CONTRACT CHOICE SELECTION WITH LAND-LEASING AGREEMENTS

Abstract

This study tests cropland contract hypotheses utilizing a landlord data set. Ordered probit and classical regression models are estimated and presented identifying factors that affect the contract type selection and terms. Results suggest credit constraints are a viable land-leasing hypothesis. Risk aversion, managerial ability, and social capital are also supported.

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Introduction

Land leasing plays a significant role in the structure of U.S. production

agriculture. Leased land accounts for 40% of total farm acreage (USDA/NASS, 1997)

and approximately 35% of farm assets (estimated by authors). Leasing allows farm

operators to control more acreage with less equity, carries lower financial risk, and allows

for greater managerial flexibility than purchasing land with debt financing. Aside from

inheritance, leasing is the primary method by which family farms are able to control

sufficient acreage to be commercially viable. Over two-thirds of leased land is found on

farms with 1000 or more operating acres (USDA/NASS, 1999).

The U.S. land leasing literature (see Dasgupta, Knight and Love, 1999, and Allen

and Lueck, 1995) is not reflective of its importance in U.S. agriculture. In particular,

there is a paucity of literature describing the behavior of the contracting parties at the

lease-level. As noted by Bierlen and Parsch (1996), this is likely due to a lack of good

lease-level data. Lease-level data are difficult to collect because lease agreements are

determined by private negotiation between tenants and landlords in localized markets,

which are often unique. Tenants and landlords are often unwilling to release proprietary

information and data collecting agencies may be reluctant to use up goodwill with

producers and landlords to collect lease data.

Contract type (cash rent and various share arrangements) substantially affects

tenant/landlord sharing of revenue, costs, risk, and managerial responsibilities. Because

of this, a literature has developed which tests cropland contract choice hypotheses based

on tenant/landlord incentives in each contract type. Existing U.S. research, see e.g.,

Allen and Lueck (1992, 1993), Bierlen et al. (2000a), Gwilliam (1993), and Brown and Atkinson (1981), test for and find evidence consistent with the agency problem, tenant/landlord sharing of risk, social capital, tenant managerial ability, the agricultural ladder, and tenant credit constraints. However, except for Bierlen, Parsch and Dixon (1999), the literature focuses on the selection of contract type while ignoring the terms of the contracts.[2] Also, conclusions are difficult to draw because often studies provide empirical support for alternative and sometimes conflicting hypotheses.

The primary purpose of this paper is to test cropland contract decision-making hypotheses with data from owners of Arkansas farmland. The study follows the approach applied in BPD testing both contract choice and selection of contract terms hypotheses. While the BPD study examined factors affecting tenant decisions, the present study serves to provide information on leasing arrangements from the landlord's perspective. There are no investigations to our knowledge that solely examine landlord selection of cropland contracts and the terms thereof. Because this study's sample area is almost identical to the earlier BPD tenant study, the analysis serves as a companion piece to the earlier study. In an effort to compare and contrast tenant and landlord behavior, models similar to those in BPD are estimated. Comparing the results from both studies allows analysis of factors affecting the selection of contract choice and terms for both landlords and tenants from the same region.[3]

Data

In late fall 1998 a survey of 706 landlords who likely had leases in five Arkansas crop-reporting districts (3, 4, 5, 6 and 9) was administered. These districts are located in

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[2] Throughout this study, BPD refers to Bierlen, Parsch and Dixon (1999).

the Delta (eastern third of state) and the River Valley (along the Arkansas River) regions of Arkansas. The two regions include almost all of the State's cropland operations.

The sampling frame used did not have a complete listing of all landlords since such information is very difficult, if not impossible to obtain. The sampling frame used relied upon information available from the National Agricultural Statistics Service (NASS) 1997 Census of Agriculture records. Of the 706 sampled cropland owners, 199 usable questionnaires were returned. This study only includes landlords who lease cropland for rice, soybean or cotton production and who personally farm fewer than 80 acres. Because of different information levels, we wanted to exclude landlords who also were farm operators.

The landlords were queried about their largest rice, full-season soybean or cotton leases for 1998 cropping arrangements. Thus, each landlord gave information on one and only one of these crops as requested by the survey instrument. Model variable definitions utilized from the survey are reported in Table 1.

Summary statistics for the variables utilized are reported in Table 2. Landlord age ranged from 34 to 93, but as found in other studies (U.S. Dept. of Commerce, Bureau of the Census, 1990, and Johnson et al., 1988), the average landlord age of 64 shows that landlords are of retirement age or close to it. The average tenant age was 47 ranging from 23 to 80.[4] More than 75% of the respondents were over the age of 55 and the landlords were typically males representing 79% of the respondents. Landlord respondents were well educated with almost 90% of landlords having finished high

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[3] The landlords and tenants were not paired, i.e. we do not have observations from both the landlord and tenant for the same lease parcel. Likewise, the data for both studies were not collected in the same years.
[4] Results of a similar 1997 tenant survey reported 50.7 years for the median tenant age (Bierlen et al., 2000a).

school, 65% having pursued post-secondary education, and 42% were college graduates.

