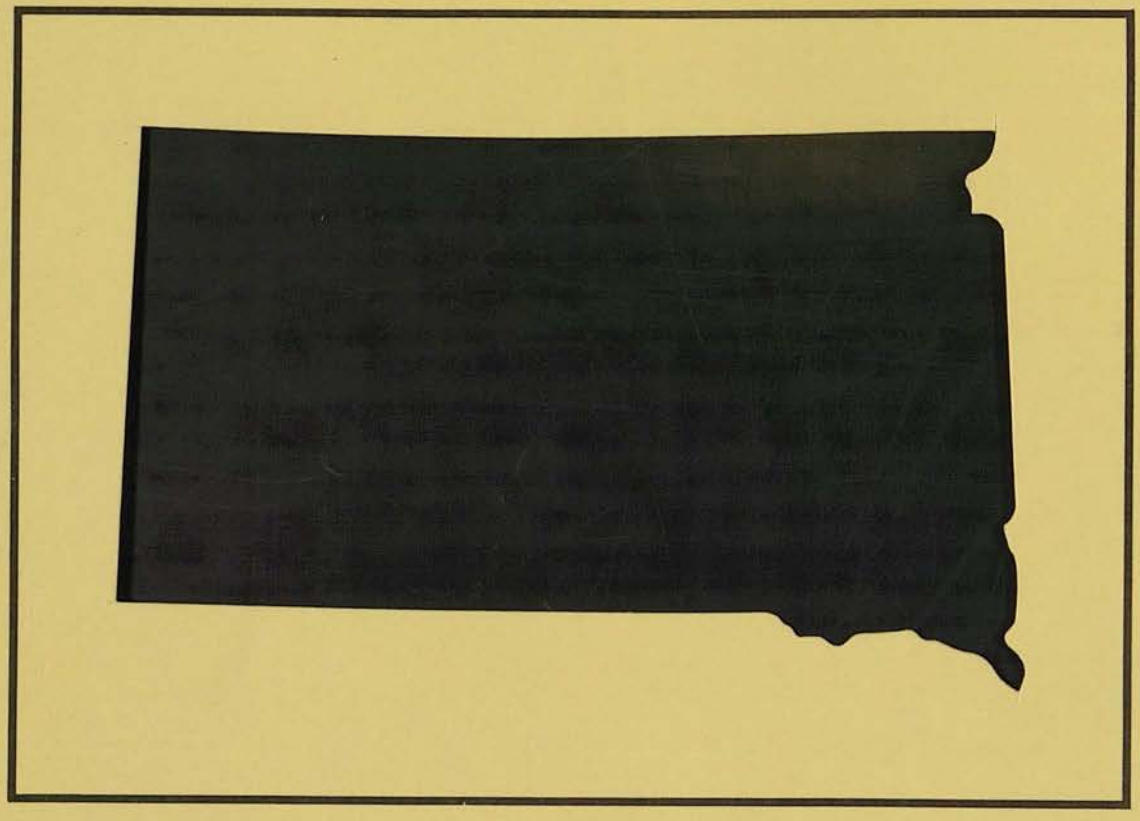

Dept. of

ECONOMICS DEPARTMENT

South Dakota State University
Brookings, South Dakota

Determinants of Farmland Prices During Periods of Rising and Declining Farmland Values *

by

Larry L. Janssen and Cindy R. Swinson **

Economics Staff Paper Series No. 85-6 ***

July, 1985

*Presented at Selected Papers Session of 1985 Western Agricultural Economics Association Annual Meeting, Saskatoon, Saskatchewan, Canada, July 9, 1985.

**Associate Professor and Research Associate in the Department of Economics at South Dakota State University.

Determinants of Farmland Prices During Periods of Rising and Declining Farmland Values

ABSTRACT

A study of farmland sales in four South Dakota counties indicated productivity and location variables are important in explaining variation in per acre sale price, while financial variables are not. The same explanatory variables are significant in periods of rising (1979-1980) and declining (1981-1982) prices but parameter estimates vary significantly between the periods. Over 80% of per acre sale price variation was explained in both periods. These findings (1) support traditional explanations of cross-sectional farmland price variation, and (2) suggest that explanatory factors exert varying pressure on farmland sale prices at different times.

