative if the present value of net cash receipts is equal to or greater than the preaent value of the cash outlays. Present values of net cash receipts minus present value of cash outlays ia called the net present value. Thus, if the net present value is equal to or greater than zero the investment is acceptable. Present value of future income is determined by discounting income. The concept is the converse of growth in value due to accrued interest. Thus, with the interest rate at 12 percent, $1.00 today grows to $1.12 in a year and, conversely, $1.12 a year from now is only worth $1.00 today.

Nelson et al. (1980) states that the reason for the change in the value of the dollar from one year to the next is the time value of money, the universal preference for a dollar today over a dollar at some future time. The $.12 received on your dollar is compensation for getting your dollar back a year from now. There are three basic reasons for the universial preference for a dollar now over the prospect of receiving a dollar in the future. The first reason is uncertainty. A dollar today is a certain thing while the promise of a dollar one year from now is not. The second reason is alternative uaes. It may be preferred to have the dollar now to buy something else or to help pay off a debt. Inflation is the third factor that accounts for the time value of money. The price level in the U.S. economy haa risen almost continiously for several decades. With continuing inflation a dollar in the future will have less purchasing power than a dollar today. (p. 49).

The present value of future income is derived by using equation (3.1).

$$(3.1) \qquad V=I/(1+i)^n$$

Where V=present value.

I=future income

i=discount rate

n=number of years before income is received

This is the equation to use when future income is discounted on an annual basis. If the income is discounted m times per year, i should be divided by m and n multiplied by m. (p. 51).

The present value of a sequence of annual incomes is derived by using equation (3.2).

$$(3.2) \qquad V=I_1/(1+i) + I_2/(1+i)^2 + \ldots\ldots + I_n/(1+i)^n$$

In this equation I represents annual (net) income, which may or may not be the same each year. (p. 52).

Thomas (1982) states that an appropriate example of the usuage of present value would be bond valuation. Bonds are debt-instruments where the purchaser (lender) pays a certain sum of money in exchange for the right to receive a flow of payments in the future. (p.63).

Since the debt-instrument (bond) involves payment to be made in the future, the face amount of these payments must be discounted if we are to properly evaluate the present worth to the investor. Consider the formulation for evaluating the worth of a bond, expressed in equation (3.3).

(3.3) $$V=I_1/(1+i)+I_2/(1+i)^2+...+I_n/(1+i)^n+F/(1+i)^n$$

Notice it is similar to equation (3.2). The present value of the sequence of annual income is added to the present value of the face (F) of the bond to give the present value of the bond with it's present value earnings. (p. 63).

Suppose a bond having four years to maturity provides an annual coupon of $50, and the yield on comparable bonds are 5 percent. Then the market valuations of this bond may be approximated using equation (3.3) as follows:

$$V=\$50/1.05+\$50/(1.05)^2+\$50/(1.05)^3+\$50/(1.05)^4+\$1,000/(1.05)^4=\$1,000$$

If yields on comparable bonds are 5 percent, the market will dictate that the rights to this bond which pays $50 annually will be priced at $1,000. If this bond was priced at less than $1,000, other securities would be sold in order to purchase this one. If this bond was priced at more than $1,000, market participants would sell it in order to buy alternative securities yielding 5 percent. (p. 64).

Since the market interest rate is used to discount the fixed stream of return from a bond to place a value on the security, it should be clear that the price and yield of a bond are inversely related. The higher the price, the lower is the yield, and vice-versa. The lower the price, the higher the yield, and vice-versa. (p. 64).

When an investor's annual income is constant and continues into infinity, equation (3.4) can be used. (Lee, p. 2).

$$V=I/D$$

This method is called the traditional capitalization model. As stated earlier this model will give an accurate estimate only of three conditions are met: (1) the investment produces the same net rent over time; (2) the discount rate remains unchanged; and (3) an infinite or very long planning period is used. It was suggested that these three conditions are rarely met. (Crowley, 1974, pp. 52-57).

When the annual income is constant but does not continue to infinity the equation (3.5) becomes:

$$(3.5) \quad V=I\,x(1+i)^{n}-1/i(1+i)^{n}$$

A constant income stream that continues for a finite period is called an annuity. (Nelson et al., pp. 52-53). For example a three-year $50 annuity would be a constant annual income stream of $50 continuing for three years, with the $50 received at the end of each year. The present value of this annuity, discounted at 5 percent would be:

$$V=(\$50)x(1.05)^{3}-1/.05(1.05)^{3}$$

$$V=(\$50)x(1.1576-1)/.05(1.1576)=\$136.16$$

The same result could have been obtained by equation (3.2), as shown:

$$V=\$50/1.05+\$50/(1.05)^{2}+\$50/(1.05^{3}$$

$$V=\$47.62+\$45.35+\$43.19=\$134.16$$

Table 1 illustrates the net present value method in a hypothetical investment. We will assume an initial investment outlay of $500 is made at the beginning of year 1 (end of "year 0"). This net cash outflow is followed by cash inflow of $300, $200, and $100 received at the end of years 1, 2, and 3. These future cash inflows are discounted to the present value using the 8 percent discount factors.

The net present value of this investment is \$511.45-\$500 = +\$11.45. According to the capital budgeting criteria, this would be an acceptable investment alternative because the net present value is greater than or equal to zero.

If the discount rate rises to 9 percent the net present value becomes \$477.79-\$500 = -\$22.21. Because the net present value is less than zero when the discount rate rises to 9 percent the investment becomes unacceptable.

Table 1. Analysis of a Hypothetical Investment Using the Net-Present-Value Method

(1) Time	(2) Cash Inflow (+) Cash outflow (-)	(3) 8% Present Value Factor	(4) Present Values of Cash Flows
0	-\$500	1.0000	-\$500.00
1	+\$300	.8573	+\$279.19
2	+\$200	.7938	+\$158.76
3	+\$100	.7350	+\$73.50
		Net Present Value =	+\$11.45

There is a discount rate between 8 and 9 percent where the net present value is zero. The discount rate where the net present value is zero is called the internal rate of return. In this case the internal rate of return is between 8 and 9 percent (8.28 to be exact). In Lee's model, for the investment to be acceptable the net present value is equal or greater than zero or, in other words, the internal rate of return exceeds the necessary opportunity cost of capital. The opportunity cost of capital is the rate of return the person could earn on alternative investment opportunities. In the case shown, the investor could earn 8 percent but not 9 percent. If he was satisfied to earn 8 percent the investment was acceptable. If the investor wanted to earn 9 percent he would have to forego the investment or pay less than $500 for the initial cash outlay. Assuming the net inflows stay the same and the investor pays $475 for the initial cash outlay, the net present value becomes $477.79-$475.00 = +$2.79. The investment is now acceptable and the investor is earning slightly more than 9 percent on the investment.

The major cash inflows associated with an investment in real estate consists of annual returns to land (usually estimated from rental rates of comparable land in the area) and returns from selling the land at the end of the planning period. Cash outlays consist of the down payment, principal and interest payments on the mortgage loan, and income taxes. The annual net returns to land should be regarded as residual income. Lee suggests this can be done with a budgeting method. This is computed by deducting all production costs, with the exception of interest charges on land debt, from gross receipts. In areas where there is an active rental market, the net rental or landlord method may be used to estimate the residual returns. (p. 3).

Lee's model incorporates 11 variables with the objective of developing a discounted cash-flow model providing the land buyer with a method for evaluating a parcel of land using his discount rate, income estimations, planning period, income growth and land inflation (deflation) expectations, credit terms, and income and capital gains tax situation.

The 11 variables in Lee's model are:

1. The average price per acre of recent sales of comparable parcels in the area.
2. The after-tax opportunity cost of capital.
3. The buyer's planning period in years.
4. The expected annual net cash income per acre before taxes.
5. The expected annual rate of growth in annual net cash income per acre.
6. The buyer's marginal tax rate.
7. The portion of the purchase price paid down. Thus, one minus the down payment percentage is the proportion of the purchase price financed with borrowed funds.
8. The nominal rate of interest charged on the mortgage loan.
9. The amortization period on the loan.
10. The expected annual rate of inflation in land values.
11. The tax rate that will apply to capital gains income when the parcel is sold at the end of the planning period (year n).

The 11 preceeding variables will generate the maximum bid price a prospective buyer can offer for a tract of land. For those interested, an indepth mathematical derivation of the model is given in Lee (1976).

Lee wrote a computer program that facilitates using the 11 variables. Let us consider a case where a farmer is considering purchasing a tract of land that recently came up for sale. From recent sales of comparable land in the area, he knowa that land has been selling for about $500 per acre. However, the asking price for the tract he is intereated in is $575 per acre.

From the farmer's knowledge of rental rates of comparable land in his area, he assumes that this additional land will add $40 per acre to his annual net cash income before taxea and that this income will grow at 2.5 percent per year. He can obtain a mortgage of 10 percent for 75 percent of the purchase price. Thus, the down payment will be 25 percent of the purchase price. The loan amortization will be over 12 years in equal annual installments. The income stream from the investment will be subject to a 30 percent marginal tax rate and the estimated capital gaina tax when the property is sold at the end of the 12 year planning period is 12 percent. He expects land prices to increase from the average price of comparable land of $500 at a rate of 5 percent per year. He wants his inveatment to yield a minimum after-tax return of 8 percent per year.

The data for this general case can be summarized as follows:

1. Price of comparable land...$500.
2. After- tax opportunity coat of capital...8 percent.
3. Buyer's planning period...12 years.
4. Annual net income per acre (before tax)...$40.
5. Expected growth in annual net income per acre....2.5

Percent.

6. Marginal tax rate...30 Percent.
7. Down payment...25 percent.
8. Nominal interest rate on mortgage....10 percent.
9. Length of mortgage amortization...12 years.
10. Expected annual inflation in land prices...5 percent.
11. Tax rate that will apply to capital gaina income in the year when the tract is sold...12 percent (40% of marginal tax rate).

    Note: Buyer's planning period must be greater or equal to length of the loan amortization.

This data results in a maximum bid price of $610.26. If the farmer's estimationa and expectationa hold true he can bid $110.26 more than the average price of recent aalea of comparable land in the area and atill earn hia required 8 percent after-tax rate of return. He can pay the asking price of $575 per acre and earn slightly more than 8 percent rate of return on his investment. If the asking price for the parcel was more than $610.26, the farmer could still buy the parcel but hia rate of return would be less than 8 percent. In other words, the investment would be acceptable if he is willing to earn leas than a after-tax rate of return of less than 8 percent. Therefore, if he paya $610.26 per acre for the parcel and all his expectations and eatimationa hold true, the net preaent value will be equal to zero and the internal rate of return will be equal to the 8 percent after-tax opportunity cost of capital.

If he paya the indicated $610.26 per acre and hia expectations and estimations materialize, the cash flows from the investment will be as shown in table 2.

Column 2 of table 2 shows the cash outlays for the down payment and mortgage loan payments. The initial cash outlay, the 25 percent down payment of $152.57, is followed by 11 annual payments of $67.19 and a final payment of $66.80 on the loan balance of $457.69 in year 0. The decline in the principal balance of the loan and in the interest component is shown in column 3 and 4.

Column 5 shows the expected income stream of $40 per year initially, increasing at the rate of 2.5 percent per year to $53.80 per acre in year 12. The taxable income in column 6 is calculated by subtracting the interest in each loan payment from the net income. The marginal income tax rate, 30 percent of taxable income, is shown in column 7. The net cash flows, which are calculated by subtracting the total loan payment and tax from taxable income, are given in column 8. The net cash flows' discounted values (calculated by multiplying net cash flow and the 8 percent discount factor) are shown in column 10. As expected, the net present value of the bid price of $610.26 is approximately zero. The 15 cent discrepancy is due to rounding errors.

Perhaps the most interesting observation in table 2 is that after meeting debt service charges and income taxes, the net cash flow is negative in all years except in the last year when the parcel is sold. Lee suggests that to feasibility finance the land, farmers generally need to have extra cash income from other

Table 2. Summary of Discount Cash Flows Per Acre For the Given Maximum Bid Price of $610.26.

(1) (n) (Years end)	(2) Total Loan Payment	(3) Loan Balance	(4) Interest	(5) Cash Inflow	(6) Taxable Income	(7) Income Tax	(8) Net Cash Flow	(9) 8% Discount Factor	(10) Present Value of Flows	(11) Market Value of Land	(12) Equity
0	152.57[a]	457.69	-	-	-	-	-152.57	1.000	-152.57	500	42.31
1	67.19	436.27	45.77	41.00	-4.77	-1.43[b]	-24.76	.9259	-22.93	525	88.73
2	67.19	412.71	43.63	42.03	-1.60	-0.48[b]	-24.68	.8573	-21.16	551.25	138.54
3	67.19	386.79	41.27	43.08	1.81	0.54	-24.65	.7938	-19.57	578.81	192.02
4	67.19	358.28	38.68	44.16	5.48	1.64	-24.67	.7350	-18.13	607.75	249.47
5	67.19	326.92	35.83	45.26	9.43	2.83	-24.76	.6806	-16.85	638.14	311.22
6	67.19	292.42	32.69	46.39	13.70	4.11	-24.91	.6302	-15.70	670.04	377.62
7	67.19	254.47	29.24	47.55	18.31	5.49	-25.13	.5835	-14.66	703.55	449.08
8	67.19	212.72	25.45	48.74	23.29	6.99	-25.44	.5403	-13.75	738.72	526.00
9	67.19	166.80	21.27	49.96	28.69	8.61	-25.84	.5002	-12.93	775.66	608.86
10	67.19	116.29	16.68	51.21	34.53	10.36	-26.34	.4632	-12.20	814.44	698.15
11	67.19	60.72	11.63	52.49	40.86	12.26	-26.96	.4289	-11.56	855.16	794.44
12	66.80	0	6.07	53.80	47.73	14.32	-27.71	.3971	-11.00	897.92	897.92
12	----Sale of Parcel--------			897.92[c]	278.66[c]	34.52[c]	863.40[c]	.3971	+342.86	-	-
Sum	958.59	-	348.21	1463.59	1115.38	99.76	404.98	-	-0.15[d]	-	-

a. Down payment=25 percent of $610.26.
b. Negative income tax implies there are other sources of income from which the loss can be deducted.
c. Sale price($897.92)-initial cost($610.26)=capital gain($287.66)x capital gains tax(12%)=income tax ($34.52). Net cash flow=sale price($897.92)-income tax($34.52)=$863.40.
d. Expected net present value=0. Difference is due to rounding errors.

sources, such as land already owned with small or no mortgage against it, or non-farm income. (p. 4).

Columns 11 and 12 show that although the annual net cash income is continually negative, landowners benefit from capital gains income. The parcel appreciates at a rate of 5 percent per year from the initial price of comparative land of $500 per acre to $897.92 per acre. At the same time the principal balance of the loan declines as shown in column 3. Therefore, the owner's equity, calculsted by subtracting the loan balance from the current market value of the land, increases fairly rapidly from $43.21 per acre in year 1 to $897.92 per acre in year 12.

Lee suggests that opportunities for converting this growing equity in land to "disposable" income are limited; however, he states that "these equity gains should be regarded as part of real income." (p.5). Bhatia (1972) also concluded, "in all likelihood, people treat realized gains like any other income." (p.866-879).

This general case also agrees with Crowley's observation that the actual rate of return generally exceeds the apparent rate of return given by the traditional capitalization formula. According to the formula, lsnd value equsls residual net return per acre divided by the capitalization rate (V=I/D). The formula can be manipulated to find the apparent rate of return. The rate of return is equal to residual net return per acre divided by the maximum bid price (D=I/V). Both the residual net return per acre and the maximum bid price are known. Thus, D=$40/$610.26=6.55 percent. The actual rate of return is 8 percent, and the 1.45

percent difference is largely due to appreciation in land prices and growth in net income per acre.

The solution of the general case can now be used to study the response of the maximum bid price to changes in the 11 variables. The maximum bid price's sensitivity was examined by changing the 11 input variables one at a time. Each variable was examined over a fairly comprehensive range. In every case, values for variables other than the one being examined were fixed as they were in the general case.

Table 3 summarizes the sensitivity of the maximum bid price to changes in the input variables. The three variables related to expected returns have the greatest effect on the maximum bid price. As the expected rate of land inflation is increased from 0 to 15 percent per year, the maximum bid price increases from $458 to $1291 per acre. The bid price is also very responsive to changes in values of the expected annual net income per acre, and the expected rate of growth in net income per acre. When net income increases from $10 to $100 per acre, the maximum bid price increased from $410 to $1010 per acre. When growth in net income per acre increases from 0 to 8 percent, the bid price increases from $575 to $712 per acre.

The maximum bid price varies inversely with the buyer's opportunity cost of capital. A potential buyer who is satisfied with a 4 percent after-tax rate of return can bid up to $750 per acre. But, if the person requires a 14 percent after-tax rate of return he can bid only $457 per acre.

The terms of financing are also fairly important. High down payments and interest rates lead to significant decreases in the bid price that can be offered. As the interest rate is increased from 4 to 14 percent per year, the maximum bid price drops from $733 to $542 per acre. A buyer who can borrow the full amount of the purchase price at 10 percent interest can bid up to $619 per acre, while the buyer paying cash for the total amount can earn the required 8 percent rate of return only if he can buy the parcel for $585 per acre. This leverage effect will occur if the after-tax opportunity cost of capital exceeds the after-tax rate of interest on the mortgage.

Table 3 Sensitivity of Maximum Bid Price to Changes in the Input Variables.

Input Variables	Range of Values in Input Variables	Corresponding Range in Maximum Bid Price
A. <u>Terms of Financing</u>		<u>Dollars per acre</u>
Interest Rates	.04-.14	733-542
Down Payment	0-1.0	619-585
B. <u>Opportunity Cost of Capital</u>	.04-.14	750-457
C. <u>Land Prices and Inflation</u>		
Average Price of Comparable Land	$200-$1,000	404-954
Expected Rate of Inflation in Land Values	0-.15	458-1291
D. <u>Income and Tax Variables</u>		
Net Income per Acre	$10-$100	410-1010
Growth in Net Income per Acre	0-.08	575-712
Marginal Income Tax Rates	0-.50	641-585
Capital Gains Tax Rate	0-.20	625-600
E. <u>Planning Period and Loan Amortization Period</u>	5-20-40	599-642-658

In the general case, the after-tax opportunity cost of capital is 8 percent and the after-tax rate of interest on the mortgage is 7 percent (10 percent - (10 percent x .30 marginal tax rate)). Therefore, for values of after-tax opportunity cost of capital less than 7 percent, the maximum bid price would be highest for a cash purchase (the total amount paid down). Lee states that in addition to tax deductible interest payments, inflation also encourages the use of credit because the value of the land and the income are increasing while the loan is being repaid with inflated dollars. (pp. 6-7). This does not hold when general inflation increases and land prices fall as is the case of the past few years. However, inflation still allows the mortgage to be repaid in deflated dollars.

Lee asserts, however, that despite the advantage of financial leverage, there are practical limits on the extent to which land purchases can be financed with credit. Large amounts of debt involve greater risks for both the borrower and the lender. The amount of credit that can or should be used depends on the repayment capacity of the total farm business. (p. 7).

The income tax rate (marginal tax rate) and the capital gains tax rate appear to have only a minor effect on the maximum bid price. Varying the two tax rates results in relatively small variations in the bid price. The small response to the income tax rate occurs because reductions in expected annual net returns per acre due to income taxes are almost completely offset by tax deductible interest payments, especially during the first half of the 12 year investment. The small response of the maximum bid price to changes in the capital gains tax rate occurs because differences in the net sale price are discounted from 12 years in the future. Changes in the capital gains tax rate will become more noticeable if you use a shorter time period and a lower discount rate.

The response of the maximum bid price to changes in the planning period and length of the loan ammortization are quite small.

THEORY OF LAND SUPPLY AND DEMAND

Sher and Pinola (1981) have researched the supply and demand for land. They point out that "traditionally, economists consider the supply of land as fixed, since the size of the earth is constant." However, it has been agrued that this is not strictly true because land can be created by drainage, and the fertility of land can be either depleted by overutilization or enhanced by use of fertilizers. "This arguement may be valid for certain categories of land, but land, as a whole, is indeed fixed." (p. 565).

When the supply of land is fixed, the price of land will be determined by demand alone. Consider Figure 2, in which acres denotes the quantity of land and price is the right to use (renting) and not actually owning the land. As the representation of the fixed supply of land, S is a line that is perpendicular to the horizontal axis (perfectly inelastic) for all prices above and touches the horizontal axis at zero price. Therefore, the fixed supply of land is represented by two straight-line segments: a straight line perpendicular to the horizontal axis and

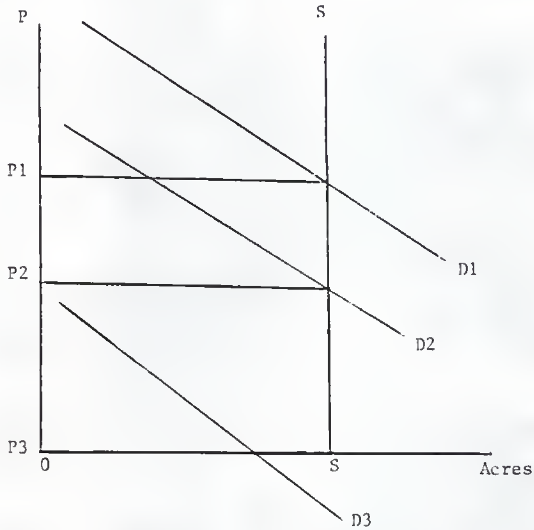


Figure 2. The fixed supply of land and demand for land and the determined price (rent) for the land. (Nicholson, 1972, p. 333).

that portion of the horizontal axis from the origin to the vertical (fixed supply) straight line. This definition prevents the possibility of negative rent. Thus, the amount of land available does not change (increase or decrease) at any price above zero. If the demand is D1, the market price is P1, and if the demand is D2, the corresponding market price is P2. When the demand is as low as D3, the price (P3) is zero. Examples of this last case would be land located in remote areas or in a desert which doesn't commsnd a positive price becsuse of low demand. (pp.556-567).

"Economically speaking, the amount of money paid to buy the right to use an acre of land (called rent) rather than the amount of money paid to buy ownership is considered to be the price of land." Although the concept of rent is distinct from thst of ownership, theoretically, the price for ownership of land and the price for the right to use (rent) the same sre closely related. Therefore, one could conceivably use either when analyzing the land market. However, "in economics, the price of land denotes the price for the right to use (rent) the land." Another example of this would be the wsge rate. "The wage rate is not the money paid to buy the ownership of labor (slavery) but it is the money paid for the right to use labor for a period of time." (pp.566-567).

David Ricardo, a 19th century economist, responded to the public's blaming of the high price of corn on the high price of land snd the relsted high rent by stsʈing:

> "It is not really true that the price of corn is high becaues the price of cornland is high. Actually, the reverse is more nearly the truth; the price of cornlsnd is high because the price of corn is high. Land's totsl supply being inelastic, it will always work for whatever is given it by competition. Thus the value of the land is completely derived from the value of the product, and not vice versa." (p. 567).

