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A Cross Sectional Study of Farmland Prices in South Dakota 1976-1984

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A CROSS SECTIONAL STUDY OF FARMLAND PRICES IN SOUTH DAKOTA 1976-1984

BY

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PRICES IN SOUTH DAKOTA 1976-1984

This thesis is approved as a creditable and independent study by a candidate for the degree, Master of Science, and is acceptable for meeting the thesis requirements for this degree. Acceptance of this thesis does not imply that the conclusions reached by the candidate are necessarily the conclusions of the major department.

Dr. Larry L. Janssen Date
Major and Thesis Advisor

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Finally, this thesis is dedicated to the farmers and ranchers of South Dakota who currently are experiencing problems and hardships, with the hope that they overcome their problems in the near future.

M.Z.H.

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CHAPTER I

INTRODUCTION

Man is interested in land either for direct use as a consumption good, such as a homesite or for recreation, or as a factor of production, a means of making a living. Man uses it as an instrument for the creation of economic goods and services, either for the satisfaction of his own wants or to exchange with others for goods and services they have to offer (Ely and Wehrwein, p. 24-25).

The value of farmland concerns man for many reasons and in the market it is an important item of interest to landowners, buyers and sellers of farm real estate, agricultural lenders, land appraisers and public officals. The important items of interest are the distribution of wealth, income received from its use and real estate taxation (Folke Dovering, p. 11).

Problem Statement

U.S. land prices experienced a skyrocketing trend with the increase of commodity prices during World War I, collapsed with prices in 1921, remained steady in the 1920's, collapsed again with the farm prices in early 1930's, recovered slowly as farm prices increased in the late 30's and during World War II. In the lull between World War II and Korean War, farm prices and land values moved upward together (Walter E. Chryst).

Consistent with the majority of regions in the United States, agricultural land prices in South Dakota also fluctuated during the first half of the twentieth century. South Dakota's average farmland values increased from $39 per acre in 1910 to a peak of $71 per acre in

1920. Values then declined to a low of $12 per acre in 1941. Farmland prices then began another upward trend (Larry Janssen, Jan. 1985).

South Dakota farmland values increased at a steady 3-5% annual rate from 1950 to 1973. From 1973 to 1981, farmland value increases accelerated to 17% per year with some year-to-year increases exceeding 25%. This boom in land values was directly related to rapid growth in export demand and major changes in international economic and trade policies.

South Dakota farmland values peaked in late 1981 and early 1982 and have since declined. Changing federal economic policies (leading, for example, to high deficits/spending, interest rates and exchange rates) and unfavorable export market developments have been the major contributing factors (Larry Janssen, Oct. 1985).

The change in farmland prices influences the wealth of the landowners and buyers. It also has significant influences on the lending policies of the agricultural lenders, who usually are concerned with the security of their loan. Farmland prices influence property tax assessments, tax revenues, and publicly sponsored farm credit programs. Farmland price changes also have significant influence on investors who may wish to invest their capital in farm real estate.

Various factors within and outside the domain of agricultural economy influence the change in farmland prices, e.g., expected returns, technological advance, location, tax policies and flexible exchange rates. In recent years, a "strong" dollar adversely affected the levels of agricultural exports, commodity prices and farmland values.

The factors that influence recent changes in agricultural land values in South Dakota are the underlying bases for this research effort.

Research Objectives

The main objective of this research effort is to determine the significance of factors influencing farmland prices in South Dakota and in different regions in the state between January 1976 and June 1984.

Specific objectives are to:

(1) develop cross-sectional econometric models to explain variation in farmland prices in (a) South Dakota and in (b) different regions in the state.

(2) determine the significance of added location variables to explain variation in farmland prices, statewide and by region.

(3) determine the significance of added financial/lender variables to explain variation in farmland prices, statewide and by region.

(4) test the stability of coefficients over different time periods. Time periods used are: (a) 1976-78 (b) 1979-81½ and (c) 1981½-84½.

Procedures

Multiple regression and analysis of covariance are the statistical techniques used to complete the objectives of this study. Cross-sectional data are used to estimate the relationships between the dependent variable, deflated per acre farmland price, and selected explanatory variables. Two types of model are developed: The state

model and regional models. The regional models are based on crop reporting districts in the state.

Data Sources

Data used in this study for individual sale tracts are collected from the Federal Land Bank of Omaha, Nebraska. Officials at each Federal Land Bank Association (FLBA) office record information on all bona fide farmland sales, made known to them within their territory. Farmland sales of forty acres or more are recorded by means of FLB's prescribed "Farm and Ranch sale sheet". This sale sheet provides information on location and legal description of the tracts, buildings, price paid, financing term of the transaction, productivity and income potential and other key variables. (A copy of the FLB farmland sale sheet is available in appendix).

Data are collected statewide and maintained at the FLB's computerized databank in Omaha, Nebraska. This computerized dataset is made available for this study by cooperative agreement between the Farm Credit Banks of Omaha and the Economics Department of South Dakota State University.

Organization of Study

This thesis contains seven chapters. Chapter one contains the introduction, problem statement, research objectives, outline of procedures and data source. Chapter two includes discussion of economic theory of land resource use and pricing and a review of empirical literature on cross-sectional and time series studies of land valuation. Research methodology used to complete this study is discussed in chapter three. A discussion of conceptual and empirical

models, model specifications, selection of variables, selection of time period and test of hypotheses are included in this chapter. Empirical results of the state model are the subject of chapter four. Chapter five contains the empirical results of the base equation in each region for the entire time period and for each time period. Results of the final equation for each region are discussed in chapter six. Statistical tests and results of added location and financial/lender variables explaining farmland values in each region are also discussed in chapter six. Statistical tests for stability of coefficients across time periods for each regional model are discussed in this chapter. The final chapter (seven) contains the summary, conclusions and implications of this research effort.

CHAPTER II

ECONOMIC THEORY OF LAND VALUATION AND REVIEW OF EMPIRICAL LITERATURE

Introduction

This chapter includes (1) discussion of economic theory related to land resource use and pricing and (2) review of empirical literatures concerning agricultural land valuation. Economic theory of land valuation includes brief discussion on economic supply and demand of land, Johann Von Thunen's location theory, Ricardo's rent theory and characteristics of farm real estate markets.

Economic Theory of Land Resource Use and Pricing

Land is an economic good, it satisfies human needs and wants. Land is useful as: (1) soil, a major component of life supporting system, (2) substrate - it provides support for plants and animals, water courses, buildings, transportation arteries etc. (3) store of value: it stores stocks of minerals, fossil fuel etc. Land is a factor of production, the source of food, fibers, building materials, mineral resources and other raw materials used in modern society (Alan Randall, p. 16-17).

Economic supply of land

The economic supply of land is that portion of physical quantity of land which we use. It is responsive to price and demand factors and reflects the scarcity or abundance of physical land resources, their relative accessibility and their general use capacity. The supply can be expanded or contracted and in an ultimate sense it is

limited only by the total physical quantity of land (Barlowe, p. 18-20).

The supply concept used in explaining land prices is an aggregate supply function stating the quantities of farmland which would be offered for sale at various prices. Farmland is offered on the market and contributes to the supply when an agricultural landowner decides to sell his farm. Several reasons may be listed which contribute to the economic supply: death of owners, financial pressure arising from family or personal circumstances, occupational mobility, locational mobility of the landowners and capital appreciation.

It is assumed that the individual's supply function for land is inelastic, but even if it is assumed that above the minimum sale price an individual's supply function is perfectly inelastic, aggregate supply is not perfectly inelastic if individuals enter the market at different prices.

Different minimum prices acceptable to various suppliers have the effect of increasing the amount of land offered on the market as price rises. The aggregate supply function therefore, slopes upward in the normal way and for this reason should be explicitly included in the analysis of farmland prices (Herdt and Cochrane, p. 248-250).

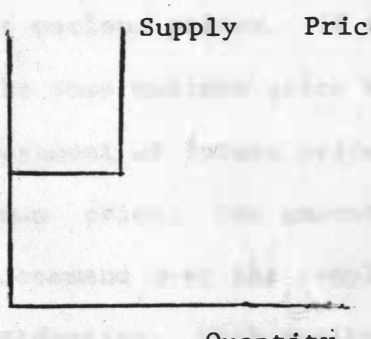

Figure 2.1
Individual supply curve of land.

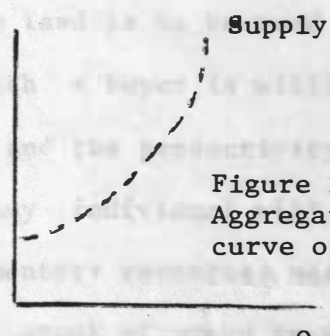

Figure 2.2
Aggregate supply curve of land.

Shifts in supply curve: Shifts in the farmland supply curve occur only when (1) some changes occur in landowner's ideas with respect to future price or profits or (2) when new knowledge or technological developments occur that affect the supply of the land itself.

Elasticity of supply of land: The supply of most type of lands are responsive to commodity price changes. When grain commodity prices are high relative to variable production costs and market outlook is favorable, grazing lands are often plowed and converted to crop production. When commodity prices drop, land uses are sometimes abandoned and areas often shift to lower uses. The elasticity of supply of land for any particular use or combination of uses are determined by its scarcity, fertility and accessibility (Barlowe, p. 20-21).

Economic Demand for Land

The demand for land is a derived demand. People are usually interested in the productive potential of the land or in its location, scenery or other advantages rather than in the land itself. People want land resources because they provide a means to an end. People want land because it offers opportunities for income and employment, because it can meet our various satisfactions.

The demand function for land is a schedule of the quantities of land purchased at various prices. If the land is to be used for farming there will be some maximum price which a buyer is willing to pay depending on assessment of future prices and the productivity of land. Below that maximum price, the amount any individual will demand is dependent on his command over the complementary resources necessary to make the land productive. With a given stock of money to invest, at

very high land prices a buyer will be able to command a meager amount of other capital and will buy a small amount of land. At lower land prices the same buyer will buy more. An individual demand curve slopes downward in the normal way. The aggregate demand curve will be negatively inclined because of the slopes of the individual demand curves, and because of differences in maximum price buyers are willing to pay (Herdt and Cochrane).

The pricing of final products and factors of production differs. Since the demand for land is a derived demand, its demand reflects indirectly the "utility" derived from the demand for final products, e.g. wheat, corn, housing etc., while the demand for the final products reflects directly the "utility" attached to them. The link between the demand for the final product and the demand for factors is closest when the amount of the factor required is rigidly and technically linked to the amount of the product (Milton Friedman, p. 148-161).

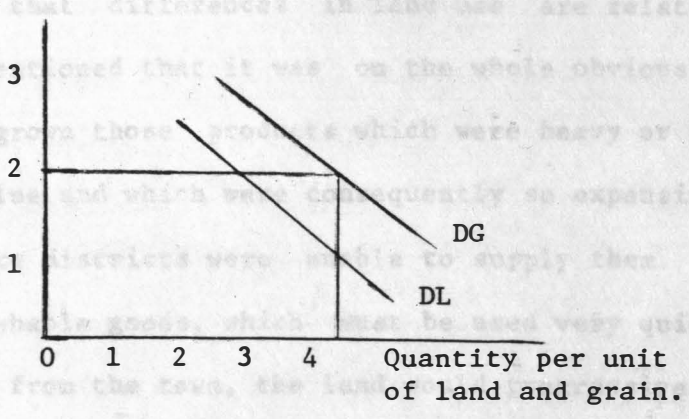

Figure 2.3
Derived demand curve for land.

In the diagram, the maximum price for grain can be obtained for any given amount of grain is given by the demand curve for grains.

There will be a movement along the demand curve, when the change in price per final product e.g. for grains, wheat, adequate housing, more school and recreational facilities occurs. Since demand for land is a derived demand, any change in the production potential of land will cause movement along the demand curve.

Shifts in the demand curve: Shifts in the demand curve will occur with any change in the demand for goods and services derived from land utilization. Shifts may also occur when changes in the market for the other factors of production--capital, labor or entrepreneurship, either through price changes or through innovations (Renne, p. 29-30).

Von Thunen's Location Theory

In economic uses of land, location and accessibility play important role for which various tracts of land are suited. Famous German economist Johann von Thunen in his work "the isolated state", discussed the importance of location of land. Von Thunen in his empirical studies found that differences in land use are related to transport costs. He mentioned that it was on the whole obvious that near the town would be grown those products which were heavy or bulky in relation to their value and which were consequently so expensive to transport that the remote districts were unable to supply them. Here also we found the perishable goods, which must be used very quickly. With increasing distance from the town, the land would progressively be given up to products cheap to transport in relation to their value. His intensity theory says that the intensity of production will,

ceteris paribus, depend on the price the farmer gets for his grain and that will depend directly on the transport cost and thus distance from the sole market.

Above land rent, he mentioned that the rent of a farm springs from its superiority in soil or location, over the least favored farm which is still producing for the market (Johann Von Thunen, p. 9-22).

Ricardo's Theory on Rent

Ricardo argued that in initial state only the most fertile lands would be used for cultivation to support the population and that no cost or economic rent would be associated with their use. But as the population increases, the demand for land increases, as a result people bring the less fertile land into cultivation and in this case rent arises on the most fertile land, and the amount of rent depends on the difference in the quality of the two portions of land.

Similarly, when land of lower quality is taken into cultivation, rent immediately commences on lower quality land. At the same time rent on the superior quality land will rise (Ricardo, p. 36-37). The following figure demonstrates Ricardo's rent theory.

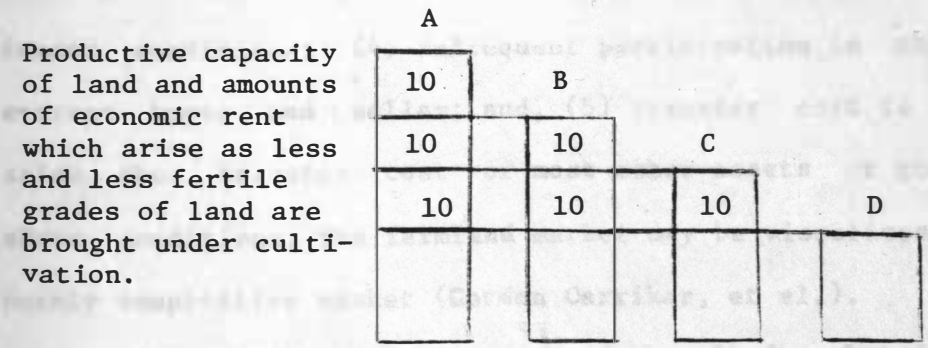

Figure 2.4 Illustration of Ricardo's explanation of economic rent(Barlowe, p. 153)

Both von Thunen and Ricardo did not take into consideration improvement made by man in land. Technological advance affecting land was also beyond their consideration. Due to technological advances applied to land (fertilizer, insecticides and other) less fertile land has been turned into more productive land. Human capital has therefore played an important role in land economics.

Alfred Marshall felt that the rent of farmland, in a settled country, is based on three factors: the first being due to the value of the soil as it was made by the nature, the second to improvements made in it by man, and the third, which is often most important of all, to the growth of a dense and rich population and to facilities of communication by public roads, railroads etc. (Marshall, p. 156).

Characteristics of the Farm Real Estate Market

In economic theory, a purely competitive market is characterized by homogeneous products, large numbers of buyers and sellers, free entry into the market, perfect knowledge. Unlike the pure competitive market, the farm real estate market is characterized by: (1) fixed location of land; (2) heterogeneous nature of the land because each parcel has unique attributes; (3) dependence on local supply and demand conditions; (4) infrequent participation in the market by the average buyer and seller; and, (5) transfer cost is higher for land sales than transfer cost of most other assets or goods. Under the above conditions, the farmland market may be visualized as a less than purely competitive market (Gordon Carriker, et al.).

The equilibrium condition of the land market is determined by the willingness of the buyers to pay the minimum acceptable price of

the seller. The buyer's bid price is determined on the basis of several considerations. These are: (1) the projected net cash return to land; (2) the cost of debt capital and equity capital; (3) his marginal tax rates; (4) how much he thinks the land's value will appreciate; (5) how much he thinks the net and cash returns to land will increase in years to come; and, (6) his planning horizon--how far into the future he looks as he calculates both profitability and repayment ability (Rick Klemme).

Considering those factors the buyer will determine his bid price which intersect with the seller's minimum supply price and the land market will reach the equilibrium position.

Review of Empirical Literature

Explanation of farm real estate price variation has historically been an important topic of agricultural economic research. Researchers have used econometric analysis, with time series or cross-sectional data at different geographical levels (national, state or county) to determine the factors influencing the variation of farmland prices. This section includes a review of empirical literature, both cross-sectional and time series, pertinent to this thesis.

Cross-sectional Models:

Shalit and Schmitz (1984) found the impact of credit granted on the basis of the net wealth on land prices. They mentioned that the accumulation of farm real estate debt accelerates the rate of increase of farmland values up to the level where the amount of debt burdens the farmers and forces them to sell some land. Then prices fall and credit terms are strengthened to reduce debt size. This cycling behaviour of the real estate debt is, in fact, destabilizing farmland values.

In their previous model of farmland accumulation, emphasizing the factors affecting farmland prices, they indicated that savings (difference between farm income and consumption) and accumulated real estate debt are the main determinants of high farmland prices.

Tim T. Phipps (1984) using causality techniques, found that farm based returns cause farmland prices, but farmland prices do not cause farm based returns. Aggregate farmland price movements, therefore, should be closely tied to factors that affect farm-based

returns, such as agricultural policies or changes in domestic and world markets, he added.

Anne E. Hammill (1969) in her study of "variables related to farm real estate values in Minnesota counties" developed a regression model using four variables (population/distance, crop production value index, percent cropland, percent rural nonfarm and urban). She found that the variables had important influences on county real estate values in 1959 and 1964.

Clifton and Spurlock (1983) in their work presented a model of per acre farm real estate price for the Southeastern U.S. for the period 1971 to 1979. The authors used the databank of the Federal Land Bank of Columbia, SC, for four states, South Carolina, North Carolina, Florida and Georgia. They grouped farmland sales into homogeneous regions by means of sixteen county-specific demographic factors. For each region, the researchers used Ordinary Least Squares methods to estimate the coefficients on per acre value of farm buildings, the reciprocal of tract size, reason for purchase, degree of urban influence, percent of tract in timberland and a subjective measure of income stability.