Determinants of Farmland Prices During Periods of Rising and Declining Farmland Values

Recent declines in U.S. farmland prices have rekindled interest among economists on determinants of farmland prices. U.S. farmland prices soared upward from 1972-1980 and have been declining since then. Percentage declines have been most severe in the Cornbelt and Northern Plains states (USDA, FREMD, 1984).

Factors related to current or expected net returns to land have been emphasized in several major time series studies. The most important of these factors are technological changes in agriculture, farm enlargement pressure, government farm programs and taxation, level of interest rates and expected capital appreciation (Herdt and Cochrane, 1966; Tweeten and Nelson, 1966; Klinefelter, 1973; Duncan, 1977; Pope, et al, 1979).

Agricultural production, market and tract location factors are the variables primarily emphasized in cross sectional farmland pricing studies (Reiss and Gordon, 1980; Mundy, et al, 1978; Carricker, Curtis and Johnson, 1984). Nonfarm factors influencing the demand for farmland have been the focus of some studies (Scharlach and Schuh, 1962; Chicoine, 1981).

Financial variables have been widely used in maximum bid price models to determine how much one can afford to pay for farmland (Lee and Rask, 1976; Kletke and Plaxico, 1978). However the importance of financial/credit variables on farmland price levels have been investigated in few cross sectional studies.

The impact of financial variables on farmland prices in Iowa, Nebraska or South Dakota during the early and mid-1970's have been analyzed in two studies (Herr, 1975; Osburn and

Johnson, 1978). Results from both studies indicated that financial variables did not significantly explain variations in farmland price levels. Data from periods of rising farmland prices and relatively stable credit terms were used in these studies. The experience since early 1979 is one of rapid changes and reversals in farmland prices and financing terms.

Ojectives

This study examines the importance of agricultural productivity, location, financial and other variables in explaining variation in farmland sale price per acre during periods of rising and declining farmland values. Specific hypotheses tested are:

1) Agricultural productivity and tract location variables significantly explain per acre price variation while financial variables do not.

2) Coefficients of estimated equations are stable between periods of rising and declining land prices.

Procedures and Data Sources

Sales of agricultural land in four South Dakota counties were examined from 1979-1982. The analysis was conducted during a period of rising agricultural land values (1979-1980) and a period of declining values (1981-1982). Turner and Yankton counties were selected as representative of the cornbelt region in southeastern South Dakota, while Edmunds and McPherson counties were selected as representative of the wheat and small grains region of north central South Dakota. These counties have extremely wide variation in per acre sale prices and agricultural productivity.

Data on the 383 sales of agricultural land used in this

study were obtained from the Federal Land Bank of Omaha (FLB). The FLB data were supplemented with information obtained from local county courthouse offices, soil maps and county road maps.

Multiple linear regression (OLS) techniques were used to determine the significance and impact of agricultural productivity, financial, location and other independent variables on the per acre sales price (SAS, 1982, pp. 39-83). The analysis was conducted for a period of rising farmland prices (1979-1980) and a period of declining farmland prices (1981-1982). Two regression equations were used to estimate parameters for each time period. Restricted and unrestricted models were tested in each time period to determine if the set of financial variables significantly added to the explanation of variation in price per acre (Johnston, 1972, pp. 192-199). The stability of regression coefficients across time periods was examined by the use of the Chow test (Maddala, 1977, pp. 198-199).

Model Specifications

The explanatory variables used in the regression equations were in three general groups; 1) agricultural productivity variables, 2) location and other tract related variables, and 3) financial variables. The definition and description of each variable are given in Table 1.

Agricultural productivity variables include those variables that are related to expected physical productivity of each tract which is highly correlated to estimated net returns from land. The latter economic variable could not be directly estimated from available data. The productivity variables are expected to have a major impact on price per acre.