In short, the situation Ricardo was explaining is the result of the inelasticity of supply. Ricardo's arguments are that the high price for corn increases the demand for land to raise corn on and thus raises the price of land.

As was pointed out, the outstanding feature of the land market is that the supply of land is fixed. Hence, the concept of rent can be extended to all those factors for which supply is fixed. Nicholoson (1972) explains that the economic rent earned by such factors is defined to be that portion of total paymenta to the factor which ia in excess of what is needed to keep the factor in it's current occupation. In other words, economic rent is the payment to any productive factor in fixed supply which is above "normal" profits. "Normal" profits could be described as the best earnings that the factor could achieve when employed in any other way. All of the returns to a factor which is in fixed supply (land in this case) is in the form of economic rent. "The factor payments in such a situation are determined solely by demand, and there ia no notion of aacrifice on the part of the supplier of this fixed reaource. It will alwaya be supplied no matter what factor reward is offered." (pp. 332-333) In other worda, if there is a great increaae in the demand for corn and the price goes to $10 per bushel a factory can't be built to produce more land to grow corn on. Any return which will be received is a result of demand.

An example of thia analysis of economic rent in the fixed land supply is represented in Figure 3. The vertical aupply curve illustratea the existing level of land (S). As stated earlier, no matter what the level of demand ia, the supply will be fixed. If demand were given by the line D1 the rental rate on the land will be R1 and the total return to the owner will be the area O-S-E1-R1. If demand rises to D2, the equilibium rental rate would be R2 and total rentals would be the area O-S-E2-R2. This illustrates that an increase in the demand from D1 to D2 has no effect other than to enrich the land owner. (pp. 333-335).

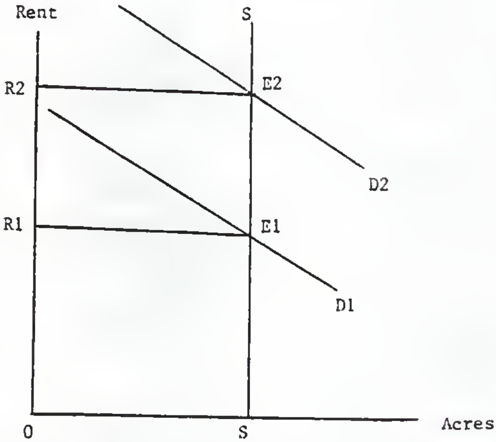


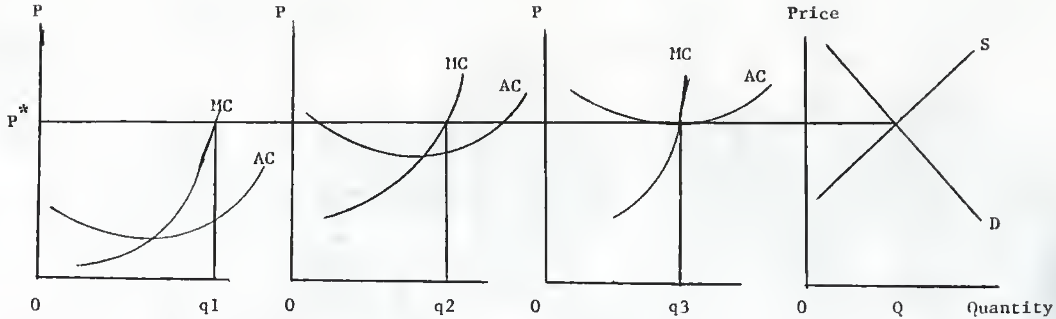
Figure 3. All returns to a fixed supply of land are economic rent. (Sher and Pinola, 1981, p. 566).

Ricardo gave a more comprehensive explanation of the determinants of land rent. He suggested that rents of land varied according to the quality of land. "Ricardo theorized that additional land (of inferior quality) would be cultivated up to the point at which the last acre planted earned exactly zero in economic profits." "The more productive parcels of land would earn high economic profits (rent), and these profits would be considered a return for their superior fertility." Since price is determined by the marginal producer and at the margin rents are zero, Ricardo demonstrated that "rent was not a determinant of price but more properly as resulting from demand and the land's fertility." (pp.334-335).

Ricardo's argument can be demonstrated using graphs and tables. The graphical analysis will be offered first in Figure 4.

Assume there are many parcels of land suitable for growing corn. These parcels range from very fertile to rather poor. Because land differs in quality, farms with the most fertile land will have lower variable costs per bushel yield. The long-run supply curve for corn can be constructed as follows: at low prices only the best land is cultivated; as price rises, production continues on the fertile land and additional corn is planted on land of poorer quality. At still higher prices it will be profitable to utilize lower quality land in production. The market is also pictured in Figure 4. At the equilibrium price P* owners of low-cost (high fertility) land parcels earn large economic profits (rent); those less favorably situated (less fertile) earn smaller rents; the marginal (high cost) farm earns zero in rents. If it were possible to earn any rent on additional pieces of land these would be brought into cultivation. Those acres which are left unplanted must be of lower quality than those of the marginal farm. This analysis shows how the demand for land is a demand derived from the product market. (pp.336-337).

Figure 4 shows that price of corn determines rent. It is the fact that land differs in quality and that land of high quality is in fixed supply which creates the conditions making rent possible. The location of the demand curve will determine exactly how much will be earned in total rents.



(a) Low-cost farm (b) Medium-cost farm (c) High-cost farm (marginal farm) (d) The market

Figure 4. The creation of Ricardian rent on land of differing quality.

Because land differs in quality, farms with the most fertile land will have lower costs. Since price will be determined by the costs of the marginal supplier low-cost firms will earn pure economic profits. These profits might be called rent and will persist even in the long run since fertile land is in fixed supply. (Nicholson, 1972, p. 335).

Table 4 shows Ricardo's theory of rent by denoting how rent is measured from land of differing quality. We have three grades of land - A, B, and C. Investing $10 per acre gives us the

Table 4 Rent Measured from Land of Differing Quality.

Price of corn per bushel	Rent Derived from Each Grade of Land A	B	C
	Input: $10 Yield: 20 bu./acre	Input: $10 Yield: 20 bu./acre	Input:$10 Yield: 20 bu./acre
$.50	0*		
$.66	$3.33	0*	
$1.00	$10.00	$5.00	0*

* Denotes that Normal Profits are made.
(Oser and Blanchfield, 1975, p.96).

greatest return from A because it is the best land and the lowest return from C because it is the worst land. If corn were under $.50 per bushel, none would be produced. At $.50 it pays to invest $10 per acre on land A because the yield covers all labor and capital costs, including a normal profit. However, there would be no rent. If the price of corn rises to $.66 per bushel it pays to invest $10 per acre on land B as well as A. The corn produced on land A would also sell for $.66 per bushel and the return on A would be $13.33. Since a return of $10 is considered reasonable by tenants, competition amoung them causes them to bid $3.33 per acre for the right to farm land A, and the landlord receives this sum in the form of economic rent. If the corn price rises to $1.00 per bushel, land C becomes the no rent marginal land, land B yields rent of $5 per acre, and land A yields $10 rent. This table does not incorporate the principle of diminishing returns. Ricardo, however, was one of the first economists to use marginal productivity concepts. (Oser and Blanchfield, 1975, pp. 95-97).

CHAPTER IV

DATA

INTRODUCTION

This chapter contains a description of the data used in the study. There will be a discussion of how the basic data (11 variables used in Lee's model) was derived and graphs of the data along with sources of the data. There will also be a justification for using each of the 11 variables in Lee's model.

DERIVATION, DESCRIPTION, AND USUAGE OF DATA

Data from 1925 to 1984 were assembled to explore historical relationships between the investment value and market values of land values in Kansas. Some data series were assembled from 1915 to 1984 to calculate 10 year moving averages.

Data for Kansas land value was established using records provided by the USDA (1981;1984). Kansas land inflation was calculated as shown in equation (4.1).

(4.1) $In=(An-An-1)/An-1$

Where: In=Inflation in land value in year n.

An=Value of land in year n.

$An-1$=Value of land in year n-1.

The 10 year moving average of Kansas land inflation was calculated from annual land inflation as shown in equation (4.2).

(4.2) $Imn=(In+In-1+In-2+.....+In-9)/10$

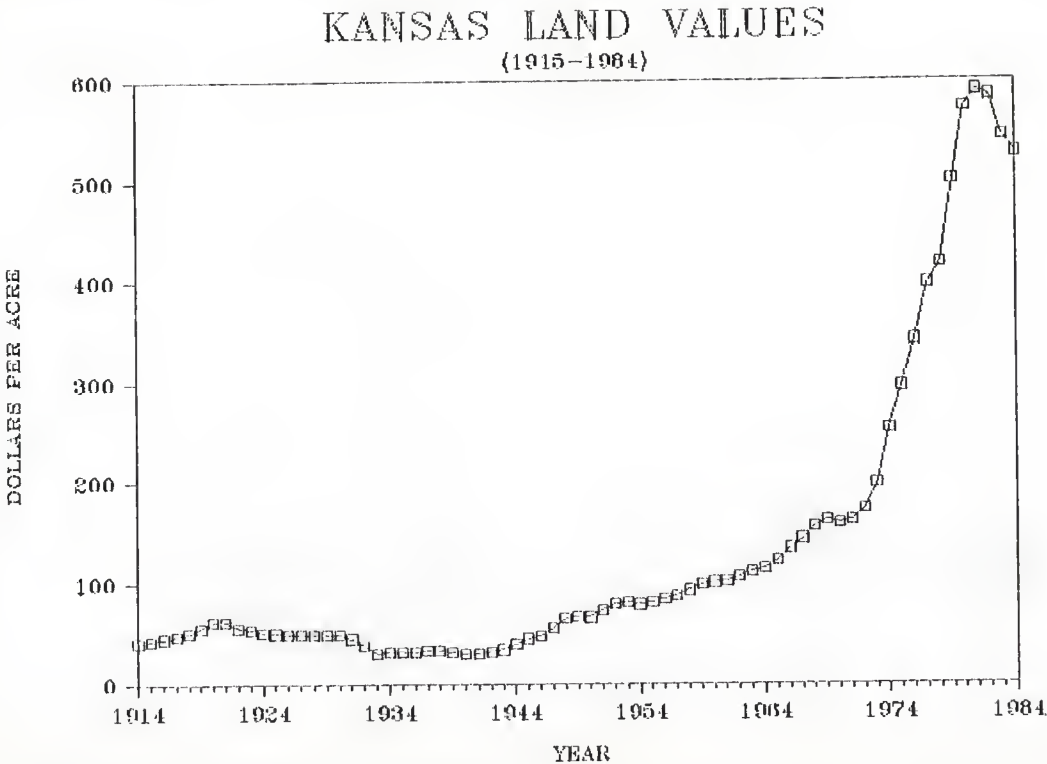
Where:

Imn=10 year moving average of Kansas land inflation in year n.

In=Inflation in year n.

Figure 5 shows the value of Kansas land from 1914 to 1984. Land value in Kansas in 1914 was $41/acre and increased to $62/acre in 1920. By 1933 the value had dropped to $30/acre and stayed fairly steady through the depression years. From 1943 to 1948 the values of land rose from $34/acre to $65/acre. From 1948 to 1972 the value rose moderately with only three years of value decline (1950, 1954,and 1970). From 1972 to 1980, land value rose fairly rapidly from $174/acre to $573/acre. The value rose moderately in 1981 to $590/acre. The value of farmland declined in 1982 and continued to fall to $528/acre in 1984. These historical land value were used in the model as the price of comparable land. Since this is a study of Kansas farmland prices the actual price is what farmers should use as the price of comparable land.

Figure 6 shows the annual inflation (deflation) of Kansas farmland value and the 10 year moving average of the inflation (deflation) of farmland value. There was moderate land inflation from 1915 to 1919. From 1926 to 1930 the value stayed constant. There was sharp land deflation from 1931 to 1933. Through the rest of the depression prices varied from slightly higher to moderately lower. From 1943 to 1948 there was sharp land inflation. There was moderate land inflation, as a whole, between 1949 and 1972. There was sharp land inflation from 1973 to 1980. Between 1981 and 1984 there was moderate land deflation. The 10 year



□ Kansas land values (column 3, appendix table A-8).

Figure 5. Kansas land values.

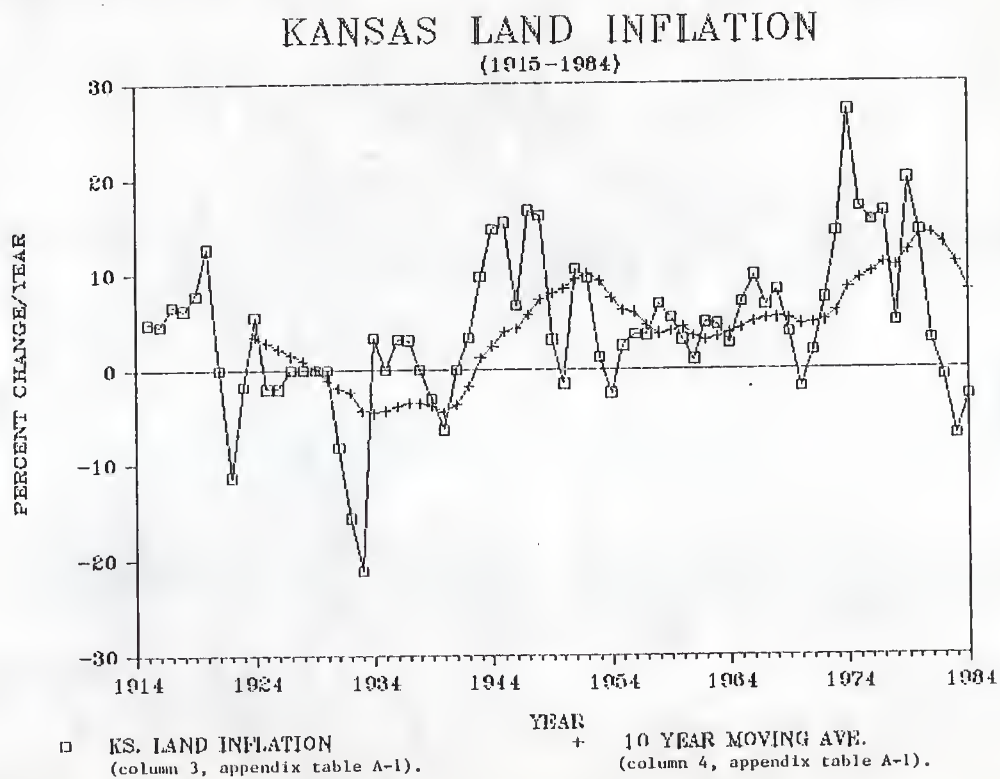


Figure 6. Annual Kansas land inflation and 10 year moving average of land inflation.

moving average delivers an average of what land inflation (deflation) did in the immediate past 10 years. The 10 year moving average was used in the model as the expected future rate of land inflation (deflation). It is assumed that potential buyers look at the average inflation (deflation) of the immediated past 10 years to calculate a forecast of future land inflation (deflation). The 10 year moving average will help modify any large fluctuations in the inflation (deflation) figure.

Data was supplied by the Kansas Crop and Livestock Reporting Service (1984-A) on rent per acre of all farmland in Kansas. Net rent per acre was calculated by subtracting property tax per acre from rent. Property tax data was also supplied by the Kansas Crop and Livestock Reporting Service (1984-B). Growth in net rent was calculated from net rent as shown in equation (4.3).

(4.3) $GNRn=(NRn-NRn-1)/NRn-1$

Where:

$GNRn$=Growth in net rent in year n.

NRn=Net rent in year n.

$NRn-1$=Net rent in year n-1.

The 10 year moving average of the growth in net rent was calculated from the growth in net rent as shown in equation (4.4).

(4.4) $MGn=(GNRn+GNRn-1+.....+GNRn-9)/10$

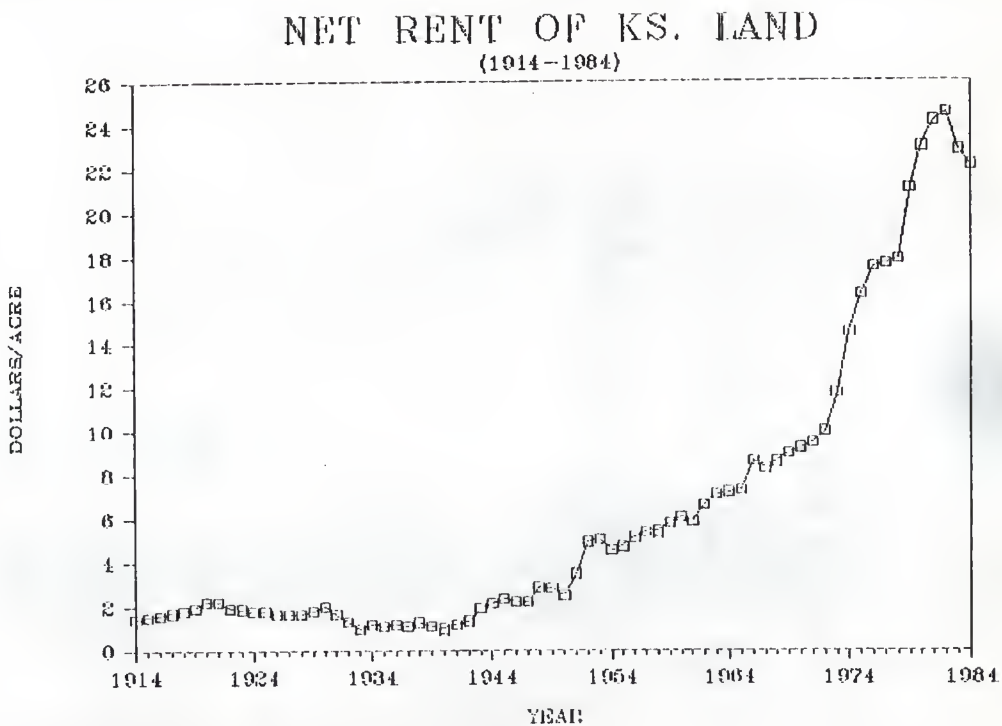
Where:

MGn=The 10 year moving average of the growth in net rent in year n.

$GNRn$=Growth in net rent in year n.

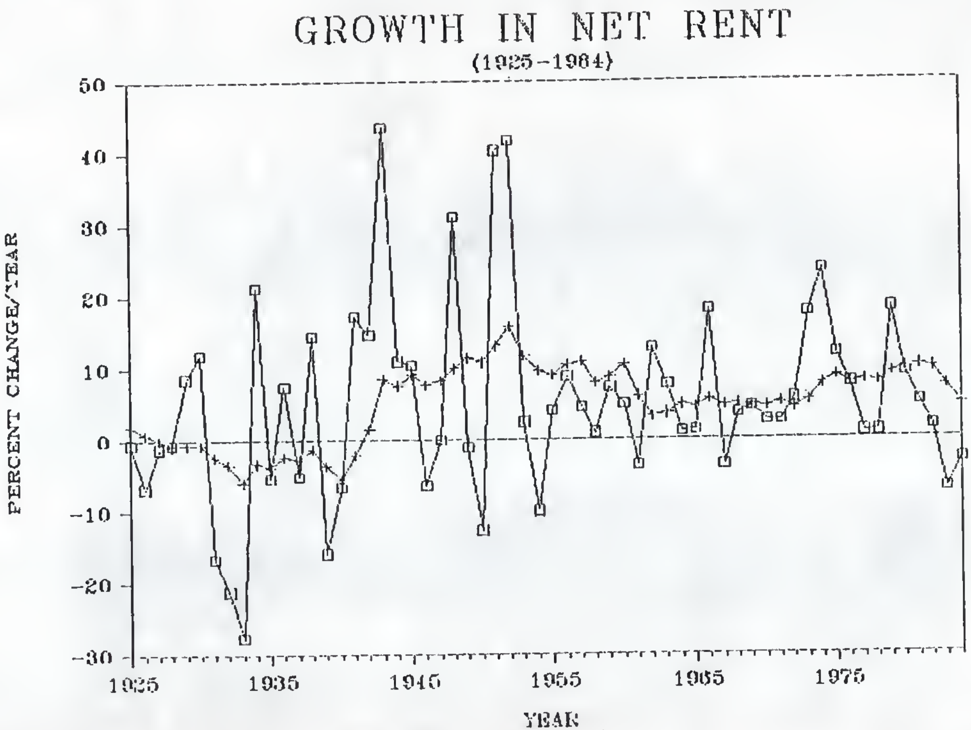
Figure 7 shows net rent in Kansas from 1915 to 1984. Net rent rose steadily from 1915 through 1920 but fell through most of the 1920's. Net rent showed considerable variability through the 1930's and 1940's before showing consistent growth, on the whole, through the 1950's and 1960's. Net rent grew quite rapidly from 1972 to 1976 and again in 1979. Net rent peaked in 1982 before falling in 1983 and 1984. Rent data was not available from 1915 through 1924 so the average land value/net rent ratio from 1925 through 1934 was used to calculate net rent. Likewise, rent data was not available from 1982 through 1984 so the average land value/net rent ratio from 1977 through 1981 was used to calculate net rent. This was done in both cases by dividing the actual land value for each year by the appropriate average ratio. Net rent per acre was used in the model as the annual net income per acre. Lee (1976) , as well as Scott (1982), have suggested that this is an appropriate approximation of residual return per acre. It was necessary, as Lee points out, to subtract landlord expenses of property tax, maintenance, and insurance from rent to calculate net rent. (p. 8). We have subtracted the annual property tax but did not subtract maintenance or insurance so the net rent figure may be slightly high.

Figure 8 shows the annual percentage change in the growth of net rent and the 10 year moving average of the growth in net rent from 1925 to 1984. There was large fluctuations in the growth in net rent from 1925 through 1955 with more stabliility shown from 1955 through 1984. There was moderate to strong growth in the 1970's but there was negative growth in net rent in 1983 and



□ Net rent of Kansas farmland (column 4, appendix table A-2).

Figure 7. Net rent of Kansas farmland.



□ Annual percentage change in net rent (column 5, appendix table A-2).

+ Ten year moving average of net rent (column 6, appendix table A-2).

Figure 8. Annual change and 10 year moving average of net rent.

1984. The 10 year moving average was negative from 1928 through 1941 but was relatively high from the mid 1940's through the late 1950's and remained positive through 1984. The 10 year moving average in the growth of net rent was used in the model as the expected growth in annual net income per acre. It was assumed that potential buyers look at the average growth of the immediate past 10 years to calculate a forecast of future growth. The 10 year moving average will help modify any large fluctuations in the growth.

Opportunity cost data was collected from two separate series. Short-term yields on U.S. securities data provided by the Federal Reserve (1943) were used as the opportunity cost from 1923 to 1932. Three to five year treasury bill rates were used as the opportunity cost from 1933 to 1984. Treasury bills were not used prior to 1933 since they did not exist. The treasury bill rate data were supplied by Federal Reserve (1943;1971;1977;1984). It should be noted that we are using the nominal opportunity cost, hence, they are not adjusted for inflation. The after-tax opportunity cost was calculated from the opportunity cost and marginal tax rate as shown in equation (4.5).

