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Larry Janssen
South Dakota State University

John Cole
South Dakota State University

Xuan Xu
South Dakota State University

Bruce Johnson
South Dakota State University

ECONOMIC EVALUATION OF CROPSHARE AND CASH LEASE CONTRACTS IN SOUTH DAKOTA AND NEBRASKA *

by

Dr. Larry L. Janssen, Dr. John Cole, Dr. Bruce Johnson, and Ms. Xuan Xu

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Dr. Janssen is Professor of Economics at South Dakota State University, Brookings, SD; Dr. Cole is Assistant Professor of Agribusiness, Southwest State University, Marshall, MN; Xuan Xu received her Master's degree in Economics from SDSU, Summer 2002; Dr. Bruce Johnson in Professor of Agricultural Economics, University of Nebraska, Lincoln, NE. Funding for this research was from the Agricultural Experiment Stations of Nebraska and South Dakota.
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Economic Evaluation of Cropshare and Cash Lease Contracts in South Dakota and Nebraska[1]

Dr. Larry Janssen, Dr. John Cole, Ms. Xuan Xu, and Dr. Bruce Johnson [2]

Abstract

Factors influencing choice of share or cash rental leases for cropland are examined using a 1996 dataset containing 1071 lease contracts in Nebraska and in South Dakota. Logistic regression results indicate tenant's age, capital position, and relationship with landlord were more important than leased land use or crop management variables.

Introduction

Agricultural land rental markets are an important component of the organization of production in the Northern Plains. The leasing of farmland has changed from the full tenant of the past to the part-owner operator of today. In 1997, part owners operated 60 percent of all farms and 71 percent of all farmland in the United States. Leasing is no longer viewed by many as a step towards full ownership but rather an effective way to gain control of land resources. Leasing of crop, hay, and pasture land is being used by agricultural producers as a management tool to expand or contract their operation, conserve limited capital, finance farm operations, increase management flexibility, and reduce risk. An estimated 44 percent of the total land in farms in Nebraska and 39 percent of the land in farms in South Dakota is leased. These percentages are consistent for the states bordering Nebraska and South Dakota, with the rate of land in farms leased varying from 35 to 55 percent (1997 Census of Agriculture).

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2 Dr. Janssen is Professor of Economics, South Dakota State University (SDSU), Brookings, SD; Dr. Cole is Assistant Professor of Agribusiness, Southwest State University, Marshall, MN; Xuan Xu received her Master of Science degree in Economics from SDSU; Dr. Bruce Johnson is Professor of Agricultural Economics, University of Nebraska, Lincoln, NE. Funding for this research is from the Agricultural Experiment Stations of Nebraska and South Dakota.

Study Purpose, Data, and Methods

In this study, we examine economic characteristics of cropland lease arrangements in South Dakota and Nebraska and revisit the issue of contract choice between cropshare and cash leases in both states. Allen and Lueck (1992) developed a logit model to examine the contract choice of cash rent versus cropshare leases. Their model was applied to data from a 1986 survey of farmland leasing contracts in South Dakota and Nebraska. We plan to re-estimate and extend their econometric model of leasing contract choice using a more recent (1996) data set of cropland leasing arrangements in both states.

A major pilot study of agricultural land leasing markets in 1986 was completed by the University of Nebraska - Lincoln and South Dakota State University. This effort included a mail survey of both farm operators and non-operators landlords involved in land rental agreements in Nebraska and South Dakota (Johnson et. al., 1988).

South Dakota and Nebraska were selected for these studies in part because both states are located in the Northern Plains transition region characterized by wide variations in agricultural and climatic conditions and thus in cropland leasing practices. The dominant types of agriculture from east to west in these states are: 1) western Cornbelt agriculture characterized by non-irrigated corn, soybean, and small grain enterprises and may include hog, dairy, or beef cattle enterprises, 2) transitional (semiarid) agriculture characterized by irrigated and some non-irrigated corn, soybeans, wheat, oats, and other small grains, and 3) Great Plains agriculture characterized by beef cattle, sheep, and wheat farms and ranches and some irrigated specialty crops. These agricultural settings developed in response to climatic differences and were also influenced by land settlement patterns, urban/regional

trade center sizes, and other socio-economic/demographic patterns that influence farmland values, rental arrangements, and institutions (Johnson et. al., 1988).