Fred C. White and Rod F. Ziemer (1982) used regression model in their work on "farm real estate price under risk". They included expected farm real estate returns per acre, variance of real estate returns and covariance of real estate and stock market returns as explanatory variables in their model. They found expected farm real estate returns per acre statistically significant having a positive effect on the average value of farm real estate. The regression

coefficient on the variance of farm real estate returns was significant and negative, indicating that as the variance in own returns increases the certainty equivalent of real estate returns decline.

Vollink (1978) divided North Carolina into four land market regions in order to analyze bona fide farmland sales data from the Federal Land Bank of Columbia, South Carolina, for the years of 1975 and 1976. The author used a single equation model and tested the significance of explanatory variables such as reason for purchase, size of tract, nonfarm influence, financier and pounds per acre of tobacco allotments. He found most of them significant.

Carriker, Curtis and Johnson (1984) used cross-sectional data in their research for estimating Nebraska agricultural land prices from 1978 to 1982. They found that the percent of land cultivated, percent in pasture, urban influence, irrigation and time were significant factors.

William E. Burton and James R. Nelson (1982) developed three models to explain the variation in rural real estate values in Eastern Oklahoma. The models were used to estimate the (a) values of all rural real estate, (b) values of rural agricultural real estate and (c) values of rural non-agricultural real estate. They found that the value of improvements per acre and the distance to the nearest county seat have a significant impact on the value of rural agricultural real estate.

Sandrey (1982) pooled time-series and cross-sectional data together to identify the variables influencing farmland prices in

Oregon. He used OLS regression methods, the model was first estimated in linear logarithmic form, using county level price data from six U.S. census of agriculture from 1954 to 1978. The explanatory variables used were value of agricultural sales per acre, capital gains, average farm size, irrigation, population density and percent of land in farms. The empirical model showed that the value of agricultural product sales had a positive effect on farm land values while average farm size and percent of farmland had a negative effect.

Larry Janssen and Cindy Swinson (1985) developed four equations to explain the variation in per acre land price in South Dakota. They compared two time periods, 1979-80 and 1981-82. The authors found soil productivity rating, proportion of cultivated acre, location, distance to local and regional market centers and farm buildings were significant. They found that structural changes in farmland prices probably occurred between periods of rising and declining prices.

An earlier study by Swinson indicated the coefficients for the variables of soil productivity, product grain, location, sale method private, percent of tract cultivated, percent of tract irrigated, building value per acre, distance to local market and month of sales are significant to explain the variation in per acre land price.

Fred Westin et. al. (1973) studied the relationship between soil productivity/climatic factors and South Dakota farmland sale prices from 1967 to 1969. Soil slopes, average precipitation,

temperature, and soil family texture were used as explanatory variables in their regression model to explain per acre price. Average precipitation explained the most variation in per acre land price in their model.

Time Series Models:

Walter E. Chryst (1965) found that technology alone can be expected to decrease returns to land and land values unless differential rates and or immobility of labor causes a major change in relative distribution toward land. Price and income support programs alone will tend to increase rents and land values. The interaction of technological advance and price and income support programs has a strong positive effect upon land income and values.

Reinsel and Reinsel (1979) mentioned that if the terms of trade in land are modified by changing access to debt financing and interest rates, this will shift the demand for farm real estate to the extent they modify the ability of buyers, with a given set of earnings expectations, to bid for land. They added that an extension of the payment period, a reduction in the down payment or lower interest rate will each result in an increase in the number of potential buyers at any price. The authors also mentioned that tax policy alters the earnings of land through taxation of receipts from production, taxation of appreciation (capital gains), and taxation of real estate values. Preferential or use value assessment of real estate has also changed land values.

Tweeten and Martin's (1966) recursive model used a combination of ordinary least squares, autoregressive least squares

and recursive least squares methods to reach a final estimate of the deflated price index of the United States farm real estate for the period of 1923 thru 1963. Their main question was "Are land prices too high"? Their process involved initial estimation of three exogenous variables - number of U.S. farm transfers per thousand farms, number of U.S. farms in thousands, and millions of acres of cropland - by way of ordinary or autoregressive least squares methods. The estimates were then incorporated into two final equations to explain the two endogenous variables - land in farms in millions of acres and deflated U.S. farm real estate per acre price index - by way of ordinary, autoregressive or recursive least squares.

John R. Ottensmann (1977) found that land values would be directly affected by levels of expectations and hence population change. In addition, population and income levels were expected to have direct effects on land prices. In his regression model, he found that a one percent increase in the rate of population growth produced a twenty-five to fifty dollar per acre increase in land prices across fifty-one metropolitan areas. Each additional thousand population was associated with approximately a one dollar increment in median incomes and produces a twenty-to-forty cent increase in land values.

Castle and Hoch (1982) developed an expectation model to examine actual agricultural real estate price behaviour from early 1920 to 1978. Their expectations model attempts to identify and differentiate monetary components that a prospective investor uses in constructing an expected real estate price. The authors then

estimated annual values for those components and employed their respective totals to predict actual price. Their results support the thesis that recent increases in agricultural real estate prices cannot be explained on the basis of earnings in agricultural production alone. The capital value of farm real estate appears to involve considerably more than the capitalized value of current rents for its services in agricultural production. It appears to include the capitalized value of a stream of expected future increases (or decreases) in rent plus capital gains (or losses) not associated with the service flows in agricultural porduction.

Martin Feldstein (1980) indicated that changes in the rate of inflation alter the relative price of assets while at any constant inflation rate equilibrium real estate prices remain unchanged. Thus an unanticipated jump in the expected rate of inflation causes an immediate jump in the level of the land prices.

Herdt and Cochrane (1966) used a simultaneous supply-demand model and found that technological advance is a main source of price changes over time.

Reynolds and Timmons (1969) used a two equation recursive model to identify the factors influencing the variation of farmland prices in the U.S. from 1933 to 1965. Their work found that most of the land price variations are influenced by expected capital gains, government program payments, farm enlargement and rates of return on common stock.

Duncan (1977) presented a single equation model to explain the farm real estate market in the U.S. He used a time series model

of the U.S. farmland values, and used data for the time period of 1929-1975. His research found that farm enlargement pressures, expected capital gains and farm incomes are the main determinants of U.S. farmland prices.

Summary of Empirical Literature

Researchers using cross-sectional models to explain farm real estate price variation have generally found that land tract and location variables have significant influence on farm real estate price. They concluded that percent cropland, size of tract, value of farm buildings, per acre returns, percent irrigated tract and nonfarm influences are significant factors to explain farm real estate price variation.

Researchers using time series models found that price and income support programs, tax policies, population change, levels of expectation, farm enlargement pressures, expected capital gains, inflation, technological advance and the change in domestic and world markets of agricultural products are significant factors to explain farm real estate price variation over time.

CHAPTER III

DEVELOPMENT AND SPECIFICATIONS OF ECONOMETRIC MODELS

Introduction

This chapter includes: (1) conceptual and empirical models for farmland valuations, (2) statistical model specifications of the state and regional models, (3) selection of time period, (4) selection of dependent and explanatory variables, (5) data limitations and (6) statistical tests of hypotheses. Statistical tests conducted in this study include: (a) significance of individual variables, (b) significance of added variables and (c) stability of coefficients over different time periods.

Conceptual Model

Agricultural economists have conducted considerable research explaining farm land prices in different regions and localities in the United States. They have developed many models to explain the relationship between the dependent variable, per acre land price and various explanatory variables. Researchers have identified several key factors which explain the variation in farmland prices. They found the factors that explain farmland price movement over time are: expected returns from the land, farm technological advance, inflation, tax policy, price and income support programs and institutional factors such as zoning regulations.

Researchers have also identified several factors that influence farmland price in a given time period. The key factors are expected returns from the land, location, soil productivity, nonfarm influence,

interest rate, availability of loan, population density and principal products.

Empirical Model

Multiple regression and analysis of covariance techniques are used to determine the significance of the selected explanatory variables on the dependent variable, deflated per acre farmland sale price.

In the model, three categories of explanatory variables are used. These are land tract variables, location variables and financial/ lender variables. The empirical model of this study is:

$$P = f(X_{1i}, X_{2i}, X_{3i}/T)$$

where P = the dependent variable, the deflated per acre farmland price

X_{1i} = land tract and other selected variables

X_{2i} = location variables

X_{3i} = financial/lender variables

T = specific time period

Model Specifications

In this study, models have been developed to examine statewide and regional variations in South Dakota farmland sale prices. The statewide model is used to explain farmland price and to test selected hypotheses for the entire state. Regional models are developed to explain farmland prices in each region of the state. The regions used in this study are: Southeast, East Central, Northeast, North Central, Central, South Central and Western. (A map of South Dakota is included in this chapter to identify regional boundaries and county groupings within each region.)

Three separate equations are used in the statewide model and each regional model for the purpose of explaining farmland price variations and testing selected hypotheses. The equations are: base equation, equation II and final equation. The unit of observation for estimation of all models are individual sale tracts.

The base equation includes those variables which are hypothesized to explain the variation in per acre farmland prices. The base equation is as follows:

$$PPA = f(X_{1i})$$

Where dependent variable PPA = deflated price per acre

Acres purchased	= total acres purchased
Percent cropland	= percent of tract cultivated
Percent irrigated	= percent of tract irrigated
Dbvpa	= deflated building value per acre
Time	= time trend (values:

1 = 1/1976, 102 = 6/1984)

Principal products = products (wheat, corn, grain etc).

Nonfarm = nonfarm influences, e.g. residential, commercial, recreational.

Farm class = income security classification of sale tract.

Statistical model used for this equation is:

$$PPA = a + b_1 Ap + b_2 \text{ pct. crop} + \ldots\ldots + b_8 \text{ farm class} + e$$

where PPA = the dependent variable, deflated price of per acre farmland

Ap, Pct. crop.....farm class are the independent variables

$b_1 \ldots\ldots b_8$ are the regression coefficients of the model

a is the intercept term

and e is the error term

A more complete description of and reason for selecting each variable is presented in the next section.

Equation II for the state includes the variables in the base equation and the regional dummy variables (X_{2i}). The equation is altered in the following manner:

$$PPA = a + b_1 Ap + \ldots\ldots + b_8 \text{ farm class} + R_1 D_1 \ldots\ldots + R_{p-1} D_{p-1} + e$$

where Ap+.....+farm class are the base equation model specification

$D_1 \ldots\ldots D_{p-1}$ = binary variables for the first through (P-1)th region in state

$R_1 \ldots\ldots R_{p-1}$ = coefficient estimates for the first through (P-1)th regional dummy variables.

P = total number of regions in the state

e = error term

It should be noted that of the "P" regions in the state only "P-1" regions are assigned a dummy variable.

A similar equation for the regional model has been used. It includes the base equation and county dummy variables. One county in each region is used as intercept.

The final equation includes the base equation, county or regional dummy variables and the lender and financial variables. Final equation is presented below.

$$PPA = a_1 + b_1 \text{ Ap+.....+} b_8 \text{ farm class +}$$
$$C_1D_1 + \ldots\ldots + C_{n-1}D_{n-1} + b_9 \text{ pct. fin +}$$
$$b_{10} \text{ pct. cash + } b_{11} \text{ real interest + } b_{12}$$
$$\text{term + } F_1L_1 + \ldots\ldots + F_{L-1}L_{L-1} + e$$

where Ap..... farm class are the base equation model specification

$C_1D_1 \ldots\ldots C_{n-1}D_{n-1}$ = added county (regional) dummy variables.

$L_1 \ldots\ldots L_{k-1}$ = binary (zero-one dummy) variables for the first through (k-1)th lender variable in a region

$F_1 \ldots\ldots F_{k-1}$ = coefficient estimate for the first through (k-1)th lender variable in a region

pct. fin = percent of purchase price borrowed

pct. cash = percent of purchase price seller received upon settlement

real interest = real interest rate

term = years to repay note

$b_9 \ldots\ldots b_{12}$ = coefficient estimates of the corresponding variables

e = error term

a = intercept

Selection of Time Period

An 8½ year time period is selected in this study beginning from January 1976 through June 1984. There are several major reasons for selecting this time period. First, several trends in farmland prices, high interest rates and inflation rates were experienced during this time period. Farmland prices were rapidly increasing from 1976 to 1978 and nominal interest rates were relatively low but the inflation rate was increasing.

From 1979 to mid 1981 real (inflation adjusted) farmland prices started to decline (but nominal land prices were still increasing) and interest rates increased. The inflation rate also peaked at the same time. During this period the Federal Reserve changed its monetary policy which influenced the level of interest rates, exchange rates and other variables impacting farmland prices over time.

Since mid 1981, nominal and real farmland prices sharply declined and high nominal interest rates prevailed, the inflation rate declined rapidly and real interest rates increased. Considering these factors, the time period was selected to identify the factors influencing farmland prices in South Dakota. Another important consideration is the availability of data for this study. The Federal Land Bank of Omaha, which is the sole source of data, has adequate information on individual sale tracts during this time period.

Test of Hypotheses

In this study, t-tests are performed to find the significance of coefficients of each variable. Individual variables are identified as significant at different confidence levels. The confidence level assigned for these tests are .10, .05 and .01.

F-tests are also performed in this study for the models containing added variables to verify whether the added variables are significant. A confidence level of .01 is set to identify the significance of the added variables. The statistical equation used to compute the F-test for the added county variables is as follows:

$$\text{Calculated F-value} = \frac{(RSSE-USSE)/k}{USSE/n-p-1} \quad \text{(Johnston pp. 192-199)}$$

where RSSE = restricted error sum of squares of base equation

USSE = unrestricted error sum of square of equation II (with added county variables)

k = number of added parameters in equation II less number of parameters in base equation

p = number of explanatory variables in unrestricted equation

n = number of sales (observations)

The denominator of this equation is equivalent to the unrestricted mean square error. The equation is tested for a critical value of $F\alpha = 0.01$, with k degrees of freedom in the numerator and n-p-1 the degrees of freedom in the denominator and α respresents the level of significance.

A similar statistical equation is used to compute the F-tests for the added financial/lender variables. In this case the restricted model is equation II while the unrestricted model is the final equation with the financial/lender variables.

Another F-test is conducted to test the stability of coefficients over time. This F-test is performed with both the base equation and final equation. The statistical equation used to perform the F-test is as follows:

$$\text{F-value} = \frac{SSE_T - (SSE_1 + SSE_2 + SSE_3)/k}{(SSE_1 + SSE_2 + SSE_3)/(n+m+p-3k)}$$ (Maddala pp. 198-201)

where SSE_T = Error sum of squares in entire time period

SSE_1 = Error sum of squares in first time period

SSE_2 = Error sum of squares in second time period

SSE_3 = Error sum of squares in last time period

k = number of parameters including the intercept

n = number of sales (observations) in first time period

m = number of sales (observations) in second time period

p = number of sales (observations) in last time period.

This equation was tested for a critical value of $F\alpha = 0.01$, with k degrees of freedom in the numerator and n+m+p-3k the degrees of freedom in the denominator and α represents the level of significance.

Empirical results of added county and financial/lender variables and results of F-tests for stability of coefficients over time are discussed in chapter six.

Data Limitations

A total of 7207 sales are analyzed in this study. The Federal Land Bank recorded a total of 9746 sales during 1976 to mid 1984 time period with the use of the "Farm and Ranch sale sheet". Out of 9746 sales, 1470 sales of equity financed are deleted, because this variable is not used in the study. Another 275 sales are deleted because of no information or unusable information on product code such as dairy, feeder livestock etc. Another 792 sales are deleted because inadequate information was available on financing terms or other variables used in analysis besides "product codes". Finally, seven more sales are

deleted for very specific reasons. Among these seven sales, there are three in South Central, two in East Central and one each in Southeastern and North Central regions respectively.

In this study, regions have been used instead of Crop Reporting Districts (CRDs). Regions are based on CRDs. In South Dakota, there are nine "Crop Reporting Districts", and they have been divided into seven regions. All three Western CRDs are combined into a single region, western South Dakota, because of a low number of sale tracts in each western CRD. A total of seven regional models are developed in this study[1].

Selection of the Dependent and Explanatory Variables

Three different categories of explanatory variables are used in the model to explain variation in per acre farmland price, the dependent variable. In Table 3.1, the definition, abbreviations and types of these explanatory variables are presented. The variables indicated with a "C" are continuous variables, the variables indicated with a "D" are the zero-one dummy variables and the variables indicated with a D-I are zero-one dummy variables but are located in the intercept.

The dependent variable deflated per acre farmland price is used instead of nominal per acre price. During the time period selected for this study, several trends in farmland prices and fluctuations of inflation and the interest rates occurred. For example, farmland prices were rapidly increasing from 1976 to 1978, interest rates were low but the inflation rate was increasing. But from 1979 to mid 1981 real farmland prices started to decline and inflation rate also peaked at the same time. Since mid 1981, nominal and real farmland prices

Table 3.1 Abbreviations, Types and Definitions of Variables to Analyze Per Acre Farmland Price

Dependent Variable	Type	Definition
PPA	C	Deflated per acre farmland price (GNP-PCE adjusted)
Explanatory Variables		
Land Tract Variables		
Acres purchased	C	Number of acres purchased
Percent cropland	C	Percent of tract cultivated
Percent irrigated	C	Percent of tract irrigated
Dbvpa	C	Deflated building value per acre (GNP-PCE adjusted)
Nonfarm	D	Degree of nonfarm influence. If degree is greater than 1 then nonfarm influence present, otherwise no influence present
Product	D	
Farm class	D	Farm security class. If security is listed as A or B then farm class = 1, zero otherwise
Financial Variables		
Percent financed (borrowed)	C	Percent of purchase price financed by lender
Percent cash received	C	Percent of purchase price seller received upon settlement
Real interest	C	Interest rate (inflation adjusted by GNP-PCE deflator, 1972 = 100)
Term	C	Note term, length measured in years
Lsell	D-I	
LFLB	D	Primary lender, where Lsell = seller, LFLB = FLB
LFmHA	D	LFmHA = FmHA
Lother	D	Lother = other
Location and Other Variable		
Time	C	Month of sale (1 = January 1976.....102 = June 1984)
Counties	D	For regional model
	D-I	One County in the intercept for each region
Regions	D	For State model
	D-I	Central region in the intercept for State model

sharply declined and high nominal rates prevailed. During this period, inflation rate declined rapidly and real interest rates increased. Considering these factors, deflated per acre farmland prices is used instead of nominal per acre price. Deflated per acre price is calculated as the nominal price divided by the GNP deflator index for personal consumption expenditures (GNP-PCE, 1972 = 100) times 100.