(4.5) $ATOn=OPPn-(OPPn \times MTRn)$

Where:

ATOn=After-tax opportunity cost in year n.

OPPn= Opportunity cost in year n.

MTRn=Marginal tax rate in year n.

The after-tax opportunity cost will depend on the marginal tax rate. A high marginal tax rate for a certain year will decrease the after-tax opportunity cost and vice-versa. The three year moving average moderates the fluctuations of the after-tax opportunity cost due to both tax changes and treasury bill changes. Figure 9 shows the after-tax opportunity cost and three year moving average of the opportunity cost between 1925 and 1984. The opportunity cost showed a downward trend from 1929 through 1942, but rose steadily through the 1970's. After briefly falling the opportunity cost remained fairly steady through the mid to late 1970's, but rose sharply in the 1980's. The three year moving average of the opportunity cost will be used in the model as the after-tax cost of capital. Using the 3 to 5 year treasury bill as the opportunity cost gave an intermediate run forecast of what investors could earn by other means. The three year moving average will reduce wide fluctuations that may occur in the after-tax opportunity cost caused changes in treasury bill rates or marginal tax rates.

Marginal tax rate data was derived by first establishing an annual farm income and calculating it's appropriate tax rate for that particular year. Annual farm income from 1925 to 1948 was derived from data from the USDA (1962). From 1949 to 1984 annual farm income data was assembled from the Kansas Crop and Livestock Reporting Service(1984-C). The Kansas Crop and Livestock Reporting Service did not start collecting farm income data until 1949. Thus, it was assumed that Kansas farm income from 1925 to 1948 was similar to the annual national farm income data from USDA. Marginal tax rates and capital gains tax rates were derived from the Treasury Department (1984) using the appropriate annual

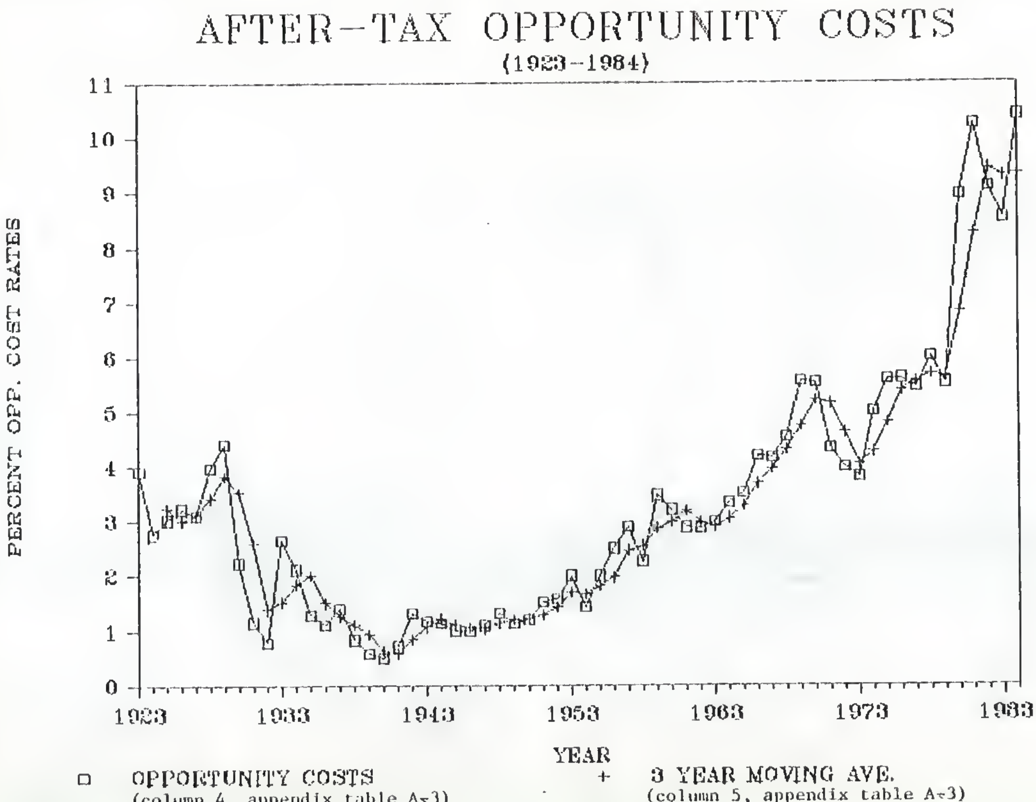


Figure 9. After-tax opportunity cost of capital.

farm income. Figure 10 shows the marginal tax rate and capital gains tax rates from 1925 to 1984. The marginal tax rates were extremely low from 1925 to 1938, but the capital gains tax rate from 1925 to 1935 was 12.50 percent. The capital gains tax rate went to 33 percent of the marginal tax rate in 1936 and 1937, but increased to 50 percent of the marginal tax rate in 1938 and stayed at that figure until 1978. From 1978 through 1984 the capital gains tax was 40 percent of the marginal tax rate. From 1942 through 1953 the marginal tax rate increased but remained relatively steady through 1969. From 1970 through 1984 the marginal tax rate fluctuated widely. This was due to the fluctuations in the annual farm income which were used to derive the tax rates. The two tax rates will be used in the model as their respective tax rates. Thus, the land investment will be exposed to the marginal tax rate for the duration of the planning period and the capital gains tax rate would apply when the parcel is sold at the end of the planning period.

Data on the nominal interest rate paid for borrowed money was assembled from the Federal Reserve (1933) and Federal Land Bank(1984). Data for the nominal interest rate from the years 1925 to 1933 was collected from the Federal Reserves' 1933 annual report. Nominal interest rate data for 1934 to 1984 was collected from the Federal Land Bank.

Figure 11 shows the nominal interest rates on land mortgages from 1925 to 1984. The interest rates were fairly steady from 1925 to 1932 but fell to 4 percent in 1935 and remained there until 1957. The interest rate rose steadily until 1970 but fell

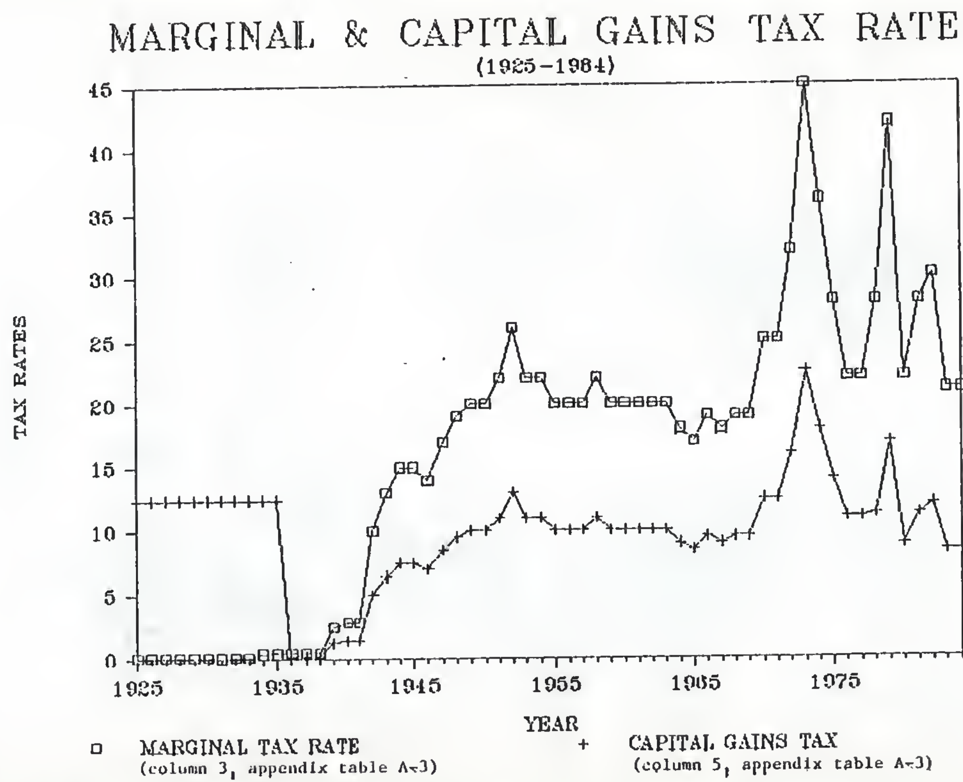


Figure 10. Marginal and capital gains tax rates.

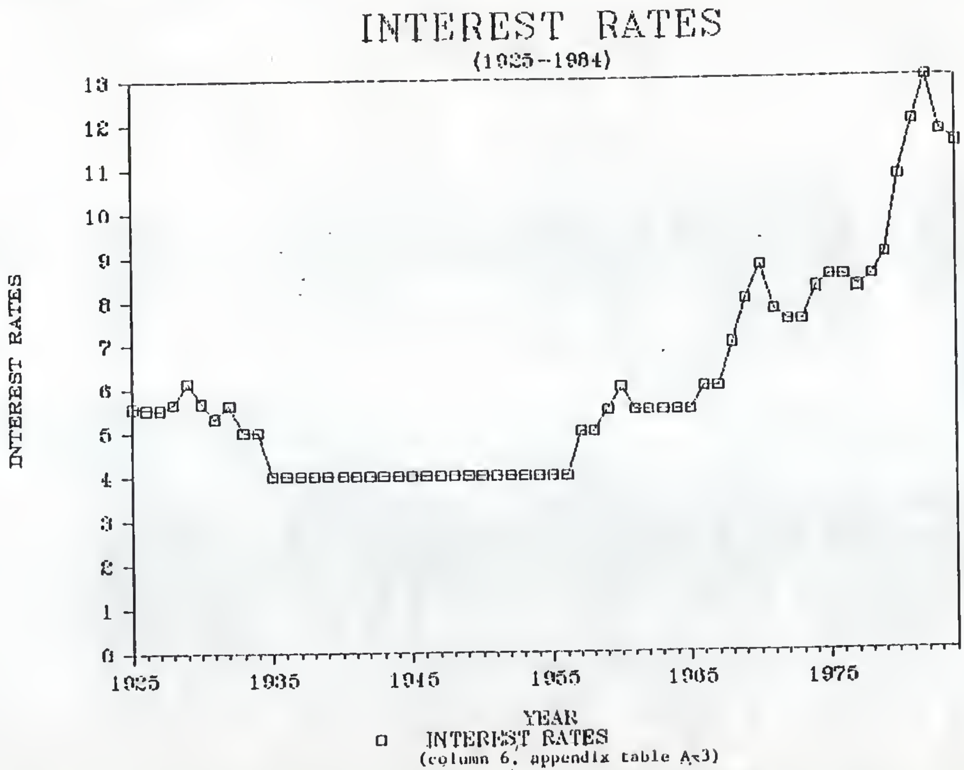


Figure 11. Nominal interest rates on land mortgages.

briefly in the early 1970's. The interest rate peaked at 13 percent in 1982 and settled to 11.5 percent in 1984. The nominal interest rate, obviously, will be used in the model as the interest rate on the land mortgage. It was assumed that the potential buyer plans on the interest rate that is given in that year and that the interest rate given will remain unchanged for the duration of the loan.

The length of loan amortization remained constant at 33 years through the study. The 33 year period was chosen because it reflects current lending practices by the Federal Land Bank.

The down payment was assumed to be 25 percent of the purchase price and was kept constant through the study. There was no documented data on this variable.

It was also assumed the buyer's planning period was 40 years. Again, there was no documented data on this variable. The computer program written for the model, however, required that the buyer's planning period must be equal to or greater than the length of the loan amortization.

CHAPTER V

RESULTS

INTRODUCTION

This chapter contains the results of the study. The first section includes the model results with five different modifications of the data. Also included will be a a comparison of the actual land values and each of the model's values. The second section shows how much four of the most important variables in the model have to be changed so that the model's value equals the actual market value. The four variables which were changed include the nominal interest rate, opportunity cost of capital, expectations in future land inflation, and expectations in future growth in net rent. The affect of these four variables on actual land values will be discussed. The following section includes a discussion of the Kansas land value to net rent ratio, the traditional capitalization model, and a comparison between Kansas land inflation and national land inflation. The concluding section analyzes five different farmland values and provides scenerios of the interest rate on land mortgages-opportunity cost of capital combinations and interest rate-net rent combinations that would be needed to achieve an equilibrium at each of the differing land values.

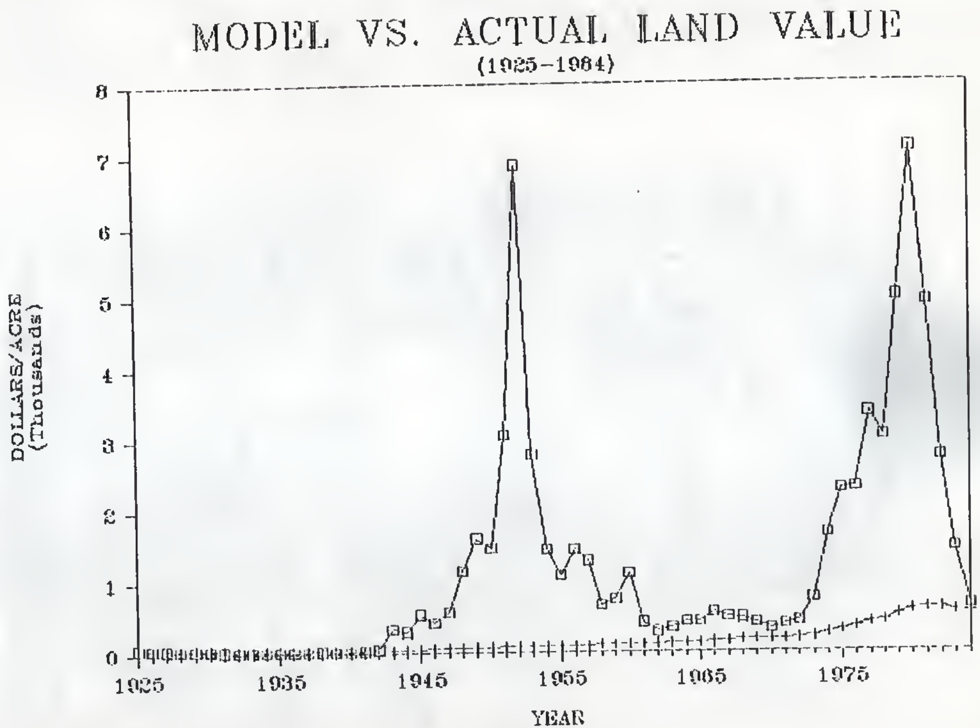
MODEL RESULTS

This section includes the model results with five different modifications to the data.

Figure 12 shows the model results (using all future expectations) and the actual land value. This model is with all the values at their historical level as given in chapter IV. The model's value was slightly more than the actual value in 1925 and 1926. From 1928 through 1941 the model's value was less than the actual value. The model's value became larger than the actual value in 1942, and soared to $6863/acre in 1952, but fell to $285/acre in 1962. The model showed relatively little variation from 1963 through 1974, but soared to $7079/acre in 1980 and settled to $632/acre in 1984.

The model, obviously, did not trace the actual land value. The future expectations in land inflation and net rent growth seem to cause the most dramatic differences between the model's value and the actual value. Negative expectations caused the model's value to be less than the actual land value in the late 1920's through the early 1940's and high positive expectations caused the large differences in 1952 and 1979. The model, however, followed relatively close to the actual value from 1962 through 1972 and was getting closer to the actual value as each year progressed in the 1980's. The model is, however, far more sensitive to future expectations in land inflation and net rent growth than the actual land market. Four different modifications were made to the future expectations in the model to determine if the modifications would make the actual land value equal the model's value.

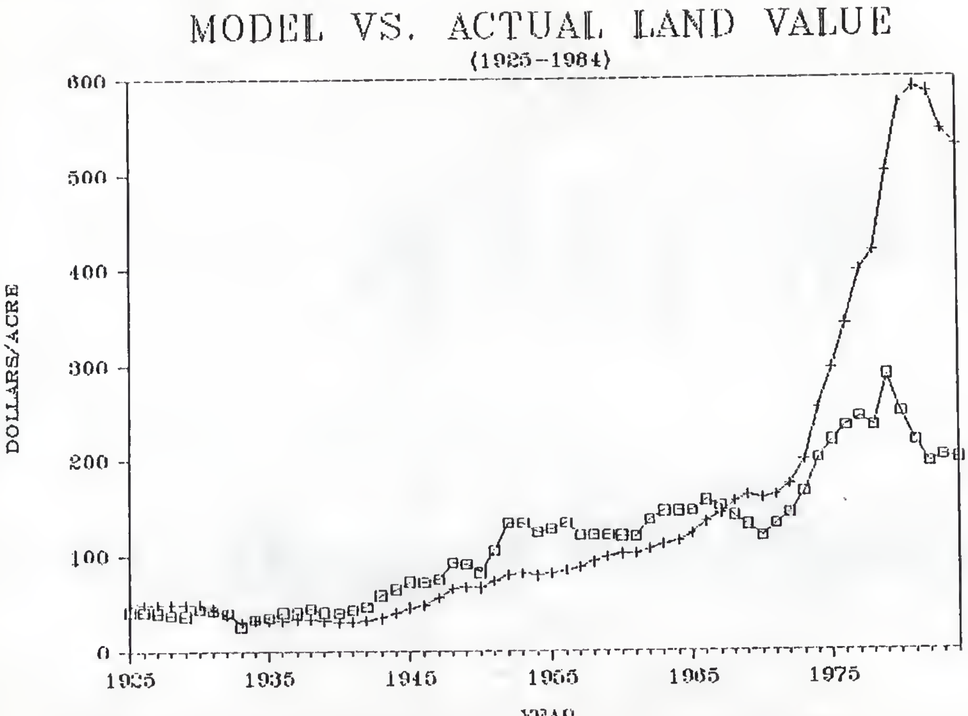
The first modification (Figure 13) shows the actual market value and model's value with both the future expectations in land



□ Model's value using all variables (column 3, appendix table A-3).

+ Actual Kansas land values (column 2, appendix table A-3).

Figure 12 Model results using all variables at their historical level and the actual Kansas land values.



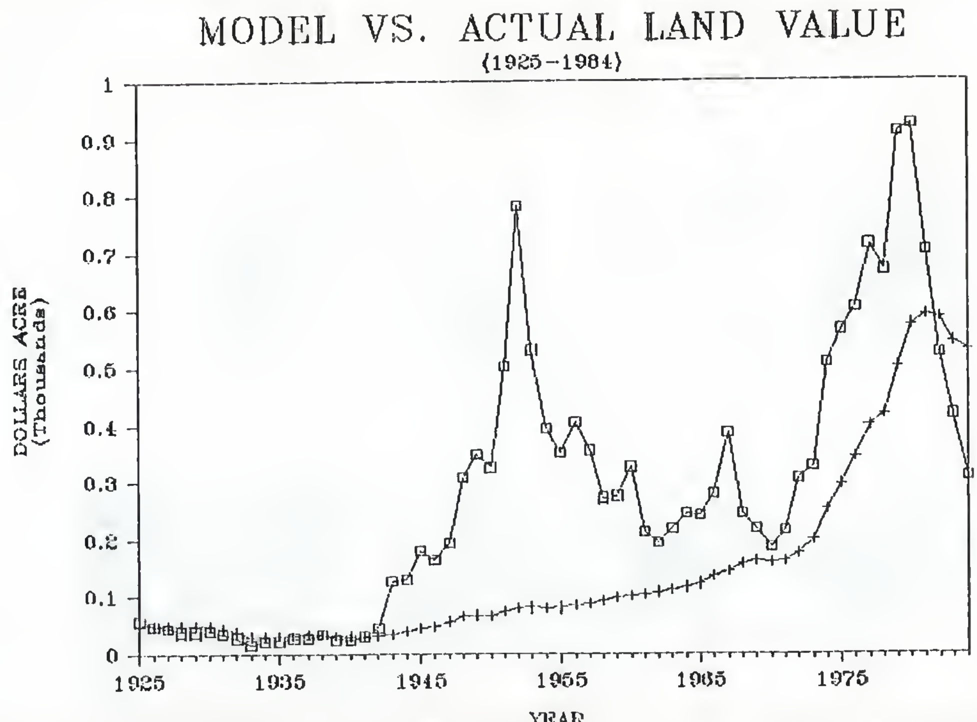
□ Model's values using all variables except the two future expectations variables (column 4, appendix table A-4).

+ Actual Kansas land values (column 2, appendix table A-4).

Figure 13. Model results using all variables at their historical level except the two future expectations variables,

inflation and net rent growth held constant at zero. From 1925 through 1931 the actual land value was greater than the model's value. From 1933 through 1967 the model's value was greater than the actual value by a relatively large margin between 1942 and 1946 and again between 1952 and 1956. From 1968 through 1984 the actual value was, once again, greater than the model's value by a relatively wide margin in the latter years. This modification, though not tracing the actual land value, is much closer to doing so than the first model. Low interest rates on land mortgages and opportunity cost of capital seem to cause the model's value to be higher than the actual value between 1934 and 1967, and may imply that land was undervalued during that time. High interest rates and opportunity costs coupled with a relatively low net rent (compared to land value) seemed to cause the actual value to be higher than the model's value from the mid 1970's to 1984 and may signal that land was overvalued during this period. The actual value was above the model's value from 1925 to 1933 by a relatively small margin and this may have been due to high interest rates on land mortgages and a relatively low net rent (compared to land value). This whole analysis suggests that the model is more sensitive to the interest rates on land mortgages, opportunity costs of capital, and net rent than the actual land market.

The second modification (Figure 14) shows the model results when using half of the value in future expectations in land inflation and net rent growth. The model's value was larger than the actual in 1925 but this reversed and remained that way until



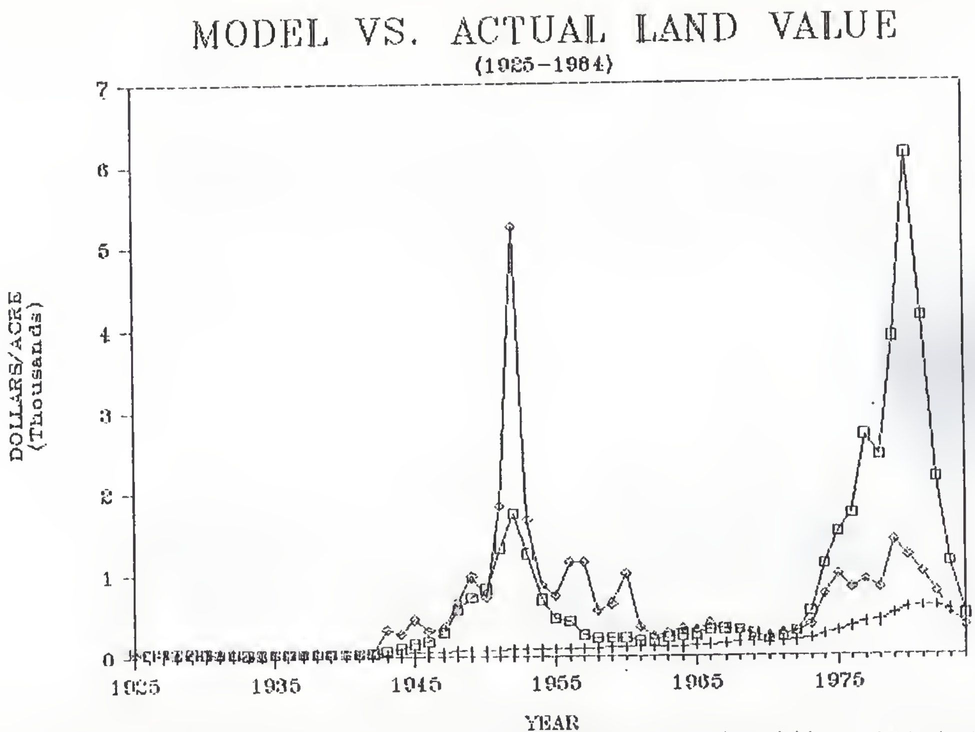
□ Model's values using the two future expectation variables at half of their given values (column 5, appendix table A-4).