Compared with the earlier 1997 tenant survey, the landlords had more formal education

than the responding tenants did. Bierlen et al. (2000a) report that 88% of their surveyed

tenants were high school graduates but only 33% graduated from post-secondary

institutions.

Table 1. Model Variable Definitions.

Variable	Definition
Dependent Variables	
CONTRACT	0 if cash rent contract; 1 if crop-share contract; 2 if cost-share contract.
RENT	Cash rent ($/acre) if CONTRACT = 0.
CROPCROP	Landlord's share (%) of crop if CONTRACT = 1.
CROPCOST	Landlord's share (%) of crop if CONTRACT = 2.
COSTCOST	Landlord's share (%) of operating expenses if CONTRACT = 2.
Explanatory Variables	
EQUITY	Ratio of tenant owned to operated acres.
VALUE	Total value ($1,000) of the cropland that landlord owns and leases out to others:1 if under 100; 2 if 100-249; 3 if 250-499; 4 if 500-999; and 5 if 1,000 and above.
START	1 if landlord purchased all or part of leased parcel; 0 otherwise.
YEARS	Number of years parcel has been leased to tenant.
INCOME	Percent of landlord income from leasing: 1 if less than 25%; 2 if between 25-49%; 3 if between 50-75%; and 4 if greater than 75%.
IRRIGATE	1 if leased parcel is irrigated, 0 otherwise.
QUALITY	1988-97 county average soybean yield (bu./acre).
SUPPLY	Ratio of 1997 contracted acres in county to number of operators in county.
VARIANCE	1988-1997 county yield coefficient of variation for pertinent crop.
OUTLAY	1 if tenant has a desire to reduce cash expenses, 0 otherwise.
KNOW	Relative landlord knowledge compared to tenant of current agricultural prices and production methods: 1 if less than; 2 if equal to; 3 if more than.
DENSITY	1998 county population per square mile.
ACRES	Number of acres in leased parcel.
RELATIVE	Social closeness of the contracting parties: 0 if stranger or institution; 1 if acquaintance; 2 if close friend; 3 if relative.
TENEDU	Tenant highest education attained: 1 if less than 8 years; 2 if some high school; 3 if completed high school; 4 if vo-tech school; 5 if some college; 6 if completed college.
AGE	Age of landlord in years.
TENAGE	Age of tenant in years.
BILL	Landlord perception of who benefited most from FAIR's passage: 1 if more advantage to tenant; 2 if no change or opinion; 3 if more advantage to landlord.
RICE	1 if leased parcel is planted in rice, 0 otherwise.
COTTON	1 if leased parcel is planted in cotton, 0 otherwise.
RISK	1 if landlord has a desire to share risk with tenant, 0 otherwise.
AVOID	1 if landlord has a desire to avoid risk, 0 otherwise.
TENRISK	1 if tenant has a desire to share risk with landlord, 0 otherwise.

Table 2. Summary Statistics of Model Variables.

Variable	Full Sample	Cash Rent	Crop-share	Cost-share	Minimum	Maximum
			Sample mean			
Dependent Variables						
CONTRACT	1.38	0	1	2	0	2
RENT	-	50.08	-	-	20	112
CROPCROP	-	-	25.05	-	3	50
CROPCOST	-	-	-	29.70	13	50
COSTCOST	-	-	-	14.61	3.23	50
Explanatory Variables						
EQUITY	0.16	0.27	0.20	0.11	0	0.89
VALUE	3.14	3.04	3.15	3.16	1	5
START	0.52	0.33	0.53	0.56	0	1
YEARS	10.39	6.33	8.64	12.68	0	58
INCOME	1.76	1.50	1.82	1.79	1	4
IRRIGATE	0.84	0.75	0.87	0.84	0	1
QUALITY	27.93	26.79	28.00	28.25	28.14	33.78
SUPPLY	423.47	483.72	430.68	403.60	47.49	913.21
VARIANCE	12.12	14.77	12.24	11.52	4.73	22.89
OUTLAY	0.08	0	0.08	0.10	0	1
KNOW	1.57	1.58	1.45	1.66	1	3
DENSITY	58.11	69.50	53.84	58.57	14.69	465.66
ACRES	564.84	497.08	580.85	569.10	80	4500
RELATIVE	1.69	1.58	1.72	1.69	0	3
TENEDU	4.05	3.32	4.35	3.98	2	6
AGE	64	64	65	63	34	93
TENAGE	47	46	47	46	23	80
BILL	1.95	2.04	1.93	1.94	0	3
RICE	0.37	0.13	0.41	0.39	0	1
COTTON	0.15	0.13	0.17	0.13	0	1
RISK	0.31	0	0.16	0.49	0	1
AVOID	0.17	0.54	0.21	0.05	0	1
TENRISK	0.17	0.04	0.12	0.24	0	1

Consistent with a national survey, respondent landlords were not overly dependent on leasing income.[5] For 56% of landlords, leasing income represented 25% or less of their total income, and only 21% of respondents indicated that leasing income

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[5] The Agricultural Economics and Land Ownership Survey reported that 68% of landlords derive less than 25% of their income from leasing income (Dept. of Commerce, 1990).

represented over half of their income.[6] Respondents leased out an average of 565 acres with a range from 80 to 4,500 acres.