In order to establish a new comprehensive benchmark of agricultural land leasing data, a total of 5,800 farmers in South Dakota and Nebraska received the 1996 Cropland Leasing Survey. Stratified random sampling procedures were used to select the sample of farm operators in different regions of both states. The data set was constructed from the mail survey questions on cropland leasing arrangements completed by 1343 farm operators in 1996. Key sections of the 1996 and 1986 leasing surveys can be directly compared. The 1996 survey contains more questions about management practices in each type of leasing agreement, while the 1986 survey included responses from farmers and non-operator landlords leasing farmland.

Cropland Rental Market Characteristics

Farm operators in South Dakota and Nebraska leasing cropland typically operate small to medium size farms of less than 2000 acres with less than $500,000 gross farm sales. Three-fifths of South Dakota and 72 percent of Nebraska cropland renters rely on net farm income for the majority of their household income (Table 1).

Most agricultural producers operate owned and leased land. A majority of leased cropland acres in both states are in cropshare leases. The majority of tenants reported participation in at least one crop share lease also reported participation in at least one cash lease, with 39 percent of renters in both states involved in both types of leases (Table 1).

Farmland renters in South Dakota and Nebraska average more than three farmland leases (Table 1). Nearly 65 percent of renters have leases with two or more landowners with the majority of rented cropland leased by tenants from three or more landlords. Contact

between tenant and landowner is fairly frequent. Most tenants reported having four or more management contacts per year with their landlords (Cole, 2000).

Most rental agreements for cropland were reported as leases from unrelated individuals or relatives. Approximately one-half of rented farmland acres are leased from unrelated individuals, three-eighths are leased from parents or other relatives, and one-eighth of rented farmland acres are leased from government, tribal, or corporate entities (Cole, 2000; Xu, 2002). The incidence of leasing farmland by type of landlord is shown in Table 2. One-half of respondents lease some cropland from local unrelated individuals, while more than one-third lease some land from parents and/or from other relatives.

Individually, most cropland leases are oral, annual leases. Cash leases are more likely to be written, multi-year leases in Nebraska and oral, annual leases in South Dakota. Most individual lease agreements between tenant and landowner have been in effect for extended periods (> 10 years). Most tenants were very satisfied or generally satisfied with their cropland leases. Satisfaction levels were reported higher with crop share leases than with cash leases, yet there is a trend toward more cash leasing (Table 3).

The majority of cropland leased in South Dakota and Nebraska are in crop share leases, while most rented pasture are in cash leases. The 60-40 or 50-50 tenant-landlord share lease is prevalent for non-irrigated cropland leases in eastern Nebraska and southeastern South Dakota and are dominant for irrigated cropland leases. The 2/3 – 1/3 share lease is dominant for non-irrigated crops in most of South Dakota and in western Nebraska. The incidence and extent of sharing input costs varies systematically by output share for non-irrigated and irrigated crop leases. Almost all irrigated and most non-irrigated crop shareleases have cost sharing for one or more variable inputs. The number of shared inputs

increases as the landlord's share of output increases from 1/3 to 2/5 to ½. For shared inputs, almost all cropshare leases have these input costs shared in the same proportion as the share of crop output (Cole, 2000; Xu, 2002).

Contract Choice of Cash and Cropshare Leases – Revisited

Considerable economic literature exists on the rationale for various contractual arrangements in agriculture including land leasing. More detailed literature reviews of land leasing articles were included in recent theses completed by Cole (2000) and Xu (2002) and a recent RAE review article on evolution of land leasing models by Dasgupta et.al. (1999). In this paper, we revisit the issue of contract choice of cash rent vs. cropshare leasing as developed by Allen and Leuck (1992) using 1986 data from landowners and tenants leasing cropland in Nebraska and South Dakota (Johnson, et.al. 1988, Janssen and Peterson, 1988)

The basic approach is to examine the conceptual model and actual variables reported in the Allen and Leuck (A/L) study and re-estimate the coefficients for the same variables using the more recent 1996 dataset of cropland leases in South Dakota and Nebraska. Next, we extend their basic model by adding possible explanatory variables that were not available in the 1986 dataset or not included in their empirical model.

Allen and Leuck assume the relevant choice is to lease cropland, instead of owner cultivation, and the important choice is between a cash rent and cropshare contract. The two main inputs are farmland supplied by landowners and farm capital (both human and physical) owned by farmer-renters and both parties are risk-neutral. A lease contract is not selected unless both parties expect to benefit (joint wealth-maximization). Actual crop output amount and quality level is subject to random fluctuation and considerable uncertainty, which implies the landowner cannot effectively monitor the input levels applied by observing output.

