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Small Holders' Demand for Alternative Types of Crop Insurances: The case of corn in China

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Introduction

- Corn production and market
 - Production distribution
 - Small scale family farm
 - Production trend and import
- Risks
 - World market price risks
 - "stock up" policy





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Crop Insurance in China

- Chinese Crop insurance
 - Started in 2007, covering most major crops in major areas
 - Heavily subsidized, farmers pay 20%-50% of premium
 - Private companies try to design different products
 - Four Insurance types: yield, price, revenue, weather index
- Multi Peril Yield Insurance is the primary type
 - Coverage is at the level of material cost (seed, fertilizer, etc.)
 - Premium is set 2~10% of the coverage
 - Indemnity = Time adjusted coverage X Loss ratio X Acreage insured

When disasterAssessment isSign up at theoccurs, reportmadebeginning



Issues and Objectives

- Issues
 - Village approximate loss assessment
 - Farmers' purchasing motivation
 - Small household farms
 - Specialized farms with land rented
 - Current insurance participation rate
- Objective
 - To explore Chinese corn growers' demand or stated preference for alternative types of insurance
 - Preference for alternative types
 - WTP for different contract parameters

Literature

- Actuarially fair premium level based on risk assessment
 - Yield, revenue, weather types
 - Risk distribution and expected loss (Goodwin & Ker, 1998; Goodwin 1994;Zheng et al, 2014)
 - US, EU, China
- Farmers' willingness to pay (WTP) premium
 - Expected utility based welfare gain (Fraser, 1992; Wang et al, 1998)
 - Assumption on risk preferences, no financial constraint
- Survey based farmers demand for insurance
 - WTB (Boyd et al, 2011)
 - WTP Contingent Valuation(Hill et al. 2013; Akter et al 2009; Ning et al, 2006; Peng et al, 2012)
- Choice experiment WTP methods applied in non-insurance

- (Lusk et al,2003; Ortega et al, 2014)

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Survey

- Liaoning province, stratified sampling
 - Four cities
 - Shenyang, Jinzhou, Panjin, Anshan
 - Four counties, one in each city
 - Ten villages, 2-3 in each county
 - ~20 farmers in each village
- In person interview in November 2017
- 198 valid surveys from 220 rural households
- Choice experiment





Data

• Farmers

- Demographics: gender, age,
 education, family size, having
 children
- Economics: family income and expenses
- Production: Corn planting area and cost, other crops
- Risk attitude: risk preference, evaluation of crop insurance, contingent valuation of crop insurance

Demographics	Average
Female	37.9%
Age	54.27
College and up education	6.6%
Tech school	11.6%
High School	53.0%
Primary School	28.8%
Family Size	4.3
Number of children	0.6

Corn Planting Acreage (Mu, 1 acre=6.1 Mu)



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Annual Family Income and Expenditure





The Attributes for Crop insurance

Attributes	Levels
Insurance Products	Yield Insurance, Revenue Insurance, Price Insurance, Index Insurance
Coverage	¥300, 650, 1000
Self Paid Premium (1~2%)	¥3, 4.5, 6, 6.5, 9.75, 13, 15, 20
Time to receive indemnity payment	Short or long
Government or private	State-owned insurance company or private insurance company

- A combination of alternative levels of the attributes form one option. Five options, one for each product plus an optout, are provided for survey subjects to make a choice.
- Each farmer is doing 8 different experiments, called situations

Labeled Choice Experiment Example

Attribute	Yield	Revenue	Price	Index	Option C
Coverage (¥)	300	650	1000	300	
Premium	3	13	20	4.5	Not to buy
Time	long	long	short	long	insurance
Govt. or private	private	private	govt.	private	
Check one only					

- 4X3X9X2X2=432 different combinations
- Random sample design in SAS, D-Efficiency, 48 situations
- Blocked into 6 groups of 8, so each farmer did 8.

Theoretical Framework

- Lancastrian approach to utility (1966)
 - Individuals derive their utilities from a product through each of its attributes (price, normal attributes, credence attributes)
 - Attributes can be discrete or continuous, price gives disutility $U_i(p, A_1, A_2, A_3, ...), \partial U / \partial p < 0$
 - To keep the consumer just as well off, a trade off between increasing one discrete attribute from 0 to 1 and increasing the price, gives the Willingness to pay for that attribute.

 $\partial U / \partial p dp + \partial U / \partial A_i dA_i = 0$

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$$WTP \equiv dA_i / dp = -\frac{\partial U / \partial A_i}{\partial U} / \partial p$$

For a continuous attribute, this is the WTP for its marginal increase

Theoretical Framework

- Random Utility Model
 - = $U_{\text{nit}} = V_{\text{nit}} + \varepsilon_{\text{nit}}$, n for individual 1~198, i for alternative 1 ~5. and t for situation 1 ~ 8
 - $V_{\text{nit}} = \beta' x_{\text{nit}}$ is the deterministic part, and ε is the random part
 - X represents the vector of attributes
- An individual choose the bundle of attributes that maximizes the utility
- $P_{nit} = Prob(V_{nit} + \varepsilon_{nit} > V_{njt} + \varepsilon_{njt}; \forall j \neq i, \forall j \in C)$ is the probability that s/he choses alternative i over all j's