+ Actual Kansas land values (column 2, appendix table A-4).

Figure 14 Model results using the two future expectation variables at half of their given values and the actual Kansas land values.

1941. The model's value rose above the actual model's to $783/-acre in 1952 but fell and fluctuated until 1970. The value, again, rose dramatically to $924/acre by 1980 but fell below the actual value in 1982 through 1984. This modification also shows no sign of tracing the actual land value. This model followed the sctual land values better thsn the first model but not as well as the second model. This model was fairly close from 1925 through 1942 but the future expectation variables caused fluctustions from 1943 through 1969. These fluctuations were not nesrly as dramatic as the first model's values. The model grew at about the same rate in the 1970's as the actual values but peaked out in 1980 and fell from 1981 to 1984, whereas, the actual value peaked in 1981 and fell through 1984. The model's value fell slightly below the actual from 1982 to 1984. This decrease in the model's value from 1981 to 1984 seemed to be due to a decrease in future expectations and net rent and an increase in the interest rates on land mortgages and opportunity costs of capital. This analysis agsin shows that the model is more sensitive to these variables than the actual land market.

The third and fourth modifications (Figure 15) shows the actual market value of land, the model's value when using the given future expectatons in net rent growth while keeping the future expectation of land inflation constant at zero (referred to ss the growth model in the following analysis), and the model's value when using the given future expectation in land inflation while keeping the future expectations in net rent growth constant at zero (referred to as the inflation model in



□ Model results using the land inflation variable and keeping the net rent growth variable constant at zero (column 6, appendix table A-4).

◊ Model results using the net rent growth variable and keeping the land inflation variable constant at zero (column 7, appendix table A-4).

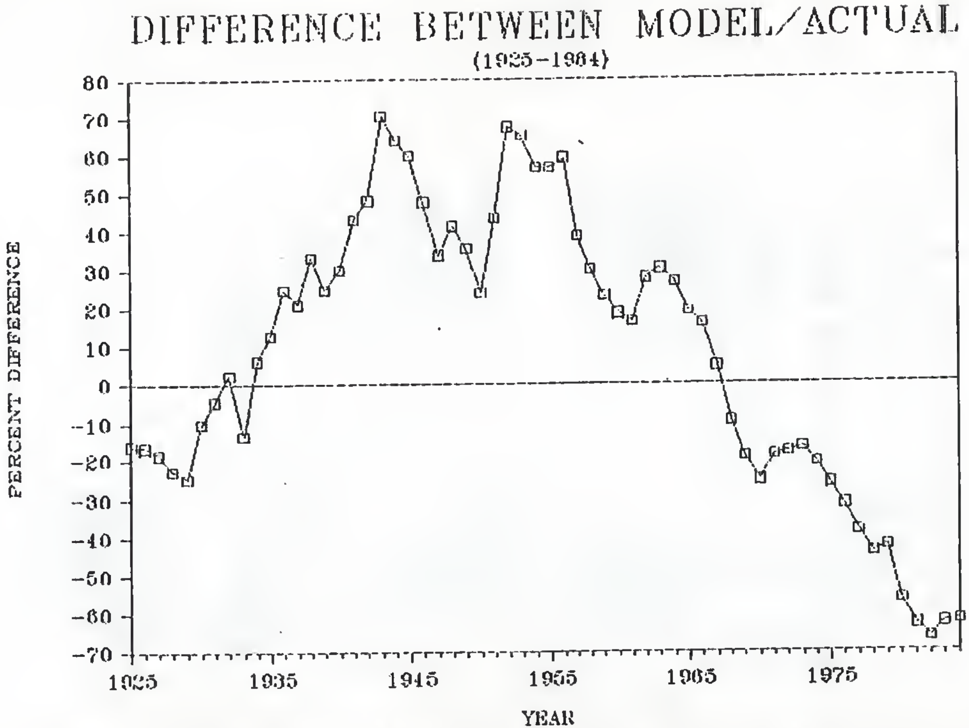
\+ Actual Kansas land values (column 2, appendix table A-4).

Figure 15. Model results using the land inflation variable and not the net rent growth variable and vice versa.

the following analysis). In 1925 both values were above the actual, but this reversed and remained this way, on the whole, until 1939. In 1942 both the growth and inflation models were above the actual value and the growth value soared to $5250/acre in 1952 while the inflation model hit a local peak of $1746/acre. Both values fluctuated and fell until 1970 when the growth model was $229/acre and the inflation value was $206/acre. Both values rose until 1979 where the inflation value had soared to $6118/acre. Both values fell to below the actual value in 1984. The future expectation in net rent growth caused the dramatic fluctuations in the early 1950's in the first model, whereas, land inflation expectations caused the dramatic variations in the late 1970's in the first model. Both of these models were relatively close to the actual values from 1925 through 1942 and again in the 1960's and were relatively close but below the actual values in 1984.

When analyzing the previous program runs it is quite evident that the original model nor any with modifications were real close to tracing the actual land values. The model results when keeping both future expectations constant at zero was by far the closest to tracing the actual value of any of the program runs. Through the end of this chapter "model value" will refer to the model results where both of the future expectations in land inflation and net rent growth were kept constant at zero.

Figure 16 shows the percent difference between the model's value and the actual land value. This percentage difference was calculated as shown in equation (5.1).



□ Percent difference between the model's value and the actual value (column 8, appendix table A-4).

Figure 16. Percent difference between the model's value (both expectations held constant at zero) and the actual Kansas land value.

(5.1) PDn=((Mn-An)/An)*100

Where:

PDn=Percentage difference in year n.

Mn=Model's value in year n.

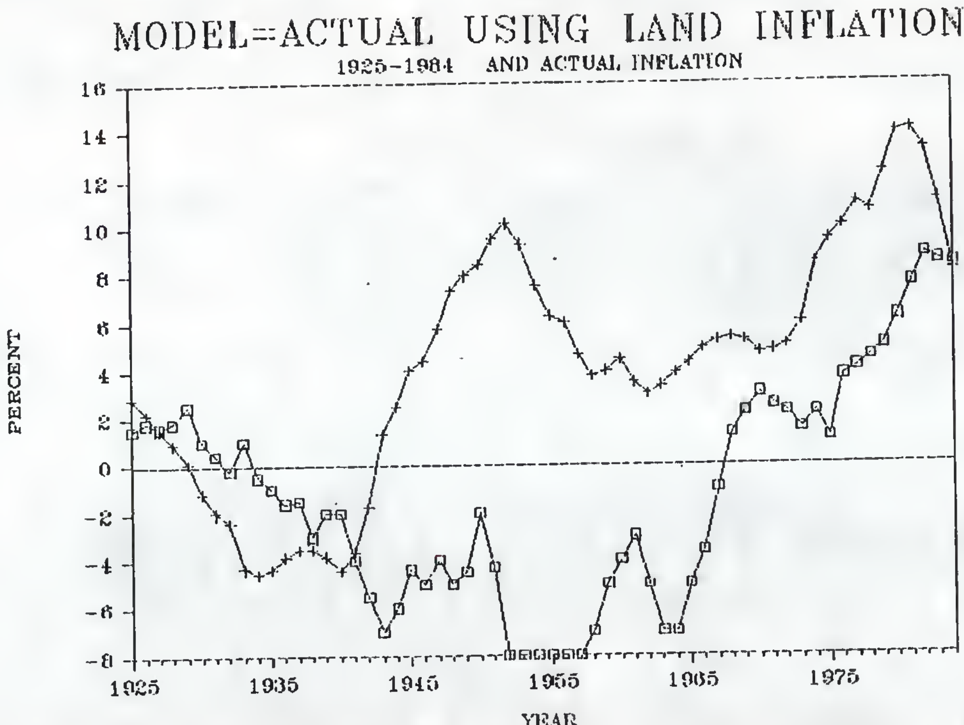
An=Actual value in year n.

From 1925 through 1931 the model's value was less than the actual value by as much as 22 percent in 1929. From 1934 through 1967 the model's value was greater than the model's value by as much as 70 percent in 1943 and 67 percent in 1952. This difference seems to be due to relatively low opportunity costs of capital and interest rates on land mortgages and a high net rent relative to land values. This analysis may imply that land prices were undervalued during this period. The margin narrowed until 1968 when the actual became larger than the model's value. The margin became relatively wide from the mid 1970's through 1984. The actual value was as much as 66 percent higher than the model's value in 1982. This big percentage margin seems to be due to relatively high interest rates on land mortgages and opportunity cost of capital and a low net rent relative to land values. Land, this analysis suggests, is overvalued from the mid 1960's to 1984.

VARING MODEL VARIABLES SO THAT THE MODEL'S VALUE EQUALS THE ACTUAL VALUE

This section includes an analysis of changing the four most important variables in the modified model so it's value will equal the actual value. This section also contains an examination of the relationship between the four variables and the actual land values.

Figure 17 shows the land inflation expectation that will make the model's value equal to the actual value and the actual 10 year moving average in land inflation. The "needed" land inflation expectation was calculated with all other variables at their historical values except for growth in net rent expectations which were held constant at zero. This is the land inflation expectation that must be used in order that the value the model gives will be equal to the actual land value at that time. The actual land inflation values (10 year moving average) were under the "needed" land inflation from 1927 through 1970 and 1984 and above the "needed" land inflation from 1925 to 1926 and 1941 to 1983. Both inflation values trended downward from 1925 through 1940 but the actual land inflation value rose to nearly 10 percent in the early 1950's as the "needed" inflation value stayed relatively steady at -4 percent. The "needed" land inflation value fell to -8 from 1952 through 1957 and then fluctuated and became positive in 1968 and rose sharply in the 1970's while the actual land inflation value dropped to 3 percent in 1962 and slowly rose until 1970 and rose sharply in the 1970's before tailing off in the early 1980's. This graph seems to point out that the model is far more sensitive to expectations in land inflation than the actual market. The wide margin between the two values from the early 1940's through the mid 1960's suggests that land was undervalued during this time. This graph does not show that land was overvalued from the mid 1960's through 1983, but



□ Land inflation expectations that makes the model's value equal to the actual value (column 4, appendix table A-5).

\+ Actual 10 year moving average of land inflation (column 5, appendix table A-5).

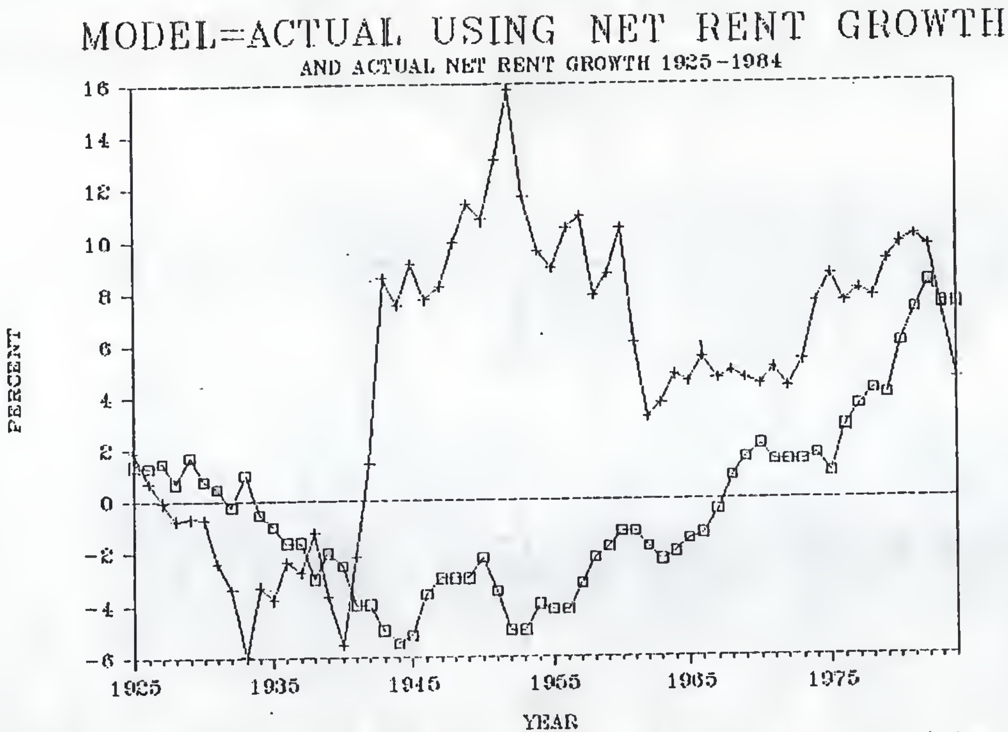
Figure 17. Land inflation expectations that makes the model's value equal to the actual value.

the actual value was below the "needed" value in 1984 which may signal that land was overvalued during that year.

Figure 17 shows the "needed" land inflation to make the model's value equal to the actual value when expectations in net rent growth is kept constant at zero. Thus, for the model to achieve the same value as net rent growth expectation increase (decrease) will cause a land inflation expectation decrease (increase).

Figure 18 shows the net rent growth expectations needed to make the model's value equal to the actual value and the actual 10 year moving average of the growth in net rent. The "needed" net rent growth expectations were calculated with all other variables at their historical values except for land inflation expectations which were held constant at zero. The "needed" net rent growth expectations is the number the model must have so the value it generates will be equal to the actual market value at that time. The actual net rent growth (10 year moving average) was under the "needed" net rent growth expectations as they both trended downward from 1925 to 1940 but the actual growth skyrocketed as the "needed" growth value remained negative and fairly steady. The huge gap from the early 1940's to the mid 1960's strongly suggests that land was undervalued during this time. The gap narrowed until 1970 and remained relatively constant as they both trended upward but the actual growth dropped below the "needed" growth value in 1983 and 1984. This may suggest that land was overvalued during these two years.

Figure 18 shows the "needed" net rent growth expectations to



□ Net rent growth expectations that makes the model's value equal to the actual value (column 6 in appendix table A-5).

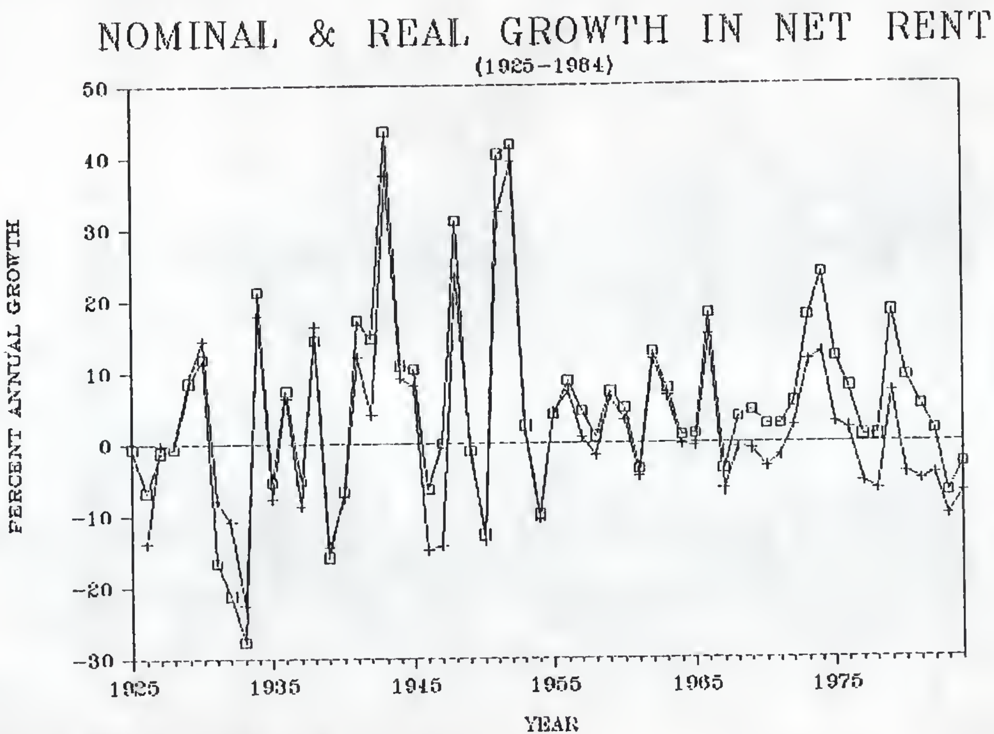
+ Actual 10 year moving average of the net rent growth.

Figure 18. Net rent growth expectations that makes the model's value equal to the actual value and the actual 10 year moving average of the growth in net rent.

make the model's value equal to the actual value when land expectation is kept constant at zero. When land inflation expectation is increased (decreased) net rent growth expectation will have to decrease (increase) for the model to achieve the same land value.

It should be noted that both the "needed" expectations in figure 17 and 18 will both be positive in the same year. There is no significance to this. It just reflects that as the model's value is greater than the actual value, there must be negative expectations used in the model so it's value will be equal to the actual value and vice versa. Because one value is held constant at zero while the other is found, both values must be both positive or negative in the same year.

The next portion of this section shows the effect of land inflation and net rent growth on land values. Figure 19 shows the nominal and real growth in net rent. Real growth was calculated by subtracting inflation (CPI measured) from the nominal growth. Both the nominal and real growth values fluctuated widely from 1925 through 1955. There was less variability in the two values from 1955 through 1984 but from 1967 through 1984 the real growth was farther below the nominal growth rate as compared to 1955 to 1966. This seems to be due to a rise in the general inflation level. From 1965 through 1984 real growth was negative 13 out of the 20 years and negative 8 out of the 10 years from 1975 through 1984 (column 6, appendix table A-6). Nominal growth, however, was positive 17 years from 1965 through 1984 and 8 years from 1975 through 1984. (column 4, appendix table A-6). High nominal growth may help explain why positive expectations of future net rent



□ Nominal growth in net rent (column 4, appendix table A-6),
+ Real growth in net rent (column 6, appendix table A-6),

Figure 19. Nominal and real growth in net rent,

growth was needed to equate the modified model's value to the actual model in the analysis of Figure 18. The prospect of high nominal growth could help explain the upward pressure on land prices in the 1970's. Actual land values have not increased, as shown earlier, as much as the original model's value because the "needed" net rent growth expectations to make the model's value equal to the actual value is less than the actual net rent growth expectations as shown in figure 18. The percentage of real growth shown in several years of the 1940's and 1950's doesn't correspond to the need for negative expectations of net rent growth. There was, however, wide fluctuations in both nominal and real growth rates which may have caused skepticism leading to tentative bidding for farmland which caused it to be undervalued.

Figure 20 shows the annual Kansas land inflation and annual inflation (CPI measured). The graph shows that land inflation traced general inflation relatively close through the whole period. There were moderate fluctuations in both inflation values from 1925 through 1955 with both generally following the same trends. There was relative stability in both the CPI and land value inflation from 1955 through 1969. From 1970 through 1984 both values, again, showed fluctuations and there were relatively wide margins between the two values. Figure 20 sets the background for an analysis of real capital gains and losses in Figure 21.

