Crop Share or Cash Rent: How Does Risk Affect the Decision?

Chelsea Arnold, Jisang Yu, and Mykel Taylor

Risk and Profit Conference

August 2020

Leasing Arrangements

"Traditional"

- Crop share (share income and some expenses)
- Net share (share income but not expenses)
- Fixed cash rent

"Hybrid"

- Flex leases (flex on price, yield, or revenue)
- Fixed cash rent with bonus

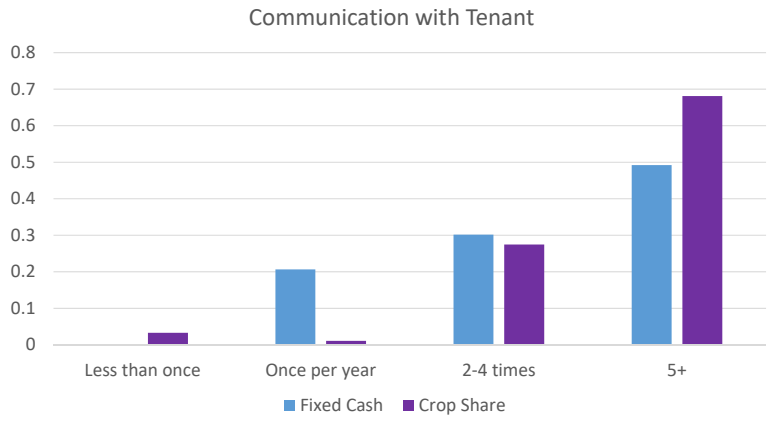
Crop Share Leases

- Farmer and landowner share risk
  - Production risk: disease, drought, pests
  - Commodity prices
  - Input prices
- Management decisions
  - Made jointly or with a lot of communication
  - Technology adoption may change arrangement

Fixed Cash Leases

- Farmer takes on majority of risk
  - Payments are made regardless of production, prices, or costs
- Management decisions
  - Do not typically involve the landowner
  - Communication levels are often lower

Communication

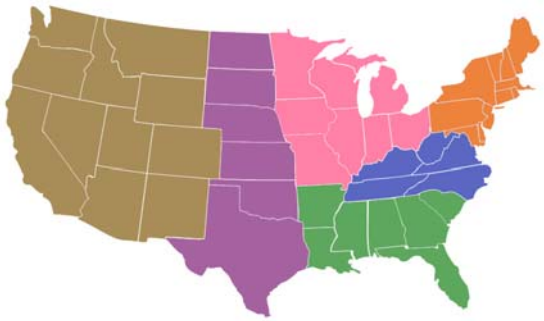


Flex Leases

- Fixed cash component
  - Agreed to prior to production year
- Flexes on sources of risk
  - Production levels
  - Market prices
  - Revenue
- Combines good features of other types of leases

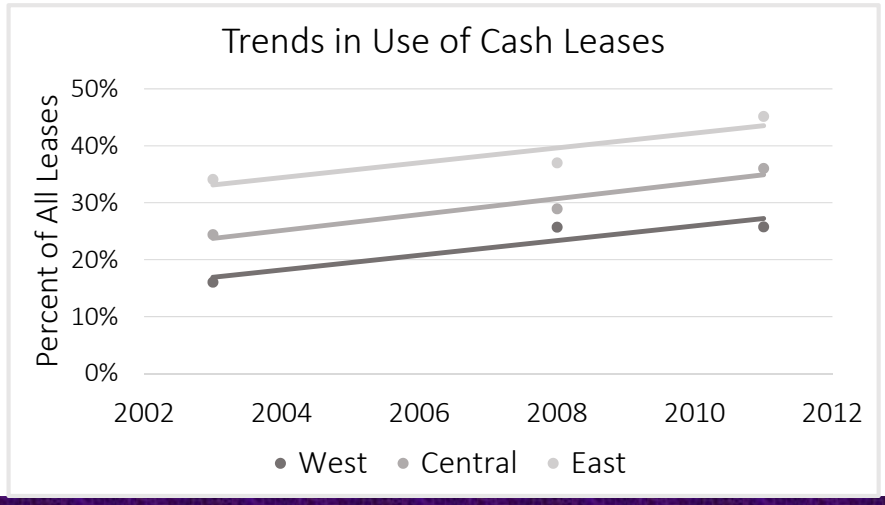
Types of Leases

Region	Cash	Share	Flex
Great Plains	64.9%	25.4%	5.9%
Kansas	39.6%	57.9%	2.5%



Source: USDA-NASS TOTAL Survey 2014, KSU Survey 2019

Trends in Leasing Arrangements



Use of cash leases in Kansas

2011: 35.37%

2016: 29.8%

Source: Schlegel and Tsoodle – 2002, 2008, 2011 KAS/KSU surveys, Tsoodle and Li 2016