Cropshare contracts have less total input distortion than a cash lease, but incur costs associated with accurate division of the output and from both parties marketing their share of the crop output. Cash leases are fixed payments per acre and the farmer receives the entire crop output. According to A/L, in annual cash leases the farmer-renter supplies the optimal amounts of farm capital inputs but has possible incentives to overuse the land input by intensive cropping practices that deplete soil moisture, reduce soil fertility, increase erosion rates, etc. Thus the contract choice problem is the trade-off between output-division costs and input-distortion costs within a framework of joint wealth maximization (Allen and Leuck, 1992, pp. 403).

In general, share leases are preferred when the "costs" of dividing the crop output are relatively low and the potential to exploit the land resource (soil erosion, moisture, fertility etc) is relatively high. Cash leases are more likely when the costs of output division (and monitoring quality levels) are high and when the potential costs of exploiting the land resource are relatively low.

The type and extent of relationships between landlord and renter can also be included in leasing contract choice models if it is assumed that relationships can alter costs of contract monitoring and compliance. It is important to note that farm lease decisions are made within a legal framework of common law, state statutes, and various Federal policies.

Model Specification and Variable Selection

The logistic regression procedure is used to estimate the likelihood of a cropshare contract compared to a cash lease. Logistic regression analysis often used to investigate the relationship between the response probability and the explanatory variables (Allison, 1999) The response, Y, is a binary (0,1) variable representing the cropland lease decision. Let X denote a vector of explanatory variables and p = pr(Y=1/X) is the response probability to be modeled. The linear logistic regression model has the form logit (p) = log (p/ (1-p)) = a + b'X, where p is the probability of selecting a specific lease (share lease in this study), 'a' is the intercept parameter, and 'b' is the vector of slope parameters.

The dependent (response) variable, CONTRACT, is the cropland lease choice decision with a value of 1 for a crop share lease and 0 for a cash lease. The explanatory variables include land use, management practices, and location attributes on the cropland tract leased; farm business and demographic characteristics; and relationships between renter and landlord. The list of variable names, definition, and simple statistics from the 1996 dataset are shown in Table 4. The variables in bold script are those included in the contract choice model reported by Allen and Lueck (1992) using the 1986 dataset.

Tract size (ACRES) and land uses of the leased tract are some key explanatory variables. Irrigation is an important method of crop production ,especially in Nebraska, and is capital and management intensive. Irrigated crop yields are much higher and relatively more stable than non-irrigated cropland yields in the same locality. Allen and Lueck suggested that irrigated tracts are more likely to be cash leased as irrigation reduces the need to conserve soil moisture. Two alternative specifications for irrigated leased tracts are used in alternative

models, incidence of irrigated cropland (IRRIGATE) or percent of leased tract acres in irrigated crop production (IRRPCT), and the predicted signs are negative.

Some leased cropland tracts are also used for hay production that requires minimal tillage (except for establishment). Also since hay output and quality levels are more difficult to measure at harvest and transport / storage costs as a percent of value are relatively high, cropland tracts with hay production are more likely to be cash leased. Again two alternative specifications for hay land use are used, incidence of hay (HAY) on leased tracts or percent of leased tract acres in hay production (HAYPCT), and the predicted signs are negative.

Some leased cropland tracts also have pasture, especially in the central and western regions of both states. Most pasture tracts are cash leased, due in part to the high costs of monitoring and sharing livestock performance gains, and mixed cropland – pasture tracts are more likely to be cash leased. Alternative explanatory variables are incidence of leased cropland tracts with pasture (PASTURE) or percent of leased acres used for pasture (RNGPCT) and that predicted signs are negative. The amount of pastureland per leased cropland tract is only available in the more recent (1996) dataset.

Selection of cropping pattern over time is an important management decision for renters and/or landowners. Corn and alfalfa hay have been and continue to be the major irrigated crops in both states, while increasing corn and soybean acres are replacing less profitable small grains (wheat, oats, rye, and barley) in crop rotations in the Northern Plains. Thus, incidence of rowcrop only (ROWC) cropping patterns are increasing in both states. Allen and Leuck suggested that leased tracts with only rowcrops are more likely to be share leased, as tillage levels increase and potential for soil erosion or moisture loss is higher.