Figure 21 shows real capital gains and losses from farmland value. Real capital gains were calculated by subtracting annual inflation (CPI measured) from annual Kansas land inflation. There

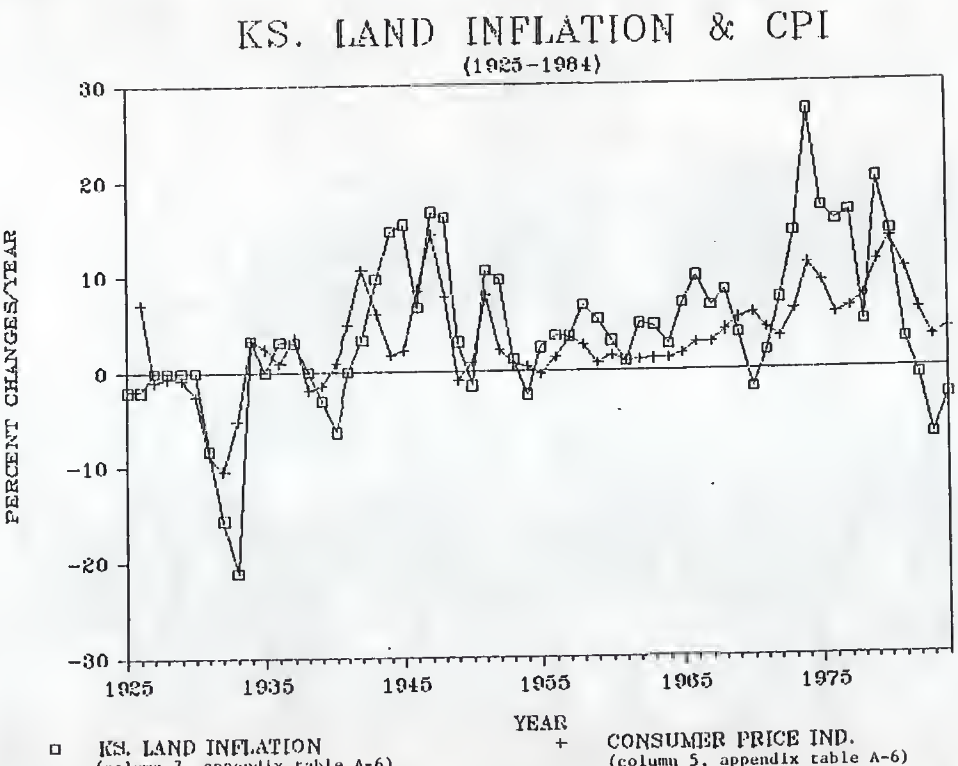


Figure 20, Annual Kansas land inflation and inflation (CPI measured),

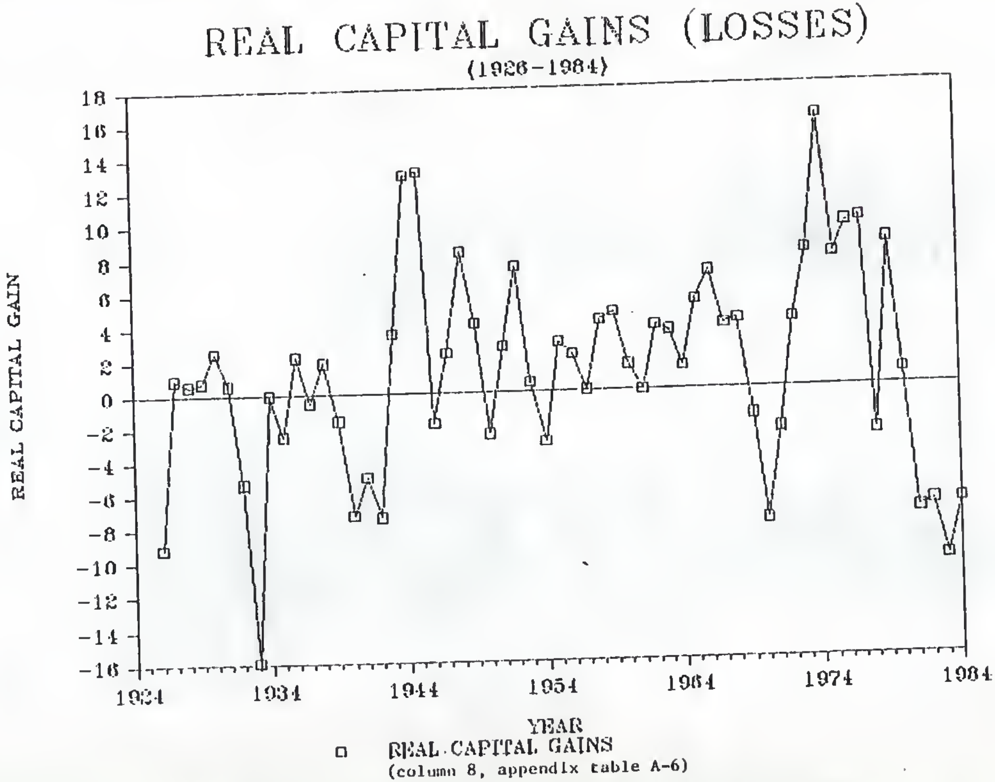
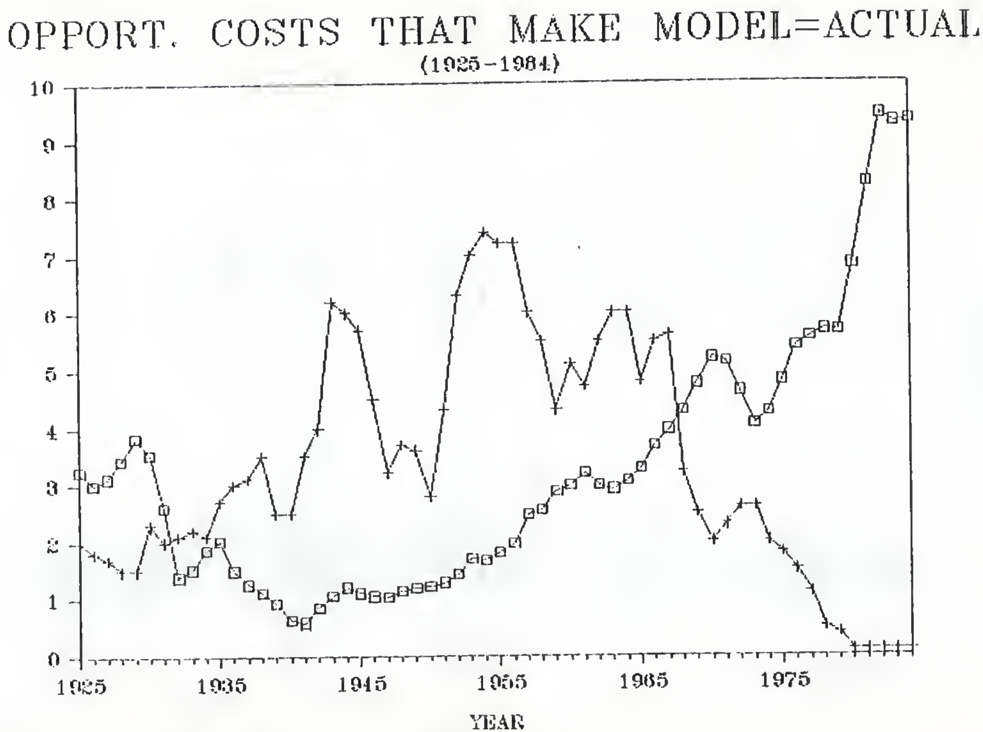


Figure 21, Real capital gains and losses from farmland value, were real capital losses, generally, from 1926 through 1943 but there was some years of large real capital gains with wide vsrisbility in the lste 1940's snd early 1950's. From 1955 through 1968 there were consistent moderate real capital gains. There were large real capital gains in the mid 1970's and 1979 before having real capital losses from 1980 through 1984. From 1955 through 1984 there were real capital gains 22 out of the 30 years. From 1965 through 1984 there were 12 years of real capital gains and 5 yesrs of real capital gains from 1975 through 1984 (column 8, appendix table A-6). The large real capital gains will help explain why expectations of future land inflation were needed in the snalysis of Figure 17 to make the modified model equate to the sctual land vslue. Because of the real capital gains in the 1970's buyers may have expected them to continue in the future snd thus put upwsrd pressure on lsnd values. Actual land value has not increased, as shown earlier, as much as the original model's value because the "needed" land inflation expectations to make the model's value equal to the actual value is less than the 10 year moving average of the actual land inflation as shown in figure 17. The capital gains in the mid 1940's to the mid 1960's do not correspond to the need for negative expectations to make the model's value equal to the actual value. Capital gains during this same period were also less variable than st other times during the study period. This snalysis seems to agree with Melichar (1979) that real capital gain expectations did not have a major impact on the land market until the 1970's.

Figure 22 shows the sctusl three yesr moving sverage of the

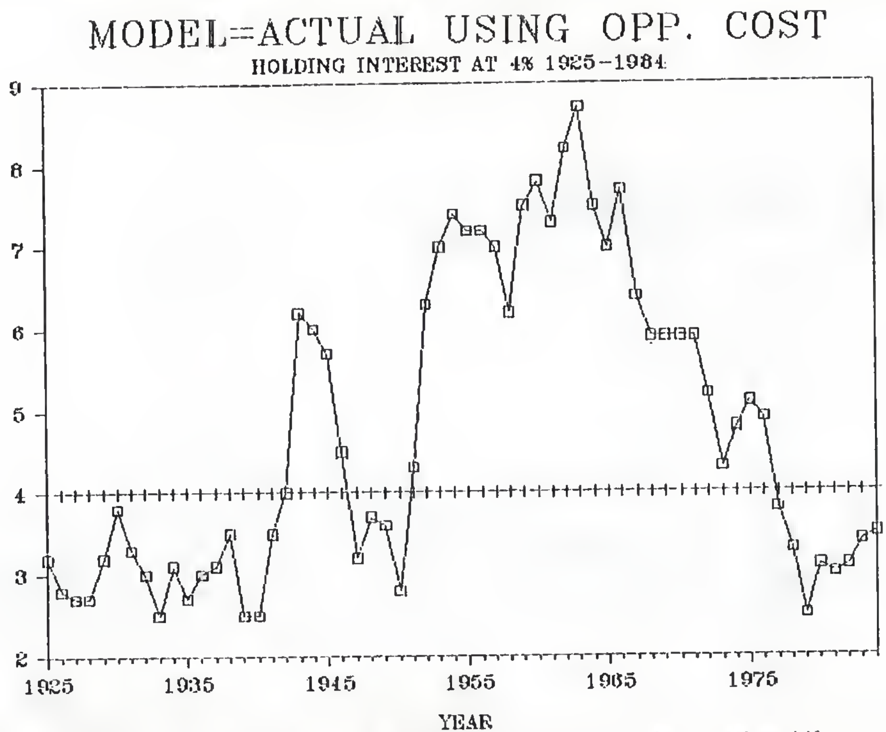


□ The actual opportunity cost of capital (column 5, appendix table A-7).
+ The "needed" opportunity cost of capital to make the model's value equal to the actual value (column 4, appendix table A-7).

Figure 22. The actual and "needed" opportunity cost of capital.

opportunity cost of capital and the "needed" opportunity cost that makes the actual value equal to model's value. The "needed" opportunity cost is the opportunity cost that must be used so the value the model generates will equal the actual land value at that time and was calculated with most of the other variables at their historicsl level and the two expectation variables held at zero. From 1923 through 1931 the "needed" opportunity cost was below the actual opportunity cost. From 1932 through 1967 the "needed" opportunity cost was above the actual. The "needed" opportunity cost fluctuated widely and some years the margin was relatively wide. From 1968 through 1984 the actual opportunity cost wss sgsin grester thsn the "needed" opportunity cost with the margin becoming relatively wide from the mid 1970's through 1984. This sgsin implies thst land was undervalued from the 1940's to the mid 1960's and overvalued from the mid 1960's to 1984. This may also suggest that either the buyer had positive expectations about future land inflation and net rent growth or they were not very sensitive to the opportunity cost increases.

Figure 23 shows the "needed" opportunity cost of capital to make the model's value equal to the actual value when keeping the interest rate paid on land mortgages constant at 4 percent and most other variables at their historical level and the two expectations held at zero. From 1925 through 1941 the "needed" opportunity cost wss less thsn the interest rate but from 1943 through 1946 the reverse wss true. From 1952 through 1972 the "needed" opportunity cost was higher than 5 percent and in many yesrs it was higher than 7 percent. The "needed" opportunity cost



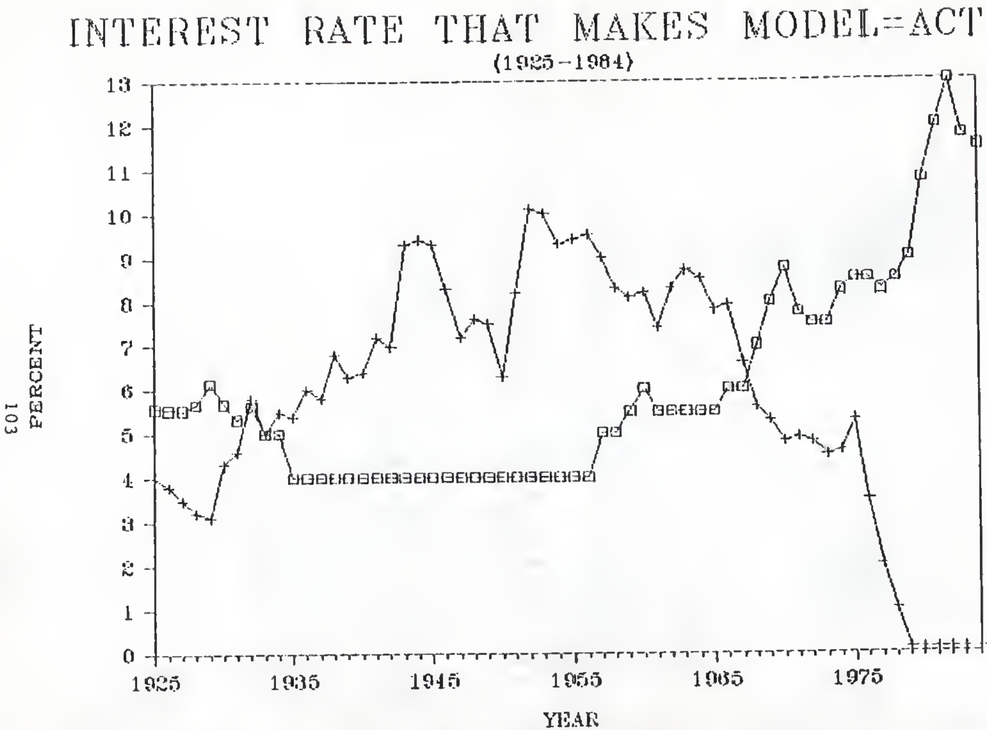
□ The "needed" opportunity cost of capital to make the model's value equal to the actual value while holding interest rates constant at 4 percent (column 8, appendix table A-7).

+ Interest rates on land mortgages (held constant at 4 percent,

Figure 23. The "needed" opportunitu cost of capital when interest rates are held at 4 percent.

was still above 4 percent through 1976 but fell to between 2.5 and 3.5 percent from 1978 through 1984. This should compare to the actual interest rates between 11 and 13 percent and the actual opportunity costs from 9 to 10 percent. The margin between the two comparative rates is quite large in each case. This again may suggest that land buyers may not be very sensitive to the opportunity cost and interest rates and that land was overvalued from the 1940's to the mid 1960's and becoming increasingly overvalued from the mid 1970's to 1984. We will further investigate the interest rates in the following section.

Figure 24 shows the "needed" nominal interest rates on land mortgages to make the model's value equal to the actual land value and the actual nominal interest rate. In other words, the "needed" interest is the interest rate the model needs to generate the actual market value and was calculated with most of the other variables at their historical values and the two expectations held constant at zero. From 1925 through 1931 the actual interest rate was greater than the "needed" interest rate. From 1932 through 1967 the "needed" interest rate was greater than the actual interest rate and in some years by a relatively large margin. The actual interest rate was larger than the "needed" interest rate from 1968 through 1984 with a relatively wide margin from 1975 through 1984. The relatively large margin between the two interest rates from the mid 1940's through the mid 1950's reflects how undervalued land really was during this period. Likewise, the widening margin in the mid 1970's through 1984 shows that land was becoming increasingly overvalued during



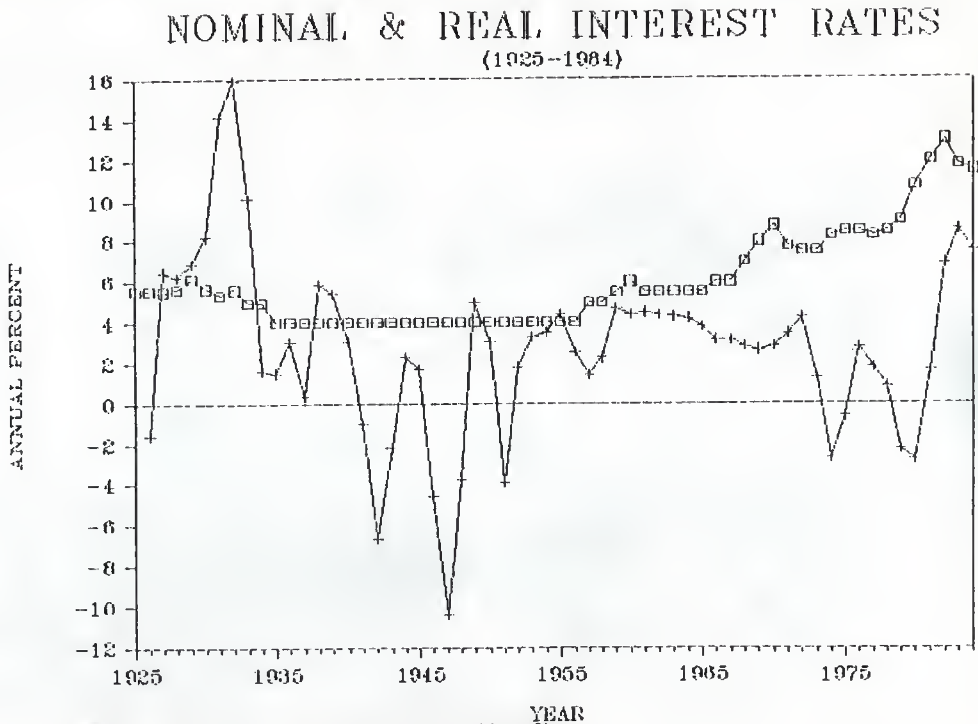
□ Actual interest rates on land mortgages (column 7, appendix table A-7).
+ The "needed" interest rates to make the model's value equal to the actual value (column 6, appendix table A-7).

Figure 24. The actual and "needed" interest rates on land mortgages.

that time. This may also suggest that land buyers have become insensitive to nominal interest rates. One explanation may be that they held expectations of future land inflation and positive expectations of future net rent growth.

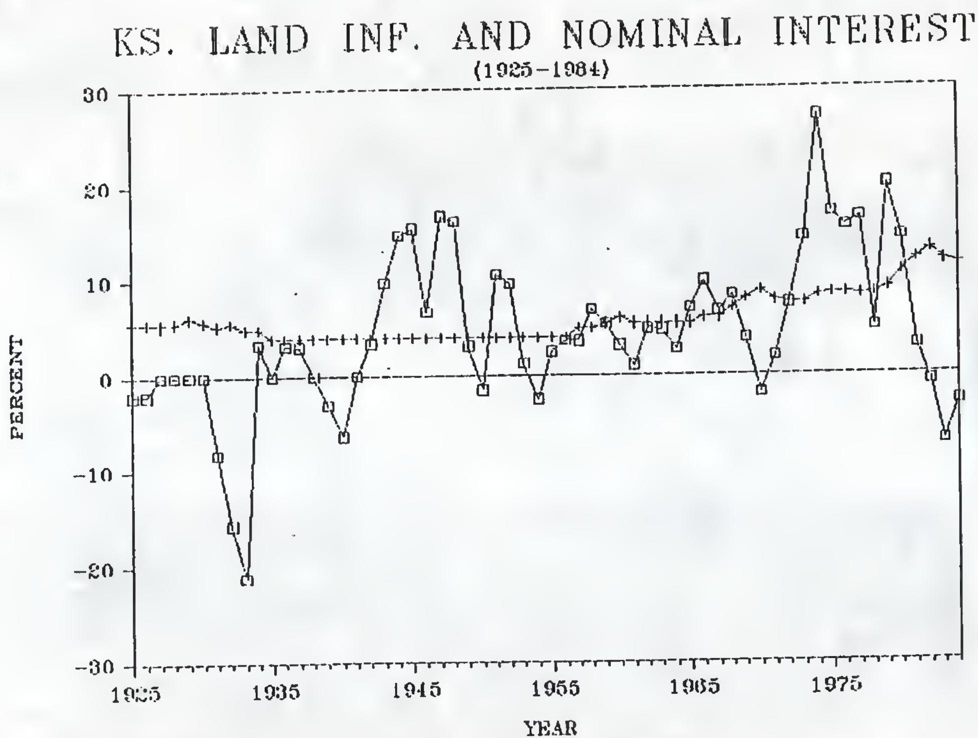
Figure 25 shows the nominal interest rate and the real interest rates. The real interest rates were calculated by subtracting the annual inflation (CPI measured) from the annual nominal interest rate. The real interest rate fluctuated from 1925 through 1955 where it hit a high of 16 percent in 1932 and a low of -10.4 percent in 1947. The real interest rate remained relatively steady from 1959 through 1972 but showed modest fluctuations through the 1970's. The real interest rate hit a local peak of 8.5 percent in 1983. The relatively high real interest rates from 1982 through 1984 has probably been a big factor in the land price decline during this period.

Figure 26 shows the nominal interest rate and Kansas land inflation from 1925 through 1984. The land inflation rate fluctuated but remained below the interest rate through 1941. From 1943 through 1972 land inflation varied from slightly below to moderately above the interest rate. From 1973 through 1980 land inflation was relatively high compared to the nominal interest rates but from 1982 through 1984 the opposite was true. The land inflation was higher than the nominal interest rates on land mortgages in the mid 1970's probably contributed to land inflation expectations and put heavy upward pressure on land prices in the 1970's. The relatively wide margin between interest rates and land inflation in the 1980's suggests that this has put



□ Nominal interest rates (column 7, appendix table A-7),
\+ Real interest rates (column 10, appendix table A-7),

Figure 25. Nominal and real interest rates on land mortgages.



□ Annual Kansas land inflation (column 13, appendix table A-7).
+ Nominal interest rates on land mortgages (column 7, appendix table A-7).

Figure 26, Nominal interest rates on land mortgages and Kansas land inflation, downward pressure on land values. This gap may continue to put downward pressure on land prices in future years.

Figure 27 shows annual Kansas land inflation and annual national land inflation. The two inflation rates are relatively close to each other from 1925 all the way through 1984. This suggests that Kansas land inflation is not unlike national land inflation. There is not a boom in the national land value when there is a bust at the state level and vice versa.

Figure 28 shows the net rent to land value ratio and was calculated by dividing the net rent by the actual land value. There were moderate fluctuations from 1925 through 1940 but there were wide fluctuations from 1941 through 1952. It remained relatively stable and high from 1953 through 1973. From 1973 through 1981 there was a general downward trend. The 1982 through 1984 figures were artifically derived by multiplying the land value from 1982 through 1984 by the average net rent to land values ratios from 1977 to 1981. The falling ratio from 1973 through 1981 suggests that land values are high compared to net rent when considering the period from 1953 through 1973. The ratio is not, however as low as it was during the 1924 through 1937 period. The low ratio from 1977 through 1981 seems to be a sign of imbalance in that net rent is too low relative to land prices.

Figure 29 shows the model's value, actual land value, and the traditional capitalization's value. The traditional capitalization's value was calculated by dividing the net rent by the nominal interest rate on land mortgages. The traditional capital-

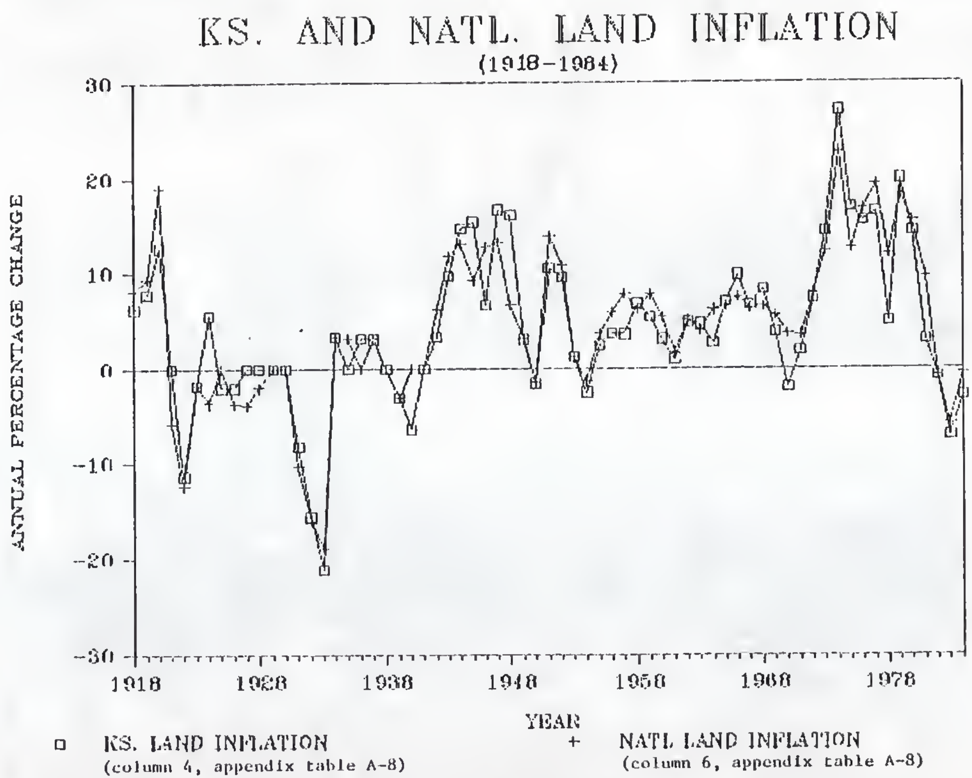


Figure 27. Annual Kansas and national land inflation.