Conceptual Model and Testable Implications

Landlords and tenants in our sample chose among the following contract types: cash rent, crop-share, and cost-share. A cash rent contract requires the tenant to pay the landowner a fixed annual cash payment and be responsible for all operating expenses, but the tenant receives all income from production. In a crop-share contract the tenant shares the production output with the landlord but is responsible for all operating expenses. A cost-share contract not only includes a sharing of the output between tenant and landlord but also—unlike the crop-share contract—a sharing of the operating expenses.

The type of contract chosen affects the level of tenant cash outlays. In a cash rent contract the tenant must pay the cash rent in addition to the full normal operating expenses. With a crop-share lease, expenses are similar to those of a cash rent lease, less the cash rent. In a costshare lease, the tenant pays no cash rent and only a share of the operating expenses--normally the same share as he receives of the crop. Since landlord income is dependent on variable crop yields and market prices with share contracts, additional financial and managerial compensation is typically negotiated to induce landlords to utilize these contracts.

The credit constraint paradigm follows the premise that producers use leasing arrangements as a substitute for debt (BPD and Bierlen et al., 2000b). This paradigm assumes that tenants surmount credit constraints and increase the scale of operation by moving from a cost-share to a crop-share to a cash rent contract. This hypothesis says

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[6] Bierlen et al. (2000a) report that 71.2% of tenants relied on farming income for 50% or more of total family income with 54.9% relying on farming for more than 75% of total income.

that the probability of choosing a cost-share (cash rent) contract should increase (decrease) with operating expenses, cash rent levels, and landlord financial strength. The hypothesis also implies that tenants with strong financial conditions will choose cash rent contracts because per acre tenant profits are typically highest with a cash rent contract (BPD). This study tests the credit constraint framework by using variables that indicate the levels of operating expenses, cash rent, and tenant and landlord financial strengths.[7]

Variables impacting operating expenses and cash rent levels include land quality, and availability of contracted land. First, characteristics increasing the quality of the land are hypothesized to increase the probability of a cost-share contract. Soil fertility (QUALITY) and irrigation (IRRIGATE) enhance the land's productive value. These two variables increase operating expenses and cash rent levels by encouraging higher input usage and being relatively more desirable resources to manage. Also, per acre cash rent levels are directly affected by the supply and demand of cropland acreage. High per acre rent levels are associated with a small supply of available contract acres. Therefore, leased cropland acreage per operator (SUPPLY) is hypothesized to be negatively related to the probability of selecting a cost-share contract.

Financial indicators reflect (1) landlords' ability to provide operating capital and (2) tenants' credit constraints. As noted in BPD, tenants with higher equity (owned/total operated acres) levels in their operations should be more financially stable than tenants with lower levels of ownership. The probability of choosing a cost-share contract should decrease as tenant equity (EQUITY) increases. Similarly for landlords, the total value of owned and operated cropland acreage (VALUE) should indicate their financial strength.

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[7] The survey instrument only queried landlords, therefore tenant information is based solely on landlord opinions.

Therefore, VALUE is hypothesized to increase the probability of choosing a cost-share contract. Another variable indicating landlord financial strength is their percentage of total income derived from leasing (INCOME). This implies that the probability of selecting a cost-share contract decreases as INCOME increases. Relatively speaking, landlords with highly valued cropland acreage and significant non-farm income should have a superior financial condition and are more able to assume the added risk and increased expenses associated with a cost-share contract. Landlords who inherited all or part of their cropland should face reduced debt payment obligations compared with landlords who purchased their acreage. The landlords who purchased their acreage would likely require a higher return for their acquired resources. This suggests that landlords who purchased their land (START) are more likely to prefer cost-share contracts.

Following BPD we hypothesize that tenants with a weak financial position continue to secure leased parcels for relatively longer periods of time. Therefore, we hypothesize that the probability of selecting a cost-share contract increases as the length of the leasing period (YEARS) increases. Similarly, we hypothesize that tenants attempting to reduce cash operating expenses during lease negotiations (OUTLAY) are more likely to utilize cost sharing arrangements. Lastly, crop yield variability measured by the county-level coefficient of variation for the crop raised (VARIANCE) is used as a proxy for risk aversion. Increasing crop variance is hypothesized to increase the probability of selecting a cash rent contract by risk averse landlords.