Choice of Lease Arrangement

- Risk aversion by parties involved
  - Crop insurance reduces producer risk
  - Landowners want a guaranteed income
- Transaction costs
  - Landowners becoming generationally and geographically removed from farming
  - Producers management multiple leases/landowners

Motivation

- Western Kansas sits atop the Ogallala Aquifer, one of the largest in the word
- Water extraction is outpacing recharge
- Technology has helped
- Self-limiting programs (LEMA's)

Research Question

- Nearly half of Kansas farmland is rented by farmers from other landowners
- Limiting groundwater usage may increase variability in yields
- Does the increase in riskiness of yields and profits affect contract choice?

Literature Review

- Risk-sharing models of contract choice often use a CV for crop yields (county and state level) – greater risk increases use of cropshares
- Examples:
  - Allen and Lueck (2002) – landlords are mostly retired farmers (TC and RS models)
  - Bryan, Deaton, and Weersink (2015) – CV result is counter to RS model
  - Fukunaga and Huffman (2009) – CV result is in line with RS model

Literature Review

Our contribution to the literature:

- **Direct measure of risk aversion by both tenants and landowners**
- **Allows us to control for preferences regarding risk of both parties**
- **Still control for risk through a crop-specific CV that supports the RS model**

Optimal Contract Choices

Model set-up

We consider the following two types of farmland rental contracts (we assume the contract choice is the only choice variable):

- **Fixed cash rent with a rate denoted by F,**
- **Crop share contract represented by a share to the owner, s.**

The preferences of the tenant and the owner, are represented by a simple mean-variance utility function:

$$U(\tilde{\pi}) = E\tilde{\pi} - 0.5kV(\tilde{\pi})$$

where $\tilde{\pi}$ is a stochastic profit, and k is the Arrow-Pratt constant risk aversion coefficient.

Two Optimization Problems:

The tenant (denoted by a subscript T), who rents field i, maximizes

$$U_T = \max\{\mu_i - 0.5k_T\sigma_i^2 - F, (1-s)\mu_i - 0.5k_T(1-s)^2\sigma_i^2\}$$

where μ_i and σ_i^2 are the mean and the variance of the profit from crop production in field, i.

The owner (denoted by a subscript O), who lends out field i, maximizes

$$U_O = \max\{F, s\mu_i - 0.5k_O s^2\sigma_i^2\}.$$

We deduce the following stylized facts by solving the two problems simultaneously.

Stylized Facts

- **If the tenant is more risk averse than the owner, the optimal contract is likely to be the crop share.**
- **If the owner is more risk averse than the tenant, an increase in the profit variability would increase the likelihood of the optimal contract being the crop share contract.**
- **If the optimal contract is the fixed cash rent, an increase in the profit variability decreases the amount of the optimal fixed cash rent.**

Data

- We use the dataset from mailing survey
  - Producer/tenant survey: 339 observations with non-missing lease-type variable.
  - Matched with Landowner survey (389 observations): 179 pairs were matched.
- The final sample consists of 133 tenant-landowner pairs.
- We also use the NASS survey data on crop yields to create the proxy variable for the output variability.

Empirical Approach

- The goal is to link farmland rental contract choices to a) the variability of output and b) the risk preferences of tenants and owners.
- Measuring the output variability
  - We identify the main crop that the tenant on field i grows: 1) Corn, 2) Soybeans, 3) Wheat.
  - We use the coefficient of variation (CV) of yields (based on 15-year data, 2002-2017) of the crop from the county where field i is located in.
- Risk preference variables–We consider two specifications:
  - Self-stated 10-point scale (1=completely unwilling to take financial risks, 10=willing to take financial risks).
  - Categorical variable (risk averse <5, risk neutral=5 or 6, risk loving>6)

Logit model and Conceptual Framework

The dependent variable is whether the contract is fixed cash rent or not. Thus, the logit model is

$$Prob(Fixed\ Cash\ Rent = 1) = \frac{1}{1 + \exp\left(-(\mathrm{B}X + \varepsilon_i)\right)}$$

where X is the vector of covariates, including three key explanatory variables: 1) the variability of output, 2) the tenant's risk preference, and 3) the owner's risk preference.