Interaction terms for various land use combinations are included as control variables (ROWCHAY, ROWCPAST, and HAYPAST) in selected models. The variable ROWCHAY was the only interaction term used in the 1986 A/L study as pasture data were not available.

Farmers lease cropland from various types of landlords and long-term relationships between renter and landlord are common (see data in tables 2 and 3). Leasing cropland from parents or other relatives often involves more interaction and knowledge about the situation of each party than leases from other individuals or institutions. Cropland leases between family members or relatives (FAMILY) should more likely be share leases, compared to greater incidence of cash leases from nonlocal (ABSENT) individuals unrelated to the renter.

Farmers may also lease land from corporations or from federal, state, tribal, or local governmental entities (INSTITUTION). In most cases, the agents for these formal landlords are more likely to want the certain return of a cash lease and less likely to monitor tenant performance and accept the uncertain returns from a share lease.

AGE , CAPITAL, and FARMINC are included in all models. Allen and Leuck (1992) suggested increasing AGE is negatively related to cropshare leasing following the idea of the "agricultural ladder." Farmers facing a greater capital constraint would more likely participate in a share lease where input cost sharing occurs and output is divided after harvest, instead of partial or full cash payment before harvest in a cash lease. Farmers owning a greater share of their land operation, CAPITAL, usually have a lower capital constraint and would more likely engage in a cash lease, thus implying a negative coefficient for CAPITAL. Greater dependence on net farm income for family living expenses implies a positive coefficient for FARMINC and greater tendency for share leasing, if tenant risk aversion is present. However, risk-averse landlords would be expected to prefer a cash lease.

DENSITY was included as a proxy for extent of urbanization and development potential for farmland in the county of the leased tract. The predicted sign is negative as potential land use shifts favor cash lease rates that are above returns from a share lease.

Conservation management, PRACTICE, and tillage practices, TILLAGE, on the leased tract were not included in the earlier study as data were not available. Allen and Lueck (1992) suggest "cropshare is more likely to be chosen when tillage becomes more important because the potential for land exploitation is greater" (pp. 410). We include conservation management practices and index of soil loss from tillage practices on the leased tract as possible measures, but have no apriori expectations on coefficient sign.

Two additional variables, STATE and ORAL, were not included in the earlier study. STATE is a control variable used to reflect different regional outcomes in cash or share leasing not captured by land use, farm operator, and lease specific variables. Cash leases are more likely to be written and may include specific cropland management control provisions. Share leases often imply some landlord involvement in management decision-making and flexibility in renegotiating resource use during a growing season as crop conditions change. An oral cropshare lease provides greater flexibility if tenant and landlord remain in contact with each other. Thus we predict a positive coefficient for the ORAL variable.

Empirical Results

The dataset used to empirically estimate the model coefficients are from 1182 cropland lease agreements in Nebraska and South Dakota. Due to missing values for various explanatory variables, only 1071 cropland leases are included in the empirical models shown in Table 5. The data for 1071 cropland leases were obtained from 760 respondents to the 1996 cropland leasing survey conducted in both states. A logistic regression program (PROC

LOGISTIC in SAS/STAT, Version 8) was used to estimate the coefficients of the cropland leasing models. Maximum likelihood procedures were used in all models. Full model I contain the 1996 results for the variables used in the farmer-sample of the 1986 dataset reported by Allen and Lueck. Stepwise model I is a stepwise version (backward elimination) of Full Model I with a 0.15 probability level cutoff for exiting variables. Stepwise model II was estimated from an alternative full model specified by the authors that include all variables considered in model I plus added variables discussed earlier. Stepwise model III is an alternative version where land use percentage variables are substituted for land use incidence variables in models I and II.

In both versions of model I, coefficients are significant ($p<0.01$) for the variables HAY, ROWCHAY, FAMILY, AGE, and CAPITAL while the coefficient for INSTITUTION is statistically significant at $p<0.07$. The negative coefficients for HAY, INSTITUTION, and CAPITAL were expected and are related to greater incidence of cash leasing. The positive coefficient for FAMILY indicates share leasing is more likely to occur when the tenant is renting land from parents or other relatives. The positive coefficient for AGE indicates that older renters are more likely to share lease cropland than younger renters, contrary to the "agricultural ladder" hypothesis, but in accord with the trend to more cash leasing which is more likely to impact younger, perhaps less established, farmers. Also respondent AGE is highly correlated with the number of years the specific tract has been leased which is closely related to the incidence of share leasing (see table 3).