Ordered Probit Analysis of Contract Choice Hypotheses

The estimation and statistical testing utilizes McFadden's (1981) ordered probit (discrete dependent variable) models to test hypotheses about cropland contract decision-making. The dependent variable numerical values indicate an ordinal ranking of the outcomes, with higher values indicating a more preferred or desired outcome than lower values. The underlying model of binomial or ordinally ranked estimation assumes that the true value of the dependent variable (y^*_i) is unobservable. The process generating the unobserved values of (y^*_i) is:

$$y^*_i = \beta' x_i + \varepsilon_i,$$

where y^*_i represents the unobserved value; x_i is a vector of explanatory variables on the ith observation; and ε_i the error term (normally distributed with mean zero and unit variance). The observable y_i is defined as follows for the ordered probit model:

If $y^*_i \leq 0$, then $y_i = 0$;

If $0 < y^*_i \leq \lambda$, then $y_i = 1$;

If $\lambda < y^*_i$ then $y_i = 2$.

For the ordered probit model, the λ is an unknown "threshold" parameter to be estimated along with β.

The models are estimated using maximum likelihood methods. The probability of a given discrete outcome is a function of $\beta' x_i$. In the case of binomial models, where the two outcomes are coded as zero or one, the sign on β_K indicates the qualitative (directional) change in the probability of selecting $y_i = 1$ as the kth component of x_i increases. The components of β do not have the classical regression model (CRM)

interpretation of the marginal change in the dependent variable as the levels of x_i change

(Greene, 2000). Unlike the CRM, the marginal change in probabilities is a function of x_i

as well as β. In the general case, the signs of the coefficients only indicate direction of

changes in the highest and lowest ranked categories of y_i for changes in x_i but not for the

interior categories. That is, if a component of β is greater than zero, then an increase in

the corresponding x_i means that the probability that $y = 0$ decreases and the probability

that $y = 2$ increases.

Credit Constraint Model Results and Interpretation

Table 3 reports the coefficient estimates for the credit constraint model (column

1) with the asymptotic standard errors reported in parentheses. The estimate of λ is

positive and significant supporting the hypothesis that the three contracts are ordered

according to their financial incentives as *a priori* hypothesized.[8] Variables significantly

impacting contract selection in the credit constraint model are EQUITY, VALUE,

YEARS, and VARIANCE.

The coefficients of the variables representing landlord and tenant financial

strengths give contradictory findings. As hypothesized, increasing tenant financial

strength, EQUITY, makes cash rent contracts more likely. This finding is consistent with

the results reported in the BPD study. But contrary to the hypothesized outcome,

strengthening the landlord's financial condition, VALUE, also makes cash rent contracts

more likely. Comparing the p-values for both variables suggests that tenant financial

condition is the more significant variable. The EQUITY result provides support for the

credit constraint hypothesis and further supports the idea that tenants have significant

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[8] The result supporting the ordering of the contracts is supported in all three of the estimated models.

Table 3. Estimated Ordered Probit Coefficients for Contracted Choice Models.

Explanatory Variable	1: Credit Constraint Model	2. Alternative Hypothesis Model	3: Risk Aversion Model
EQUITY	-1.9350***		-1.6939**
	(0.6843)		(0.8328)
VALUE	-0.1946*		-0.3081**
	(0.1165)		(0.1549)
START	0.3279		0.5758*
	(0.3043)		(0.3188)
YEARS	0.0311*		0.0309*
	(0.0165)		(0.0178)
INCOME	0.0828	0.0844	0.1852
	(0.1248)	(0.1053)	(0.1577)
IRRIGATE	-0.4210	0.1733	-0.3846
	(0.3470)	(0.2513)	(0.4353)
QUALITY	0.0701		0.1189*
	(0.0694)		(0.0693)
SUPPLY	-0.0008		-0.51E-04
	(0.0005)		(0.0007)
VARIANCE	-0.0514*		
	(0.0274)		
OUTLAY	-0.2965		
	(0.4827)		
KNOW		0.2681	
		(0.1703)	
DENSITY		0.0006	
		(0.0011)	
ACRES		-0.82E-05	
		(0.0001)	
RELATIVE		-0.0213	
		(0.1118)	
AGE		-0.0066	
		(0.0091)	
TENAGE		0.0065	
		(0.0098)	
BILL		-0.1006	
		(0.1625)	
RICE			0.3022
			(0.3303)
COTTON			-0.6290
			(0.4014)
RISK			1.4679***
			(0.4724)
AVOID			-0.8169**
			(0.3514)
TENRISK			-0.3053
			(0.4497)
λ	1.5331***	1.1069***	1.7770***
	(0.2436)	(0.1243)	(0.3467)

Table 3 (continued)