Three categories of explanatory variables used in this model are land tract variables, financial/lender variables and other explanatory variables.

Land tract variables

Land tract variables used in this study are: acres purchased, percent irrigated, percent cropland, deflated building value per acre, principal products, nonfarm and farm class. These variables are included in each equation to explain the impact of land tract variables on per acre farmland price.

The relationship between the number of acres purchased and the per acre farmland price is expected to be negative. Because the buyers in the farmland market operate within a budget constraint which limits the size of the tract they may buy. Moreover, a high percentage of farm land is purchased for farm expansion. As a result, more buyers are interested in smaller tracts, so they can operate it within their existing operation.

Percent cropland in the sale tract is expected to show a positive influence on per acre farmland price. The expected net return of per acre cropland is generally higher than expected net return of pasture land.

Percent irrigated is also expected to have a positive relationship to the dependent variable[2]. The use of irrigation technologies has increased crop production. As a result, it increases the income of the owners, and reduces some production uncertainties.

The presence of buildings in the tract usually adds value to the property. Therefore, a positive relationship to per acre farmland price is expected. In the model building value of the tract is expressed on per acre basis. The total value of buildings assigned by FLB officals has been divided by total acres purchased. This per acre value is deflated by the GNP deflator index for personal consumption expenditures (GNP-PCE, 1972 = 100).

Principal products are included as binary variables. Principal products are selected because producers tend to select cropping patterns which produce the highest expected returns subject to some management, risk and technical constraints. Net returns per acre are expected to vary based on particular cropping patterns most suited to tracts. Principal products differ from region to region because of soil type, climate, management and other reasons. Detailed categories of principal products in different regions are shown in Table 3.2.

The explanatory variable "nonfarm" is included in this study to show the impact of alternative uses of farmland for residential, industrial, commercial or other nonfarm developmental purposes[3]. Income elasticity of these alternative uses is higher than the agricultural uses. Therefore, a positive sign is expected for this coefficient.

Farm class is used in the model as a binary (zero-one dummy) variable. It is expected to show a positive relationship to the

Table 3.2

List of Principal Products Used in State and Regional Models

State and Regions	Principal Products			
State	Pcorn	Pwheat	Pgrain	Pcowhay
Southeast	Pcorn	Pcowhay	---	---
East Central	Pcorn	Pcowhay	---	---
Northeast	Pgraincorn	Pcowhay	---	---
North Central	Pwheat	Pcowhay	---	Pgraincorn
Central	Pwheat	Pcowhay	---	Pgraincorn
South Central	Pwheat	Pcowhay	---	Pgraincorn
Western	Pwheat	Pcowhay	---	Pgraincorn

Where Pcorn = Corn or soybean
Pwheat = Spring and winter wheat
Pgraincorn = Corn, feed grains and mixed grains
Pgrain = Feed grains and mixed grains
Pcowhay = Range cattle, other cattle and roughage

Pcowhay is in the intercept in all equations of State and regional models.

In the Southeast and East Central regions wheat and mixed grains are included in the intercept, Pcowhay.

dependent variable. It implies that, given the FLB's classification scheme, general income stability as well as the quality of the general area and surrounding properties increases the transaction value of a sale property.

Financial/Lender variables

Financial variables used in the model are percent financed (borrowed), percent cash seller received, real interest, term and lenders.

Percent financed is the percent of purchase price financed by lenders. It is computed by the amount financed divided by the total purchase price times 100. It is expected to have a positive coefficient, because, as the proportion of debt financing increases, the down payment decreases permitting the buyer to pay more for the tract.

Percent cash seller received is computed by cash received divided by total purchase price times 100. This variable is expected to have a negative relationship to the dependent variable, per acre farmland price, because of capital gains and income tax implications for the seller. As the percent cash seller received increases, the seller's taxes would increase in the sale year and the seller's after-tax present values of sale receipts would be expected to decrease with a higher portion of cash received upon settlement.

Real interest rate is calculated as the contract interest rate at time of sale minus the inflation rate for the previous twelve months. The inflation rate is estimated by the annual percentage change in the GNP-PCE deflator. Previous inflation rate is the proxy for the expected inflation rate of future. It is assumed that as real

interest rates increase, price of per acre farmland is expected to decline, because increased total cost over the loan term and increased annual payments would cause buyers to bid a lower price. The relationship between real interest rates and per acre sale price is expected to be negative.

Term (years to repay) indicates the length of time period, stated in years, during which the note or contract is repaid. The variable is expected to have a positive coefficient, because as the length of the time to repay increases, the rate of annual payments decrease, and buyers may be willing to pay a higher price per acre.

The lender variables have been developed as zero-one dummy variables. FLB, FmHA, seller and other are the categories of lenders used in the model. Lender other includes all the sales which are financed by a commercial bank, PCA or an insurance company. It is expected that seller financed sales might have a higher price per acre than other categories of debt financed sales due to sellers' increasing price and lowering interest rates for the tax advantage.

Location and other explanatory variables

In this category of explanatory variables, zero-one county dummy variables for the regional model and zero-one regional dummy variables for the state model are included. These county and regional dummy variables might include differential location impacts of per acre net returns, population density and different property tax rates.

The time variable is used in the model to identify differences in sale dates. It is included as a monthly time trend. It is used to indicate future speculative trends in farmland market and it also

indicates linear trends on deflated price over time. The variable takes the value of 1 to 102. A value of 1 indicates that a sale occurred in January 1976 and a value of 102 indicates that a sale occurred in June 1984. In the 1976-78 time period, as the time variable increased the price per acre was expected to increase to reflect the inflation during this high inflationary period. In the 1979 to mid 1981 time period, as the time variable increased the price per acre was expected to increase too. During mid 1981 to mid 1984 time period as the time increased, the price per acre was expected to decline reflecting the declining inflationary period.

Endnotes

1) In the Central region, Buffalo and Jerauld Counties have been combined into a single county. Instead of county variables, regional variables have been used in the Western regional model. All of the counties in the western CRDs were combined and six different regions were formed. Black Hills region is used as the intercept term. (See map for description of regions in Western South Dakota).

2) The variable percent irrigated tract is not used in the South Central, Central and East Central regions, because either it is absent or it has very scanty observations in these regions. Farm security class (zero-one dummy) variable is only used in the Southeast and East Central regions. In other regions it is absent in the data set.

3) The variable nonfarm influence is not used in the South Central region in the 1979-81½ time period. Because during this time period, data for this variable were not available.

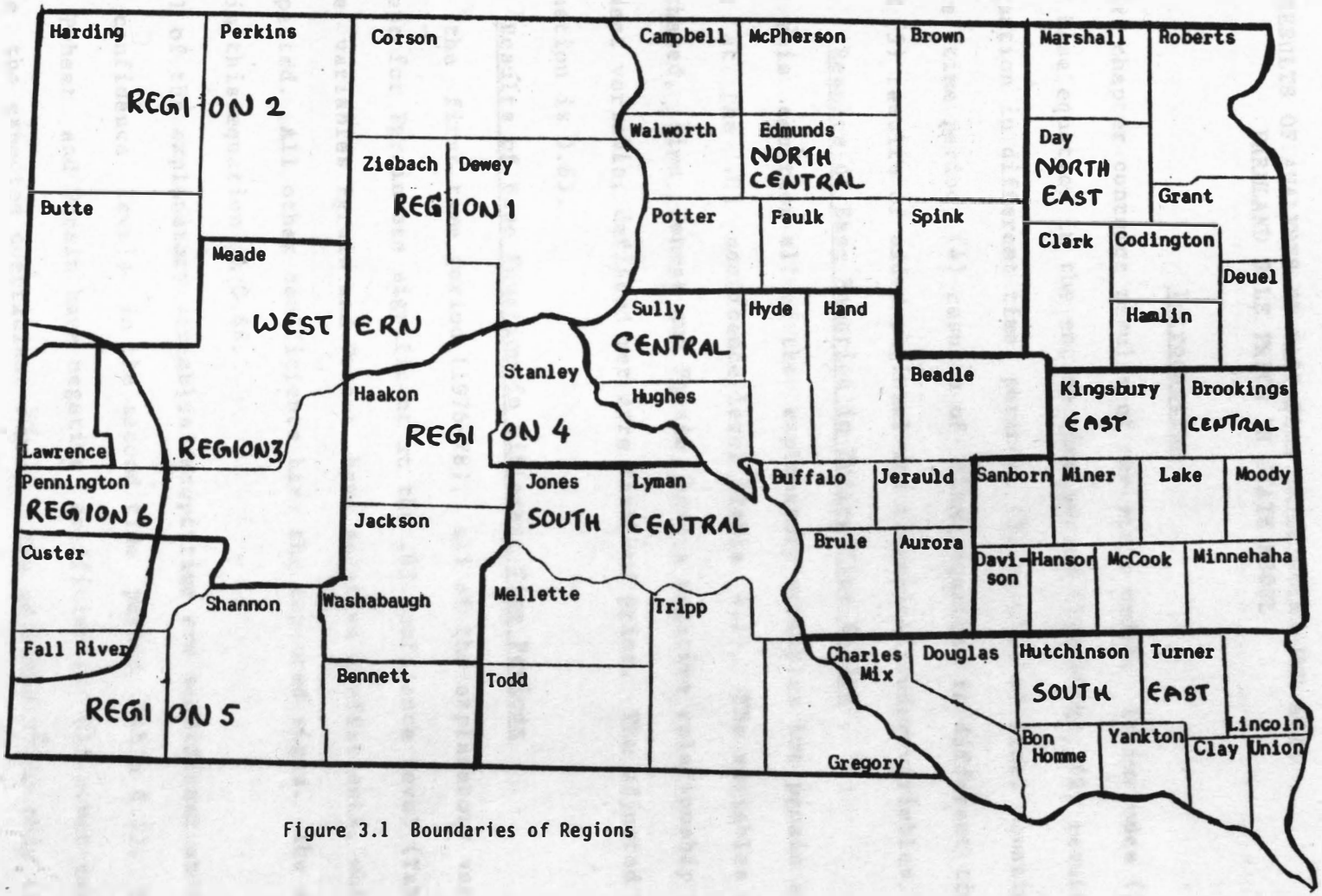

Figure 3.1 Boundaries of Regions

CHAPTER IV

RESULTS OF ANALYSES OF VARIABLES INFLUENCING PER ACRE FARMLAND SALE PRICE IN STATE MODEL

Introduction

This chapter contains results of the state model. It includes (1) results of base equation in the entire time period (1976-84½), (2) results of base equation in different time periods, (3) results of final equation over entire time period, (4) results of final equation in different time periods and (5) results of added regional and financial/lender variables.

Results of Base Equation in Entire Time Period

In this equation all of the explanatory variables but pgrain are significant at the .01 confidence level (Table 4.1). The variables of acres purchased, time, Pwheat and Pgrain have a negative relationship to the dependent variable, deflated per acre farmland price. The adjusted R^2 in this equation is 0.63.

Results of Base Equation in Different Time Periods

In the first time period (1976-78), all of the explanatory variables except for Pgrain are significant at the .01 confidence level (Table 4.1). The variables Pgrain and Pwheat have negative coefficients, which are not expected. All other coefficients have the expected signs. The adjusted R^2 in this equation is 0.68.

All of the explanatory variables except time are significant at the different confidence levels in the second time period (Table 4.1). The variables Pwheat and Pgrain have negative coefficients. All other variables have the expected coefficient signs. The adjusted R^2 in this time period equation has a value of 0.65.

In the last time period (1981½-84½), all of the explanatory variables are significant at the .01 and .05 confidence level (Table 4.1). The variable Pwheat has a negative coefficient. Coefficients of the other variables have the expected signs. The adjusted R^2 in this time period of 0.63 is lower than that found for the two previous time periods.

Results of Final Equation in Entire Time Period

In this equation, the land tract variables of acres purchased, percent cropland, percent irrigated, deflated building value per acre, Pcorn, Pgrain, Pwheat, nonfarm and farm class are significant at the .01 or .05 confidence level (Table 4.2). The financial variables, percent cash seller received, real interest, LFmHA, Lother and regional variables, Southeast, East Central, Northeast, North Central and Western are also significant at the different confidence levels. The variables acres purchased, percent cash seller received and real interest have the expected coefficients. The variables Pgrain, Pwheat and percent financed and LFmHA have negative coefficients. The adjusted R^2 in this equation is 0.67.

Results of Final Equation in Different Time Periods

In the first time period, the land tract variables of percent cropland, percent irrigated, deflated building value per acre, Pcorn, Pwheat, Pgrain, nonfarm and farm class, all of the locational variables of and time are significant at the .01 confidence level (Table 4.2). The variables, South Central, North Central and percent cash received are significant at the .05 confidence level. Pwheat and Pgrain have negative coefficient signs. Real interest rate is significant and has a positive coefficient which is not expected. The adjusted R^2 in this equation has a value of 0.71.

In the second time period, the land tract variables of acres purchased, percent cropland, percent irrigated, deflated building value per acre, Pcorn, Pgrain, Pwheat, nonfarm and farm class and the locational and financial variables of Southeast, East Central, Northeast, North Central, percent cash received, term, percent financed and real interest are significant at different confidence levels (Table 4.2). The variables Pwheat, Pgrain and percent financed, have negative coefficients. Real interest rate has a positive coefficient which is not expected. The adjusted R^2 of 0.69 is lower than that of previous time period.

In the last time period, all of the explanatory variables but Pgrain, South Central, percent financed, real interest, term, LFLB, LFmHA and Lother are significant at different confidence levels (Table 4.2). Pgrain, Pwheat and percent financed have negative coefficients which are not expected. The adjusted R^2 of 0.68 in this time period is lower than those found in the two previous time periods.

Results of the Added Locational and Financial/Lender Variables in Entire Time Period

The added locational variables are collectively significant at the .01 confidence level in the entire time period. The adjusted R^2 increased to 0.67 from 0.63. Individually, all of the locational variables except South Central are significant at the .01 confidence level. South Central and Western regions have negative coefficients.

The added financial/lender variables are collectively significant at the .01 confidence level. Individually, percent cash received, real interest, LFmHA and Lother are significant at different confidence levels. Percent cash, real interest and LFmHA have negative coefficients.

Results of the Added Locational and Financial/Lender Variables in Different Time Periods

The added locational variables for all three time periods are collectively significant at the .01 confidence level (Table 4.3). The adjusted R^2 increased from 0.68 to 0.70. Individually, all of the regions are significant at different confidence levels in the first time period. The Western and South Central regions have negative coefficients.

In the 1979-81½ time period, individually, the coefficients of the Western and South Central regions are not significantly different from the Central region. All other regions are positive and significant at the .01 confidence level.

In the 1981½-84½ time period, only the South Central coefficient is not individually significant. South Central and Western regions have negative coefficients.

The added financial/lender variables are collectively significant at the .01 confidence level in all three time periods (Table 4.3). Individually, percent cash received and real interest are significant in the first time period and percent cash received has a negative coefficient.

In the second time period, individually significant coefficients are percent financed, percent cash received term and real interest. Percent financed and percent cash received have negative coefficients. And in the last time period, the only individually significant financial variable is percent cash received and it has a negative coefficient.

Summary

The results of the base and final equations in the State model show that most of the land tract variables are significant in almost all of the time periods. In the literature review, researchers using cross-sectional model have found that land tract and location variables have significant influences on farm real estate prices. In the final equation, principal products grain and wheat are found to have negative coefficients in most of the time periods which was not expected. Demand conditions of these products might be a factor, because the demand for these products is determined in a world market and a "strong dollar" coupled with good harvests in the importing countries may have affected the coefficients. All other land tract variables have the expected coefficients.

The location variables are found to be significant collectively at the .01 confidence level. Individually most of the location variables are significant in almost all time periods. The added financial/lender variables are found collectively significant at the .01 confidence level. Individually, percent cash received, real interest rate and percent financed are occasionally significant. In most of the cases, the lender variables are not significant.