Table 1. Definition of Variables Used in Analyzing Per Acre Price

Variable	Type	Expected Sign	Definition
Dependent Variable:			
PPA	C		Sales Price Per Acre
Agricultural Productivity Variables:			
SPR	C	−	Average Soil Productivity Rating
SPRSQ	C	+	Soil Productivity Rating Squared
CVSPR	C	−	Coefficient of Variation of Soil Productivity Rating
PCTCULT	C	+	Percent of Tract Cultivated
PCTIRR	C	+	Percent of Tract Irrigated
PGRAIN	D	−	Principal Product is Wheat or Small Grains
Location and Other Variables:			
SOUTHEAST	D[a]	+	Located in Southeastern Region
LMKT	C	−	Distance in Miles to Local Market
ERMKT	C	−	Estimated Distance in Miles to Regional Market
GROAD	D	+	Road Surface of Road Bordering
PROAD	D	+	Tract where: PROAD=paved GROAD=gravel
NONFARM	D	+	Non-farm Influence Present
ACREPRCH	C	−	Total Acres Purchased
BVPA	C	+	Assigned Building Value Per Acre
EXPAND	D	+	Reason for Purchase is Expansion
MONTH	C	n	Month of Sale (1-24)
Financial Variables:			
PCTFIN	C	+	Percent of Purchase Price Financed
YTR	C	+	Years to Repay Note
IR	C	−	Interest Rate
PCTCSR	C	−	Percent of Purchase Price Seller Recieved upon Settlement
LFMHA	D	n	Primary Lender where:
LSELL	D	n	LFMHA=FmHA, LSELL=Seller,
LOTHR	D	n	LOTHR=All Other Non-FLB Lenders
LNONE	D	−	LNONE=No Lender

Type:
C = Continuous variable
D = Zero-one dummy variable

Expected sign of beta coefficient:
+ = Positive
− = Negative
n = No prior expectation

[a]Each equation includes an intercept term which incorporates an omitted variable from each set of zero-one dummy variables. For example, the SOUTHEAST region is included as an explanatory variable while the North Central region is contained in the intercept.

The average soil productivity rating (SPR) for each tract was calculated from soil classification data using methodology developed by the Plant Science Department at South Dakota State University (Malo and Westin, 1978). The soils of South Dakota are given a percentage productivity rating (0-100%) based on expected yields of suitable crops under non-irrigated "good" management conditions. SPR for each tract is found by weighting the soil productivity rating of each soil type in the tract by its number of acres and dividing the sum by total tract acres.

As soil productivity rating, which is an expected yield index, increases net returns and price per acre would be expected to increase at a faster rate. A squared term (SPRSQ) for soil productivity was included to reflect an expected postive nonlinear relationship to per acre sales price.

The coefficient of variation in tract soil productivity (CVSPR) was included to examine whether increased within-tract variablilty in productivity has a discount effect on average price per acre.

The percent of tract cultivated (PCTCULT) or irrigated (PCTIRR) are indicators of expected increases in per acre net returns and sale price. Cropland primarily used to produce wheat and small grains (PGRAIN) is expected to have lower net returns and sale prices than cropland used to produce corn or soybeans.

Location and other nonfinance explanatory variables can also influence per acre sales price.

The variable SOUTHEAST was included to account for regional variation in per acre sales price that other variables were not able to capture. Farmland price per acre is generally higher in

the southeast region than in the north central region.

Increased distance to market, either local or regional (LMKT and ERMKT) increase transportation costs, reduce net returns and are expected to reduce per acre sale price.

Both gravel and paved roads (GROAD and PROAD) were expected to have a positive influence on sale price compared to no roads or a dirt road bordering the tract.

The dependent variable, per acre price, includes the price of buildings on the tract. Building value was included on a per acre basis (BVPA) to determine the amount of building value recaptured. The beta coefficient is expected to be positive.

The total number of acres in the sale tract (ACREPRCH) is expected to be negatively correlated to price per acre. A "discount" in the per acre price is expected as the number of acres sold increases.

Two other variables, NONFARM and EXPAND, were expected to have a positive correlation with per acre sale price. Month of sale (MONTH) was also included to account for price changes within each 24 month period.

The financial terms of a sale may also affect the per acre price. Percent of purchase price financed (PCTFIN), years to repay (YTR), interest rate (IR), percent cash seller received upon settlement (PCTCSR) and lender are included in one equation from each period.