Explanatory Variable	1:Credit Constraint Model	2:Alternative Hypothesis Model	3:Risk Aversion Model
Davidson-McKinnon Tests of Non-nested Hypotheses Tests			
H_0: 1 true model H_1: 2 true model	$\chi^2 = 13.92*$		
H_0: 1 true model H_1: 3 true model	$\chi^2 = 24.67***$		
H_0: 2 true model H_1: 1 true model		$\chi^2 = 179.06***$	
H_0: 2 true model H_1: 3 true model		$\chi^2 = 198.80***$	
H_0: 3 true model H_1: 1 true model			$\chi^2 = 8.48**$
H_0: 3 true model H_1: 2 true model			$\chi^2 = 17.47**$

***Significant at the 0.01 level.
**Significant at the 0.05 level.
*Significant at the 0.10 level.
Standard errors are in parenthesis.

influence in the contracting process. We hypothesized that tenants with a weak financial position would desire to secure lease parcels for longer periods of time. Their limited financial and bargaining position makes cost-sharing arrangements more likely. The estimated result for YEARS supports this hypothesis.

The coefficient of VARIANCE, as hypothesized, indicates that increasing the variability of the cropland's yield makes cash rent contracts more likely. The coefficient, although weakly significant, is consistent with a risk aversion hypothesis that suggests landlords attempt to limit their exposure to risky returns. A similar sign was reported in the BPD tenant study.

Alternative Model: Agency Problem

Following the specifications of BPD, an alternative hypothesis model examining the agency problem is estimated and presented. The estimated coefficients of the Agency Problem Model are presented in the second column of Table 3. Under the agency

paradigm, each lease presents unique opportunities for morally hazardous behavior, i.e.

the tenant can take advantage of the landlord without detection.[9] This implies outputs are

not a sufficient proxy for tenant effort because of uncontrollable events like weather.

Examples of the agency problem as listed in BPD include: 1) inputs are not set at levels

which maximize joint tenant/landlord net returns for crop-share contracts, 2) incentives

are present in share contracts to underreport production levels, 3) cost-share contracts can

lead to diversion of landlord supplied inputs to other enterprises, and 4) landlord supplied

inputs like irrigation or soil fertility can be over-exploited in cash rent contracts. Two

groups of variables are utilized to test the agency problem hypothesis: one group of "asset

specific" variables quantify the productive characteristics of the cropland acreage, and the

other group describes the experience, managerial ability and the profit motives of the

tenants and landlords.

Variables identifying asset characteristics include irrigation equipment, alternative

productive uses for the acreage, and size of the leased parcel. The presence of irrigation

equipment (IRRIGATE) removes the incentive for tenants to deplete soil moisture. On

the other hand, the equipment creates an incentive to "over-farm" the land. Therefore the

relationship of IRRIGATE is uncertain. Increasing DENSITY–which proxies for

alternative uses of cropland–should increase the likelihood of cash rent contract being

utilized. This result follows since landowners should be less concerned with annual

returns from the land when alternative uses for cropland are comparatively profitable.

The alternative uses make the tenant misuse of cropland issue less important. It also

gives the landowner other options to generate returns from their resource, thereby

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[9] Landlords can take advantage of tenants through land improvement requirements, i.e. irrigation, fertilization, etc.

increasing the landlord's bargaining position. ACRES is hypothesized to increase the

probability of selecting a cost-share contract because opportunities for undetected abuse

or misuse of resources increase with lease size. To investigate possible effects of Federal

Agriculture Improvement and Reform (FAIR) Act of 1996 and the production flexibility

contract payment issue, landlord perceptions of who benefits most from the legislation

(BILL) are examined. The respondents indicated that only 7% of the leases experienced

changes in rent and/or share levels between 1995 and 1998. This suggests that a more

prevalent way for landlord's to benefit from FAIR's provisions is through share

contracts. Since there have been limited changes in the terms of leases for this sample,

BILL is hypothesized to increase the probability of a cost sharing arrangement.

Under the risk aversion hypothesis, INCOME is expected to be negatively related

to the probability of choosing a cost-share contract.[10] This results from the idea that

landlords are thought to want to reduce the variability of their farm income as the

importance of their leasing income increases. Income is included in the agency problem

model to gauge the risk perceptions of the landlords.

Tenant/landlord experience and managerial ability also impact the operating

expenses and cash rents levels. Tenants with relatively better production backgrounds

are thought to be better managers and are able to negotiate better contract terms, thereby

reducing contract costs and increasing tenant profits. This also holds true for landowners

because experienced landlords are more likely to vigorously pursue profit opportunities

with their resources. KNOW indicates who between the landlord and tenant has more

agricultural production knowledge, i.e. managerial ability. The variable compares the

landlord's agricultural prices and production knowledge relative to his/her tenant. We

hypothesize that KNOW is positively correlated with the probability of selecting a cost-share contract. Landlords possessing this production expertise will more likely want relatively more involvement in production decisions, utilizing their knowledge to generate a return. We also use age for both the landlord and tenant to measure their relative experience levels. We hypothesize that increasing tenant experience (TENAGE) decreases the likelihood of cost-share contracts, while increasing landlord experience (AGE) makes cost sharing arrangements more likely.