Table 4.1 Results of Base Equation for South Dakota

Parameter	1976 - 1984 Parameter Estimate	1976 - 1984 Standard Error	1976 - 1978 Parameter Estimate	1976 - 1978 Standard Error	1979 - 1981½ Parameter Estimate	1979 - 1981½ Standard Error	1981½ - 1984½ Parameter Estimate	1981½ - 1984½ Standard Error
Intercept	114.123	4.323 ***	96.002	6.643 ***	106.784	7.808 ***	148.288	7.318 ***
Acres purchased	-0.0099	0.0015***	-0.0052	0.0019***	-0.0166	0.0032***	-0.0157	0.0032***
Percent cropland	1.924	0.064 ***	1.727	0.096 ***	2.042	0.115 ***	1.916	0.111 ***
Percent irrigated	1.123	0.170 ***	1.080	0.286 ***	1.369	0.299 ***	0.635	0.274 **
Dbvpa	1.064	0.023 ***	1.094	0.036 ***	1.108	0.044 ***	0.956	0.039 ***
Time	-0.261	0.045 ***	0.691	0.188 ***	0.394	0.258	-3.211	0.216 ***
Pcorn	123.992	5.412 ***	127.980	8.134 ***	126.354	9.742 ***	111.182	9.576 ***
Pwheat	-52.101	5.247 ***	-36.914	7.721 ***	-65.494	9.415 ***	-52.869	9.458 ***
Pgrain	-1.058	5.158	-9.822	7.701	-23.831	9.381 **	26.014	9.046 ***
Nonfarm	154.647	8.611 ***	166.178	13.365 ***	186.680	15.945 ***	113.529	14.707 ***
Farm class	221.194	5.995 ***	221.845	10.327 ***	237.602	11.396 ***	217.417	9.218 ***
Summary statistics	N_2 = 7202 R^2 = 0.640 $\bar{R}^2$ = 0.639 Dep. Mean = 287.02 C.V. = 37.93 F = 1280.11		N_2 = 2365 R^2 = 0.689 $\bar{R}^2$ = 0.688 Dep. Mean = 285.36 C.V. = 33.60 F = 523.71		N_2 = 2414 R^2 = 0.654 $\bar{R}^2$ = 0.652 Dep. Mean = 295.82 C.V. = 38.35 F = 454.41		N_2 = 2423 R^2 = 0.640 $\bar{R}^2$ = 0.639 Dep. Mean = 279.88 C.V. = 38.34 F = 430.44	

Level of significance: *** = .01, ** = .05, * = .10

Table 4.2 Results of Final Equation for South Dakota

Parameter	1976 - 1984 Parameter Estimate	1976 - 1984 Standard Error	1976 - 1978 Parameter Estimate	1976 - 1978 Standard Error	1979 - 1981½ Parameter Estimate	1979 - 1981½ Standard Error	1981½ - 1984½ Parameter Estimate	1981½ - 1984½ Standard Error
Intercept	91.725	8.733 ***	81.543	13.737 ***	111.019	15.654 ***	147.026	14.796 ***
Acres purchased	-0.0042	0.0015***	-0.0014	0.0019	-0.0089	0.0033***	-0.0082	0.0031***
Percent cropland	1.735	0.061 ***	1.597	0.094 ***	1.865	0.110 ***	1.606	0.107 ***
Percent irrigated	1.897	0.166 ***	1.751	0.283 ***	2.249	0.295 ***	1.551	0.269 ***
Dbvpa	1.009	0.022 ***	1.055	0.035 ***	1.056	0.041 ***	0.900	0.037 ***
Time	0.132	0.055 **	0.969	0.185 ***	0.026	0.259	-3.103	0.306 ***
Pcorn	71.215	5.615 ***	88.303	8.839 ***	78.449	10.101 ***	50.897	9.757 ***
Pwheat	-34.228	5.119 ***	-26.136	7.707 ***	-48.885	9.118 ***	-24.377	9.282 ***
Pgrain	-29.342	5.139 ***	-31.432	7.811 ***	-52.995	9.288 ***	-7.192	9.083
Nonfarm	174.302	8.275 ***	167.999	12.976 ***	199.295	15.264 ***	144.388	14.360 ***
Farm class	210.433	5.854 ***	210.052	10.454 ***	211.300	11.201 ***	207.374	8.825 ***
Southeast	113.388	5.705 ***	77.962	9.429 ***	132.840	10.000 ***	127.808	9.747 ***
East Central	92.512	5.300 ***	59.518	8.823 ***	88.261	9.238 ***	111.232	9.080 ***
Northeast	70.335	5.034 ***	42.111	8.204 ***	89.737	8.788 ***	74.218	8.740 ***
North Central	20.799	5.110 ***	16.496	8.590 **	22.076	8.796 **	18.496	8.618 **
South Central	-3.205	5.928	-23.833	10.145 **	7.363	10.129	-3.715	10.003
Western	-16.199	5.986 ***	-28.614	10.247 ***	-5.475	10.454	-19.592	9.948 **
Percent financed	-0.043	0.080	0.006	0.128	-0.241	0.145 *	-0.055	0.138
Percent cash rec.	-0.217	0.074 ***	-0.255	0.120 **	-0.449	0.137 ***	-0.396	0.126 ***
Real interest	-5.361	0.555 ***	5.904	1.994 ***	3.135	1.589 **	0.009	1.523
Term	0.186	0.186	0.209	0.309	0.547	0.324 *	-0.0026	0.315
LFLB	8.557	5.829	-3.465	9.413	7.964	10.364	11.766	9.934
LFmHA	-13.271	7.938 *	-5.131	13.161	3.877	14.170	-1.669	13.569
Lother	17.652	8.048 **	4.653	13.010	12.784	15.581	9.021	13.064
Summary statistics	N = 7202		N = 2364		N = 2414		N = 2423	
	Dep. Mean = 287.023		Dep. Mean = 285.360		Dep. Mean = 295.826		Dep. Mean = 279.882	
	R^2 = 0.678		R^2 = 0.713		R^2 = 0.694		R^2 = 0.685	
	$\bar{R}^2$ = 0.677		$\bar{R}^2$ = 0.710		$\bar{R}^2$ = 0.691		$\bar{R}^2$ = 0.682	
	RMSE = 102.989		RMSE = 92.483		RMSE = 106.962		RMSE = 100.671	
	F = 659.028		F = 253.065		F = 235.930		F = 227.560	

Table 4.3 Summary of Statistical Test for Added Location and Financial/Lender Variables in the State Model

Added Location Variables

F-test	1976-84	1976-78	1979-81½	1981½-84½
Calculated	114.42	26.83	48.56	51.28
Critical	2.96	2.96	2.96	2.96

Added Financial/Lender Variables

F-test	1976-84	1976-78	1979-81½	1981½-84½
Calculated	21.58	3.93	3.45	4.48
Critical	2.79	2.79	2.96	2.79

Critical F-value for each equation in the state model is given for the 0.01 probability level.

CHAPTER V

ANALYSES OF RESULTS OF BASE EQUATION IN REGIONAL MODELS

Introduction

This chapter includes the tables containing results of the base equations for each regional model for the entire 8½ year period (1976-84½) and for each time period. Analyses of the results of base equations for each regional model and time period are also included in this chapter.

Results of the Base Equation for Each Region and for Entire Time Period

Southeast region

In this region, all of the explanatory variables acres purchased, percent cropland, percent irrigated, deflated building value per acre, time, Pcorn, nonfarm and farm class are significant at the .01 confidence level (Table 5.1). The variables of acres purchased and time are negatively related to per acre farmland price. All other variables exhibit a positive relationship to the dependent variable, deflated per acre farmland price. The adjusted R^2 in this equation has a value of 0.52.

East Central region

In this region, all of the explanatory variables except time are significant at the .01 confidence level (Table 5.2). Acres purchased has a negative coefficient. The adjusted R^2 in this regional model equation has a value of 0.56. The variable percent irrigated is not included in this regional model, because sale of irrigated tracts were not present in the data set.

Northeast region

In Northeast region, all of the explanatory variables are significant at the .01 or .05 confidence level (Table 5.3). The variables acres purchased, percent irrigated and time are significant at the .05 confidence level. The variable farm class is excluded from the equation of this region, as well as other remaining regions of South Dakota, because all farm sales in these regions are in the same class. Therefore, it is not used as a discriminating variable. The adjusted R^2 in this equation is 0.40.

North Central region

All of the explanatory variables in this regional model except for acres purchased and Pwheat are significant at the .01 confidence level (Table 5.4). The variables time and acres purchased have negative coefficients. The equation has an adjusted R^2 of 0.57.

Central region

All of the explanatory variables except for Pwheat in the Central region are significant at the .01 confidence level (Table 5.5). The coefficient for Pwheat is not significant in this regional model. The variables acres purchased and time have negative coefficients. The adjusted R^2 of 0.39 is the lowest in this region compared to those found in all other regions.

South Central region

All of the explanatory variables except for Pwheat exhibit significance at the .01 confidence level in the South Central region (Table 5.6). The variable Pwheat is not significant. The variables

acres purchased and time are negatively related to the dependent variable. The adjusted R^2 has a value of 0.56 in this regional model.

Western region

In this region, all of the explanatory variables except for acres purchased and Pwheat are significant at the .01 confidence level (Table 5.7). The variable Pwheat is not significant and has a negative coefficient. The variable time is significant at the .01 confidence level with a negative coefficient. The adjusted R^2 in this regional model has the highest value of 0.66 compared to other regional models.

Results of Base Equation Model in Different Time Periods in Each region

Southeast region

In this region, in the 1976-78 time period, all of the explanatory variables are significant at the .01 confidence level. The variable acres purchased has a negative coefficient, while all other variables have positive coefficients. The equation has an adjusted R^2 of 0.63.

In the second time period (1979-81½), the variables percent cropland, deflated building value per acre, nonfarm, farm class, Pcorn and percent irrigated are significant at the .01 or .05 confidence level and have positive coefficients. The variable acres purchased is not significant and has a negative coefficient. The adjusted R^2 in this time period dropped to 0.48.

In the last time period (1981½-84½), the equation results show that percent cropland, percent irrigated, deflated building value per acre, time Pcorn, farm class, acres purchased and nonfarm are significant at different confidence levels. The variables acres

purchased and time have negative coefficients. The adjusted R^2 of 0.58 in this time period is better than in the previous time period (Table 5.1).

East Central region

In this region, in the 1976-78 time period, all of the explanatory variables are significant at the .01 or .10 confidence level. The variable acres purchased is the only significant variable with negative coefficient.

All of the explanatory variables except for time are significant at the .01 confidence level in the second time period. The variable acres purchased is the only variable with negative coefficient. The adjusted R^2 in these two time periods are the same with a value of 0.59.

In the last time period, all of the explanatory variables are significant at the .01 confidence level. The variables acres purchased and time are the only varibles with negative coefficients. In the two previous time periods, the variable time had a positive coefficient. The adjusted R^2 of 0.56 in this time period is lower than in the previous time periods (Table 5.2).

Northeast region

In the 1976-78 time period, the statistically significant variables are percent cropland, deflated building value per acre, Pgraincorn, time and nonfarm. The variable acres purchased is not significant and has a negative coefficient.

In the second time period, the statistically significant variables are percent cropland, percent irrigated, deflated building

value per acre, time and Pgraincorn. They are significant at different confidence levels. The variable acres purchased is not significant in all three time periods and has negative coefficient.

In the last period (1981½-84½), all of the explanatory variables except acres purchased and percent irrigated are significant at the .01 confidence level. The variable time has a negative coefficient. The values of adjusted R^2 in three time periods differ significantly from each other. In the first time period it has a value of 0.35 and in the second time period it jumped to 0.49 and in the last time period it dropped to 0.43 (Table 5.3).

North Central region

In this region, the 1976-78 time period equation results show that all of the explanatory variables except for acres purchased, time and Pwheat are significant at the .01 or .05 confidence level. The variable acres purchased has a negative coefficient.

The variables percent cropland, deflated building value per acre, nonfarm, time and Pgraincorn are statistically significant at different confidence level in the second time period (1979-81½). The variable time has a negative coefficient. The adjusted R^2 in this time period is slightly lower than that of the previous time period (0.54 vs. 0.57).

In the last period (1981½-84½), all of the explanatory variables except Pwheat and Pgraincorn are significant at the .01 confidence level. The variables acres purchased and time are statistically significant with negative coefficients. This equation has a higher

adjusted R^2 value of 0.63 than those of the two previous time periods (Table 5.4).

Central region

In this region, in the first time period, the only statistically significant variables are percent cropland and deflated building value per acre. They are significant at the .01 confidence level.

In the second period, all of the explanatory variables except for Pwheat are significant at the .01 or .10 confidence level. The variables acres purchased and time have negative coefficients.

In the last time period, all of the explanatory variables except for Pwheat and nonfarm are statistically significant at the .01 or .05 confidence level. The variables acres purchased and time have negative coefficients.

There is a great difference in the values of adjusted R^2 in three time periods in this regional model. In the 1976-78 period, the adjusted R^2 is 0.27, while in the second period, it jumped to 0.43. In the last time period, the adjusted R^2 further jumped to 0.54 (Table 5.5).

South Central region

In the South Central region during 1976-78, all of the explanatory variables except for acres purchased are statistically significant at the .01 confidence level. The variable time has a negative coefficient.

During the second time period, the statistically significant variables are all but Pgraincorn. They are all significant at the .01 confidence level. The variables acres purchased, time and Pwheat have

negative coefficients. The variable nonfarm is excluded from the equation because data for this time period was not available in the data set.

In the last period, all of the explanatory variables but Pwheat are significant at the .01 confidence level. The variables acres purchased and time have negative coefficients.

The adjusted R^2 of 0.58 is about the same in all three time periods (Table 5.6).

Western region

In this region, in the 1976-78 time period, the variables percent cropland, percent irrigated, deflated building value per acre and nonfarm are statistically significant at the .01 confidence level.

All of the explanatory variables but acres purchased and Pwheat are statistically significant at different confidence levels during the later two time periods. The variable time is the only significant variable with a negative coefficient in both time periods.

There is a great discrepancy in the value of adjusted R^2 in the three time periods. In the first time period, it has a value of 0.92 and in the second period it dropped to 0.71. In the last time period, the value further dropped to 0.52 (Table 5.7).

Summary

The variables percent cropland and deflated building value per acre are found significant in all regions and in all three time periods. The variables nonfarm and time are also significant in all regions in almost all time periods. Percent irrigated and acres purchased are also occasionally significant in different regions. Farm

class variable is present only in the Southeast and East Central regions and found to be significant in all three time periods. Pcorn was found significant in all three time periods in the Southeast and East Central regions. Pgraincorn also found significant in the Northeast, North Central, South Central and Western regions in almost all the time periods.

The adjusted R^2 is comparatively stable across time periods in the East Central, North Central and South Central regions. In all other regions, the adjusted R^2 is unstable. The most unstable adjusted R^2 is found in the Western region. There is a great variation across periods in the values of adjusted R^2 in this region.

The highest number of observations is recorded in the East Central region. The region has a total number of observations of 1503 followed by Northeast and Southeast regions respectively. The lowest number of observations is recorded in the South Central region. It has totally 560 observations and followed by the Western region with a total of 659 observations.

Table 5.1 Results of Base Equation for Southeast Region

Parameter	1976 - 1984 Parameter Estimate	1976 - 1984 Standard Error	1976 - 1978 Parameter Estimate	1976 - 1978 Standard Error	1979 - 1981½ Parameter Estimate	1979 - 1981½ Standard Error	1981½ - 1984½ Parameter Estimate	1981½ - 1984½ Standard Error
Intercept	120.203	21.403 ***	106.140	33.920 ***	28.298	43.270	216.393	31.315 ***
Acres purchased	-0.134	0.043 ***	-0.194	0.074 ***	-0.086	0.072	-0.111	0.067 *
Percent cropland	2.957	0.224 ***	2.135	0.347 ***	3.637	0.439 ***	2.788	0.320 ***
Percent irrigated tract	3.681	0.501 ***	4.211	0.755 ***	2.668	1.095 **	3.235	0.661 ***
Dbvpa	0.831	0.068 ***	0.847	0.092 ***	0.947	0.147 ***	0.771	0.108 ***
Time	-0.488	0.150 ***	2.410	0.628 ***	1.370	1.004	-5.698	0.545 ***
Pcorn	93.836	11.787 ***	101.681	17.084 ***	123.349	23.884 ***	52.100	17.446 ***
Nonfarm	237.238	29.189 ***	181.473	39.109 ***	344.878	54.349 ***	117.235	55.807 **
Farm class	188.610	10.699 ***	202.791	17.550 ***	163.307	21.261 ***	199.586	14.294 ***
Summary statistics	N_2 = 1210 R^2 = 0.521 $\bar{R}^2$ = 0.518 Dep. Mean = 457.57 CV = 32.41 RMSE = 148.33 F = 163.83		N_2 = 378 R^2 = 0.646 $\bar{R}^2$ = 0.638 Dep. Mean = 442.16 CV = 29.31 RMSE = 129.61 F = 84.27		N_2 = 373 R^2 = 0.497 $\bar{R}^2$ = 0.486 Dep. Mean = 501.70 CV = 33.21 RMSE = 166.65 F = 45.08		N_2 = 459 R^2 = 0.591 $\bar{R}^2$ = 0.584 Dep. Mean = 434.40 CV = 28.20 RMSE = 122.52 F = 81.59	

Level of significance: *** = .01, ** = .05, * = .10

Table 5.2 Results of Base Equation for East Central Region

Parameter	1976 - 1984 Parameter Estimate	1976 - 1984 Standard Error	1976 - 1978 Parameter Estimate	1976 - 1978 Standard Error	1979 - 1981½ Parameter Estimate	1979 - 1981½ Standard Error	1981½ - 1984½ Parameter Estimate	1981½ - 1984½ Standard Error
Intercept	142.849	15.333 ***	102.413	23.030 ***	133.324	26.304 ***	223.862	25.482 ***
Acres purchased	-0.1700	0.0287***	-0.0854	0.0461*	-0.1533	0.0436***	-0.3349	0.0630***
Percent cropland	1.926	0.155 ***	1.759	0.258 ***	1.635	0.283 ***	2.241	0.257 ***
Dbvpa	1.035	0.049 ***	1.217	0.092 ***	1.043	0.092 ***	0.953	0.076 ***
Time	0.102	0.118	0.938	0.494 *	0.793	0.646	-2.698	0.582 ***
Pcorn	109.206	6.970 ***	127.984	10.988 ***	151.452	13.743 ***	54.786	11.969 ***
Nonfarm	327.838	28.037 ***	326.408	36.477 ***	442.019	57.442 ***	206.269	58.875 ***
Farm class	241.456	15.293 ***	194.417	30.150 ***	295.616	28.872 ***	224.299	21.740 ***
Summary statistics	N_2 = 1503 R^2 = 0.562 $\bar{R}^2$ = 0.560 Dep. Mean = 374.85 CV = 33.05 RMSE = 123.89 F = 274.63		N_2 = 563 R^2 = 0.598 $\bar{R}^2$ = 0.593 Dep. Mean = 362.05 CV = 31.88 RMSE = 115.45 F = 118.23		N_2 = 474 R^2 = 0.598 $\bar{R}^2$ = 0.592 Dep. Mean = 389.72 CV = 31.84 RMSE = 124.08 F = 99.29		N_2 = 466 R^2 = 0.568 $\bar{R}^2$ = 0.561 Dep. Mean = 375.19 CV = 32.69 RMSE = 122.66 F = 86.05	

Level of significance: *** = .01, ** = .05, * = .10

Table 5.3 Results of Base Equation for Northeast Region

Parameter	1976 - 1984 Parameter Estimate	1976 - 1984 Standard Error	1976 - 1978 Parameter Estimate	1976 - 1978 Standard Error	1979 - 1981½ Parameter Estimate	1979 - 1981½ Standard Error	1981½ - 1984½ Parameter Estimate	1981½ - 1984½ Standard Error
Intercept	107.411	8.712 ***	110.497	12.752 ***	101.783	14.750 ***	159.457	15.904 ***
Acres purchased	-0.0231	0.0120**	-0.0103	0.0174	-0.0134	0.0216	-0.0317	0.0211
Percent cropland	1.730	0.090 ***	1.475	0.136 ***	1.894	0.151 ***	1.787	0.167 ***
Percent irrigated tract	1.498	0.591 **	0.515	0.699	2.704	1.012 ***	1.384	1.732
Dbvpa	1.049	0.051 ***	0.890	0.092 ***	1.210	0.076 ***	0.896	0.097 ***
Time	0.168	0.076 **	0.525	0.284 *	1.037	0.422 ***	-2.905	0.397 ***
Pgrncrn	20.789	4.921 ***	18.905	6.922 ***	16.301	8.705 *	30.806	9.202 ***
Nonfarm	80.090	21.500 ***	87.753	25.673 ***	12.331	41.946	171.380	48.840 ***
Summary statistics	N_2 = 1445 R^2 = 0.403 $\bar{R}^2$ = 0.400 Dep. Mean = 266.64 CV = 30.93 RMSE = 82.48 F = 138.90		N_2 = 516 R^2 = 0.367 $\bar{R}^2$ = 0.358 Dep. Mean = 251.68 CV = 28.11 RMSE = 70.74 F = 42.08		N_2 = 478 R^2 = 0.502 $\bar{R}^2$ = 0.494 Dep. Mean = 282.09 CV = 29.51 RMSE = 83.25 F = 67.67		N_2 = 451 R^2 = 0.439 $\bar{R}^2$ = 0.430 Dep. Mean = 267.49 CV = 31.48 RMSE = 84.22 F = 49.57	