We expect that

- **The more owner is willing to take risks, the fixed cash rent contract is less likely,**
- **The more tenant is willing to take risks, the fixed cash rent contract is more likely,**
- **The variability of output is negatively correlated with the probability of fixed cash rent contract in place, holding the risk preferences constant.**

Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.
Fixed Cash (=1)	133	0.43	0.50
Owner's willingness to take risk	133	6.78	2.27
Tenant's willingness to take risk	133	7.08	1.80
Output CV (%)	133	24.86	6.84
Crop (=1)			
Corn	133	0.42	0.50
Soybeans	133	0.22	0.41
Wheat	133	0.36	0.48
Association (=1)			
NC	133	0.23	0.42
SC	133	0.26	0.44
SW	133	0.06	0.24
NE	133	0.20	0.40
NW	133	0.10	0.30
SE	133	0.16	0.37

Estimated marginal effects: Model I
(10-point scale as risk preference variables)

	(1)	(2)
Owner's willingness to take risks	-0.0711***	-0.0776***
	(0.0243)	(0.0239)
Tenant's willingness to take risks	0.0610*	0.0728**
	(0.0324)	(0.0324)
Output CV	-0.00726*	-0.00835*
	(0.00761)	(0.00805)
Association fixed effects	Yes	Yes
Output CV interacting with crop indicators	No	Yes
No. of observations	133	133

Estimated marginal effects: Model II
(Categorical risk preference variables)

	(1)	(2)
Owner (Risk neutral)	-0.136	-0.138
	(0.166)	(0.166)
Owner (Risk loving)	-0.316**	-0.332**
	(0.142)	(0.141)
Tenant (Risk neutral)	-0.0116	-0.00655
	(0.150)	(0.145)
Tenant (Risk loving)	0.219	0.248*
	(0.139)	(0.137)
Output CV	-0.00637*	-0.00833*
	(0.00379)	(0.00476)
Association fixed effects	Yes	Yes
Output CV interacting with crop indicators	No	Yes
Observations	133	133

Results

Consistent with the conceptual framework, our empirical findings are

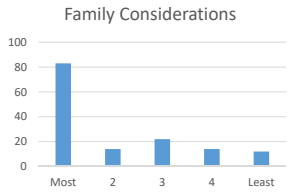
- The more owner is willing to take risks, the fixed cash rent contract is less likely,
- The more tenant is willing to take risks, the fixed cash rent contract is more likely,
- The variability of output is negatively correlated with the probability of fixed cash rent contract in place, holding the risk preferences constant.

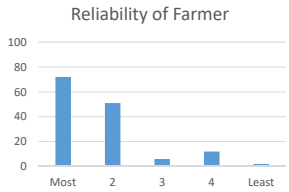
Implications to the case of irrigation restrictions are

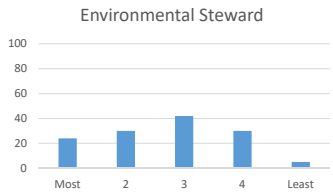
- Assuming the variability increases with the irrigation restriction, we expect more crop share contracts.
- The baseline level of the variability and which crops will dictate the degree of probability changes.
- Both tenant's and owner's risk preferences play important roles.

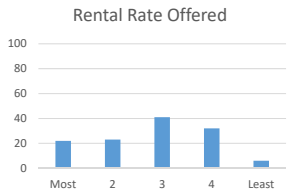
Future Research

Who do you rent to?









Renting to Young and Beginning Farmers

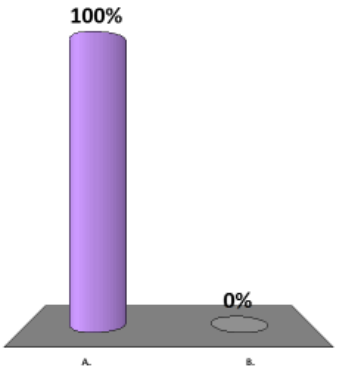
- You currently get $100/acre for your land. A 30-year old farmer offers you $100/acre and a 60-year old farmer offers you $110. Who do you rent to and why?
- Experience versus transparency
- Potential for social capital

Who has more power in negotiating lease terms?

A. Landowner
B. Tenant

Who has more power in negotiating lease terms?

A. Landowner
B. Tenant



KANSAS STATE UNIVERSITY | Agricultural Economics

Negotiating Power

- Farmers tend to have better information
  - Rental rates (their other leases, coffee shop)
  - Market and production conditions
  - Technology
  - Government programs
- Landowners tend to have…the land.

Future Research

- Comprehensive survey of Kansas landowners
  - Asking them questions about who they would consider renting to and the conditions under which they would rent
- Simultaneous survey of young and beginning producers
  - Asking them about their willingness to share information with a landowner and other issues with obtaining land

Questions?

Chelsea Arnold, Jisang Yu, and Mykel Taylor

Risk and Profit Conference

August 2020