PCTFIN was expected to have a positive coefficient because as percent financed increases the downpayment decreases thus allowing the buyer to pay more. As the years to repay (YTR) increases the annual payments decrease again allowing the buyer

to pay more. As interest rate (IR) increases price per acre is expected to decrease due to an increased total cost over the loan period. PCTCSR is also expected to have a negative coefficient because of tax implications for the seller.

The type of lender (LFMHA, LSELL, LOTHR, LNONE) who financed the sale was included to account for differences in financing terms not incorporated into other financial variables. Sales financed by the FLB were left in the intercept.

Empirical Results

Four equations explaining farmland price variation are presented in Table 2. Two equations are compared in each period. The only difference between equations is the presence/absence of financial explanatory variables.

A relatively high percentage (R^2>0.80) of price variation was explained in each time period by both equations. Findings are discussed by major sets of variables across both periods.

Agricultural Productivity Variables

The analysis indicates that agricultural productivity variables had a major impact on per acre sales price in both time periods.

Soil productivity rating (SPR and SPRSQ) has a strong nonlinear relationship to per acre sale price. The coefficient for SPRSQ is positive and highly significant (p=.01) in all equations. The combined effect of the negative SPR and the positive SPRSQ coefficient indicates that, above a minimum soil productivity rating, per acre farmland sale price is an increasing positive function of soil productivity rating. Very few tracts had average soil ratings below the minimum level.

Table 2. Explanation of Per Acre Sale Price, 1979-1980 and 1981- 1982

	1979-1980				1981-1982			
	Financial Variables		No Financial Variables		Financial Variables		No Financial Variables	
Variable	Beta	Std Error	Beta	Std Error	Beta	Std Error	Beta	Std Error
INTERCEPT	1063.834	231.334 ***	1081.688	200.045 ***	929.207	439.995**	724.615	345.543 **
SPR	-28.888	6.259 ***	-28.947	6.104 ***	-19.9213	11.123 *	-18.586	10.821 *
SPRSQ	0.271	0.049 ***	0.271	0.048 ***	0.235	0.083 ***	0.232	0.081 ***
CVSPR	-2.873	1.150 **	-2.867	1.134 **	2.370	1.852	3.007	1.829
LMKT	-7.297	2.128 ***	-8.515	2.039 ***	-11.611	2.523 ***	-11.815	2.433 ***
ERMKT	-1.999	1.080 *	-1.806	1.023 *	-3.501	1.708 **	-3.516	1.655 **
GROAD	6.878	34.105	0.550	33.501	67.295	50.080	56.655	47.984
PROAD	2.970	37.372	1.844	36.827	57.295	53.502	32.928	51.584
NONFARM	96.836	42.622 **	86.322	41.654 **	-49.477	119.848	-52.985	119.021
BVPA	0.652	0.113 ***	0.666	0.112 ***	0.752	0.148 ***	0.767	0.143 ***
PRE	44.373	24.384 *	32.551	22.555	16.811	35.618	17.825	34.586
PCTCULT	1.885	0.506 ***	1.811	0.485 ***	3.266	0.686 ***	3.279	0.684 ***
PCTIRR	4.192	1.245 ***	4.140	1.227 ***	7.347	1.238 ***	7.284	1.212 ***
MOS	8.116	3.085 ***	7.078	2.977 **	-2.597	4.200	-3.572	3.888
PGRAIN	-62.837	31.375 **	-57.557	30.635 *	-149.374	51.900 ***	-145.049	49.459 ***
ACREPRCH	0.054	0.073	0.061	0.067	0.028	0.048	0.028	0.046
SOUTHEAST	341.977	58.544 ***	348.928	56.435 ***	187.779	91.926 **	186.481	89.476 **
PCTFIN	-0.558	0.738			0.604	1.013		
YTR	0.604	1.570			-1.532	2.310		
IR	4.369	5.655			-1.859	11.394		
PCTCSR	-0.655	0.675			-2.136	0.925 **		
LNONE	52.102	78.554			40.041	176.730		
LFMHA	53.144	46.009			-3.220	69.328		
LOTHR	72.670	80.112			-32.550	112.666		
LSELL	29.741	54.987			-135.344	70.314 *		
	R^2=.8726 RMS=141.560 F=47.098 N=190		R^2=.8673 RMS=141.090 F=70.688 N=190		R^2=.8276 RMS=193.208 F=33.598 N=193		R^2=.8182 RMS=193.842 F=49.500 N=193	

***=significant at .01
**=significant at .05
*=significant at .10

The proportion of cultivated acres (PCTCULT) is significantly and positively correlated with per acre sales price in both periods, while the coefficient for wheat-small grain production (PGRAIN) is negative and significant. In both regions cropland generally sells for a higher price per acre than pastureland and farmland typically used to produce wheat or small grains sells for a lower price per acre than corn-soybean tracts. The proportion of irrigated acres was also positively correlated with per acre sales price.