The coefficients for IRRIGATE, ROWC, ACRES, DENSITY, and for FARMINC were not significant as $p>0.25$ in all cases. The signs of these coefficients were the same as apriori predictions (compare Tables 4 and 5).

In comparing model I results to A/L model results for the farmer-sample in the 1986 dataset, it is important to note that the 1996 dataset has a considerably lower proportion of cropshare leases (0.54 vs. 0.653), higher proportion of rowcrop only incidence (0.796 vs. 0.662), and higher age of farmer than reported in the 1986 dataset. The coefficients for IRRIGATE, ROW, and INSTITUTION were statistically significant ($p<0.05$) in the earlier dataset while coefficients for HAY, FAMILY, and AGE were not significant. The actual and predicted signs of the coefficients were the same except for AGE, which also had a positive sign in the earlier dataset (Allen and Lueck, 1992, pp. 411-415).

Results from models II and III, which includes additional explanatory variables, indicate that coefficients for hay and/or pasture land use and for individual tenant-landlord relationships (FAMILY and ABSENT) were statistically significant, mostly at the $p<0.01$ level and had the predicted signs. However, the coefficient for INSTITUTION retained a negative sign but was not significant in the expanded models II and III. The positive sign for the AGE coefficient and negative sign for CAPITAL were highly significant in all models. The coefficients for ORAL and STATE were positive and highly significant in both model II and III indicating that oral lease and cropland leases in Nebraska were more likely to be cropshare leases, than written leases or cropland leases in South Dakota.

Coefficients for irrigation, rowcrop, contract acres, and population density were not statistically significant in any logistic regression model examined using the 1996 dataset. Also coefficients for conservation management and tillage practice variables were insignificant indicating little if any relationship to incidence of cropshare or cash leasing.

The C index of rank correlation, which assumes a value between 0 and 1, is used for assessing the predictive ability of a model. The closer the C index value is to 1.0 the better

the predictive ability. Model I (full and stepwise) have C-index values of 0.598, while the stepwise models II and III have C-index values of 0.683 and 0.685 respectively. Based on the chi-square tests for covariates in all models, the combined effect for all explanatory variables are significantly different from zero with a p-value of <0.001.

Selected Implications

Traditional thought suggests share leases are preferred if the tenant is young and climbing the tenure ladder or if land exploitation is a consideration. Results from this study reject this and indicate that older producers are more likely to be involved in a share lease. This may reflect the longer-term nature of successful landowner/tenant relationships some of which may be between family members or successful farm producers shift some of the risk of crop production to the landowner to help insure survivability. Regardless, it is likely share leases will remain a viable option into the future.

Results from this study reject the hypotheses that lease preference is related to conservation or tillage practices needed or even required on the tract. Leases for cropland tend to be relatively long term relationships of at least ten years allowing tenants to capture benefits from long-term improvements to the tract regardless if the cost was shared initially. Combined, this suggests that tenant's stewardship of leased and owned land is the same regardless of ownership or lease type.

Crop-related uses were not important explanatory variables, while hay and pasture variables indicate mixed land use tracts tend to be cash leased instead of primarily share leasing cropland and cash leasing the hay or pasture.

Finally, if most traditional factors are not influencing selection of lease type, then social factors such as local customs, values, and beliefs should be included in future models

examining lease preference. The relatively low concordant scores (C-index of 0.599 to 0.685) suggests further improvements can be made in modeling leasing decisions.

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Table 1. Characteristics of Farm Operator Respondents, Nebraska and South Dakota, 1996

Characteristic	Nebraska	South Dakota
Acres Operated:	percent of respondents	
50-499	42	37
500-999	29	24
1000-1999	17	21
2000 or more	13	18
Ag Land Operated:	percent of acres operated	
Owned	53	57
Leased	47	43
Leased Cropland Acres In:	percent of leased cropland acres	
Share Lease	62	55
Cash Lease	38	45
Avg. Number of:	average number per renter	
Leases	3.5	3.2
Landlords	3.2	2.8
Crop Lease Type:	percent of respondents	
Cash only	22	36
Share only	39	25
Both Share & Cash	39	39
Gross Farm Sales ($1000):	percent of respondents	
Less than 100	56	59
100-249	27	28
250-499	11	9
500 or more	9	4
Operator Age:		
20-44	31	30
45-64	45	42
65 or more	24	28
Net Farm Income to Household Income:		
Less than 30%	18	23
30-49%	10	16
50-79%	20	22
80% or more	52	39