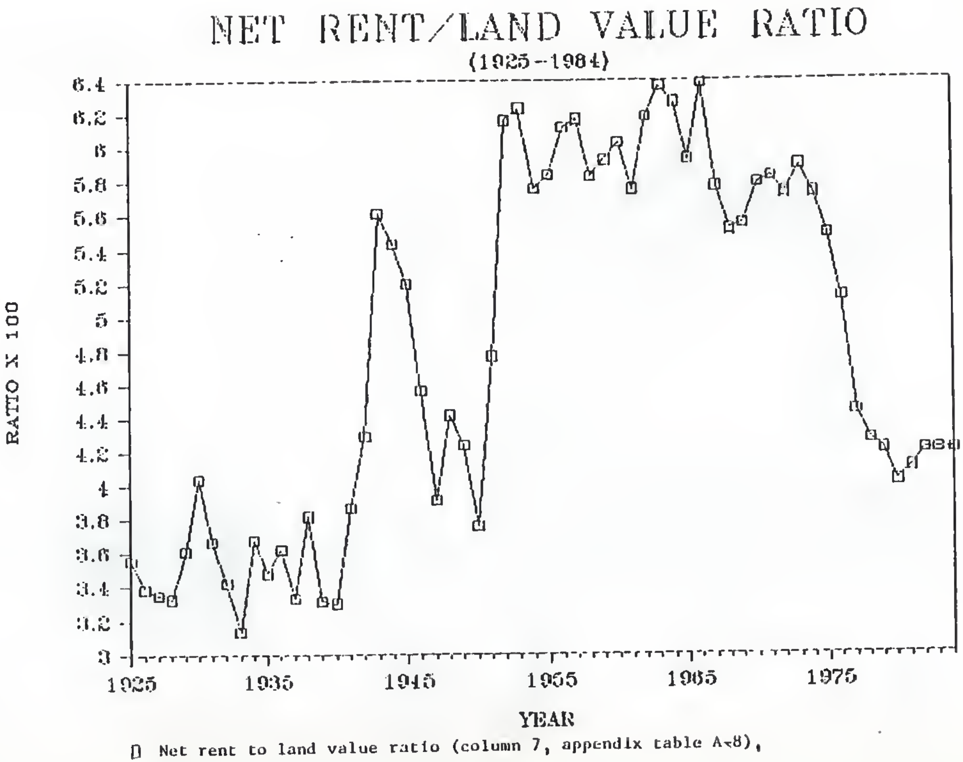
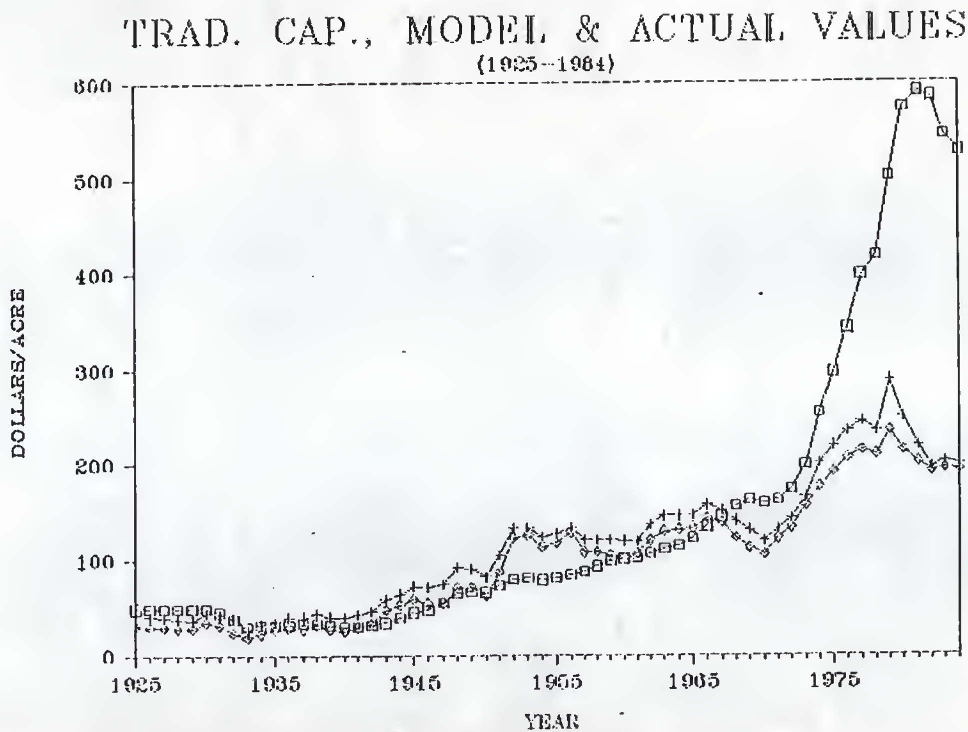


Figure 28. Net rent to land value ratio.



□ Actual Kansas land values (column 3, appendix table A-8).
\+ Model's value (column 2, appendix table A-8).
◇ Traditional capitalization's values (column 8, appendix table A-8).

Figure 29. Model's value, traditional capitalization's value, and the actual Kansas land values.

ization's values follows closely to the model's values. However, neither follows the actual closely. The traditional capitalization model's value followed the actual land values better than the model between 1940 and 1967 but both were still above the actual value. This also suggests that land prices were undervalued during this time. The wide difference between the actual value and the model's value and the traditional capitalization model's value from the mid 1960's to 1984 also points out that land was overvalued during this time. The model's value will be close to the traditional capitalization's value because all of the future expectations were taken out of the model. Any differences will be due to marginal tax rate and the that the model's values is capitalized by an opportunity cost that is less than the interest rate on land mortgages (which was used to capitalize the traditional capitalization model). So the model's value will be slightly more than the traditional capitalization model's value.

EQUILIBRIUM IN THE LAND MARKET

This section analyzes five different land values and provides a scenerio of the interest rates on land mortgages and opportunity cost of capital that would allow the model to achieve each differing land value. This procedure could be interpeted as finding the opportunity cost and interest rates that would be needed to obtain an equilibrium at the given land value.

Because of the pessimism demonstrated lately in the agricultural community we assumed no future land inflation (or deflation) and no change in future net rent growth. Otherwise all other variables were held at their 1984 level. The five different land values used were $528 (the 1984 level), $450, $375, $300, and $200 per acre. The procedure used was to alternatively set the interest rates on land mortgages at 4, 6, 8, 10, 12, and 14 percent adjusting the opportunity cost until the model attains the desired land value.

Figure 30 provides the scenerio of interest rates and opportunity costs that allows the model to obtain each land value. Obviously, as the interest rate increases the opportunity cost that can be attained will decrease. When land is $528/acre (1984 level) and the interest rate is 4 percent the opportunity cost you can earn is 3.5 percent. As stated earlier, actual interest rates are 11 to 12 percent and actual opportunity costs are 9 to 11 percent. The land value, interest rates, opportunity costs, or a combination of the three must drop dramatically for an equilibrium between investment and market value to occur. The land value was dropped to the four other levels to develop other combinations of interest rates and opportunity costs that achieve an equilibrium. Even at a land value of $300/acre (which is a drop of over $225/acre from the 1984 level) an interest rate of 12 percent (which is close to the 1984 level of 11.5 percent) a land buyer could only earn an opportunity cost of 1.7 percent. Land would have to be $200/acre to reach an equilibrium with 1984 interest rates and opportunity costs. This analysis dramatizes how far land is currently overvalued. It again shows how insensitive land buyers are to their opportunity costs and interest

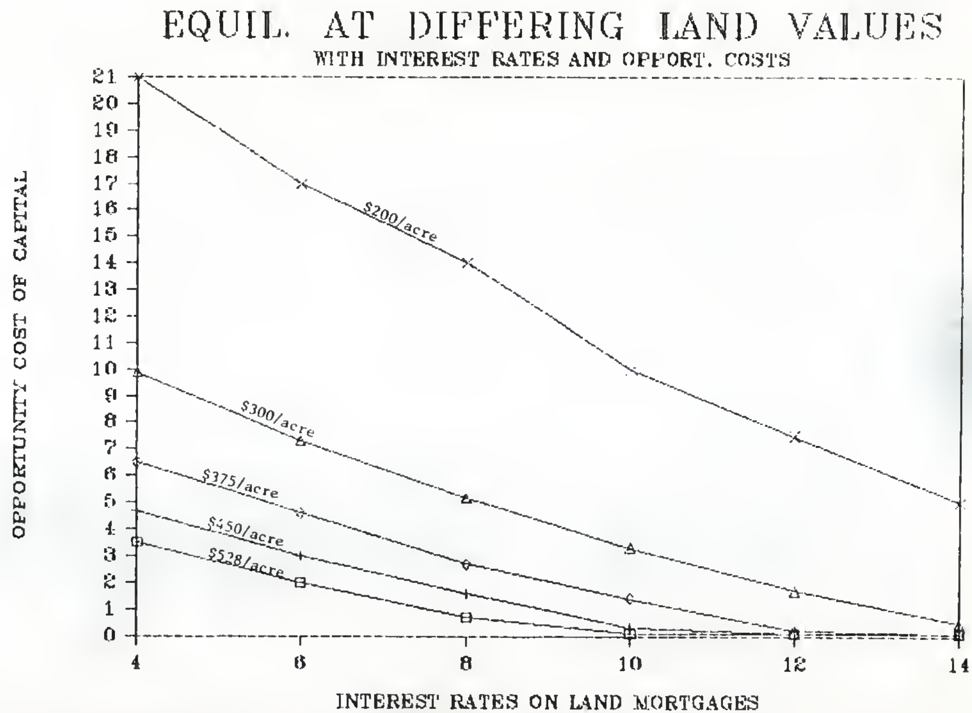


Figure 30. Scenario of interest rates and opportunity costs that allows the model to obtain each of the five different land values (corresponds to columns 1 to 6 appendix table A-9).

rates. Relatively large drops are needed in the land values, interest rates, and opportunity costs if an equilibrium in the land market is to be obtained. It seems unlikely that nominal interest rates or opportunity costs (which usually lags below the nominal interest rates) will fall in the near future. In fact, the Federal Land Bank (which was the source of interest rates on land mortgages for this study) recently raised their interest rate from 11.5 to 13 percent. This rise in interest rates only compounds the problem. With this analysis it seems probable that there will be future land deflation.

This section analyzes scenarios of interest rate-net rent combinations that would allow the model to obtain the same five land values. As in the previous analysis, future expectations in land inflation (deflation) and net rent growth were held at zero and all other variables were held at their 1984 level. Figure 31 shows that with 1984's net rent ($22.18/acre) and interest rates (11.5 percent), and equilibrium price would be $200/acre. To be able to pay $528/acre (1984 level) you would have to have a net rent of nearly $63/acre to reach an equilibrium. This again points out how far land is currently overvalued. A consistent growth in net rent would help reach an equilibrium with smaller drops in the interest rates, opportunity costs, and land values. But figure 31 shows that net rent would have to be nearly $63/acre to reach an equilibrium in 1984 which is nearly three times it's current level. Recent cutbacks in the government's agricultural programs and a lackluster export market makes the prospect of net rent growth seem bleak.

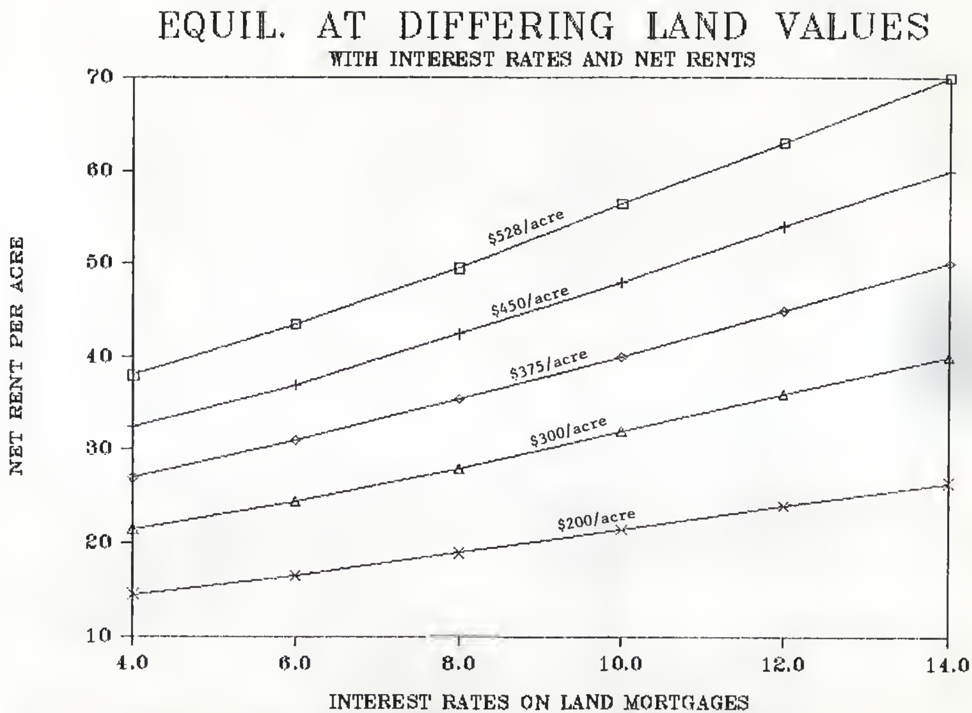


Figure 31. Scenario of interest rates and net rents that allows the model to obtain each of the five different land values. (corresponds to columns 1 to 6, appendix table A-10).

With continued high interest rates and opportunity costs and no net rent growth, it seems probable that there will be more land deflation. With no favorable change in the interest rates, opportunity costs, or net rents it is uncertain whether land prices will fall far enough to reach the investment values given by the model. Land would have to drop $328/acre to reach an equilibrium in 1984. This seems unlikely since a large portion of farmland is sold to existing farmers seeking to expand. It is common knowledge that it takes income from three acres of farmland just to buy one acre of comparable farmland. Thus, financially secure farmers or farmeres with surplus cash income from other sources, such as land owned with little or no mortgage against it, rented land, or non-farm income would probably buy land before it drops to the investment value. It seems more likely that there will be future land deflation but not to a point that the model's value equals the actual land value. The existing, well-established farmers will probably be the major participant in the future land market leading to larger farms and more concentrated farmland wealth. There could also be fewer new farmers because of their inability to compete with larger farmers. New farmers may have to rent most, if not all, the land they farm or have part-time jobs to supplement their income. The inability of a large number of people to buy land could also mean that the primary way to own a farm in the future is to be fortunate enough to inherit one.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The purpose of this study was to compare the market value and investment value of Kansas farmland from 1925 to 1984. This was accomplished by using Lee's capital budgeting model to calculate the investment value based on 11 variables and comparing this to the actual land value at the time. The data was modified so the model would trace the actual land values more closely. This study also explored the relationship between some important variables in the model and the actual land value.

The original model which used all of the variables at their historical level did not trace historical land values well. It was very inconsistent on the whole and showed no consistent differences, patterns or lags. The effects of future growth in net rent and land inflation variables seemed to cause the most dramatic differences. This analysis showed that the model was far more sensitive to the future expectation variables than was the actual land market. The model using half of the future expectations, the model using the net rent growth variable and not the inflation variable, and the model using the land inflation variable and not the net rent growth variable came closer to tracing the actual values, but even these models generated values which were substantially different from the actual values.

Because of the model's sensitivity to future expectations and because these future expectations caused the most dramatic differences between the model's value and the actual land values further reaearch needa to be done on how farmera preceive future land inflation and net rent growth. No consistent manipulation of the two future expectations has been found in this study to make the model's value equal to the actual value. Using poaitive expectationa in the model made it's value closer to the actual value from 1968 to 1984 but made the model's value farther from the actual land values from 1934 to 1967. More research is needed to be able to find a consistent expectations series that will make the model's value equal to the actual value.

The model with both future expectationa held constant at zero came closer than any other model to tracing the actual values. Even in the case of thia model (again referred to as the model'a value in the following analyais), the percentage difference was as much as 67 percent higher in 1952 and 66 percent lower in 1982 than the actual land value. The model'a value was above the actual value from 1934 through 1967 and below the actual value from 1968 through 1984. Model values greater than actual values from 1934-1967 may suggeat that land was a good investment even with no future expectations in land inflation and net rent growth. Thia also impliea that land waa undervalued during this time. Model values is lower than actual value from the mid 1960'a to 1984 may suggeat that land waa not a good investment and may aignal that land was overvalued. The "needed" and actual land inflation expectations were compared and it was found that the model ia more sensitive to this variable than the actual land market and implied that land was undervalued from the early 1940's to the mid 1960's, becoming increasingly overvalued until 1984. The "needed" and actual net rent growth expectations were also compared and it was suggested that the model is again more sensitive to this variable than the actual land market. The results of this comparison were very similar to that of the actual and "needed" land inflation.

Nominal growth in net rent, real growth in net rent, land inflation, and real capital gains in land value were further analyzed. There were wide fluctuations in both nominal growth and real growth from 1925 through 1955 and more stablility there-after. There was slight real growth and relatively high nominal growth in the mid 1970's. There were capital losses, on the whole, from 1933 through 1941, but consistent real capital gains from 1944 through 1969. There were large real capital gains in the mid 1970's and 1979 and real capital losses from 1981 through 1984. The real capital gains and high nominal growth in the mid 1970's seems to have caused the future expectations to rise in light of the prospect of more real capital gains and net rent growth and thus caused land prices to rise. The real capital gains in the 1940's and 1950's, on the whole, do not correspond with the need for negative expectations so the model's value equals the actual value. This agrees with previous research (Melichar, 1979) that real capital gains were not anticipated and did not play an important role in the land market until the 1970's. There was, however, wide variability in net rent growth through the 1930's, 1940's, and early 1950's. The wide variation in net rent probably caused the farmers, who may be predominately conservative and risk averse as a result of the depression, to be skeptical about the future. This be partly to blame for the undervalued land during this period. The people who lived through the depression era would probably remember the hard times. Because of the "memories" of the depression and seeing land prices fall through the 1920's and 1930's they seemed tentative to bid up the price of land which caused it to be undervalued. By the mid 1960's to early 1970's these "memories" seem to fade and yield to a younger, more agressive generation of land buyers. When agriculture prospered during much of the 1970's, farmers bid up land to the extent that land is now overvalued. The new generation of land buyers seem to be less cautious than their counterparts 30 years ago and more willing to accept risk. This boldness msy have put upward pressure on land prices to the point of it's current overvaluation.

The interest rates on land mortgages and opportunity costs of capital that were needed to make the model's value equal to the actual value were also investigated. In both cases the "needed" values were higher than the actual values from 1934 through 1967 and by a relatively wide margin in some years. This suggests that land was undervalued during this time. From 1968 through 1984 the actual values were above the "needed" values in both cases and by a widening margin from 1975 to 1984. This strongly suggests that land was becoming increasingly overvalued during this period. This also points out that the model is much more sensitive to these variables than the land buyers that are bidding for the farmalnd. Opportunity costs have been at their highest level ever and substantially higher than returns to farmland in the 1980's. This suggests that investors could get a higher rate of return on their money in areas other than farmland. Therefore, increased profitability on alternative investments has probably helped depress the land values in recent years. From 1982 to 1984 the nominal interest rates have also been at record levels ever and the real interest rates have been at their highest rate since 1933. This most definitely is partly to blame for the recent land value decline. This would agree with Shalit and Schmitz (1984) when they suggest that as farmland prices were increasing (as in the 1970's) farmers requested and received more money from banks for land purchases. Loans were available since bankers expected farmland values to increase. But if prices are expected to fall or are falling (as in the 1980's) credit terms are strengthened, thus compounding the problem. They state that credit allocation that helped increase farmland values in the 1970's has now depressed them because of accumulated debt. This was accomplished because the "accumulation of farm real estate debt accelerates the increase in farmland values up to a level where the amount of debt burdens the farmer and forces him to sell more land. Then, prices fall and credit terms are strengthened to reduce debt size." (pp. 303-312). This may also correspond to the psychology of a land buyer. When land values are increasing he would buy land which causes more land inflation. When land values are decreasing he would wait to buy land which would cause more land deflation.

The high land inflation relative to the interest rates during most of the 1970's seemed to cause the expectations of future land inflation which caused upward pressure on land prices. The nominal interest rates have been much higher than the land inflation rate from 1981 to 1984. This also seemed to contribute to the land price decline.

The net rent to land value ratio had been fairly high and stable from the mid 1950's to the mid 1970's. The ratio fell and has been relatively low since 1977. This seems to be a sign of imbalance because the net rent is low compared to land values.

The traditional capitalization's value was higher than the actual land values from the mid 1930's to the mid 1960's and implies that land was undervalued during that time. Actual land values have become much more than the traditional capitalization's values from the early 1970's to 1984 and suggests that land values have become increasingly overvalued during this time.

The model's value with expectations for land inflation and net rent growth held constant at zero should be close to the feasibility value. The feasibility value, as you remember, is the value the buyer's cash flow would permit him to pay. The widening gap between the model's value (which is close to the feasibility value) and the actual value from the mid 1960's to 1984 also suggests land is becoming increasingly overvalued during this time and may help explain why farmers are having an increasingly hard time making land mortgage payments and why many farmers are going out of business because of their inability to make these payments.

The study concluded that land values, interest rates and opportunity costs have to decrease by large amounts and net rents have to increase by large amounts if there is to be an equilibrium in the land market. The relatively large changes needed in these variables dramatized how far land is currently overvalued. The study suggested that land buyers have been insensitive to the interest rate, opportunity cost and net rent in recent years. The prospect for real net rent growth seemed bleak because of current government action and it seemed likely there would be continued high interest rates and opportunity costs. This suggests that there will be more land deflation. The investigator suggested that large, well-established farmers will keep land from deflating to the equilibrium point. This suggests that large farmers will be the major buyers of farmland in the future leading to larger farms and more concentrated farmland wealth. This trend could lead to fewer new farmers, more part-time farmers, and more farmers exclusively renting the land they farm because of their inability to compete with large farmers in the land market. The investigator also suggested that inheriting a farm could be the primary way to acquire a farm in the future.

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APPENDIX A

Table A-1. Yearly Kansas Land Values and Inflation in Land Values.