Intra-tract variation in soil productivity (CVSPR) was significant and negatively correlated with per acre sales price in 1979-1980 but was not significant in 1981-1982.

Location and Other Variables

Region (SOUTHEAST) was the most important location related variable in all equations. The SOUTHEAST coefficient was considerably higher during the 1979-1980 period when land prices were rising than during 1981-1982 when farmland prices were declining. The lower regional difference in 1981-1982 coincides with the fact farmland sale prices declined first and more rapidly in southeastern South Dakota than elsewhere in the state.

Increased distance from local and regional market centers had a significant negative impact on per acre sale price. Sale tracts adjacent to gravel or paved roads usually obtained higher sales prices than tracts located next to dirt roads but the coefficient was not significant or stable between time periods.

Farm buildings (BVPA) significantly added contributory value to the per acre sales price in both periods. The beta value indicates that buildings recaptured 66-67% of their value in

1979-1980 compared to 75-77% in 1981-1982.

No premium or discount in per acre sales price was associated with tract size (ACREPRCH), even though tract size varied from 40 acres to 3600 acres.

The coefficient for local non-farm influence was positive and significant in 1979-1980 but not significant in 1981-1982. However, local nonfarm factors only influenced the sale price of about 4-5% of sale tracts.

Buyers expanding farm operations (EXPAND) had a weakly significant upward impact on per acre sale price during the period of rising prices but were not a significant factor during the initial period of declining prices.

Financial Variables

Financial variables showed little significance in explaining per acre sale price variation. No financial variables had significant coefficients in 1979-1980 while coefficients for LSELL and PCTCSR were negative and significant in 1981-1982.

Credit terms are often considered important variables influencing farmland market prices. Approximately 85% of farmland sales in each period were credit financed and wide variations in interest rates, years to repay and percent of purchase price borrowed existed within each period. However, none of these variables were significantly related to per acre sale price in either time period.

Credit information on seller financed sales did not specify if repayment terms were partially or fully amortized or whether interest rates were fixed or variable. The negative seller financed coefficient for 1981-1982 may reflect the influence of

these factors.

A statisical test (restricted vs. unrestricted models) was applied to both equations in each time period to determine if the set of financial variables significantly added to explanation of price per acre variation. The null hypothesis was that the set of financial variables were not significant. The calculated values for 1979-1980 were 0.86 and for 1981-1982 were 1.15. The critical value for the test statistic at p=.05 and p=.01 are 2.96 and 4.93 respectively. The null hypothesis was not rejected in either period.

Stability of Coefficients Across Time Periods

A Chow test was conducted to determine if the coefficients were stable between time periods of rising and declining land price for the equations excluding financial variables. The null hypothesis was that the coefficients were stable between the two time periods. The alternative hypothesis was that some coefficients significantly varied between the two time periods. The calculated value of the Chow statistic is 2.84 and the critical value is 2.70 for p=.01 indicating that the null hypothesis is rejected at the 1 percent probability level. Essentially, the same explanatory variables are significant in both periods but the parameter estimates vary.

Conclusions and Implications

This study examined the importance of agricultural productivity, location and financial variables in explaining variation in per acre farmland sale price during periods of rising (1979-1980) and declining farmland values (1981-1982). Farmland sales from four South Dakota counties were used as a

case study.

Multiple regression results confirmed that agricultural productivity and location variables were important explanatory variables while most financial variables were not important. Over 80% of per acre price variation was explained in both periods. Per acre sale price was an increasing positive function (non-linear) of soil productivity. Percent of cultivated acres, percent of irrigated acres, principal product, building value per acre, region and distance to local and regional markets were also significant variables in both periods. All significant coefficients had the expected sign. However, the coefficients were not stable between periods.