Level of significance: *** = .01, ** = .05, * = .10

Table 5.4 Results of Base Equation for North Central Region

Parameter	1976 - 1984 Parameter Estimate	1976 - 1984 Standard Error	1976 - 1978 Parameter Estimate	1976 - 1978 Standard Error	1979 - 1981½ Parameter Estimate	1979 - 1981½ Standard Error	1981½ - 1984½ Parameter Estimate	1981½ - 1984½ Standard Error
Intercept	129.330	5.379 ***	116.478	8.849 ***	122.502	8.872 ***	146.889	12.269 ***
Acres purchased	-0.0048	0.0036	-0.0028	0.0066	-0.0004	0.0044	-0.0402	0.0121***
Percent cropland	1.191	0.075 ***	1.267	0.121 ***	1.111	0.123 ***	1.071	0.145 ***
Percent irrigated tract	1.278	0.276 ***	1.807	0.530 ***	0.359	0.467	1.518	0.442 ***
Dbvpa	0.931	0.032 ***	1.030	0.066 ***	0.848	0.057 ***	0.917	0.047 ***
Time	-0.426	0.060 ***	0.211	0.266	-0.779	0.324 **	-2.145	0.318 ***
Pgrncrn	25.066	7.954 ***	27.341	12.999 **	24.142	12.870 *	22.297	14.682
Pwheat	6.363	5.465	-6.072	8.883	13.363	8.526	14.642	10.585
Nonfarm	134.344	11.149 ***	154.101	16.876 ***	98.927	15.925 ***	169.935	30.216 ***
Summary statistics	N_2 = 1144 R^2 = 0.573 $\bar{R}^2$ = 0.570 Dep. Mean = 209.23 CV = 27.67 RMSE = 57.89 F = 190.93		N_2 = 385 R^2 = 0.587 $\bar{R}^2$ = 0.579 Dep. Mean = 215.51 CV = 25.49 RMSE = 54.94 F = 67.00		N_2 = 390 R^2 = 0.557 $\bar{R}^2$ = 0.548 Dep. Mean = 206.45 CV = 26.67 RMSE = 55.081 F = 60.01		N_2 = 369 R^2 = 0.639 $\bar{R}^2$ = 0.631 Dep. Mean = 205.62 CV = 28.95 RMSE = 59.54 F = 79.66	

Level of significance: *** = .01, ** = .05, * = .10

Table 5.5 Results of Base Equation for Central Region

Parameter	1976 - 1984 Parameter Estimate	1976 - 1984 Standard Error	1976 - 1978 Parameter Estimate	1976 - 1978 Standard Error	1979 - 1981½ Parameter Estimate	1979 - 1981½ Standard Error	1981½ - 1984½ Parameter Estimate	1981½ - 1984½ Standard Error
Intercept	163.104	6.074 ***	138.241	12.750 ***	153.428	10.394 ***	144.946	6.255 ***
Acres purchased	-0.0132	0.0036***	-0.0102	0.0092	-0.0156	0.0057***	-0.0098	0.0040**
Percent cropland	0.649	0.076 ***	0.736	0.148 ***	0.602	0.139 ***	0.538	0.084 ***
Dbvpa	0.803	0.073 ***	0.779	0.158 ***	0.844	0.130 ***	0.881	0.077 ***
Time	-0.539	0.067 ***	0.532	0.386	-0.617	0.353 *	-1.136	0.202 ***
Pgrncrn	24.778	5.942 ***	9.344	10.699	35.921	10.711 ***	17.016	7.080 **
Pwheat	4.936	6.217	2.004	11.082	4.611	11.550	6.621	7.191
Nonfarm	73.471	15.712 ***	15.840	24.070	249.817	31.061 ***	-12.955	22.971
Summary statistics	N_2 = 681		N_2 = 183		N_2 = 260		N_2 = 238	
	R^2 = 0.399		R^2 = 0.304		R^2 = 0.452		R^2 = 0.557	
	$\bar{R}^2$ = 0.393		$\bar{R}^2$ = 0.276		$\bar{R}^2$ = 0.437		$\bar{R}^2$ = 0.544	
	Dep. Mean = 186.10		Dep. Mean = 200.98		Dep. Mean = 198.44		Dep. Mean = 161.17	
	CV = 26.24		CV = 24.56		CV = 26.81		CV = 19.77	
	RMSE = 48.84		RMSE = 49.37		RMSE = 53.20		RMSE = 31.86	
	F = 63.92		F = 10.95		F = 29.80		F = 41.39	

Level of significance: *** = .01, ** = .05, * = .10

Table 5.6 Results of Base Equation for South Central Region

Parameter	1976 - 1984 Parameter Estimate	1976 - 1984 Standard Error	1976 - 1978 Parameter Estimate	1976 - 1978 Standard Error	1979 - 1981½ Parameter Estimate	1979 - 1981½ Standard Error	1981½ - 1984½ Parameter Estimate	1981½ - 1984½ Standard Error
Intercept	130.065	4.579 ***	120.194	8.750 ***	129.278	7.307 ***	121.654	6.330 ***
Acres purchased	-0.0059	0.0016***	-0.0013	0.0019	-0.0154	0.0036***	-0.0131	0.0043***
Percent cropland	0.822	0.063 ***	0.788	0.104 ***	1.116	0.113 ***	0.544	0.104 ***
Dbvpa	0.961	0.086 ***	0.844	0.179 ***	1.003	0.165 ***	1.040	0.110 ***
Time	-0.441	0.056 ***	-0.751	0.284 ***	-1.076	0.269 ***	-0.798	0.219 ***
Pgrncrn	15.117	4.688 ***	31.771	8.368 ***	-6.746	7.808	20.339	7.693 ***
Pwheat	0.718	4.850	23.370	7.687 ***	-22.636	8.499 ***	2.843	8.193
Nonfarm	49.450	13.235 ***	54.714	20.338 ***			50.531	15.666 ***
Summary statistics	N_2 = 560 R^2 = 0.570 $\bar{R}^2$ = 0.565 Dep. Mean = 155.69 CV = 22.20 RMSE = 34.57 F = 104.84		N_2 = 161 R^2 = 0.593 $\bar{R}^2$ = 0.574 Dep. Mean = 165.66 CV = 20.59 RMSE = 34.12 F = 31.89		N_2 = 208 R^2 = 0.591 $\bar{R}^2$ = 0.579 Dep. Mean = 162.76 CV = 21.37 RMSE = 34.79 F = 48.53		N_2 = 191 R^2 = 0.603 $\bar{R}^2$ = 0.588 Dep. Mean = 139.57 CV = 21.77 RMSE = 30.39 F = 39.85	

Level of significance: *** = .01, ** = .05, * = .10

Table 5.7 Results of Base Equation for Western Region

Parameter	1976 - 1984 Parameter Estimate	1976 - 1984 Standard Error	1976 - 1978 Parameter Estimate	1976 - 1978 Standard Error	1979 - 1981½ Parameter Estimate	1979 - 1981½ Standard Error	1981½ - 1984½ Parameter Estimate	1981½ - 1984½ Standard Error
Intercept	101.288	10.649 ***	88.069	8.416 ***	121.481	18.041 ***	118.158	20.109 ***
Acres purchased	-0.0023	0.0017	-0.0012	0.0010	-0.0053	0.0038	-0.0031	0.0041
Percent cropland	0.989	0.165 ***	0.874	0.135 ***	0.917	0.280 ***	1.206	0.334 ***
Percent irrigated tract	1.735	0.284 ***	2.036	0.269 ***	2.365	0.479 ***	0.883	0.536 *
Dbvpa	1.160	0.056 ***	1.225	0.034 ***	1.361	0.103 ***	1.022	0.226 ***
Time	-0.432	0.142 ***	-0.282	0.337	-1.870	0.787 **	-3.154	0.804 ***
Pgrncrn	132.506	22.104 ***	22.114	19.942	156.530	37.832 ***	147.837	41.640 ***
Pwheat	-10.728	12.378	6.022	9.640	-13.752	20.906	-20.386	26.751
Nonfarm	271.578	14.295 ***	116.126	21.870 ***	244.907	26.492 ***	291.303	22.787 ***
Summary statistics	N_2 = 659 R^2 = 0.672 $\bar{R}^2$ = 0.668 Dep. Mean = 169.17 CV = 58.70 RMSE = 99.31 F = 167.011		N_2 = 179 R^2 = 0.927 $\bar{R}^2$ = 0.924 Dep. Mean = 154.47 CV = 27.68 RMSE = 42.76 F = 271.46		N_2 = 230 R^2 = 0.729 $\bar{R}^2$ = 0.719 Dep. Mean = 179.42 CV = 54.67 RMSE = 98.09 F = 74.83		N_2 = 249 R^2 = 0.539 $\bar{R}^2$ = 0.523 Dep. Mean = 170.23 CV = 69.77 RMSE = 118.78 F = 35.09	

Level of significance: *** = .01, ** = .05, * = .10

CHAPTER VI

ANALYSES OF FINAL EQUATION AND STABILITY OF COEFFICIENTS TEST BY REGIONS AND TIME PERIODS

Introduction

This chapter contains: (1) the results of the final equation with the added location and financial/lender variables in all regions for the 1976-84½ time period; (2) the results of added locational and financial/lender variables in all regions in three time periods; and, (3) the results of statistical tests for stability of coefficients across the three time periods.

Results of Final Equation in All Regions in the 1976-1984½ Time Period

Southeast region

In this region, the coefficients for the variables of acres purchased, percent cropland, percent irrigated, deflated building value per acre, time, nonfarm and farm class are significant at different confidence levels (Table 6.1). The added county variables are collectively significant at the .01 confidence level (Table 6.8). The adjusted R^2 increased from 0.51 to 0.62. Individually, all county coefficients are significant except for Douglas County.

The added financial/lender variables are also collectively significant at the .01 confidence level (Table 6.9). Individually significant financial/lender variables are real interest, term and LFmHA. The adjusted R^2 increased from 0.62 to 0.66.

The variables acres purchased, Pcorn, percent borrowed, percent cash received, real interest, LFLB and LFmHA have negative coefficients.

East Central region

The coefficients of acres purchased, percent cropland, deflated building value per acre, time, Pcorn, farm class and nonfarm are significant at different confidence levels (Table 6.2).

Collectively the added county variables are significant at the .01 confidence level (Table 6.8). The adjusted R^2 increased from 0.56 to 0.69. Individually, all of the county coefficients are significant at the .01 confidence level. All of the counties but Minnehaha and Moody have negative coefficients. These two counties exhibit higher average sale price than found in Brookings county.

The added financial/lender variables in this region are collectively significant at the .01 confidence level (Table 6.9). The adjusted R^2 increased to 0.70 from 0.69. Individually, the significant variables are percent cash received, real interest and LFLB. The variables percent cash received, real interest and term have negative coefficients.

Northeast region

In this regional model, the variables acres purchased, percent cropland, percent irrigated, deflated building value per acre, time, Pgraincorn and nonfarm are significant at the .01 or .05 confidence level (Table 6.3). Acres purchased has a negative coefficient.

The added county variables are collectively significant at the .01 confidence level (Table 6.8). The adjusted R^2 of 0.49 increased

from 0.40. Individually, all of the county coefficients except for Roberts county are significant and have negative coefficients.

In this region, the added financial/lender variables are collectively significant at the .01 confidence level (Table 6.9). Individually significant variables are percent cash received, real interest, term and LFmHA. The variables of percent financed, percent cash received, real interest and FmHA have negative coefficients.

North Central region

The variables percent cropland, percent irrigated, deflated building value per acre, time and nonfarm are significant at the .01 confidence level in this regional model (Table 6.4). The variables acres purchased and time have negative coefficients.

The added county variables are significant at the .01 confidence level collectively (Table 6.8). The adjusted R^2 shows an increment from 0.57 to 0.66. All of the added county variables are significant at the .01 confidence level individually and have negative coefficients.

The added financial/lender variables in this region are not collectively significant (Table 6.9). Individual significant variables are percent financed and real interest rate. The variables percent cash received, percent borrowed, real interest, LFmHA and Lother have negative coefficients.

Central region

In this region, the coefficients of acres purchased, percent cropland, deflated building value per acre, time, Pgraincorn and

nonfarm are significant at the .01 confidence level (Table 6.5). The variables acres purchased and time have negative coefficients.

The added county variables in this region are collectively significant at the .01 confidence level (Table 6.8). The adjusted R^2 increased from 0.39 to 0.43. Individually, all of the added county variables but Hughes and Aurora counties are significant at the .01 to .10 confidence level. All of the counties have negative coefficients and average lower sale price than found in Beadle county.

The added financial/lender variables are not collectively significant in this region (Table 6.9). Individually, the only significant financial variable is the real interest rate. All of the financial/lender variables except for percent cash received have negative coefficients.

South Central region

In the South Central region, the coefficients for acres purchased, percent cropland, deflated building value per acre, time, Pwheat, Pgraincorn and nonfarm are statistically significant at the .01 or .05 confidence level (Table 6.6). The variables acres purchased and time have negative coefficient.

The added county variables in this regional model are collectively significant at the .01 confidence level (Table 6.8). The adjusted R^2 increased from 0.56 to 0.61. Individually significant counties are Jones, Mellette and Gregory. Gregory county has a positive coefficient.

The added financial/lender variables are not collectively significant in this region. The adjusted R^2 dropped from 0.61 to 0.60. None of the financial/lender variables are individually significant.

Western region

The coefficients for percent cropland, percent irrigated, deflated building value per acre, nonfarm and Pgraincorn are statistically significant at the .01 confidence level (Table 6.7) in this region.

The added regional variables are collectively significant at the .01 confidence level (Table 6.8). The adjusted R^2 increased from 0.66 to 0.68. Individually, all of the regions are significant at the .01 confidence level and have negative coefficients, relative to the Black Hills region.

The added financial/lender variables are not collectively significant in this region (Table 6.9). The adjusted R^2 remains the same with a value of 0.68. Individually, only the real interest rate is significant with a negative coefficient.

Results of Final Equation in Each Region in Different Time Periods

Southeast region

In this region, there are some differences in level of significance of specific coefficients in each time period. The coefficients of percent cropland, percent irrigated, deflated building value per acre and farm class are significant at the .01 confidence level in each time period (Table 6.1). The coefficients of nonfarm and time are significant in each time period at the .01 or .05 confidence level, except that time is not significant in the second time period. The

negative coefficient of acres purchased is significant in the 1981½-84½ time period at the .10 confidence level.

The added county variables are collectively significant in all three time periods at the .01 confidence level (Table 6.8). The adjusted R^2 increased from 0.63 to 0.73 for 1976-78, from 0.48 to 0.62 for 1979-81½ and 0.58 vs. 0.67 for 1981½-84½ time period.

The added financial/lender variables collectively are not significant in the 1976-78 and 1979-81½ time periods, but are significant at the .01 confidence level in the 1981½-84½ time period (Table 6.9). Percent financed and Lother are the only significant financial/lender variables in the latter time period.

East Central region

In this regional model, the coefficients of percent cropland, deflated building value per acre, farm class, Pcorn and nonfarm are significant at the .01 confidence level in all three time periods (Table 6.2). The coefficients of the time variable are significant at the .01 confidence level in the first and the last time period. The coefficients of acres purchased are significant at the .01 confidence level with negative signs in the last two time periods.

The added county variables for all three time periods are collectively significant at the .01 confidence level (Table 6.8). The adjusted R^2 increased from 0.59 to 0.71-0.72. Individually, all of the county variables are significant in the two earlier time periods while only Lake county does not have a coefficient significantly different from Brookings county in the last time period. Moody and Minnehaha counties have positive coefficients.

The added financial/lender variables are not collectively significant in any time period (Table 6.9). The variable percent cash received is negatively significant at the .05 confidence level in the two later time periods. LFLB is significant in the second time period.

Northeast region

The coefficients of percent cropland and deflated building value per acre are significant in all three time periods at the .01 confidence level (Table 6.3). The coefficient of time is positive and significant at the .05 confidence level in the first two time periods and in the last time period is negative and significant at the .01 confidence level. The variable Pgraincorn is significant in the first two time periods and nonfarm is significant in the first and the last time periods. The variable acres purchased is negative and significant in the last time period, while percent irrigated is significant only in the second time period.

The added county variables are collectively significant in all three time periods at the .01 confidence level (Table 6.8). The adjusted R^2 increased from 0.35 to 0.47 for the first time period, from 0.49 to 0.58 and from 0.43 to 0.54 for the later two time periods respectively.

The added financial/lender variables are collectively significant at the .01 confidence level for the first time period, but are not significant in the other two time periods (Table 6.9). Few individual coefficients are significant in the first two time periods and none are significant in the last time period.

North Central region

In this region, the coefficients of percent cropland, percent irrigated, deflated building value per acre and nonfarm are significant at the .01 or .05 confidence level in all three time periods (Table 6.4). Coefficients of time are significant at the .01 or .05 confidence level in the later two time periods. The variable acres purchased is negative and significant in the last time period. Coefficient of Pwheat is significant at the .10 confidence level in the second time period.

The added county variables are collectively significant at the .01 confidence level in all three time periods (Table 6.8). The adjusted R^2 increased from 0.57 to 0.66 for first time period, from 0.54 to 0.63 and from 0.63 to 0.73 for the later two time periods respectively. Individually, all of the county variables have negative coefficients and all county (except for Spink in 1979-81½) coefficients are significantly different than per acre prices in Brown county.

The added financial/lender variables are not collectively significant in any time period (Table 6.9). Individually, the variable percent financed is significant in the first time period and percent cash received in the last time period. Both of these variables have negative coefficients.

Central region

The coefficients of percent cropland and deflated building value per acre are significant at the .01 confidence level in all three time periods in this regional model (Table 6.5). The coefficients of Pgraincorn is significant at the .01 confidence level in the second

time period. The variable acres purchased has a negative and significant coefficient in the later two time periods.