Source: 1996 Cropland Leasing Survey, Nebraska and South Dakota

Table 2. Percent of Respondents Leasing Land by Type of Landlord

Type of landlord:	Nebraska	South Dakota
	percent of respondents leasing some land from	
Relatives		
Parents or in-laws	44	32
Other relatives	35	28
Unrelated Individuals		
Local	50	49
Non-local Instate	26	16
Non-local Out-of-State	21	28
Institution		
Government/Tribal	8	7
Corporation	8	3

Source: 1996 Cropland Leasing Survey, South Dakota and Nebraska

Table 3. Characteristics of Cropshare and Cash Leases, Nebraska and South Dakota

Lease Characteristics	Cropshare Lease		Cash Lease	
	NE	SD	NE	SD
Size (avg. acres)	271	265	285	350
Length (avg. years)	14.9	13.7	11.3	11.7
The lease is:	**percent of respondents per lease type**			
Oral	66	81	40	57
Written	34	19	60	43
Annual	59	67	55	63
Multiyear	41	33	45	37
Satisfaction with Lease	**percent of respondents**			
Very or Somewhat Dissatisfied	6	4	11	12
Generally Satisfied	46	55	55	54
Very Satisfied	48	41	34	34
Change in Past Five (5) Years	**percent of respondents reporting changes**			
Landownership	10	10	10	12
Cropshare to Cash	n.a.	n.a.	12	12
Cash Lease Rate	n.a.	n.a.	44	47
Cash to Cropshare	0	1	n.a.	n.a.
Change in the Inputs Shared	0	4	n.a.	n.a.

Source: 1996 Cropland Leasing survey, Nebraska and South Dakota

Table 4. Variable Name, Definitions, Simple Statistics, and Predicted Sign in Logistic Regression Models: Cropshare vs. Cash Rent

Dependent Variable	Definition	Mean	Standard Deviation	Sign
Y=**Contract**	y = 1 if cropshare lease, = 0 if cash lease	0.532	0.499	
Explanatory Variables				
Acres	Number of acres in contract (lease)	249.5	274.2	?
Irrigate	1 if irrigated crop acres are in lease, 0 otherwise	0.332	0.471	-
Hay	1 if hay acres are in lease, 0 otherwise	0.188	0.391	-
Pasture	1 if pasture acres are in lease, 0 otherwise	0.213	0.410	-
Rowc	1 if row crops are only crop acres (corn, soybean, sunflowers, milo, or sugar beets) 0 if wheat, oats, or other small grains are included	0.796	0.403	+
Rowc hay	Rowc * Hay	0.155	0.362	?
Rowcpast	Rowc * Pasture	0.173	0.378	?
Haypast	Hay * Pasture	0.094	0.292	?
Family	1 if landlord are parents or relative, 0 otherwise	0.394	0.489	+
Institution	1 if landlord is corporation or Federal, state, or tribal agency, 0 otherwise	0.064	0.245	-
Absent	1 if landlord is nonlocal individual unrelated to renter	0.232	0.423	?
Capital	Proportion of farmland acres operated that is owned by renter	0.354	0.283	-
Farminc	Dependence on net farm income as percent of household income: =1 < 30% =2 30– 49% = 3 50–79% = 4 >= 80%	3.069	1.122	+
Age	Age category of renter (in years) = 1 < 25 = 2 25–34 =3 35-44 = 4 45–54 yrs. = 5 55–64 = 6 65–74 = 7 75+ yrs.	3.772	1.20	-
Practice	1 if selected conservation practices are used, 0 otherwise	0.444	0.497	?
Tillage	Index of predicted soil loss by tillage practice on lease tract	1.724	0.658	?
Oral	1 if contract is an oral lease, 0 if contract is a written lease	0.589	0.492	+
Density	Population per square mile in county of leased land	29.63	74.72	-
State	1 if lease is in Nebraska, 0 if lease is in South Dakota	0.626	0.484	?
	Percent of leased acres in:			
Irrpct	Irrigated crop	25.54	39.27	-
Haypct	Hay	3.24	8.96	-
Rngpct	Pasture	6.71	15.79	-