Lastly, the effect of the social relationship between the contracting agents is examined. One would expect that agents with close social relationships (RELATIVE) to negotiate mutually favorable contract terms and these terms should be easily enforced (Otsuka and Hayami, 1988). This implies that RELATIVE is positively related to the probability of choosing a cost-share contract.

The estimated results of the agency problem model are presented in Table 3 (column 2). None of the hypothesized variables were significant. This result is substantially different from results reported for BPD's agency model. The insignificant results of this study suggest that the agency model has little explanatory power.

Alternative Model: Risk Aversion

Following BPD, an additional model is estimated that explores risk aversion hypotheses. This paradigm examines the role that the contracting parties' risk perceptions play in cropland contract choice selection. For this framework, the risk characterizations have typically been that the landowner is risk-neutral and the tenant is risk-averse. The model estimates the trade-offs between risk-avoidance and improper incentives. The model predicts that increasing the uncertainty of the product output

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[10] The risk aversion hypothesis is specifically tested in model 3.

makes cost sharing arrangements more likely. Also, indicating that the likelihood of share contracts being utilized increases as the tenant's risk-aversion increases.

Land quality (QUALITY and IRRIGATE) should lower risk for both parties, so their signs are indeterminate.   A crop with a higher yield or financial risk variance is more likely to operate under a crop sharing arrangement. RICE and COT require intensive management and specialized equipment, thus increasing operating expenses. Therefore, RICE and COT are hypothesized to increase the probability of a cost-share contract. Similarly to the credit constraint hypothesis, variables impacting operating expenses, cash rent levels, and tenant/landlord managerial ability and financial condition also impact risk preferences and are included. Variables indicating landlord financial strength and profit motives (VALUE, START, and YEARS) indicate some tolerance for risk and are hypothesized to increase the probability of a cost-share contract. For similar reasons INCOME is hypothesized to increase the probability of a cash rent contract. Landlords dependent on a relatively higher proportion of income from leasing would more likely want to reduce the variability of that income. Tenant financial risk should decrease as his/her financial condition strengthens. Therefore, EQUITY is hypothesized to increase the likelihood of a cash rent contract to maximize tenant returns.

Since the risk aversion model examines the role of risk perceptions on the contracting process, three variables (RISK, AVOID, and TENRISK) that gauge landlord/tenant risk motives are included in the model. We hypothesize that landlords and tenants having a desire to share risks (RISK and TENRISK) are more likely to utilize cost sharing contracts. Landlords wanting to avoid risk (AVOID) are more likely to utilize cash rent contracts.

The estimated results of the risk aversion model are presented in Table 3 (column 3). The results indicate that EQUITY, VALUE, START, YEARS, QUALITY, RISK and AVOID significantly affect cropland contract selection. The financial indicator variables-- EQUITY, VALUE, START and YEARS -- indicate that landlord and tenant financial conditions affect the contract utilized. As hypothesized, the estimated coefficient of YEARS indicates that as the contracting process lengthens, cost share contracts become more likely. These results provide support for both the credit constraint and risk aversion hypotheses. Similarly to the results of the credit constraint model, the estimate for VALUE is different from the hypothesized outcome and indicates that as the landlord's cropland value increases, cash rent arrangements are more likely.

While the tenant risk variable was insignificant, the landlord risk perception variables, RISK and AVOID, were significant and had the hypothesized signs. Landlords wanting to share risks utilize crop-sharing arrangements, while landlords who want to avoid risk select cash rent contracts. These results are consistent with the risk aversion theory and suggest that landlord risk preferences play an important role in the contracting process. Contrary to the BPD study, none of the variables representing crops or irrigation were significant.

Davidson-MacKinnon tests (Greene) are used to test among the three different competing hypotheses. As in BPD, the purpose of these tests is to determine if one of the models can be judged to be superior to the other. The tests essentially use the encompassing principle. The evidence against the agency model suggests it can be rejected, at least at the .05 level. The evidence between the credit constraint and the risk aversion models is not as clear. Both models reject in favor of the other although the risk

aversion rejects the credit constraint with a higher p-value than credit constraints reject risk aversion.

Analysis of Contract Term Regressions

This section specifies and presents models for the terms of cropland contracts. The results of the estimated regression equations are presented in Table 4. Regression models are estimated which explain percentage share of crop in crop-share contract (column 1) and percentage share of crop (column 2) and costs (column 3) in a cost-share contract. Because of a lack of observations for the cash rent variable, analysis of rent levels was not possible. We hypothesize that landlord crop-share and cost-share levels are based on land characteristics, landlord/tenant characteristics, landlord/tenant social capital, type of crop grown on acreage, and the available supply of cropland.