Econometric Modeling

 $V_{i} = \beta_{1i} Prem_{i} + \beta_{2i} Cov_{i} + \beta_{3i} Sho_{i} + \beta_{4i} Gov_{i} + \beta_{5i}$

- Random parameters (mixed) logit
 - The coefficients, β 's, are random to allow heterogeneity
 - Continuous heterogeneity

$$P_{\rm nit} = \int \frac{\exp(V_{\rm nit})}{\sum_j \exp(V_{\rm njt})} f(\beta) d\beta$$

• Willingness-to-pay

WTP_{ki} = $-2 \beta_{ki} / \beta_{1i}$, k =2,...,4, the 2 is a result of effect coding WTP_{5i} = $-\beta_{5i} / \beta_{1i}$, the loss of not having this insurance



• Standard deviations of all coefficients are significant, indicating the necessity of parameter randomness for heterogeneity

Price	Coefficient	Standard	WTP	
Insurance		Deviation	(¥/Mu)	
Dromium	-0.07427	0.16026		
Premium	(0.0372)**	(0.0589)***		
	0.00156	0.0026	0.042	
Coverage	(0.0007)**	(0.0012)**		
Chart	0.58430	0.63936	15.73	
Snort	(0.1371)***	(0.1660)***		
Covernment	0.99540	0.73238	26.80	
Government	(0.1698)***	(0.2154)***	20.80	
Pace	- 1.19709	1.60864	16 10	
Kasc	(0.3565)***	(0.4532)***	-10.12	



 Relatively, farmers prefer yield insurance, index insurance, price insurance over revenue insurance

WTP (¥/Mu)	Yield	Index	Price	Revenue
Coverage	0.18	0.03	0.04	0.05
Time	28.92	3.15	15.73	6.44
Government	126.38	29.50	26.80	14.74
Casc	-59.77	-21.31	-16.12	-8.57

- Yield insurance is the primary insurance available and farmers know it well
- ⁻ The government provides the floor price
- Weather index insurance also protects yield risks only



- Farmers trust the government owned insurance firms over the private
- Shorter time to receive the indemnity payment is preferred

WTP (¥/Mu)	Yield	Index	Price	Revenue
Coverage	0.18	0.03	0.04	0.05
Time	28.92	3.15	15.73	6.44
Government	126.38	29.50	26.80	14.74
Casc	-59.77	-21.31	-16.12	-8.57

- The government ownership is a more important attribute than the fast payment
- For each Yuan increase in the coverage level, the WTP is increased by 3 to 18 cents.
 - This is consistent to the current situation that a large share of subsidy is required.

Conclusion

- Yield insurance has been widely available and farmers understand it
- Farmers are satisfied with the great subsidy
- Farmers are willing to buy higher coverage if available, 3~18%
- Farmers trust the government better than private firms



Further Research

- Impact of farmers' risk preferences to WTPs
- Impact of production factors to WTPs
 - A small number of larger farms emerge as land is allowed to be rented with the new policy
 - The material cost coverage is very low for the larger "commercial" farms
- Impact of economic factors to WTPs
 - Affordability issues







WTP Soliciting Methods

- Contingent valuation: asking consumers directly what they are willing to pay for a specific attribute, can be a hypothetical attribute.
- Auction: bring a group together, provide a limited number of products, the interested attributes are included, ask them to bid.
- Experimental methods: give shoppers real money and real products labeled with the interested attributes with reasonable prices, observe their purchasing decisions.
- Choice experience: survey based, give a few options on paper, each has a product with specific attributes and price, they can choose.



Revenue Insurance	Coefficient Estimates	Standard Deviation Estimates	Willingness to Pay (¥/contract)
Premium	-0.13286	0.11386	
	(0.02945)***	(0.05909)*	
Coverage	0.00311	0.00114	0.047
Coverage	(0.00051)***	(0.00077)	0.047
Time	0.42753	0.16359	
lime	(0.09079)***	(0.15380)	6.44
DD	0.97936	0.97106	1 4 7 4
PP	(014519)***	(0.83427)	14.74
6	- 1.13848	1.77626	17 1 4
Casc	(0.30127)***	(0.45253)***	-1/.14



Yield Insurance	Coefficient Estimates	Standard Deviation Estimates	Willingness to Pay (¥)	
Premium	-0.02548 (0.03)	0.11771 (0.05685)**		
Coverage	0.00235 (0.00053)***	0.00055 (0.00104)	0.18	
Short Time	0.36852 (0.1052)***	0.52275 (0.22366)**	28.92	
Public	1.61009 (0.20197)***	1.4101 (0.33438)***	126.38	
Yasc	- 1.52335 (0.38446)***	3.25748 (0.48221)***	-59.77	



index Insurance	Coefficient Estimates	Standard Deviation Estimates	Willingness to Pay (¥/contract)	
Premium	-0.11320	0.17274		
	(0.04538)**	(0.06268)		
Coverage	0.00194	0.00264	0.034	
	(0.00078)**	(0.00113)**		
Timo	0.17853	0.17120	2 15	
Time	(0.11967)	(0.28891)	5.15	
Deskiller	1.66949	1.32006		
Public	(0.33027)***	(0.39693)***	29.50	
	-2.41218	2.08719	24.24	
Dasc	(0.51780)***	(0.62612)***	-21.31	



optout	Coefficient Estimates
Cdum	-3.92402 (0.58212)***



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