Source: 1996 Cropland Leasing Survey, Nebraska and South Dakota

[a]The bolded explanatory variables were used in the final logistic model reported by Allen and Leuck, 1992

Table 5. Logistic Regression Model Results for Croplease Decision

A. Full Model I

Parameter	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	Odds Ratio
Intercept	-0.592	0.325	3.329	0.068	
ROWC	-0.209	0.182	1.312	0.252	0.812
IRRIGATE	0.108	0.140	0.596	0.440	1.114
HAY	-1.097	0.404	7.382	0.007	0.334
ROWCHAY	1.229	0.440	7.811	0.005	3.419
DENSITY	-0.0001	0.00085	0.009	0.926	1.000
ACRES	-0.0001	0.00025	0.096	0.756	1.000
INSTITUTION	-0.509	0.268	3.612	0.057	0.601
FAMILY	0.468	0.133	12.451	0.000	1.597
AGE	0.211	0.060	12.169	0.001	1.235
FARMINC	0.060	0.057	1.107	0.293	1.062
CAPITAL	-0.671	0.261	6.632	0.010	0.511

N = 1071 C-index = 0.598
-2 Log L = 1434.11 for intercept and covariates
Chi square for covariates = 46.12 with 11 d.f. ($p < 0.0001$)

Source: 1996 Nebraska/South Dakota Cropland Leasing Survey

B. Stepwise Model I

Parameter	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	Odds Ratio
Intercept	-0.4462	0.2736	2.660	0.103	
ROWC	-0.1710	0.1732	0.974	0.324	0.843
HAY	-1.1240	0.4005	7.876	0.005	0.325
ROWCHAY	1.2296	0.4379	7.883	0.005	3.420
INSTITUTION	-0.4829	0.2666	3.280	0.070	0.617
FAMILY	0.4836	0.1319	13.433	0.000	1.622
AGE	0.2152	0.0602	12.795	0.000	1.240
CAPITAL	-0.6648	0.2544	6.827	0.009	0.514

N = 1071 C-index = 0.599
-2 Log L = 1434.11 for intercept and covariates
Chi square for covariates = 44.13 with 7 d.f. ($p = 0.0001$)
Variables removed: DENSITY, ACRES, IRRIGATE, FARMINC

C. Stepwise Model II

Parameter	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	Odds Ratio
Intercept	-1.1817	0.3065	14.869	0.0001	
ROWC	-0.2802	0.1857	2.278	0.131	0.756
HAY	-0.9182	0.4183	4.818	0.028	0.399
PASTURE	-0.4805	0.1715	7.852	0.005	0.618
ROWCHAY	1.1650	0.4521	6.639	0.010	3.206
FAMILY	0.4512	0.1515	8.866	0.003	1.570
ABSENT	0.4554	0.1718	7.031	0.008	1.557
AGE	0.1727	0.0629	7.548	0.006	1.189
CAPITAL	-0.7336	0.2676	7.518	0.006	0.480
ORAL	1.0943	0.1404	60.740	<.0001	2.987
STATE	0.5044	0.1438	12.295	0.001	1.656

N = 1071 C-index = 0.683
-2 Log L = 1354.84
Chi square for covariates = 121.95 with 10 d.f. ($p < 0.0001$)
Variable removed: PRACTICE, IRRIGATE, INTITUTION, HAYPAST, TILLAGE, DENSITY, ACRES, ROWCPAST, FARMINC

D. Stepwise Model III

Parameter	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	Odds Ratio
Intercept	-1.393	0.262	28.223	<.0001	
RNGPCT	-0.018	0.0043	17.224	<.0001	0.982
FAMILY	0.463	0.152	9.347	0.002	1.589
ABSENT	0.476	0.171	7.694	0.005	1.609
AGE	0.168	0.062	7.268	0.007	1.183
CAPITAL	-0.670	0.267	6.277	0.012	0.512
ORAL	1.093	0.140	60.765	<.0001	2.983
STATE	0.504	0.139	13.180	0.0001	1.655

N = 1071 C-index = 0.685
-2 Log L = 1350.07 for intercept and covariates
Chi square for covariates = 130.16 with 15 d.f. ($p < 0.0001$)
Variables removed: PRACTICE, TILLAGE, INTITUTION, IRRPCT, DENSITY, ACRES, HAYPCT, FARMINC