Land characteristics include: QUALITY, IRRIGATE, ACRES and DENSITY. QUALITY and IRRIGATE increase the land's productive uses and imply a relatively more valued, i.e. higher yielding, asset to control. Therefore, both variables are hypothesized to increase landlord crop-shares and decrease landlord cost-shares. Larger land tracts may be more desirable because of operating convenience and economies of scale. However, fewer tenants may be eligible for financing the operating expenses associated with large tracks of land, thus, decreasing the pool of tenants bidding on the land. Therefore, the sign of ACRES is unclear *a priori*. DENSITY is hypothesized to increase the landlord's bargaining position, thereby increasing landlord crop share percentages.

Landlord and tenant characteristics describe the management and bargaining expertise of the contracting agents. KNOW indicates the landlords relative agricultural

Table 4. Estimated Coefficients for Regression Equations (Contract Terms).

Independent Variable	CROPCROP	CROPCOST	COSTCOST
CONSTANT	4.7028	-4.5330	-15.5324
	(22.359)	(26.640)	(28.001)
EQUITY	5.1638	-7.0790	-12.3636
	(4.927)	(11.899)	(12.507)
YEARS	-0.2618*	0.1875	0.4928**
	(0.150)	(0.226)	(0.238)
IRRIGATE	6.6388*	-3.1112	-12.9384**
	(3.615)	(6.253)	(6.573)
QUALITY	0.2529	1.4619*	1.2187
	(0.676)	(0.809)	(0.850)
SUPPLY	-0.0029	0.0042	-0.0014
	(0.006)	(0.009)	(0.010)
VARIANCE	1.4543***	0.1496	0.1659
	(0.436)	(0.768)	(0.807)
DENSITY	-0.0103	-0.0150	-0.0198
	(0.037)	(0.017)	(0.018)
ACRES	0.0003	-0.0034	-0.0043
	(0.002)	(0.003)	(0.003)
RELATIVE	0.4331	-0.1614	1.0970
	(1.152)	(1.638)	(1.721)
TENEDU	-1.8735*	-0.4220	0.1185
	(0.979)	(1.600)	(1.682)
KNOW	-1.5949	-1.2832	1.0903
	(1.803)	(3.011)	(3.164)
RICE	8.7567*	4.1831	6.6267
	(4.697)	(6.828)	(7.176)
COTTON	-6.7439**	-4.4518	-3.3113
	(3.177)	(6.253)	(6.572)
F-statistic	2.40**	1.16	1.43
ADJ R^2	0.3181	0.0370	0.0920

Note: Initially the regression models were estimated including the inverse Mill's ratio from the risk aversion model to account for possible selection bias as in BPD. Since the inverse Mills ratio coefficients from the risk aversion model were all insignificant, selection bias was judged not to be a problem and the models were estimated by least squares.
***Significant at the 0.01 level.
**Significant at the 0.05 level.
*Significant at the 0.10 level.
Standard errors are in parenthesis.

production knowledge. Landlords possessing a strong knowledge of agricultural

production, management and marketing practices are in a better bargaining position to

negotiate contracts by reducing information asymmetry and thus obtain higher crop-

shares and lower cost-shares. Tenants with good managerial ability (TENEDU), as

measured by education, should be able to negotiate favorable contract terms. Tenants

with a strong financial condition (EQUITY) are less dependent on leasing allowing them

to negotiate from a position of strength resulting in lower landlord crop-share and higher

landlord cost-share percentages.

The social closeness of the contracting agents has been found to impact the terms

of the negotiated contracts, see Gwilliam (1993). RELATIVE and YEARS indicate the

level of social capital and the information symmetry between the agents. We hypothesize

that high social capital levels increase the likelihood of favorable terms for the tenant.

The yield variability, available cropland acreage, and type of crop grown likely

impact the share levels. Relatively more risky crops will require additional tenant

financial inducements. Therefore, higher VARIANCE levels are hypothesized to result

in lower landlord share levels. COT and RICE are included to examine specific crop

effects on contract terms. The hypothesized impact of these variables on lease terms is

uncertain *a priori*. Both of these crops are highly valued thus inducing crop sharing

arrangements due to rent costs. But both crops are management intensive and require

specialized equipment indicating that tenants may need financial inducements to contract.

This idea is more compelling with cotton where operating expenses are relatively higher,

and landlords sometime require cotton production on the acreage.[11] A larger supply of

available cropland acreage, SUPPLY, increases the tenants' bargaining power. This

bargaining power results in lower landlord crop-share and higher cost-share levels.

The estimated results for the crop share model (CROPCROP) are listed in the first

column of Table 4. VARIANCE, IRRIGATE, RICE, and COT are significant at the $\alpha =$

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[11] Sometimes cropland is controlled by cotton gin owners or individuals associated with cotton processing businesses.