A major implication is that traditional explanations of cross sectional farmland per acre price variation based on agricultural productivity and location variables are largely confirmed. At a minimum, it is very important to include variables that are closely correlated to physical productivity, if direct measures of net returns per tract are not available.

A second implication is that structural changes in farmland prices probably occurred between periods of rising and declining prices. Time periods selected for study may have strong impacts on parameter estimates because explanatory factors exert varying pressures on farmland prices at different times.

Finally, financial and credit terms may not contribute much to an explanation of cross sectional farmland price variation even during periods of volatile change. It is likely that a longer term analysis of farmland markets is necessary to assess impacts of financial variables.

REFERENCES

1. Carriker, Gordon, Charles Curtis and Bruce Johnson, A Cross Sectional Analysis of Agricultural Land Prices in Nebraska 1978-1982, Agricultural Experiment Station, University of Nebraska-Lincoln, Report No. 135 (March) 1984.

2. Chicoine, David L. "Farmland Values at the Urban Fringe: An Analysis of Sales Prices." Land Economics, University of Wisconson Press, Vol. 57, No. 3, pp. 353-362, August 1981.

3. Duncan, Marvin. "Farm Real Estate Values - Some Important Determinants." Monthly Review, Federal Reserve Bank of Kansas City, pp. 3-12, March 1977.

4. Herdt, Robert W. and Willard W. Cochrane. "Farmland Prices and Technological Advance." Journal of Farm Economics Vol. 48, No. 2, pp.243-263, May 1966.

5. Herr, William McD. "The Influence of Farm Mortgage Loan Terms on Farm Real Estate Values." Southern Journal of Agricultural Economics Vol. 7, pp. 153-158, 1975.

6. Johnston, J. Econometric Methods. 2nd edition, New York: McGraw Hill, 1972.

7. Kletke, Darrel D. and James S. Plaxico, Farmland Investment Value Appraisal and Purchase Feasibility Analysis. Agricultural Experiment Station, Oklahoma State University, Research Report P-776, October, 1978.

8. Klinefelter, Danny A. "Factors Affecting Farmland Values in Illinois." Illinois Agricultural Economics Vol. 13, pp. 27-33, 1973.

9. Lee, Warren F. and Norman Rask, "Inflation and Crop Profitability: How Much Can Farmers Pay For Land?" American Journal of Agricultural Economics, Vol. 58, No. 5, pp. 984-989, 1976.

10. Maddala, G.S. Econometrics, New York:McGraw Hill, 1977.

11. Malo, Douglas D. and Fred C. Westin. Rating South Dakota Soils According to Productivity. Bulletin 657, Agricultural Experiment Station, South Dakota State University, September 1978.

12. Mundy, S. Darrel, Morgan Gray and Rodney Thomsen. Variables Related to Farm Real Estate Values in Tennessee Counties. Bulletin 576, Agricultural Experiment Station, University of Tennessee, Knoxville, March 1976.

13. Osburn, Donald D. and Darrel M. Johnson. "An Analysis of Factors Influencing Land Prices." FCA Research Journal, Vol. 3, Washington, D.C. August 1978.

14. Pope, Rulon D., et al. "An Evaluation of Econometric Models of U.S. Farmland Prices." Western Journal of Agricultural Economics, Vol. 4, No. 1, pp. 107-120, July 1979.

15. Reiss, Franklin J. and Maurice A. Gordon. Factors Associated with Differential Sale Prices for Farm Farm Estate in Champaign and Douglas Counties, Illinois. AERR-179, University of Illinois, Urbana, Ill., January 1980.

16. SAS Institute Inc. SAS User's Guide: Statistics, Cary: North Carolina: SAS Institute, 1982.

17. Scharlach, Wesley C. and G. Edward Schuh. "The Land Market as a Link Between the Rural and Urban Sectors of the Economy." Journal of Farm Economics, Vol. 44, No. 5, pp. 1406-1411, December, 1962.

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

19. U.S. Department of Agriculture. Farm Real Estate Market Developments--Outlook and Situation. CD-89, Economic Research Service, Washington, D.C., Aug 1984.