The added county variables are not significant in the 1976-78 time period, but are significant in two other time periods at the .01 confidence level (Table 6.8). The adjusted R^2 increased from 0.43 to 0.48 and from 0.54 to 0.58 for 1979-81½ and 1981½-84½ periods respectively.

The added financial/lender variables are not collectively significant in any of the time periods (Table 6.9).

South Central region

In this region, the coefficients of percent cropland and deflated building value per acre are positive and significant at the .01 confidence level in all three time periods. The coefficient for time is significant and negative in all three time periods. The variables Pwheat, Pgraincorn and nonfarm are significant at different confidence levels in the first and the last time periods. Acres purchased is significant at the .01 confidence level in the second time period and has a negative coefficient (Table 6.6).

The added county variables are collectively significant at the .01 confidence level in all three time periods (Table 6.8). The adjusted R^2 increased from 0.57 to 0.60-0.61 in the first two time periods and from 0.58 to 0.68 in the last time period.

The added financial/lender variables are collectively significant at the .01 confidence level in the last time period (Table 6.9). The adjusted R^2 increased from 0.68 to 0.70, and in the two other time periods financial/lender variables are not collectively

significant. Individually, in the last time period, percent cash received, LFmHA and LFLB are significant.

Western region

In the Western region, the coefficients of percent cropland, deflated building value per acre and nonfarm are significant at the .01 confidence level in all three time periods. The variable percent irrigated is significant at the .01 confidence level in the first two time periods. The coefficients of Pgraincorn and time are also significant in the later two time periods. Pgraincorn has a positive coefficient while the variable time has a negative coefficient (Table 6.7).

The added regional variables are collectively significant at the .01 confidence level in the first time period (Table 6.8). Individually, all of the regions are significant at the .01 confidence level and have negative coefficients.

In the second time period, the added regional variables are not collectively significant but individually, region 1 through region 4 are significant in different confidence levels and all of them have negative coefficients.

Similarly, in the last time period, the added regional variables are not collectively significant but individually region 1 and region 2 are significant at different confidence levels and have negative coefficients.

The added financial/lender variables are not collectively significant in any time period (Table 6.9). Individually, the variable

term is significant at the .10 confidence level in the later two time periods.

Statistical Test for Stability of Coefficients

In order to test the stability of coefficients across time periods, the data for this study are separated by grouping observations from 1976-78, 1979-81½ and 1981½-84½. To test the validity of the hypothesis that no structural changes occurred in the farmland market, a statistical test has been performed with both the base and final equations in three time periods. The statistical equation used to conduct an F-test for this purpose has been discussed as equation in chapter 3 (p. 29).

Results of the Statistical Tests for Stability of Coefficients

Results of the tests for stability of coefficients are presented in summary statistics form in the tables in this chapter. The calculated and critical F-values for testing stability of coefficients for the base and final equations in each regional model are also presented in the table (Table 6.10).

In all of the regions and in both the base and final equations the calculated F-value is found significant at the .01 confidence level. These F-test results reject the null hypothesis that no structural changes occurred. On the other hand the results validate that structural changes in coefficients occurred in all regions over the 8½-year time period.

The F-test results for structural change of coefficients show that the calculated F-values are lowest in the Western, South Central and North Central regions and highest in the Southeast, East Central

and Northeast regions. It may imply that land prices associated with longer-lived products, such as range cattle are influenced more slowly during downward price adjustments. On the other hand where land prices associated with shorter-lived product, such as grains, show value decline rapidly. This seems to explain higher F-test values in the regions where grain production is the primary industry.

Some other factors may also influence the structural change in the farmland market, flexible exchange rates may be one factor. During the past years the U.S. dollar has become very strong, as a result the international buyers of agricultural products found it very expensive on their part to buy U.S. products. This may be a significant cause of decline in U.S. agricultural export markets which in turn reduced land prices more rapidly in grain producing regions.

The coefficient sign of the time variable changed in different time periods in all of the regions. It is interesting to note that the coefficient sign of this variable is negative in the last period in all of the regions. During this time period, nominal and real farmland prices declined sharply. On the other hand in the 1976-78 time period, the coefficients of time are positive in all the regions except for the South Central and Western regions. Deflated land prices in these two regions are declining in all three time periods, but the magnitude of decline is greatest in the last time period. The time variable coefficient is also negative in the North Central and Central regions in the second time period. This implies that only land prices in eastern South Dakota were increasing more rapidly than the inflation rate in the middle period.

The signs of the coefficients of different financial/lender variables change in different regions in the three time periods. It indicates that variation in financial term occurred in three time periods, which validates that structural changes occurred in farmland prices. It may be mentioned here that during 1979, the Federal Reserve changed its monetary policy which influenced the level of interest rates, exchange rates and other variables impacting farmland prices over time.

The variable farm class exhibits increased coefficients in the Southeast and East Central region in all three time periods, except for 1979-81½ period in East Central region. It may imply that better tracts of land have higher differential prices than tracts with lower class qualities during the downward land price trends. It indicates that buyers put more importance on the tracts which have more stable income producing potentialities than the tracts with less income producing capabilities when land prices decline.

Table 6.1 Results of Final Equation for Southeast Region

Parameter	1976 - 1984 Parameter Estimate	1976 - 1984 Standard Error	1976 - 1978 Parameter Estimate	1976 - 1978 Standard Error	1979 - 1981½ Parameter Estimate	1979 - 1981½ Standard Error	1981½ - 1984½ Parameter Estimate	1981½ - 1984½ Standard Error
Intercept	97.597	29.424 ***	109.677	46.391 **	4.863	65.625	273.469	42.947 ***
Acres purchased	-0.080	0.037 **	-0.100	0.066	0.005	0.064	-0.100	0.060 *
Percent cropland	2.798	0.190 ***	2.486	0.302 ***	3.503	0.383 ***	2.480	0.284 ***
Percent irrigated tract	2.610	0.428 ***	2.736	0.664 ***	1.760	0.956 *	2.440	0.581 ***
Dbvpa	0.752	0.058 ***	0.789	0.080 ***	0.797	0.131 ***	0.738	0.095 ***
Time	0.643	0.176 ***	2.126	0.566 ***	0.499	0.968	-5.039	0.869 ***
Pcorn	-13.333	13.171	-36.492	23.783	12.607	25.247	-19.506	19.147
Nonfarm	213.759	24.763 ***	171.331	34.263 ***	323.643	47.025 ***	94.958	49.212 *
Farm class	85.230	11.895 ***	66.512	20.698 ***	77.355	24.190 ***	116.532	16.074 ***
Yankton County	159.245	19.019 ***	153.543	30.619 ***	239.463	38.813 ***	99.453	28.995 ***
Bon Homme County	46.205	18.098 ***	49.488	30.877	21.475	36.153	48.744	26.988 *
Hutchinson County	75.593	17.635 ***	108.525	28.948 ***	68.637	33.867 **	55.251	27.606 **
Douglas County	15.765	20.244	13.281	28.388	-2.256	43.264	30.299	32.353
Union County	289.999	20.471 ***	327.591	34.343 ***	321.859	39.767 ***	217.748	31.705 ***
Clay County	241.203	19.894 ***	286.729	36.396 ***	207.416	37.318 ***	215.332	29.542 ***
Lincoln County	250.765	19.261 ***	293.476	33.389 ***	268.132	37.558 ***	195.866	28.986 ***
Turner County	195.238	18.547 ***	186.245	31.422 ***	217.021	36.168 ***	170.767	28.055 ***
Percent financed	-0.371	0.233	-0.370	0.384	0.137	0.548	-0.842	0.307 ***
Percent cash seller received	-0.218	0.261	-0.359	0.457	-0.731	0.529	-0.292	0.386
Real interest	-16.776	1.767 ***	-1.855	7.129	3.121	7.642	-3.417	4.809
Term	1.066	0.616 *	-0.673	0.995	1.551	1.251	1.327	0.918
LFLB	-14.271	19.047	-2.131	33.881	-27.084	34.357	-31.871	28.804
LFmHA	-52.023	29.417 *	23.830	49.757	-34.107	71.325	-72.517	45.211
Lother	34.792	29.652	4.221	41.119	101.824	94.311	91.973	49.436 *
Summary statistics	N_2 = 1210 R^2 = 0.668 $\bar{R}^2$ = 0.661 Dep. Mean = 457.576 RMSE = 124.333 F = 103.880		N_2 = 378 R^2 = 0.758 $\bar{R}^2$ = 0.742 Dep. Mean = 442.165 RMSE = 109.416 F = 48.252		N_2 = 373 R^2 = 0.654 $\bar{R}^2$ = 0.631 Dep. Mean = 501.709 RMSE = 141.179 F = 28.729		N_2 = 459 R^2 = 0.707 $\bar{R}^2$ = 0.691 Dep. Mean = 434.404 RMSE = 105.546 F = 45.700	

Level of significiance: *** = .01, ** = .05, * = .10

Intercept = Charles Mix County

Table 6.2 Results of Final Equation for East Central Region

Parameter	1976 - 1984 Parameter Estimate	1976 - 1984 Standard Error	1976 - 1978 Parameter Estimate	1976 - 1978 Standard Error	1979 - 1981½ Parameter Estimate	1979 - 1981½ Standard Error	1981½ - 1984½ Parameter Estimate	1981½ - 1984½ Standard Error
Intercept	235.756	22.184 ***	147.231	39.801 ***	308.109	43.577 ***	281.854	35.206 ***
Acres purchased	-0.0792	0.0244***	-0.0014	0.0410	-0.0982	0.0372***	-0.1606	0.0527***
Percent cropland	1.789	0.129 ***	1.811	0.223 ***	1.529	0.243 ***	1.934	0.213 ***
Dbvpa	0.971	0.041 ***	1.153	0.078 ***	1.019	0.077 ***	0.876	0.062 ***
Time	0.217	0.122 *	1.277	0.440 ***	0.408	0.596	-3.300	0.906 ***
Pcorn	25.168	7.659 ***	39.486	14.888 ***	28.439	17.432 *	48.246	17.530 ***
Nonfarm	238.672	23.534 ***	230.917	32.504 ***	257.184	49.274 ***	169.493	49.369 ***
Farm class	154.546	13.147 ***	98.964	26.754 ***	182.398	25.723 ***	152.268	18.374 ***
Minnehaha County	105.968	9.853 ***	149.909	16.016 ***	84.161	17.639 ***	69.945	22.193 ***
Davison County	-101.275	15.117 ***	-63.097	25.942 **	-135.050	27.723 ***	-93.697	30.554 ***
Hanson County	-102.751	15.440 ***	-61.395	25.716 **	-131.189	31.161 ***	-121.024	31.294 ***
Kingsbury County	-116.076	10.594 ***	-88.919	17.469 ***	-143.262	21.724 ***	-118.558	18.245 ***
Lake County	-34.411	11.688 ***	-29.438	16.237 *	-71.093	23.915 ***	-9.870	22.870
McCook County	-68.878	10.113 ***	-56.716	17.029 ***	-91.465	17.178 ***	-82.231	23.194 ***
Miner County	-145.293	11.421 ***	-113.133	19.450 ***	-184.265	23.871 ***	-115.532	21.204 ***
Moody County	75.595	10.300 ***	51.490	16.055 ***	85.393	21.461 ***	84.622	17.099 ***
Sanborn County	-134.769	14.044 ***	-107.529	31.120 ***	-169.408	23.643 ***	-148.705	25.898 ***
Percent financed	0.117	0.595	0.143	0.336	0.000	0.378	0.067	0.320
Percent cash seller received	-0.365	0.193 *	-0.141	0.320	-0.931	0.397 **	-0.707	0.325 **
Real interest	-9.385	1.292 ***	4.100	4.949	7.121	4.488	0.204	4.497
Term	-0.287	0.469	-0.273	0.834	-0.164	0.863	-0.090	0.749
LFLB	41.573	15.591 ***	1.220	27.033	70.881	29.172 **	27.577	26.271
LFmHA	17.745	20.933	9.150	35.007	60.465	40.097	35.760	36.761
Lother	24.543	18.393	25.119	31.967	27.101	41.707	16.606	27.251
Summary statistics	N_2 = 1503 R_2^2 = 0.713 $\bar{R}^2$ = 0.709 Dep. Mean = 374.853 RMSE = 100.807 F = 160.138		N_2 = 563 R_2^2 = 0.722 $\bar{R}^2$ = 0.710 Dep. Mean = 362.057 RMSE = 97.373 F = 61.074		N_2 = 474 R_2^2 = 0.742 $\bar{R}^2$ = 0.729 Dep. Mean = 389.720 RMSE = 101.076 F = 56.518		N_2 = 466 R_2^2 = 0.738 $\bar{R}^2$ = 0.725 Dep. Mean = 375.192 RMSE = 97.107 F = 54.342	

Level of significance: *** = .01, ** = .05, * = .10

Intercept = Brookings County

Table 6.3 Results of Final Equation for Northeast Region

Parameter	1976 - 1984 Parameter Estimate	1976 - 1984 Standard Error	1976 - 1978 Parameter Estimate	1976 - 1978 Standard Error	1979 - 1981½ Parameter Estimate	1979 - 1981½ Standard Error	1981½ - 1984½ Parameter Estimate	1981½ - 1984½ Standard Error
Intercept	152.399	15.056 ***	133.976	21.349 ***	165.039	26.434 ***	287.580	28.992 ***
Acres purchased	-0.0250	0.0109**	-0.0085	0.0158	-0.0056	0.0197	-0.0513	0.0193***
Percent cropland	1.808	0.085 ***	1.471	0.126 ***	1.850	0.152 ***	1.966	0.155 ***
Percent irrigated tract	1.638	0.533 ***	0.727	0.628	2.633	0.916 ***	1.766	1.546
Dbvpa	0.995	0.047 ***	0.788	0.084 ***	1.138	0.069 ***	0.922	0.088 ***
Time	0.461	0.087 ***	0.557	0.254 **	0.919	0.411 **	-2.561	0.516 ***
Pgrncrn	19.459	7.236 ***	42.510	10.869 ***	35.735	14.161 ***	-4.037	11.995
Nonfarm	72.595	19.384 ***	78.336	23.139 ***	-12.501	37.765	163.621	44.032 ***
Marshall County	-19.819	10.408 *	25.721	14.424 *	-13.477	19.552	-84.230	19.300 ***
Roberts County	-9.098	8.438	25.126	12.018 **	16.552	15.624	-80.669	15.181 ***
Day County	-80.348	9.775 ***	-39.434	13.994 ***	-57.479	18.816 ***	-142.444	17.111 ***
Grant County	-36.158	7.062 ***	-29.031	10.613 ***	-41.343	12.119 ***	-52.497	12.808 ***
Clark County	-93.776	7.420 ***	-81.008	9.910 ***	-89.575	14.037 ***	-120.138	14.136 ***
Codington County	-66.742	7.443 ***	-40.400	11.053 ***	-93.553	13.166 ***	-90.063	13.306 ***
Hamlin County	-37.766	7.337 ***	-6.006	11.075	-45.592	12.222 ***	-83.423	13.791 ***
Percent financed	-0.084	0.131	-0.215	0.201	-0.287	0.245	-0.318	0.256
Percent cash seller received	-0.328	0.114 ***	-0.445	0.171 ***	-0.396	0.213 *	-0.243	0.207
Real interest	-4.585	0.914 ***	3.390	2.704	3.137	2.478	-2.838	2.429
Term	0.688	0.305 **	1.183	0.471 ***	0.494	0.499	0.790	0.596
LFLB	2.366	8.872	-11.012	12.142	1.464	15.733	4.085	18.523
LFmHA	-30.150	12.436 **	-17.412	17.983	-26.963	22.681	-38.508	23.914
Lother	13.637	12.059	9.208	20.551	3.462	23.700	9.873	20.393
Summary statistics	N_2 = 1445		N_2 = 516		N_2 = 478		N_2 = 451	
	R^2 = 0.524		R^2 = 0.516		R^2 = 0.613		R^2 = 0.573	
	$\bar{R}^2$ = 0.517		$\bar{R}^2$ = 0.496		$\bar{R}^2$ = 0.595		$\bar{R}^2$ = 0.553	
	Dep. Mean = 266.649		Dep. Mean = 251.6		Dep. Mean = 282.098		Dep. Mean = 267.493	
	RMSE = 74.012		RMSE = 62.693		RMSE = 74.462		RMSE = 74.613	
	F = 74.745		F = 25.136		F = 34.461		F = 27.513	

Level of significance: *** = .01, ** = .05, * = .10

Intercept = Deuel County

Table 6.4 Results of Final Equation for North Central Region

Parameter	1976 - 1984 Parameter Estimate	1976 - 1984 Standard Error	1976 - 1978 Parameter Estimate	1976 - 1978 Standard Error	1979 - 1981½ Parameter Estimate	1979 - 1981½ Standard Error	1981½ - 1984½ Parameter Estimate	1981½ - 1984½ Standard Error
Intercept	208.390	10.115 ***	188.809	16.429 ***	187.355	17.807 ***	214.832	18.377 ***
Acres purchased	-0.0003	0.0033	0.0032	0.0061	0.0019	0.0042	-0.0296	0.0105***
Percent cropland	0.939	0.068 ***	1.021	0.114 ***	0.849	0.115 ***	0.810	0.126 ***
Percent irrigated tract	1.442	0.244 ***	1.926	0.480 ***	0.998	0.432 **	1.495	0.374 ***
Dbvpa	0.875	0.028 ***	0.956	0.061 ***	0.804	0.052 ***	0.875	0.041 ***
Time	-0.399	0.066 ***	0.122	0.253	-0.682	0.322 **	-2.019	0.391 ***
Pgrncrn	9.221	7.475	18.169	13.266	-1.928	12.542	1.617	13.174
Pwheat	4.749	4.880	-1.919	8.218	13.569	7.852 *	2.964	9.270
Nonfarm	104.307	10.007 ***	123.943	15.620 ***	73.896	14.876 ***	134.959	25.762 ***
McPherson County	-76.005	5.565 ***	-68.384	9.039 ***	-68.710	9.235 ***	-81.118	10.846 ***
Spink County	-27.545	5.311 ***	-27.265	11.365 **	-5.179	9.505	-43.254	7.787 ***
Campbell County	-78.794	6.928 ***	-70.427	11.420 ***	-70.136	12.469 ***	-85.472	12.075 ***
Potter County	-58.675	5.992 ***	-48.680	11.379 ***	-46.757	10.263 ***	-72.225	9.463 ***
Faulk County	-67.577	5.894 ***	-67.416	9.505 ***	-49.587	9.659 ***	-93.996	11.633 ***
Edmunds County	-60.240	5.225 ***	-53.448	8.459 ***	-53.646	8.552 ***	-72.945	10.484 ***
Walworth County	-52.336	6.494 ***	-30.960	10.119 ***	-65.732	10.902 ***	-58.002	13.613 ***
Percent financed	-0.218	0.100 **	-0.286	0.168 *	-0.163	0.172	0.010	0.188
Percent cash seller received	-0.097	0.085	-0.031	0.157	-0.062	0.159	-0.247	0.145 *
Real interest	-1.357	0.652 **	2.969	2.450	-0.267	1.551	0.972	1.950
Term	0.353	0.214	0.125	0.361	0.319	0.377	0.460	0.380
LFLB	0.061	6.784	-5.163	12.187	-0.087	12.726	6.958	10.819
LFmHA	-6.591	8.872	0.028	15.232	-3.532	15.812	-8.366	16.269
Lother	-1.274	8.635	1.454	14.717	-3.118	14.931	-19.966	15.734
Summary statistics	N_2 = 1144 R_2^2 = 0.674 $\bar{R}^2$ = 0.668 Dep. Mean = 209.237 RMSE = 50.905 F = 105.594		N_2 = 385 R_2^2 =0.683 $\bar{R}^2$ = 0.664 Dep. Mean = 215.514 RMSE = 49.055 F = 35.552		N_2 = 390 R_2^2 = 0.653 $\bar{R}^2$ = 0.633 Dep. Mean = 206.454 RMSE = 49.454 F = 31.517		N_2 = 369 R_2^2 = 0.752 $\bar{R}^2$ = 0.737 Dep. Mean = 205.628 RMSE = 50.261 F = 47.896	