0.10 level or better and indicate that land and crop characteristics are important determinates of crop share percentages. VARIANCE is highly significant but does not have the anticipated sign. The coefficient indicates that as the variance increases, so does the landlord's share percentage. Perhaps, landlords extract additional compensation for a relatively more risky production enterprise. The crop variables, RICE and COT, are both significant indicating, again, that the type of production i.e. land characteristics on the acreage impacts the terms of the contract. The coefficient for RICE indicates that rice acreage contracts at a premium of almost 9 percentage points of the crop above soybean crop share percentages. Cotton cropland contracts are reported at the lowest level (6.7% below soybeans). Cotton is a management intensive crop and this discount may reflect a favorable bargaining position for tenants with the production expertise and equipment needed to produce cotton. The positive and significant sign on IRRIGATE suggests, as hypothesized, irrigated acreage contracts at a premium.

As hypothesized the negative and significant sign on TENEDU indicates that the tenants educational background affects the terms of the contract. This result is similar to the Brown and Atkinson (1981) managerial ability study. Increasing the length of the contracting relationship, YEARS, also decreases the landlord crop percentages. This hypothesized result suggests that tenants gain more favorable terms as information asymmetries decrease.

The estimated results for the crop share on cost-share contracts model (CROPCOST) are listed in the second column of Table 4. Only land quality was significant in explaining crop share levels for cost-share contracts. The positive and significant sign on QUALITY indicates that more productive land, i.e. better yields,

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contracts at a premium. In contrast, BPD find six variables significant at the 0.10 level or better, particularly with respect to crop type.

The estimated coefficients for the percent of cost shared in cost-sharing contracts model (COSTCOST) are listed in the third column of Table 4. The coefficients show that length of the leasing relationship and presence of irrigation are the only variables which significantly explain cost-share arrangements. Increasing the length of the contracting relationship, YEARS, increases the percent of costs landlords share in paying. This result, which is similar to the CROPCROP results, suggests that tenants gain more favorable terms as information asymmetries are removed. The negative coefficient on IRRIGATE implies that landlords who have irrigated cropland are compensated for this resource by paying a lower percentage of the costs of production, approximately 12 percentage points less. This is contrary to the finding of BPD. They found that irrigated land resulted in landlords paying about nine percentage points more of the costs of production. As with crop-shares on the cost-share contracts, BPD found crop effects to be significant in explaining the cost-shares of the contract.

Conclusions

This study identifies factors affecting the selection of cropland contracts and the terms thereof. Utilizing data from landlords of Arkansas cropland, three leasing paradigms were examined. Ordered probit models were estimated which test credit constraints, agency problem and risk aversion hypotheses. In addition to the probit models, regression equations were estimated to identify variables impacting the level of crop-share and cost-share percentages for cropland contracts.

In the credit constraints model, the estimated results indicated that tenant financial strength, value of landlord's cropland holdings, length of the contracting relationship, and the variance of the leased crop significantly affected cropland contract selection. The estimated coefficients for tenant equity and length of the contracting relationship provide strong support for the credit constraint hypothesis. Also, the estimated coefficients for landlord financial position and variability of the crop yield provide weak support for risk aversion hypotheses albeit from the landlord perspective. There was no support found for the agency problem hypothesis. None of the hypothesized variables were significant, indicating that perhaps an alternative specification is needed to examine the agency problem paradigm from the landlord's perspective. Similarly to the credit constraints model, the risk aversion model provided further support for both the credit constraint and landlord risk aversion hypotheses. The estimated coefficient for landlord risk preferences provides strong support for the landlord risk aversion hypothesis, while the tenant risk variable coefficient was insignificant. Neither the credit constraint nor landlord risk aversion models could be rejected, therefore credit constraints and landlord risk aversion should be considered as viable land-leasing hypotheses. This is in contrast to previous studies that have assumed risk neutral landlords.

The regression equation examining crop-share contract terms revealed that land and crop characteristics were important determinates of crop share percentages. As expected, irrigated acreage contracted at a premium. Also, there were significant differences in crop-share levels across all three crops with rice landlords receiving the highest share levels. Managerial ability hypotheses were supported by the estimates for tenant's education and length of contracting relationship. The only significant variable

for the crop-share component of the cost-share contract was land quality. For the cost-share percentage of the cost-share contract, length of the contracting relationship and irrigation coefficients were significant. The significance of irrigation suggests that irrigation plays an important role in determining landlord cost share levels indicating substantially lower sharing percentages. The length of the contracting relationship indicates that tenants benefit as the leasing period increases. This result reaffirms the importance of social capital in both lease type selection and lease terms.

The variables found to be significant and the paradigms supported are somewhat different from an early study that used tenants as the survey subject. Our results suggest that what motivates landlords is different in some ways from what motivates tenants. We would expect more commonality. This could be pursued in a study analyzing landlord and tenant data provided by both parties for the same lease parcel which would serve to eliminate sampling error.

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