(1) YEAR	(2) KANSAS LAND VALUE	(3) PERCENT KS. LAND INFLATION	(4) 10 YEAR MOVING AVERAGE INFLATION
1914	41	---	---
1915	43	4.9	---
1916	45	4.7	---
1917	48	6.7	---
1918	51	6.3	---
1919	55	7.8	---
1920	62	12.7	---
1921	62	0.0	---
1922	55	-11.3	---
1923	54	-1.8	---
1924	51	5.6	3.5
1925	50	-2.0	2.9
1926	49	-2.0	2.2
1927	49	0.0	1.5
1928	49	0.0	0.9
1929	49	0.0	0.1
1930	49	0.0	-1.2
1931	45	-8.2	-2.0
1932	38	-15.6	-2.4
1933	30	-21.1	-4.3
1934	31	3.3	-4.6
1935	31	0.0	-4.4
1936	32	3.2	-3.8
1937	33	3.1	-3.5
1938	33	0.0	-3.5
1939	32	-3.0	-3.8
1940	30	-6.3	-4.5
1941	30	0.0	-3.6
1942	31	3.3	-1.8
1943	34	9.7	1.3
1944	39	14.7	2.5
1945	45	15.4	4.0
1946	48	6.7	4.4
1947	56	16.7	5.7
1948	65	16.1	7.3
1949	67	3.1	7.9
1950	66	-1.5	8.4
1951	73	10.6	9.5
1952	80	9.6	10.1
1953	81	1.3	9.3
1954	79	-2.5	7.6
1955	81	2.5	6.3
1956	84	3.7	6.0

Table A-1. Yearly Kansas Land Values and Inflation in Land Values.

(1) YEAR	(2) KANSAS LAND VALUE	(3) PERCENT KS. LAND INFLATION	(4) 10 YEAR MOVING AVERAGE INFLATION
1957	87	3.6	4.7
1958	93	6.9	3.7
1959	98	5.4	4.0
1960	101	3.1	4.4
1961	102	1.0	3.5
1962	107	4.9	3.0
1963	112	4.7	3.3
1964	115	2.7	3.9
1965	123	7.0	4.3
1966	135	9.8	4.9
1967	144	6.7	5.2
1968	156	8.3	5.4
1969	162	3.8	5.2
1970	159	-1.9	4.7
1971	162	1.9	4.8
1972	174	7.4	5.0
1973	199	14.4	6.0
1974	253	27.1	8.5
1975	296	17.0	9.5
1976	342	15.5	10.0
1977	398	16.4	11.0
1978	418	5.0	10.7
1979	501	19.9	12.3
1980	573	14.4	13.9
1981	590	3.0	14.0
1982	585	-0.8	13.2
1983	544	-7.0	11.1
1984	528	-2.9	8.1

Table A-2. Yearly rent, property tax, net rent, and growth in net rent for Kansas Farmland.

(1) YEAR	(2) RENT	(3) PROPERTY TAX	(4) NET RENT	(5) GROWTH IN NET RENT	(6) 10 YEAR MOVING AVERAGE OF GROWTH
1914	1.66	0.22	1.44	---	---
1915	1.74	0.23	1.51	4.9	---
1916	1.82	0.24	1.58	4.6	---
1917	1.95	0.27	1.68	6.3	---
1918	2.07	0.28	1.79	6.5	---
1919	2.28	0.35	1.93	7.8	---
1920	2.59	0.42	2.17	12.4	---
1921	2.67	0.50	2.17	0.0	---
1922	2.38	0.45	1.93	-11.1	---
1923	2.37	0.48	1.89	-2.1	---
1924	2.27	0.48	1.79	-5.3	2.4
1925	2.30	0.52	1.78	-0.6	1.9
1926	2.20	0.54	1.66	-6.7	0.7
1927	2.20	0.56	1.64	-1.2	0.0
1928	2.20	0.57	1.63	-0.6	-0.7
1929	2.35	0.58	1.77	8.6	-0.7
1930	2.30	0.55	1.98	11.9	-0.7
1931	2.05	0.52	1.65	-16.7	-2.4
1932	1.70	0.40	1.30	-21.2	-3.4
1933	1.30	0.36	0.94	-27.7	-6.0
1934	1.50	0.36	1.14	21.3	-3.3
1935	1.45	0.37	1.08	-5.3	-3.8
1936	1.55	0.39	1.16	7.4	-2.4
1937	1.50	0.40	1.10	-5.2	-2.7
1938	1.65	0.39	1.26	14.5	-1.2
1939	1.45	0.39	1.06	-15.9	-3.7
1940	1.35	0.36	0.99	-6.6	-5.5
1941	1.55	0.39	1.16	17.2	-2.1
1942	1.70	0.37	1.33	14.7	1.4
1943	2.25	0.34	1.91	43.6	8.6
1944	2.45	0.33	2.12	11.0	7.5
1945	2.75	0.41	2.34	10.4	9.1
1946	2.65	0.46	2.19	-6.4	7.7
1947	2.80	0.61	2.19	0.0	8.2
1948	3.50	0.63	2.87	31.1	9.9
1949	3.55	0.71	2.84	-1.0	11.4
1950	3.20	0.72	2.48	-12.7	10.7
1951	4.25	0.77	3.48	40.3	13.1
1952	5.70	0.77	4.93	41.7	15.8
1953	5.85	0.80	5.05	2.4	11.7
1954	5.40	0.85	4.55	-9.9	9.6

Table A-2. Yearly rent, property tax, net rent, and growth in net rent for Kanaaa farmland.

(1) YEAR	(2) RENT	(3) PROPERTY TAX	(4) NET RENT	(5) GROWTH IN NET RENT	(6) 10 YEAR MOVING AVERAGE OF GROWTH
1955	5.65	0.92	4.73	4.0	8.9
1956	6.05	0.91	5.14	8.7	10.4
1957	6.35	0.98	5.37	4.5	10.9
1958	6.45	1.03	5.42	0.9	7.9
1959	6.90	1.09	5.81	7.2	8.7
1960	7.25	1.16	6.09	4.8	10.5
1961	7.10	1.23	5.87	-3.6	6.1
1962	7.90	1.28	6.62	12.8	3.2
1963	8.45	1.32	7.13	7.7	3.7
1964	8.55	1.34	7.21	1.1	4.8
1965	8.60	1.30	7.30	1.2	4.5
1966	10.10	1.48	8.62	18.1	5.5
1967	10.00	1.69	8.31	-3.6	4.7
1968	10.50	1.84	8.61	3.6	4.9
1969	11.00	2.01	8.99	4.4	4.7
1970	11.20	1.98	9.22	2.6	4.4
1971	11.50	2.05	9.45	2.5	5.0
1972	12.00	2.02	9.98	5.6	4.3
1973	13.70	1.96	11.74	17.6	5.3
1974	16.80	2.29	14.51	23.6	7.6
1975	18.60	2.36	16.24	11.9	8.6
1976	20.00	2.50	17.50	7.8	7.6
1977	2.30	2.64	17.66	0.9	8.1
1978	20.50	2.67	17.83	1.0	7.8
1979	23.70	2.62	21.08	18.2	9.2
1980	25.70	2.69	23.01	9.2	9.8
1981	27.00	2.82	24.18	5.1	10.1
1982	27.45	2.87	24.58	1.7	9.7
1983	25.81	2.95	22.86	-7.0	7.2
1984	25.21	3.03	22.19	-3.0	4.6

Table A-3. Opportunity costs, marginal and capital gains tax rates, and nominal interest rates.

(1) YEAR	(2) OPPORT-UNITY COST	(3) PERCENT MARGINAL TAX RATE	(4) AFTER-TAX OPPORT-UNITY COST	(5) 3-YEAR MOVING AVERAGE OPPORT. COST	(6) NOMINAL INTEREST RATES	(7) CAPITAL GAINS TAX RATE
1923	3.47	0.75	3.44	---	---	---
1924	2.77	0.29	2.76	---	---	---
1925	3.03	0.10	3.03	3.23	5.59	12.50
1926	3.23	0.10	3.23	3.01	5.55	12.50
1927	3.10	0.07	3.10	3.12	5.54	12.50
1928	3.97	0.10	3.97	3.43	5.67	12.50
1929	4.42	0.04	4.42	3.83	6.16	12.50
1930	2.23	0.08	2.23	3.54	5.69	12.50
1931	1.15	0.02	1.15	2.60	5.34	12.50
1932	0.78	0.04	0.78	1.39	5.62	12.50
1933	2.66	0.04	2.66	1.53	5.00	12.50
1934	2.12	0.38	2.11	1.85	5.00	12.50
1935	1.29	0.40	1.28	2.02	4.00	12.50
1936	1.11	0.47	1.10	1.50	4.00	0.14
1937	1.40	0.48	1.39	1.26	4.00	0.14
1939	0.59	2.47	0.58	0.93	4.00	1.24
1940	0.50	2.88	0.49	0.63	4.00	1.44
1941	0.73	2.88	0.71	0.59	4.00	1.44
1942	1.46	10.00	1.31	0.84	4.00	5.00
1943	1.34	13.00	1.17	1.06	4.00	6.50
1944	1.33	15.00	1.13	1.20	4.00	7.50
1945	1.18	15.00	1.00	1.10	4.00	7.50
1946	1.16	14.00	1.00	1.04	4.00	7.00
1947	1.32	17.00	1.10	1.03	4.00	8.50
1948	1.62	19.00	1.31	1.14	4.00	9.59
1949	1.43	20.00	1.14	1.18	4.00	10.00
1950	1.50	20.00	1.20	1.22	4.00	10.00
1951	1.93	22.00	1.51	1.28	4.00	11.00
1952	2.13	26.00	1.58	1.43	4.00	13.00
1953	2.56	22.00	2.00	1.69	4.00	11.00
1954	1.82	22.00	1.42	1.66	4.00	11.00
1955	2.50	20.00	2.00	1.81	4.00	10.00
1956	3.12	20.00	2.50	1.97	4.00	10.00
1957	3.62	20.00	2.90	2.46	5.00	10.00
1958	2.90	22.00	2.26	2.55	5.00	11.00
1959	4.33	20.00	3.46	2.87	5.50	10.00
1960	3.99	20.00	3.19	2.97	6.00	10.00
1961	3.60	20.00	2.88	3.18	5.50	10.00
1962	3.57	20.00	2.86	2.98	5.50	10.00
1963	3,72	20.00	2.98	2.90	5.50	10.00

Table A-3. Opportunity costs, marginal and capital gains tax rates, and nominal interest rates.

(1) YEAR	(2) OPPORT-UNITY COST	(3) PERCENT MARGINAL TAX RATE	(4) AFTER-TAX OPPORT-UNITY COST	(5) 3-YEAR MOVING AVERAGE OPPORT. COST	(6) NOMINAL INTEREST RATE	(7) CAPITAL GAINS RATE
1964	4.06	18.00	3.33	3.05	5.50	9.00
1965	4.22	17.00	3.50	3.27	5.50	8.50
1966	5.16	19.00	4.18	3.67	6.00	9.50
1967	5.07	18.00	4.16	3.95	6.00	9.00
1968	5.59	19.00	4.53	4.29	7.00	9.50
1969	6.85	19.00	5.55	4.74	8.00	9.50
1970	7.37	25.00	5.53	5.20	8.75	12.50
1971	5.77	25.00	4.33	5.13	7.75	12.50
1972	5.85	32.00	3.98	4.61	7.50	16.00
1973	6.92	45.00	3.81	4.04	7.50	22.50
1974	7.81	36.00	5.00	4.26	8.25	18.00
1975	7.77	28.00	5.59	4.80	8.50	14.00
1976	7.18	22.00	5.60	5.40	8.50	11.00
1977	6.99	22.00	5.45	5.55	8.25	11.00
1978	8.32	28.00	5.99	5.68	8.50	11.20
1979	9.52	42.00	5.52	5.65	9.00	16.80
1980	11.48	22.00	8.95	6.82	10.75	8.80
1981	14.24	28.00	10.25	8.24	12.00	11.20
1982	13.01	30.00	9.11	9.44	13.00	12.00
1983	10.80	21.00	8.53	9.30	11.75	8.40
1984	13.17	21.00	10.40	9.35	11.50	8.40

Table A-4. Kansas land values, model's values under different assumptions and percentage difference between model and actual values.

(1) YEAR	(2) ACTUAL KANSAS LAND VALUE	(3) MODEL RESULTS	(4) MODEL RESULTS BOTH EXPECT. ZERO	(5) MODEL RESULTS BOTH EXPECT. HALF VALUE	(6) MODEL RESULTS USING INFLAT. VALUE; GROWTH VALUE CONSTANT AT ZERO	(7) MODEL RESULTS USING GROWTH VALUE; INFLAT. VALUE CONSTANT AT ZERO	(8) PERCENT DIFFERENCE BETWEEN MODEL (COL. 4) AND ACTUAL VALUES
1914	41						
1915	43						
1916	45						
1917	48						
1918	51						
1919	55						
1920	62						
1921	62						
1922	55						
1923	54						
1924	51						
1925	50	66	42	56	64	55	-16.0
1926	49	60	41	47	45	45	-16.3
1927	49	49	40	44	49	40	-18.4
1928	49	39	38	38	42	35	-22.4
1929	49	35	37	38	38	34	-24.5
1930	49	37	44	40	40	40	-10.2
1931	45	27	43	34	37	33	-4.4
1932	38	19	39	27	31	28	2.6
1933	30	9	26	15	20	16	-13.3
1934	31	15	33	21	25	23	6.5
1935	31	15	35	22	27	24	12.9
1936	32	20	40	27	29	31	25.0
1937	33	19	40	27	29	31	21.2
1938	33	27	44	34	33	39	33.3
1939	32	16	40	25	28	29	25.0
1940	30	13	39	24	28	31	30.0
1941	30	22	43	30	31	35	43.3
1942	31	48	46	45	38	56	48.4
1943	34	340	58	127	69	329	70.6
1944	39	300	64	130	94	270	64.1
1945	45	534	72	181	153	452	60.0
1946	48	412	71	164	177	306	47.9
1947	56	567	75	194	297	345	33.9
1948	65	1152	92	309	574	670	41.5
1949	67	1598	91	349	714	975	35.8
1950	66	1460	82	326	820	723	24.2
1951	73	3059	105	503	1325	1839	43.8
1952	80	6863	134	783	1746	5250	67.5
1953	81	2786	134	531	1253	1667	65.4
1954	79	1442	124	393	696	870	57.0
1955	81	1078	127	350	460	744	56.8
1956	84	1444	134	404	426	1153	59.5

Table A-4. Kansas land values, model's values under different assumptions and percentage difference between model and actual values.

(1) YEAR	(2) ACTUAL KANSAS LAND VALUE	(3) MODEL RESULTS	(4) MODEL RESULTS BOTH EXPECT. ZERO	(5) MODEL RESULTS BOTH EXPECT. HALF VALUE	(6) MODEL RESULTS USING INFLAT. VALUE; GROWTH VALUE CONSTANT AT ZERO	(7) MODEL RESULTS USING GROWTH VALUE; INFLAT. VALUE CONSTANT AT ZERO	(8) PERCENT DIFFERENCE BETWEEN MODEL (COL. 4) AND ACTUAL VALUES
1957	87	1285	121	355	256	1150	39.1
1958	93	655	121	272	221	559	30.1
1959	98	732	121	275	215	638	23.5
1960	101	1107	120	326	220	1006	18.8
1961	102	410	119	213	183	346	16.7
1962	107	285	137	194	193	228	28.0
1963	112	336	146	217	215	268	30.4
1964	115	427	146	244	246	326	27.0
1965	123	428	147	242	269	306	19.5
1966	135	546	157	280	308	395	16.3
1967	144	488	151	386	321	318	4.9
1968	156	472	141	245	309	303	-9.6
1969	162	400	131	217	262	269	-19.1
1970	159	315	119	186	206	229	-25.2
1971	162	382	132	215	233	281	-18.5
1972	174	415	143	306	286	273	-17.8
1973	199	741	166	327	535	372	-16.6
1974	253	1656	201	508	1116	741	-20.6
1975	296	2268	219	565	1509	978	-26.0
1976	342	2301	234	604	1725	811	-31.6
1977	398	3354	244	714	2686	910	-38.7
1978	418	3016	234	669	2440	811	-44.0
1979	501	4993	288	910	3883	1398	-42.5
1980	573	7079	249	924	6118	1210	-56.5
1981	590	4922	218	702	4137	1003	-63.1
1982	585	2718	196	524	2158	757	-66.5
1983	544	1439	203	416	1129	514	-62.7
1984	528	632	200	308	490	341	-62.1

Table A-5. Kansas land values, model's value, "needed" and actual land inflation expectations, and "needed" and actual growth in net rent expectations.

(1) YEAR	(2) ACTUAL KANSAS LAND VALUE	(3) MODEL RESULTS BOTH EXPECT. ZERO	(4) LAND INFLATION VALUE THAT MAKES MODEL EQUAL TO ACTUAL PRICE WHILE KEEPING GROWTH IN NET RENT CONSTANT AT ZERO	(5) ACTUAL 10 YR MOVING AVERAGE IN LAND INFLATION	(6) GROWTH IN NET RENT THAT MAKES MODEL EQUAL TO ACTUAL PRICE WHILE KEEPING LAND INFLATION EXPECT. CONSTANT AT ZERO	(7) ACTUAL 10 YR MOVING AVERAGE IN NET RENT GROWTH
1914	41					
1915	43					
1916	45					
1917	48					
1918	51					
1919	55					
1920	62					
1921	62					
1922	55					
1923	54					
1924	51			3.5		2.4
1925	50	42	1.5	2.9	1.4	1.9
1926	49	41	1.8	2.2	1.3	0.7
1927	49	40	1.6	1.5	1.5	.0
1928	49	38	1.8	0.9	0.7	-0.7
1929	49	37	2.5	0.1	1.7	-0.7
1930	49	44	1.0	-1.2	0.8	-0.7
1931	45	43	0.4	-2.0	0.5	-2.4
1932	38	39	-0.2	-2.4	-0.2	-3.4
1933	30	26	1.0	-4.3	1.0	-6.0
1934	31	33	-0.5	-4.6	-0.5	-3.3
1935	31	35	-1.0	-4.4	-1.0	-3.8
1936	32	40	-1.6	-3.8	-1.6	-2.4
1937	33	40	-1.5	-3.5	-1.6	-2.7
1938	33	44	-3.0	-3.5	-3.0	-1.2
1939	32	40	-2.0	-3.8	-2.0	-3.7
1940	30	39	-2.0	-4.5	-2.5	-5.5
1941	30	43	-4.0	-3.6	-4.0	-2.1
1942	31	46	-5.5	-1.8	-4.0	1.4
1943	34	58	-7.0	1.3	-5.0	8.6
1944	39	64	-6.0	2.5	-5.5	7.5
1945	45	72	-4.4	4.0	-5.2	9.1
1946	48	71	-5.0	4.4	-3.6	7.7
1947	56	75	-4.0	5.7	-3.0	8.2
1948	65	92	-5.0	7.3	-3.0	9.9
1949	67	91	-4.5	7.9	-3.0	11.4
1950	66	82	-2.0	8.4	-2.2	10.8
1951	73	105	-4.3	9.5	-3.5	13.1
1952	80	134	-8.0	10.1	-5.0	15.8
1953	81	134	-8.0	9.3	-5.0	11.7
1954	79	124	-8.0	7.6	-4.0	9.6
1955	81	127	-8.0	6.3	-4.2	8.9
1956	84	134	-8.0	6.0	-4.2	10.4

Table A-5. Kansas land values, model's value, "needed" and actual land inflation expectations, and "needed" and actual growth in net rent expectations.

(1) YEAR	(2) ACTUAL KANSAS LAND VALUE	(3) MODEL RESULTS BOTH EXPECT. ZERO	(4) LAND INFLATION VALUE THAT MAKES MODEL EQUAL TO ACTUAL PRICE WHILE KEEPING GROWTH IN NET RENT CONSTANT AT ZERO	(5) ACTUAL 10 YR MOVING AVERAGE IN LAND INFLATION	(6) GROWTH IN NET RENT THAT MAKES MODEL EQUAL TO ACTUAL PRICE WHILE KEEPING LAND INFLATION EXPECT. CONSTANT AT ZERO	(7) ACTUAL 10 YR MOVING AVERAGE IN NET RENT GROWTH
1957	87	121	-8.0	4.7	-3.2	10.9
1958	93	121	-7.0	3.7	-2.2	7.9
1959	98	121	-5.0	4.0	-1.8	8.7
1960	101	120	-4.0	4.4	-1.2	10.5
1961	102	119	-3.0	3.5	-1.2	6.1
1962	107	137	-5.0	3.0	-1.8	3.2
1963	112	146	-7.0	3.3	-2.3	3.7
1964	115	146	-7.0	3.9	-2.0	4.8
1965	123	147	-5.0	4.3	-1.5	4.5
1966	135	157	-3.6	4.9	-1.3	5.5
1967	144	151	-1.0	5.2	-0.4	4.7
1968	156	141	1.3	5.4	0.9	4.9
1969	162	131	2.2	5.2	1.6	4.7
1970	159	119	3.0	4.7	2.1	4.4
1971	162	132	2.5	4.8	1.5	5.0
1972	174	143	2.2	5.0	1.5	4.3
1973	199	166	1.5	6.0	1.5	5.3
1974	253	201	2.2	8.5	1.7	7.6
1975	296	219	1.1	9.5	1.0	8.6
1976	342	234	3.7	10.0	2.8	7.6
1977	398	244	4.1	11.0	3.6	8.1
1978	418	234	4.5	10.7	4.2	7.8
1979	501	288	5.0	12.3	4.0	9.2
1980	573	249	6.2	13.9	6.0	9.8
1981	590	218	7.6	14.0	7.3	10.1
1982	585	196	8.8	13.2	8.3	9.7
1983	544	203	8.5	11.1	7.5	7.2
1984	528	200	8.4	8.1	7.5	4.6

Table A-6. Real growth in net rent and real capital gains in land inflation.

(1) YEAR	(2) MODEL RESULTS BOTH EXPECT. ZERO	(3) KANSAS LAND VALUE	(4) PERCENT GROWTH IN NET RENT	(5) CPI MEASURED INFLATION	(6) REAL GROWTH IN RENT	(7) KS LAND INFLATION	(8) REAL CAPITAL GAINS
1914		41					
1915		43	4.9			4.9	
1916		45	4.6			4.7	
1917		48	6.3			6.7	
1918		51	6.5			6.3	
1919		55	7.8			7.8	
1920		62	12.4			12.7	
1921		62	0.0			0.0	
1922		55	-11.1			-11.3	
1923		54	-2.1			-1.8	
1924		51	-5.3			5.6	
1925	42	50	-0.6			-2.0	
1926	41	49	-6.7	7.1	-13.88	-2.0	-9.14
1927	40	49	-1.2	-1.0	-0.25	0.0	0.95
1928	38	49	-0.6	-0.6	-0.03	0.0	0.58
1929	37	49	8.6	-0.8	9.36	0.0	0.77
1930	44	49	11.9	-2.5	14.40	0.0	2.53
1931	43	45	-16.7	-8.8	-7.87	-8.2	0.60
1932	39	38	-21.2	-10.3	-10.91	-15.6	-5.29
1933	26	30	-27.7	-5.1	-22.56	-21.1	-15.97
1934	33	31	21.3	3.4	17.93	3.3	-0.05
1935	35	31	-5.3	2.5	-7.76	0.0	-2.49
1936	40	32	7.4	1.0	6.43	3.2	2.23
1937	40	33	-5.2	3.6	-8.79	3.1	-0.51
1938	44	33	14.5	-1.9	16.41	0.0	1.86
1939	40	32	-15.9	-1.4	-14.45	-3.0	-1.58
1940	39	30	-6.6	1.0	-7.57	-6.3	-7.26
1941	43	30	17.2	5.0	12.17	0.0	-5.00
1942	46	31	14.7	10.7	4.00	3.3	-7.36
1943	58	34	43.6	6.1	37.46	9.7	3.55
1944	64	39	11.0	1.7	9.26	14.7	12.96
1945	72	45	10.4	2.3	8.10	15.4	13.12
1946	71	48	-6.4	8.5	-14.94	6.7	-1.83
1947	75	56	0.0	14.4	-14.36	16.7	2.34
1948	92	65	31.1	7.8	23.28	16.1	8.33
1949	91	67	-1.0	-1.0	-0.07	3.1	4.07
1950	82	66	-12.7	1.0	-13.66	-1.5	-2.48
1951	105	73	40.3	7.9	32.42	10.6	2.69
1952	134	80	41.7	2.2	39.48	9.6	7.41
1953	134	81	2.4	0.8	1.68	1.3	0.55
1954	124	79	-9.9	0.5	-10.40	-2.5	-3.00
1955	127	81	4.0	-0.4	4.33	2.5	2.87
1956	134	84	8.7	1.5	7.17	3.7	2.20

Table A-6. Real growth in net rent and real capital gains in land inflation.