Level of significance: *** = .01, ** = .05, * = .10

Intercept = Brown County

Table 6.5 Results of Final Equation for Central Region

Parameter	1976 - 1984 Parameter Estimate	1976 - 1984 Standard Error	1976 - 1978 Parameter Estimate	1976 - 1978 Standard Error	1979 - 1981½ Parameter Estimate	1979 - 1981½ Standard Error	1981½ - 1984½ Parameter Estimate	1981½ - 1984½ Standard Error
Intercept	182.257	11.482 ***	166.915	23.182 ***	174.730	19.719 ***	161.757	14.379 ***
Acres purchased	-0.0118	0.0037***	-0.0105	0.0095	-0.0137	0.0061**	-0.0082	0.0042**
Percent cropland	0.598	0.074 ***	0.590	0.148 ***	0.513	0.143 ***	0.566	0.084 ***
Dbvpa	0.763	0.072 ***	0.776	0.158 ***	0.817	0.130 ***	0.804	0.077 ***
Time	-0.357	0.085 ***	0.564	0.387	-0.525	0.370	-1.542	0.271 ***
Pgrncrn	21.971	5.864 ***	6.957	10.584	34.319	11.128 ***	10.397	7.142
Pwheat	4.011	6.235	-0.445	12.646	2.880	11.431 ***	3.890	7.190
Nonfarm	67.191	15.493 ***	8.564	23.662	224.455	31.045	-6.314	23.031
Sully County	-12.265	6.921 *	-8.287	15.018	-6.957	12.016	-10.108	7.949
Hyde County	-42.820	8.016 ***	-55.991	16.504 ***	-35.243	15.655 **	-31.476	8.467 ***
Hand County	-28.015	6.401 ***	-24.199	15.206	-30.686	10.811 ***	-21.492	7.158 ***
Hughes County	-1.739	6.769	-8.089	15.135	19.359	11.798	-18.760	7.701 **
Buffalo-Jerauld County	-28.668	7.462 ***	-29.788	18.680	-24.600	13.916 *	-26.389	7.470 ***
Brule County	-30.972	7.762 ***	-34.681	13.156 ***	-33.748	16.563 **	-6.372	9.327
Aurora County	-10.403	7.152	-19.143	11.539 *	15.873	16.427	-6.774	8.886
Percent financed	-0.012	0.107	0.123	0.198	-0.079	0.187	-0.011	0.144
Percent cash seller received	0.032	0.101	0.027	0.184	-0.054	0.181	-0.137	0.143
Real interest	-2.911	0.780 ***	6.365	4.132	0.092	2.074	0.902	1.322
Term	-0.0481	0.261	-0.528	0.624	0.173	0.455	0.244	0.311
LFLB	-4.393	8.043	-17.779	16.382	-7.296	14.628	1.064	9.855
LFmHA	-12.530	11.045	-17.427	24.587	5.174	18.459	-6.511	14.362
Lother	-2.978	14.085	-58.348	27.355 **	-0.260	22.662	37.791	22.863 *
Summary statistics	N_2 = 681 R^2 = 0.461 $\bar{R}^2$ = 0.444 Dep. Mean = 186.100 RMSE = 46.750 F = 26.873		N_2 = 183 R^2 = 0.425 $\bar{R}^2$ = 0.350 Dep. Mean = 200.984 RMSE = 46.795 F = 5.678		N_2 = 260 R^2 = 0.519 $\bar{R}^2$ = 0.477 Dep. Mean = 198.444 RMSE = 51.309 F = 12.257		N_2 = 238 R^2 = 0.619 $\bar{R}^2$ = 0.582 Dep. Mean = 161.17 RMSE = 30.494 F = 16.744	

Level of significance: *** = .01, ** = .05, * = .10

Intercept = Beadle County

Table 6.6 Results of Final Equation for South Central Region

Parameter	1976 - 1984 Parameter Estimate	1976 - 1984 Standard Error	1976 - 1978 Parameter Estimate	1976 - 1978 Standard Error	1979 - 1981½ Parameter Estimate	1979 - 1981½ Standard Error	1981½ - 1984½ Parameter Estimate	1981½ - 1984½ Standard Error
Intercept	136.292	10.394 ***	139.533	19.916 ***	119.976	17.516 ***	165.437	15.874 ***
Acres purchased	-0.0043	0.0016***	-0.0005	0.0020	-0.0139	0.0036 ***	-0.0060	0.0039
Percent cropland	0.740	0.062 ***	0.694	0.106 ***	1.022	0.114 ***	0.502	0.093 ***
Dbvpa	0.929	0.083 ***	0.879	0.182 ***	0.986	0.164 ***	1.019	0.095 ***
Time	-0.432	0.069 ***	-0.599	0.294 **	-0.958	0.279 ***	-1.134	0.276 ***
Pgrncrn	13.610	4.494 ***	33.456	8.744 ***	-4.895	7.662	17.356	6.583 ***
Pwheat	10.785	5.227 **	28.0043	8.173 ***	-8.176	11.012	15.365	8.113 *
Nonfarm	43.140	12.822 ***	39.238	20.789 *			40.187	13.596 ***
Jones County	-27.496	5.848 ***	-16.891	9.638 *	-14.600	11.712	-49.605	8.897 ***
Lyman County	-0.920	4.479	12.028	7.874	7.326	9.875	-16.908	5.696 ***
Mellett County	-33.121	6.469 ***	-29.736	12.423 **	-13.200	12.055	-51.980	8.237 ***
Todd County	-5.546	6.014	-15.973	12.014	15.839	10.424	-28.070	8.028 ***
Gregory County	13.382	3.846 ***	7.606	8.497	19.367	5.930 ***	0.267	5.731
Percent financed	-0.048	0.108	-0.275	0.199	0.070	0.180	-0.283	0.184
Percent cash seller received	-0.048	0.093	0.019	0.194	-0.066	0.171	-0.264	0.129 **
Real interest	0.220	0.646	-1.766	2.647	3.832	1.596	0.810	1.334
Term	0.116	0.220	0.278	0.439	0.189	0.351	0.354	0.341
LFLB	4.231	7.489	0.495	15.887	-9.328	12.963	32.723	10.267 ***
LFmHA	-6.860	9.254	-13.818	21.412	-7.491	15.567	28.281	12.565 **
Lother	-1.019	11.175	25.089	21.455	-10.521	21.065	-12.559	15.540
Summary statistics	N_2 = 560 R^2 = 0.622 $\bar{R}^2$ = 0.609 Dep. Mean = 155.69 RMSE = 32.763 F = 46.928		N_2 = 161 R^2 = 0.654 $\bar{R}^2$ = 0.607 Dep. Mean = 165.660 RMSE = 32.786 F = 14.027		N_2 = 208 R^2 = 0.645 $\bar{R}^2$ = 0.612 Dep. Mean = 162.767 RMSE = 33.412 F = 19.155		N_2 = 191 R^2 = 0.738 $\bar{R}^2$ = 0.708 Dep. Mean = 139.578 RMSE = 25.574 F = 25.347	

Level of significance: *** = .01, ** = .05, * = .10

Intercept = Tripp County

Table 6.7 Results of Final Equation for Western Region

Parameter	1976 - 1984 Parameter Estimate	1976 - 1984 Standard Error	1976 - 1978 Parameter Estimate	1976 - 1978 Standard Error	1979 - 1981½ Parameter stimate	1979 - 1981½ Standard Error	1981½ - 1984½ Parameter Estimate	1981½ - 1984½ Standard Error
Intercept	167.995	23.722 ***	141.128	20.635 ***	170.219	37.421 ***	216.702	46.944 ***
Acres purchased	-0.0016	0.0017	-0.0011	0.0010	-0.0048	0.0039	-0.0030	0.0044
Percent cropland	0.962	0.166 ***	0.879	0.127 ***	0.941	0.285 ***	1.137	0.353 ***
Percent irrigated tract	1.021	0.309 ***	1.345	0.293 ***	1.795	0.537 ***	0.207	0.588
Dbvpa	1.148	0.054 ***	1.201	0.032 ***	1.350	0.105 ***	0.991	0.226 ***
Time	-0.264	0.177	-0.144	0.328	-1.881	0.886 ***	-4.084	1.143 ***
Pgrncrn	136.201	21.784 ***	30.332	18.885	155.066	38.365 ***	153.465	41.593 ***
Pwheat	2.569	12.599	12.097	9.258	-2.562	21.339	-7.257	28.165
Nonfarm	225.378	16.674 ***	86.428	21.780 ***	212.159	29.416 ***	236.194	29.478 ***
Region 1[a]	-79.038	14.885 ***	-59.831	12.808 ***	-72.224	25.283 ***	-76.969	30.039 ***
Region 2	-87.003	17.616 ***	-63.314	15.151 ***	-67.797	31.060 **	-90.143	33.864 ***
Region 3	-62.133	15.962 ***	-59.012	15.026 ***	-73.952	26.001 ***	-30.829	31.907
Region 4	-63.916	16.304 ***	-38.738	14.367 ***	-61.131	26.375 **	-42.325	34.421
Region 5	-48.844	17.005 ***	-51.636	14.181 ***	-37.836	27.962	-35.708	35.590
Percent financed	-0.023	0.230	0.202	0.188	-0.132	0.380	-0.079	0.493
Percent cash seller received	-0.111	0.200	-0.151	0.178	-0.159	0.344	-0.572	0.425
Real interest	-3.032	1.695 *	-5.744	3.575	6.081	4.584	5.405	5.482
Term	-0.209	0.578	-0.198	0.513	1.679	1.006 *	-1.935	1.119 *
LFLB	2.545	15.625	-0.387	13.355	-25.510	26.438	20.783	32.159
LFmHA	-2.294	21.805	-24.795	20.912	-12.358	43.174	52.768	40.611
Lother	-4.804	22.938	-15.037	23.531	-59.822	40.153	-11.865	45.333
Summary statistics	N_2 = 659 R_2^2 = 0.693 $\bar{R}^2$ = 0.683 Dep. Mean = 169.176 RMSE = 97.028 F = 72.147		N_2 = 179 R_2^2 = 0.943 $\bar{R}^2$ = 0.936 Dep. Mean = 154.474 RMSE = 39.228 F = 131.258		N_2 = 231 R_2^2 = 0.749 $\bar{R}^2$ = 0.725 Dep. Mean = 174.424 RMSE = 97.058 F = 31.414		N_2 = 249 R_2^2 = 0.576 $\bar{R}^2$ = 0.539 Dep. Mean = 170.236 RMSE = 116.829 F = 15.518	

Level of significance: *** = .01, ** = .05, * = .10

Intercept = Black Hills region

[a]The location of each region is shown on the map

Table 6.8 Summary of Statistical Test for Added County Variables by Region

	Southeast				East Central			
F-test	1976-84	1976-78	1979-81½	1981½-84½	1976-84	1976-78	1979-81½	1981½-84½
Calculated	60.85	17.94	17.9	17.22	76.18	26.67	26.78	30.58
Critical	2.96	2.66	2.66	2.66	2.56	2.56	2.56	2.56
	Northeast				North Central			
F-test	1976-84	1976-78	1979-81½	1981½-84½	1976-84	1976-78	1979-81½	1981½-84½
Calculated	38.44	17.73	15.96	16.79	46.73	14.7	14.49	20.86
Critical	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79
	Central				South Central			
F-test	1976-84	1976-78	1979-81½	1981½-84½	1976-84	1976-78	1979-81½	1981½-84½
Calculated	8.04	2.55	4.47	4.19	13.8	3.64	4.38	12.29
Critical	2.79	2.79	2.79	2.79	3.17	3.17	3.17	3.17
	Western							
F-test	1976-84	1976-78	1979-81½	1981½-84½				
Calculated	7.2	5.68	2.15	2.36				
Critical	3.17	3.17	3.17	3.17				

Critical F-value for each equation in each region is given for the 0.01 probability level.

Table 6.9 Summary of Statistical Test for Added Financial/Lender Variables by Region

	Southeast				East Central			
F-test	1976-84	1976-78	1979-81½	1981½-84½	1976-84	1976-78	1979-81½	1981½-84½
Calculated	17.57	2.36	1.82	3.91	9.48	0.42	1.4	1.58
Critical	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79
	Northeast				North Central			
F-test	1976-84	1976-78	1979-81½	1981½-84½	1976-84	1976-78	1979-81½	1981½-84½
Calculated	11.32	3.48	2.48	2.24	2.46	0.97	0.29	1.63
Critical	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79
	Central				South Central			
F-test	1976-84	1976-78	1979-81½	1981½-84½	1976-84	1976-78	1979-81½	1981½-84½
Calculated	2.65	2.16	0.33	0.86	0.82	0.94	1.04	3.02
Critical	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79
	Western							
F-test	1976-84	1976-78	1979-81½	1981½-84½				
Calculated	1.01	2.06	0.86	1.18				
Critical	2.79	2.79	2.79	2.79				

Critical F-value for each equation in each region is given for the 0.01 probability level.

Table 6.10 Results of Base Equation and Final Equation Models of Stability of Coefficients in each Region

Region	Time Period	Number of Observation	Base Equation Results RMSE	R^2	F-value	Final Equation Results RMSE	R^2	F-value
Southeast	1976-84	1210	148.339	.518	163.837	124.333	.661	103.880
	1976-78	378	129.612	.638	84.271	109.416	.742	48.252
	1979-81½	373	166.652	.486	45.085	141.179	.631	28.729
	1981½-84½	459	122.527	.584	81.591	105.546	.691	45.700
			F-Test for Stability of Coefficient					
			Calculated F-value = 21.62			Calculated F-value = 7.1		
			Critical F-value = 2.51-2.66[a]			Critical F-value = 1.79-1.95[a]		
East Central	1976-84	1503	123.895	.560	274.637	100.807	.709	160.138
	1976-78	563	115.453	.593	118.230	97.373	.710	61.074
	1979-81½	474	124.088	.592	99.296	101.076	.729	56.518
	1981½-84½	466	122.661	.561	86.052	97.107	.725	54.342
			F-Test for Stability of Coefficient					
			Calculated F-value = 14.64			Calculated F-value = 5.18		
			Critical F-value = 2.64-2.79[a]			Critical F-value = 1.79-1.95[a]		
Northeast	1976-84	1445	82.487	.400	138.907	74.013	.517	74.745
	1976-78	516	70.740	.358	42.086	62.693	.496	25.136
	1979-81½	478	83.252	.494	67.674	74.462	.595	34.461
	1981½-84½	451	84.228	.430	49.576	74.613	.553	27.513
			F-Test for Stability of Coefficient					
			Calculated F-value = 19.0			Calculated F-value = 8.99		
			Critical F-value = 2.64-2.79[a]			Critical F-value = 1.88-2.03[a]		

Region	Time Period	Number of Observation	Base Equation Results RMSE	R^2	F-value	Final Equation Results RMSE	R^2	F-value
North Central	1976-84	1144	57.897	.570	190.934	50.905	.668	105.594
	1976-78	385	54.943	.579	67.006	49.055	.664	35.552
	1979-81½	390	55.081	.548	60.014	49.637	.633	31.517
	1981½-84½	369	59.544	.631	79.665	59.217	.635	43.692
			F-Test for Stability of Coefficient					
			Calculated F-value = 9.31			Calculated F-value = 4.73		
			Critical F-value = 2.51-2.66[a]			Critical F-value = 1.88-2.03[a]		
Central	1976-84	681	48.849	.393	63.925	46.750	.444	26.873
	1976-78	183	49.376	.279	10.958	46.795	.350	5.678
	1979-81½	260	53.209	.437	29.806	51.309	.477	12.257
	1981½-84½	238	31.866	.544	41.396	30.494	.582	16.744
			F-Test for Stability of Coefficient					
			Calculated F-value = 15.95			Calculated F-value = 6.49		
			Critical F-value = 2.64-2.79[a]			Critical F-value = 1.88-2.03[a]		
South Central	1976-84	560	34.570	.563	104.841	32.763	.609	46.928
	1976-78	161	34.120	.574	31.896	32.786	.607	14.027
	1979-81½	208	34.795	.579	48.532	33.412	.612	19.155
	1981½-84½	191	30.394	.588	39.859	25.574	.708	25.347
			F-Test for Stability of Coefficient					
			Calculated F-value = 9.02			Calculated F-value = 5.87		
			Critical F-value = 2.64-2.79[a]			Critical F-value = 1.88-2.03[3]		
Western	1976-84	659	99.318	.668	167.011	99.281	.668	89.639
	1976-78	179	42.766	.924	271.465	39.228	.936	131.258
	1979-81½	231	98.093	.719	74.835	97.058	.725	31.414
	1981½-84½	249	118.789	.523	35.091	116.828	.539	15.518
			F-Test for Stability of Coefficient					
			Calculated F-value = 7.86			Calculated F-value = 3.78		
			Critical F-value = 2.51-2.66[a]			Critical F-value = 1.88-2.03[a]		

[a]Critical F-value for each equation in each region is given for the 0.01 probability level.

CHAPTER VII

SUMMARY, CONCLUSION AND IMPLICATIONS

Summary-Objective and Procedures

The overall purpose of this research effort was to determine the significance of factors influencing farmland prices in South Dakota and in different regions of South Dakota.

The specific objectives were to:

(1) develop cross-sectional econometric models to explain variation in farmland prices in (a) South Dakota and in (b) different regions of the State.

(2) determine the significance of the added locational variables to explain variation in farmland prices, statewide and by region.

(3) determine the significance of added financial/lender variables to explain variation in farmland prices, statewide and by region.

(4) test the stability of coefficients over different time periods to determine if structural change in coefficients had occurred.

Multiple regression and analysis of covariance techniques were used to accomplish the objectives of this study. Cross-sectional data were used to determine the relationship between the dependent variable and selected explanatory variables. Two models were developed: the state model and the regional models. Each model contained three equations: base equation, equation II and final equation. The base

equation contained land tract explanatory variables, equation II contained land tract and locational variables, while the final equation contained the land tract, locational and financial/lender variables.

F-tests were performed to determine the significance of the added locational and financial/lender variables. Another F-test was conducted to test for significance of stability of coefficients in different time periods.

An 8½-year time period was selected for this study (January 1976-June 1984). This time period was selected because several trends in farmland prices, interest rates and inflation rates were experienced during this time period. To test the stability of coefficients over different time periods, this overall time period was split into three different time periods of (a) 1976-78, (b) 1979-1981½, (c) 1981½-1984½. Each of these time periods had different trends, inflation rates, nominal prices of farmland and interest rates. All equations for each model were estimated for the entire time period and for each of three subperiods.

Data for individual sale tracts were collected from the Federal Land Bank of Omaha, Nebraska. Officials at each FLBA office located throughout the state recorded information on all bona fide farmland sales of 40 acres or more made known to them. During the 8½-year time period, the Federal Land Bank recorded 9746 sales in South Dakota. A total of 8276 sales were credit financed during this 8½-year period. This study was limited to analysis of credit financed sales where complete data was available for all explanatory variables. A total of

7202 farmland sales met this criteria and were included in the analysis.

Summary of Empirical Results of State Model

In the state model, during the entire time period all of the land tract variables of acres purchased, percent cropland, percent irrigated, deflated building value per acre, time, Pcorn, Pgrain, Pwheat, nonfarm and farm class, all of the locational variables but South Central region; and, all of the financial/lender variables except for percent financed, term and LFLB were found to be significant.

In different time periods, almost all of the land tract variable were found significant except for acres purchased in the first time period, Pgrain in the second and time trend in the last time period. In the first time period all of the locational variables were significant and in the second time period all but the South Central and Western and in the last time period all but the South Central region were significant.

The financial variable of percent cash received was found significant in all three time periods. Real interest rate was significant in the first and the second time period. The variables of percent financed and repayment term were found significant only in the second time period. None of the lender variables were significant in any time period.

Regional Model-Base Equation

In the base equation of the regional models, land tract variables were generally found to be significant in all equations, regions and time periods. The variables percent cropland and deflated building

value per acre found to be significant in all regions and in all time periods. The variables nonfarm and percent irrigated tract were significant in most of the time periods and in almost all regions.

Principal product corn was significant in all time periods in the Southeast and East Central regions. Product graincorn was significant in all time periods in the Northeast region, but only significant in the first two time periods in the North Central region and the last two time periods in the Central and Western regions. In the South Central region, this variable was found to be significant in the first and the last time periods. Product wheat was significant in only the first two time periods in the South Central region. In each region, predominant hayland and pasture/range tracts were included in the intercept.

The time trend coefficient was significant in the 1976-78 time period in the Southeast region. This coefficient was positive in the first two time periods in the East Central and Northeastern regions. The variable was negative and significant in the last time periods in the Southeast, East Central and Northeast regions. In the South Central region it was found negative and significant in each time period. The variable was also negative and significant from 1979-1984 in North Central, Central and Western regions. This variable reflects regional differences in real (inflation adjusted) price trends of farmland over the study period.

Regional Model-Final Equation

In the final equation of the regional models, the land tract variables of percent cropland, deflated building value per acre, farm

class and nonfarm were found to be significant in almost all time periods and in all regions. The variables acres purchased, percent irrigated tract and time were significant in many cases. Financial variables of percent cash received and repayment terms were significant in some cases, but coefficients of other financial/lender variables were found to be significant in a very few cases. The coefficient of real interest rate was found significant only in the second time period in the South Central region.

Overall Summary

In the state model, the highest average per acre sale price was recorded in the second time period and during this time period the average number of acres purchased was also highest. The lowest per acre average sale price and lowest average number of acres purchased were found in the last time period (1981½-84½). Seller financing was used in 54% of credit financed sales, followed by the Federal Land Bank with 35%.

In the regional models, the highest average per acre sale prices were found in the Southeast and East Central regions, while the lowest per acre prices were in the Western and South Central regions. In each region per acre prices of cropland were higher than per acre prices of pasture land. The average number of acres purchased was lowest (142 acres) in the Southeast region which is predominantly cornbelt, while the average number of acres purchased was highest (1224 acres) in Western region which is mainly pasture land.

Deflated building value per acre was found highest in the East Central region and the lowest in the Central region. Seller financing

was the dominant source of financing in all regions and in all time periods. The Federal Land Bank was the second major source of financing.

The added location (county) variables were collectively significant in all regions for the entire 8½-year time period. In the 1976-78 time period, they were significant in all but the Central region. In the later two time periods, they were significant in all regions except for Western South Dakota.

The added financial/lender variables were collectively significant in the Southeast, East Central and Northeast regions in the 1976-84½ time period. In the 1979-81½ period, they were not significant in any of the regions. In the last time period, they were significant only in the Southeast and South Central regions. In general, the longer the time period considered the greater the significance level of the financial/lender variables.

The F-test for stability of coefficients across time periods were found significant in all regions.

Conclusions and Implications

Several conclusions and implications can be drawn from this research effort. It was found that there were significant variations in land tract variables such as price per acre, average number of acres purchased, and the type of land use in different regions. From these informations, conclusion can be drawn that the price of farmland in South Dakota varies significantly by region and by land use. This fact is evident when one looks at farmland market behavior in the Southeast and Western regions. The Southeast region is mostly cornbelt, where

cropland is 80% of acres sold, while in the Western region cropland is only 41.7% of acres sold. It is also evident that pastureland is generally sold in larger tracts at a lower price than cropland. In the Western region, the average tract sold is much greater than the average tract size in the Southeast region.

It may be concluded that better quality of land is sold at a higher price than poorer quality of land. This assumes land use is related to quality. Even during the declining price trend of land, the potential buyer may be interested to pay higher price for better quality of land, because income potentialities in there are higher than with poorer quality of land.

Farmland prices have risen and then declined at different rates depending on dominant land uses. This is evident from farmland market behavior in Southeastern and Western South Dakota. In Southeastern South Dakota, predominantly a cornbelt area, prices declined 40-50% from 1981 to 1984, while in Western South Dakota per acre prices declined less than 20% in the same period. This fact may be supported by the nature of demand of grains and livestock. Demand for corn and soybeans is greatly influenced by international market conditions while demand for cattle is largely determined in the domestic market. In the former case, flexible exchange rate impacts on export market may have had a significant influence on demand for cropland.

The significance of added location variables collectively and individually implies that further study at the county and regional level is needed to determine which factors best explain per acre price in each local market. South Dakota has a tremendous variation in

climate, soil productivity ratings, population density, etc., and it implies that there may be some other local factors which better explain relationship between the dependent and explanatory variables.

Principal products grain and wheat in many cases exhibited negative coefficients which were not expected. Demand conditions of these products might be a factor, because demand for them is determined in world market and in recent years a "strong dollar" coupled with good harvest in the importing countries might have affected the coefficients. In many occasions real interest rate showed positive coefficients, which were not expected either. The landowners' expected return per acre might be so high to cause the coefficients to be positively related to the dependent variable, the deflated per acre farmland price.

The hypothesis test that structural changes occurred in the farmland market during the 8½-year time period implies that the explanatory power of various factors explaining characteristics on land price variation change as the general economic conditions change. This suggests that parameter estimates changed significantly in different time periods.

Potential buyers and sellers of farmland should know the factors which may influence farmland price so they can establish their maximum bid price and minimum sale price. Agricultural lenders and appraisers should have sound knowledge on the factors influencing variation in land price in a given market at a particular time period. Knowledge about some local factors which may influence valuation process is also helpful. The importance of the added location

variables in each model suggests that knowledge of changing local market conditions is important.

The insignificance of financial/lender variables in most of the regions and in most time periods may imply that they may not contribute much to an explanation of cross-sectional farmland price variation. Further study in financial/lender variables is needed to find their impacts on variation in farmland prices.

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APPENDIX

FORM 202 (Rev 12-82)

The Federal Land Bank of Omaha

FARM AND RANCH SALE SHEET

IDENTIFICATION

1. Assoc. No. and Branch Code ___ Sale Number ___ Month and year of sale ___
2. FLB loan number (Complete only if there is or will be an FLB loan on property) ...
3. Name of purchaser ...
4. Citizenship of purchaser. If purchaser is a U.S. citizen, leave both digits blank. If purchaser is not a U.S. citizen, complete both digits as follows: First digit (1-Resident alien) (2-Nonresident alien). Second digit (1-Canadian) (2-French) (3-Japanese) (4-Arabic) (5-North Central European) (6-Scandinavian) (7-Other known citizenship) (8-Unknown) ...

LOCATION AND DESCRIPTION

5. County (Where major portion of property is located) (Code) ___ State ___
6. Section, Township, and Range ...
7. Type of non-farm influence (0-None) (1-Comm. or indus. devel.) (2-Residential devel.) (3-Military installation) (4-Irrevocable hwy.) (5-Other hwy.) (6-Public and/or private recreation land) (7-Other factors) (8-Combination) (9-Mineral rights) ...
8. Degree of non-farm influence (0-None) (1-Slight) (2-Moderate) (3-Great) ...
9. Area class 1-2-3-4 and Farm class A-B-C-D ...
10. Principal product sold (Code) ... Secondary product sold (Code) ___

BUILDINGS

11. Livestock or poultry facility capacity (No. of head - one time, intensive feeding facilities only) ...
12. Type of facility (1-Broilers) (2-Eggs) (3-Other poultry) (4-Dairy) (5-Swine) (6-Beef) (7-Other livestock) ...
13. Assigned value of principal dwelling (If none, leave blank) ... $
14. Total assigned value of all buildings, including dwelling (If none, leave blank) ... $

LAND

15. Acres in permanent pasture (If none, leave blank) ...
16. Acres cultivated (If none, leave blank) ...
17. Total acres purchased ...

TERMS

18. Purchase price (per acre $ _____; per head - ranches only $ _____) Total consideration ... $
19. Cash seller received or will receive at closing (Down pay't if contract; same as line 18 if cash sale) $
20. Percent of purchase price financed with first and/or second mortgage or contract ... %
21. Amount of purchase price financed by FLB (If none, leave blank) ... $
22. If FLB financed, show second mortgage lender; if not FLB financed, who is the primary lender? (0-None) (1-FmHA) (2-PCA) (3-Insur. Co.) (4-Comm. Bank) (5-Seller) (7-Other) (8-Comb.) (9-Unknown) ...
23. Note (or contract) term (If none, leave blank) ...
24. Interest rate stated on the note or contract (If unknown or not applicable, leave blank) ... %
25. Primary reason for purchasing (1-Establish own farm) (2-Expansion) (3-Investment) (4-Non-ag development) (5-Rural home) (7-Other) (9-Unknown) ...
26. Method of sale (1-Auction - open bid) (2-Auction - sealed bid) (3-Private sale) (4-Realtor sale) (5-Other) (9-Unknown) ...
27. Reason for sale (01-Settle estate) (02-Voluntary liquidation) (03-Involuntary liquidation) (04-Retire) (05-Leave farming) (06-Estate planning) (07-Realize appreciation) (08-Purchase other land) (09-Other) (10-Unknown) ...

RELATIONSHIP TO BENCHMARK

28. Sale relates to benchmark number (If no relationship, leave blank) ...
29. Comparison to benchmark (1-Above) (2-Below) (3-Equal) ... Productivity ___ Improvements ___ Location ___
30. Loan officer's code ...
31. This price indicates an AV per (acre or head) on the above benchmark of ... $
32. Type of Sale (1-Bona fide) (2-Non-bona fide) ...

IRRIGATION

(If not irrigated, skip items 33-35)

33. Total acres irrigated (Include crop and pasture) ...
34. Method of irrigation (1-Gravity) (2-Hand- or wheel-moved sprinkler) (3-Self-propelled sprinkler) (4-Solid set sprinkler) (7-Other) (8-Combination) ...
35. Classification of water supply (1-I) (2-II) (3-III) (4-IV) ...

GRAZING LAND

(Applies only to livestock ranches)

36. Total livestock carrying capacity - total AUs (number of head - cow-calf basis) ...
37. Percent of carrying capacity from assured leases ... %
38. Type of assured lease (0-None) (1-Taylor Sec. 15) (2-BLM) (3-Nat'l forest) (4-State) (5-Private) (6-Grazing ass'n) (7-Other) (8-Combination) ...
39. Number of months available for grazing (Pasture season) ...

Boldface items must be completed on all sales. Others are optional depending on the sale.

Remarks: (Continue on reverse, if necessary) _____

Table: Mean Values of Selected Variables of State and Regional Models by Time Period

Region	Time Period	Dprice $	# of Acres Purchased	Percent Cropland	Dbvpa $	Percent Borrowed	Percent Cash	Real Interest	Years to Repay	Lsell %	LFLB %	LFmHA %	Lother %
	1976-84	287.02	349	68.1	17.96	80.4	55.9	2.37	19.2	53.9	35.2	7.3	3.6
State	1976-78	285.36	367	68.7	18.16	81.3	55.2	1.44	19.8	55.5	32.2	8.5	3.8
	1979-81½	295.82	373	67.0	17.35	80.9	55.8	0.09	19.7	53.5	37.2	6.7	2.6
	1981½-84½	279.88	309	68.4	18.37	78.9	56.6	5.56	18.2	53.0	36.2	6.6	4.2
	1976-84	457.57	142	80.1	24.26	78.6	63.1	2.78	20.1	46.0	48.0	3.5	2.5
Southeast	1976-78	442.16	150	77.4	30.94	80.6	62.9	1.54	20.5	45.9	43.1	5.8	5.2
	1979-81½	501.71	150	80.4	23.78	79.6	62.0	0.27	20.3	46.5	51.1	1.6	.8
	1981½-84½	434.40	128	82.2	19.16	76.0	64.0	5.83	19.7	45.2	50.1	3.2	1.5
	1976-84	374.85	174	76.6	27.65	79.2	51.7	2.17	18.0	61.0	32.0	4.0	3.0
East Central	1976-78	362.05	181	76.9	23.68	79.2	49.2	1.47	18.1	65.7	27.0	4.7	2.6
	1979-81½	389.72	183	76.0	26.88	79.7	51.0	-0.07	18.2	61.4	32.4	4.6	1.6
	1981½-84½	375.19	158	76.9	33.22	78.6	55.6	5.31	17.7	54.2	37.5	3.6	4.7
	1976-84	266.65	224	71.3	16.81	82.3	52.9	2.21	18.9	55.2	31.4	8.8	4.6
Northeast	1976-78	251.60	232	71.9	16.01	83.5	52.1	1.27	19.5	55.4	30.6	10.8	3.2
	1979-81½	282.09	219	70.4	17.37	82.2	51.6	0.15	19.5	56.2	34.5	6.6	2.7
	1981½-84½	267.49	221	71.5	17.13	81.2	55.3	5.47	17.6	54.0	29.0	8.8	8.2

Table: Mean Values of Selected Variables of State and Regional Models by Time Period

Region	Time Period	Dprice $	# of Acres Purchased	Percent Cropland	Dbvpa $	Percent Borrowed	Percent Cash	Real Interest	Years to Repay	Lsell %	LFLB %	LFmHA %	Lother %
	1976-84	209.23	335	66.1	14.84	81.9	59.2	2.37	19.7	49.8	34.7	10.1	5.4
North Central	1976-78	215.51	341	63.6	11.57	80.8	56.3	1.40	19.9	55.5	27.0	11.6	5.9
	1979-81½	206.45	366	63.1	14.28	83.9	63.4	0.16	20.6	45.3	38.2	11.2	5.3
	1981½-84½	205.62	296	71.9	18.85	80.0	57.8	5.72	18.6	48.7	39.2	7.3	4.8
	1976-84	186.10	413	62.8	7.74	80.0	59.8	2.61	20.0	49.7	40.0	8.3	2.0
Central	1976-78	200.98	423	65.0	7.27	80.0	60.8	1.55	22.1	48.3	40.9	8.7	2.1
	1979-81½	198.44	440	64.4	7.25	80.7	62.5	0.27	20.8	46	40.3	10.7	3.0
	1981½-84½	161.17	376	59.1	8.64	78.3	55.9	5.98	17.6	54.8	39.0	5.4	0.8
	1976-84	155.68	513	52.1	5.07	81.6	53.3	2.10	19.1	57.6	27.1	12.5	2.8
South Central	1976-78	165.66	663	53.5	5.77	83.0	59.2	1.42	20.4	50.5	31.6	13.6	4.3
	1979-81½	162.76	509	54.3	4.90	80.7	51.2	-0.10	19.4	59.7	27.4	11.0	1.9
	1981½-84½	139.57	392	48.8	4.66	81.6	50.7	5.07	17.9	61.4	23.0	13.0	2.6
	1976-84	169.17	1224	41.7	13.74	78.6	51.0	2.43	19.5	58.4	30.3	7.4	3.9
Western	1976-78	154.47	1529	44.0	16.42	80.9	51.8	1.61	21.2	54.4	34.0	8.3	3.3
	1979-81½	179.42	1250	41.1	15.17	78.2	47.9	-0.11	19.7	59.1	34.1	3.8	3.0
	1981½-84½	170.23	982	40.6	10.49	73.3	50.5	5.38	18.2	60.8	24.0	10.0	5.2