(1) YEAR	(2) MODEL RESULTS BOTH EXPECT. ZERO	(3) KANSAS LAND VALUE	(4) PERCENT GROWTH IN NET RENT	(5) CPI MEASURED INFLATION	(6) REAL GROWTH IN RENT	(7) KS LAND INFLATION	(8) REAL CAPITAL GAINS
1957	121	87	4.5	3.6	0.91	3.6	0.04
1958	121	93	0.9	2.7	-1.80	6.9	4.17
1959	121	98	7.2	0.8	6.39	5.4	4.59
1960	120	101	4.8	1.6	3.22	3.1	1.50
1961	119	102	-3.6	1.0	-4.63	1.0	-0.01
1962	137	107	12.8	1.1	11.66	4.9	3.78
1963	146	112	7.7	1.2	6.49	4.7	3.49
1964	146	115	1.1	1.3	-0.19	2.7	1.39
1965	147	123	1.2	1.7	-0.47	7.0	5.28
1966	157	135	18.1	2.9	15.23	9.8	6.94
1967	151	144	-3.6	2.9	-6.48	6.7	3.82
1968	141	156	3.6	4.2	-0.59	8.3	4.10
1969	131	162	4.4	5.4	-0.96	3.8	-1.57
1970	119	159	2.6	5.9	-3.36	-1.9	-7.82
1971	132	162	2.5	4.3	-1.80	1.9	-2.40
1972	143	174	5.6	3.3	2.31	7.4	4.10
1973	166	199	17.6	6.2	11.41	14.4	8.17
1974	201	253	23.6	11.0	12.63	27.1	16.13
1975	219	296	11.9	9.1	2.78	17.0	7.86
1976	234	342	7.8	5.8	1.99	15.5	9.73
1977	244	398	0.9	6.5	-5.54	16.4	9.95
1978	234	418	1.0	7.7	-6.70	5.0	-2.66
1979	288	501	18.2	11.3	6.97	19.9	8.64
1980	249	573	9.2	13.5	-4.37	14.4	0.88
1981	218	590	5.1	10.4	-5.29	3.0	-7.37
1982	196	585	1.7	6.1	-4.43	-0.8	-6.93
1983	203	544	-7.0	3.2	-10.22	-7.0	-10.22
1984	200	528	-3.0	4.0	-7.00	-2.9	-6.90

Table A-7. The "needed" and actual opportunity cost of capital, "needed" and actual interest rates on land mortgages, and the real interest rates.

(1) YEAR	(2) ACTUAL KANSAS LAND VALUE	(3) MODEL RESULTS BOTH EXPECT. ZERO	(4) AFTER-TAX OPPORT. COST THAT MAKES MODEL (COL. 3) EQUAL TO ACTUAL	(5) ACTUAL 3 YR. MOVING AVERAGE OPPORT. COST	(6) NOMINAL INTEREST RATES THAT MAKES MODEL (COL. 3) EQUAL TO ACTUAL	(7) ACTUAL INTEREST RATE	(8) OPP. COST THAT MAKES MODEL EQUAL ACTUAL WHEN INT. RATE ARE HELD AT 4 %	(9) CPI MEASURED INFLATION	(10) REAL INTEREST RATES	(11) ANNUAL PERCENT INTEREST RATE CHANGE	(12) ANNUAL PERCENT OPPORT. COST CHANGE	(13) KS LAND INFLATION
1914	41											
1915	43											4.9
1916	45											4.7
1917	48											6.7
1918	51											6.3
1919	55											7.8
1920	62											12.7
1921	62											0.0
1922	55											-11.3
1923	54											-1.8
1924	51			3.37								5.6
1925	50	42	2.0	3.23	4.0	5.59	3.2				-4.12	-2.0
1926	49	41	1.8	3.01	3.8	5.55	2.8	7.1	-1.6	-0.72	-7.05	-2.0
1927	49	40	1.7	3.12	3.5	5.54	2.7	-1.0	6.5	-0.18	3.73	0.0
1928	49	38	1.5	3.43	3.2	5.67	2.7	-0.6	6.2	2.35	10.04	0.0
1929	49	37	1.5	3.83	3.1	6.16	3.2	-0.8	6.9	8.64	11.58	0.0
1930	49	44	2.3	3.54	4.3	5.69	3.8	-2.5	8.2	-7.63	-7.57	0.0
1931	45	43	2.0	2.60	4.6	5.34	3.3	-8.8	14.1	-6.15	-26.54	-8.2
1932	38	39	2.1	1.39	5.8	5.62	3.0	-10.3	15.9	5.24	-46.67	-15.6
1933	30	26	2.2	1.53	5.0	5.00	2.5	-5.1	10.1	-11.03	10.36	-21.1
1934	31	33	2.1	1.85	5.5	5.00	3.1	3.4	1.6	0.00	20.97	3.3
1935	31	35	2.7	2.02	5.4	4.00	2.7	2.5	1.5	-20.00	9.10	0.0
1936	32	40	3.0	1.50	6.0	4.00	3.0	1.0	3.0	0.00	-25.66	3.2
1937	33	40	3.1	1.26	5.8	4.00	3.1	3.6	0.4	0.00	-15.96	3.1
1938	33	44	3.5	1.11	6.8	4.00	3.5	-1.9	5.9	0.00	-12.12	0.0
1939	32	40	2.5	0.93	6.3	4.00	2.5	-1.4	5.4	0.00	-15.92	-3.0
1940	30	39	2.5	0.63	6.4	4.00	2.5	1.0	3.0	0.00	-32.47	-6.3
1941	30	43	3.5	0.59	7.2	4.00	3.5	5.0	-1.0	0.00	-6.22	0.0
1942	31	46	4.0	0.84	7.0	4.00	4.0	10.7	-6.7	0.00	41.73	3.3
1943	34	58	6.2	1.06	9.3	4.00	6.2	6.1	-2.1	0.00	27.11	9.7
1944	39	64	6.0	1.20	9.4	4.00	6.0	1.7	2.3	0.00	13.22	14.7
1945	45	72	5.7	1.10	9.3	4.00	5.7	2.3	1.7	0.00	-8.61	15.4
1946	48	71	4.5	1.04	8.3	4.00	4.5	8.5	-4.5	0.00	-5.10	6.7
1947	56	75	3.2	1.03	7.2	4.00	3.2	14.4	-10.4	0.00	-1.11	16.7
1948	65	92	3.7	1.14	7.6	4.00	3.7	7.8	-3.8	0.00	9.99	16.1
1949	67	91	3.6	1.18	7.5	4.00	3.6	-1.0	5.0	0.00	4.30	3.1
1950	66	82	2.8	1.22	6.3	4.00	2.8	1.0	3.0	0.00	2.94	-1.5
1951	73	105	4.3	1.28	8.2	4.00	4.3	7.9	-3.9	0.00	5.28	10.6
1952	80	134	6.3	1.43	10.1	4.00	6.3	2.2	1.8	0.00	11.23	9.6
1953	81	134	7.0	1.69	10.0	4.00	7.0	0.8	3.2	0.00	18.61	1.3
1954	79	124	7.4	1.66	9.3	4.00	7.4	0.5	3.5	0.00	-1.69	-2.5
1955	81	127	7.2	1.81	9.4	4.00	7.2	-0.4	4.4	0.00	8.49	2.5
1956	84	134	7.2	1.97	9.5	4.00	7.2	1.5	2.5	0.00	9.22	3.7

Table A-7. The "needed" and actual opportunity cost of capital, "needed" and actual interest rates on land mortgages, and the real interest rates.

(1) YEAR	(2) ACTUAL KANSAS LAND VALUE	(3) MODEL RESULTS BOTH EXPECT. ZERO	(4) AFTER-TAX OPPORT. COST THAT MAKES MODEL (COL. 3) EQUAL TO ACTUAL	(5) ACTUAL 3 YR. MOVING AVERAGE OPPORT. COST	(6) NOMINAL INTEREST RATES THAT MAKES MODEL (COL. 3) EQUAL TO ACTUAL	(7) ACTUAL INTEREST RATE	(8) OPP. COST THAT MAKES MODEL EQUAL ACTUAL WHEN INT. RATE ARE HELD AT 4 %	(9) CPI MEASURED INFLATION	(10) REAL INTEREST RATES	(11) ANNUAL PERCENT INTEREST RATE CHANGE	(12) ANNUAL PERCENT OPPORT. COST CHANGE	(13) KS LAND INFLATION
1957	87	121	6.0	2.46	9.0	5.00	7.0	3.6	1.4	25.00	24.96	3.6
1958	93	121	5.5	2.55	8.3	5.00	6.2	2.7	2.3	0.00	3.54	6.9
1959	98	121	4.3	2.87	8.1	5.50	7.5	0.8	4.7	10.00	12.65	5.4
1960	101	120	5.1	2.97	8.2	6.00	7.8	1.6	4.4	9.09	3.43	3.1
1961	102	119	4.7	3.18	7.4	5.50	7.3	1.0	4.5	-8.33	6.93	1.0
1962	107	137	5.5	2.98	8.3	5.50	8.2	1.1	4.4	0.00	-6.38	4.9
1963	112	146	6.0	2.90	8.7	5.50	8.7	1.2	4.3	0.00	-2.42	4.7
1964	115	146	6.0	3.05	8.5	5.50	7.5	1.3	4.2	0.00	5.16	2.7
1965	123	147	4.8	3.27	7.8	5.50	7.0	1.7	3.8	0.00	7.06	7.0
1966	135	157	5.5	3.67	7.9	6.00	7.7	2.9	3.1	9.09	12.27	9.8
1967	144	151	5.6	3.95	6.6	6.00	6.4	2.9	3.1	0.00	7.52	6.7
1968	156	141	3.2	4.29	5.6	7.00	5.9	4.2	2.8	16.67	8.66	8.3
1969	162	131	2.5	4.74	5.3	8.00	5.9	5.4	2.6	14.29	10.64	3.8
1970	159	119	2.0	5.20	4.8	8.75	5.9	5.9	2.8	9.38	9.63	-1.9
1971	162	132	2.3	5.13	4.9	7.75	5.9	4.3	3.5	-11.43	-1.28	1.9
1972	174	143	2.6	4.61	4.8	7.50	5.2	3.3	4.2	-3.23	-10.20	7.4
1973	199	166	2.6	4.04	4.5	7.50	4.3	6.2	1.3	0.00	-12.44	14.4
1974	253	201	2.0	4.26	4.6	8.25	4.8	11.0	-2.7	10.00	5.54	27.1
1975	296	219	1.8	4.80	5.3	8.50	5.1	9.1	-0.6	3.03	12.65	17.0
1976	342	234	1.5	5.40	3.5	8.50	4.9	5.8	2.7	0.00	12.46	15.5
1977	398	244	1.1	5.55	2.0	8.25	3.8	6.5	1.8	-2.94	2.80	16.4
1978	418	234	0.5	5.68	1.0	8.50	3.3	7.7	0.8	3.03	2.38	5.0
1979	501	288	0.4	5.65	0.1	9.00	2.5	11.3	-2.3	5.88	-0.46	19.9
1980	573	249	0.1	6.82	0.1	10.75	3.1	13.5	-2.8	19.44	20.64	14.4
1981	590	218	0.1	8.24	0.1	12.00	3.0	10.4	1.6	11.63	20.83	3.0
1982	585	196	0.1	9.44	0.1	13.00	3.1	6.1	6.9	8.33	14.50	-0.8
1983	544	203	0.1	9.30	0.1	11.75	3.4	3.2	8.5	-9.62	-1.49	-7.0
1984	528	200	0.1	9.35	0.1	11.50	3.5	4.0	7.5	-2.13	0.54	-2.9

Table A-8. Kansas and national land values and annual inflation levels, net rent to land value ratio, and the traditional capitalization model's values.

(1) YEAR	(2) MODEL RESULTS BOTH EXPECT. ZERO	(3) KANSAS LAND VALUE	(4) KS LAND INFLATION	(5) NATIONAL LAND VALUE	(6) NATIONAL LAND INFLATION	(7) NET RENT/ LAND VALUE RATIO (x 100)	(8) TRAD. CAP. FORMULA LV=nr/i USED	(9) CPI	(10) CPI MEASURED INFLATION
1914		41				3.51			
1915		43	4.9			3.51			
1916		45	4.7			3.51			
1917		48	6.7			3.50			
1918		51	6.3	53	8.2	3.51			
1919		55	7.8	58	9.4	3.51			
1920		62	12.7	69	19.0	3.50			
1921		62	0.0	65	-5.8	3.50			
1922		55	-11.3	57	-12.3	3.51			
1923		54	-1.8	56	-1.8	3.50			
1924		51	5.6	54	-3.6	3.51			
1925	42	50	-2.0	54	0.0	3.56	31.84	49.0	
1926	41	49	-2.0	52	-3.7	3.39	29.91	52.5	7.1
1927	40	49	0.0	50	-3.8	3.35	29.60	52.0	-1.0
1928	38	49	0.0	49	-2.0	3.33	28.75	51.7	-0.6
1929	37	49	0.0	49	0.0	3.61	28.73	51.3	-0.8
1930	44	49	0.0	49	0.0	4.04	34.80	50.0	-2.5
1931	43	45	-8.2	44	-10.2	3.67	30.90	45.6	-8.8
1932	39	38	-15.6	37	-15.9	3.42	23.13	40.9	-10.3
1933	26	30	-21.1	30	-18.9	3.13	18.80	38.8	-5.1
1934	33	31	3.3	31	3.3	3.68	22.80	40.1	3.4
1935	35	31	0.0	32	3.2	3.48	27.00	41.1	2.5
1936	40	32	3.2	32	0.0	3.63	29.00	41.5	1.0
1937	40	33	3.1	33	3.1	3.33	27.50	43.0	3.6
1938	44	33	0.0	33	0.0	3.82	31.50	42.2	-1.9
1939	40	32	-3.0	32	-3.0	3.31	26.50	41.6	-1.4
1940	39	30	-6.3	32	0.0	3.30	24.75	42.0	1.0
1941	43	30	0.0	32	0.0	3.87	29.00	44.1	5.0
1942	46	31	3.3	34	6.3	4.29	33.25	48.8	10.7
1943	58	34	9.7	38	11.8	5.62	47.75	51.8	6.1
1944	64	39	14.7	43	13.2	5.44	53.00	52.7	1.7
1945	72	45	15.4	47	9.3	5.20	58.50	53.9	2.3
1946	71	48	6.7	53	12.8	4.56	54.75	58.5	8.5
1947	75	56	16.7	60	13.2	3.91	54.75	66.9	14.4
1948	92	65	16.1	64	6.7	4.42	71.75	72.1	7.8
1949	91	67	3.1	66	3.1	4.24	71.00	71.4	-1.0
1950	82	66	-1.5	65	-1.5	3.76	62.00	72.1	1.0
1951	105	73	10.6	74	13.8	4.77	87.00	77.8	7.9
1952	134	80	9.6	82	10.8	6.16	123.25	79.5	2.2
1953	134	81	1.3	83	1.2	6.23	126.25	80.1	0.8
1954	124	79	-2.5	82	-1.2	5.76	113.75	80.5	0.5
1955	127	81	2.5	85	3.7	5.84	118.25	80.2	-0.4
1956	134	84	3.7	90	5.9	6.12	128.50	81.4	1.5

Table A-8. Kansas and national land values and annual inflation levels, net rent to land value ratio, and the traditional capitalization model's values.

(1) YEAR	(2) MODEL RESULTS BOTH EXPECT. ZERO	(3) KANSAS LAND VALUE	(4) KS LAND INFLATION	(5) NATIONAL LAND VALUE	(6) NATIONAL LAND INFLATION	(7) NET RENT/ LAND VALUE RATIO (x 100)	(8) TRAD. CAP. FORMULA LV=nr/i USED	(9) CPI	(10) CPI MEASURED INFLATION
1957	121	87	3.6	97	7.8	6.17	107.40	84.3	3.6
1958	121	93	6.9	103	6.2	5.83	108.40	86.6	2.7
1959	121	98	5.4	111	7.8	5.93	105.64	87.3	0.8
1960	120	101	3.1	117	5.4	6.03	101.50	88.7	1.6
1961	119	102	1.0	119	1.7	5.75	106.73	89.6	1.0
1962	137	107	4.9	125	5.0	6.19	120.36	90.6	1.1
1963	146	112	4.7	130	4.0	6.37	129.64	91.7	1.2
1964	146	115	2.7	138	6.2	6.27	131.09	92.9	1.3
1965	147	123	7.0	147	6.5	5.93	132.73	94.5	1.7
1966	157	135	9.8	158	7.5	6.39	143.67	97.2	2.9
1967	151	144	6.7	168	6.3	5.77	138.50	100.0	2.9
1968	141	156	8.3	179	6.5	5.52	123.00	104.2	4.2
1969	131	162	3.8	189	5.6	5.55	112.38	109.8	5.4
1970	119	159	-1.9	196	3.7	5.80	105.37	116.3	5.9
1971	132	162	1.9	203	3.6	5.83	121.94	121.3	4.3
1972	143	174	7.4	219	7.9	5.74	133.07	125.3	3.3
1973	166	199	14.4	246	12.3	5.90	156.53	133.1	6.2
1974	201	253	27.1	302	22.8	5.74	175.88	147.7	11.0
1975	219	296	17.0	340	12.6	5.49	191.06	161.2	9.1
1976	234	342	15.5	397	16.8	5.12	205.88	170.5	5.8
1977	244	398	16.4	474	19.4	4.44	214.06	181.5	6.5
1978	234	418	5.0	531	12.0	4.27	209.76	195.4	7.7
1979	288	501	19.9	628	18.3	4.21	234.22	217.4	11.3
1980	249	573	14.4	725	15.4	4.02	214.05	246.8	13.5
1981	218	590	3.0	795	9.7	4.10	201.50	272.4	10.4
1982	196	585	-0.8	789	-0.8	4.20	191.15	289.1	6.1
1983	203	544	-7.0	743	-5.8	4.20	194.55	298.4	3.2
1984	200	528	-2.9	739	-0.5	4.20	192.87	310.4	4.0

Table A-9. Scenario of interest rates and opportunity costs that allows the model to obtain the five different land values.

(1)	(2)	(3)	(4)	(5)	(6)
ASSUMED INTEREST RATE ON LAND MORTGAGE	OPPORT. COST NEEDED TO GET A LAND VALUE OF $528/ ACRE	OPPORT. COST NEEDED TO GET A LAND VALUE OF $450/ ACRE	OPPORT. COST NEEDED TO GET A LAND VALUE OF $375/ ACRE	OPPORT. COST NEEDED TO GET A LAND VALUE OF $300/ ACRE	OPPORT. COST NEEDED TO GET A LAND VALUE OF $200/ ACRE
4	3.5	4.7	6.5	9.9	21.0
6	2.0	3.0	4.6	7.3	17.0
8	.7	1.6	2.7	5.2	14.0
10	.1	.3	1.4	3.3	10.0
12	.1	.1	.2	1.7	7.5
14	.1	.1	.1	.5	5.0

Table A-10. Scenario of interest rates and net rents that allows the model to obtain the five different land values.

(1) ASSUMED INTEREST RATE ON LAND MORTGAGE	(2) NET RENT NEEDED TO GET A LAND VALUE OF $528/ ACRE	(3) NET RENT NEEDED TO GET A LAND VALUE OF $450/ ACRE	(4) NET RENT NEEDED TO GET A LAND VALUE OF $375/ ACRE	(5) NET RENT NEEDED TO GET A LAND VALUE OF $300/ ACRE	(6) NET RENT NEEDED TO GET A LAND VALUE OF $200/ ACRE
4.0	38.0	32.5	27.0	21.5	14.5
6.0	43.5	37.0	31.0	24.5	16.5
8.0	49.5	42.5	35.5	28.0	19.0
10.0	56.5	48.0	40.0	32.0	21.5
12.0	63.0	54.0	45.0	36.0	24.0
14.0	70.0	60.0	50.0	40.0	26.5

A COMPARISON BETWEEN THE INVESTMENT VALUE AND
MARKET VALUE OF KANSAS AGRICULTURAL LAND

By

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AN ABSTRACT OF A MASTER'S THESIS

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1985

The purpose of this study was to compare the investment value and market value of Kansas farmland from 1925 to 1984 and to explore the relationships between four important variables and actual land values.

The investment value seems unrelated to actual land values with no consistent differences, patterns, or lags. Four attempt were made to incorporate future expectations of land inflation and net rent growth into the investment value model. The model with both future expectation variables held constant at zero resulted in the investment values closest to the actual land values. Even in this case the model was as much as 70 percent above the actual value in 1943 and 66 percent below the actual value in 1982. This suggests that land was undervalued from the early 1940's to the mid 1960's and overvalued from the mid 1960's to 1984. Comparisons were made between the actual values of the four most important variables in the investment model (future expectations in net rent growth and land inflation, interest rates on land mortgages, and opportunity cost of capital) and the values of each variable that would make the model's value equal to the actual land values. The investment values of the model were much more sensitive to these variables than was the actual land market. The recent overvaluation of land prices was particularly noticable when comparing actual interest rates to interest rates needed to generate investment values equal to market values.

Scenarios were developed showing interest rate-opportunity cost combinations and interest rate-net rent combinations that makes the model's investment value in equilibrium at five different land values. For the market value to approach the investment value the land value, interest rate, and opportunity cost need to decrease by relatively large amounts and net rent need to increase by a relatively large amount to attain an equilibrium in the land market. This suggests that continued high interest rates, opportunity costs and no net rent growth may lead to more land deflation. It was suggested that established farmers will probably keep land from falling to the equilibrium point. It was also suggested that larger farmers will be the major buyer of farmland in the future leading to larger farms and more concentrated farmland wealth.