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

Holly Wang, Purdue University

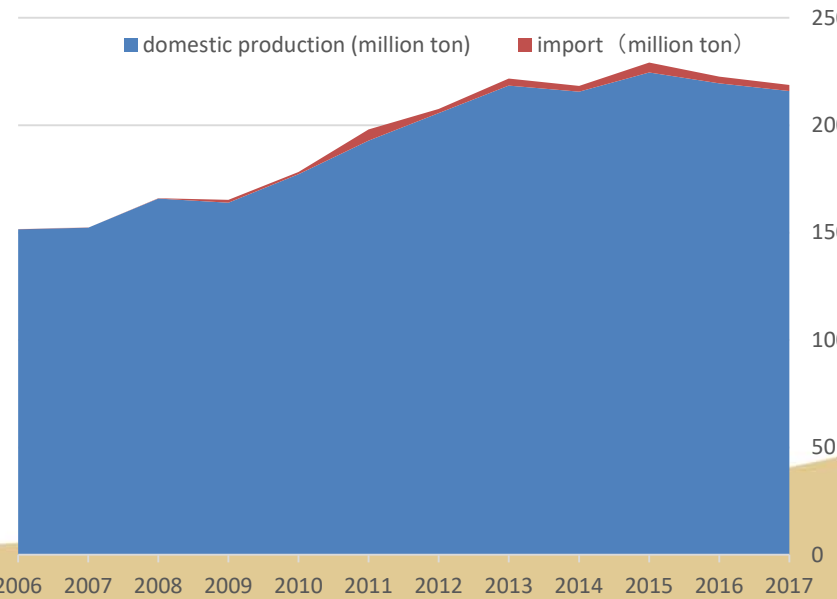
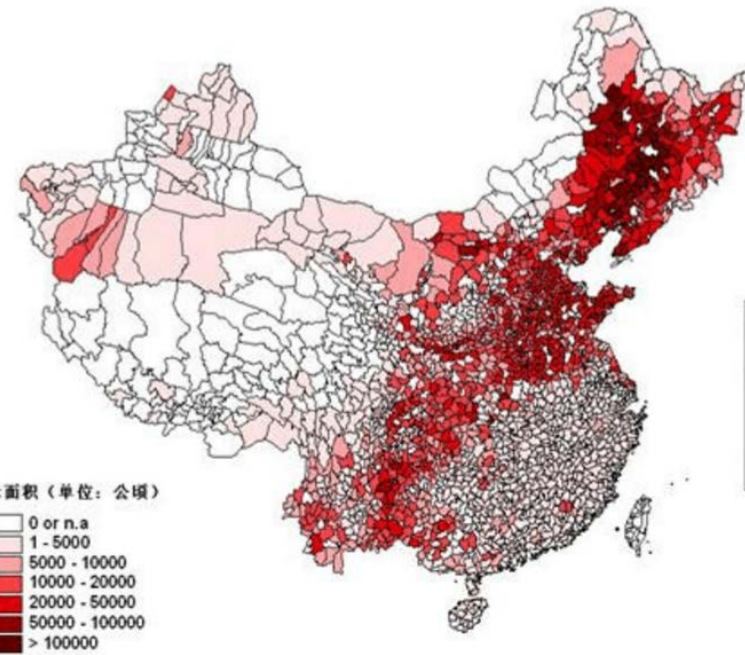
Liu Lu, Chinese Academy of Agricultural Science

SCC76, Kansas City, MO

April 7, 2018

# Introduction

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



# 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 disaster occurs, report

Assessment is made

Sign up at the beginning

# Issues and Objectives

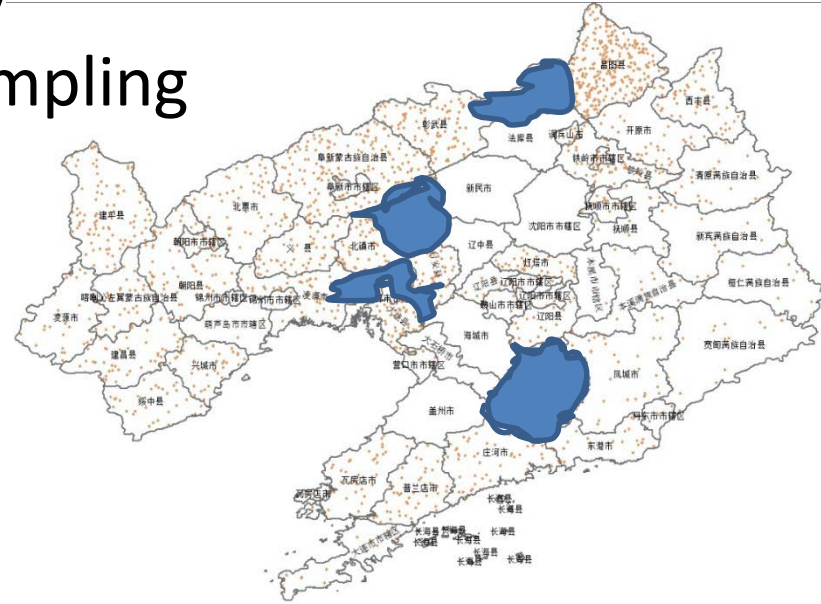
- Issues
  - Village approximate loss assessment
  - Farmers' purchasing motivation
    - Small household farms
    - Specialized farms with land rented
  - Current insurance participation rate
- Objective
  - To explore Chinese corn growers' demand or stated preference for alternative types of insurance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

# 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



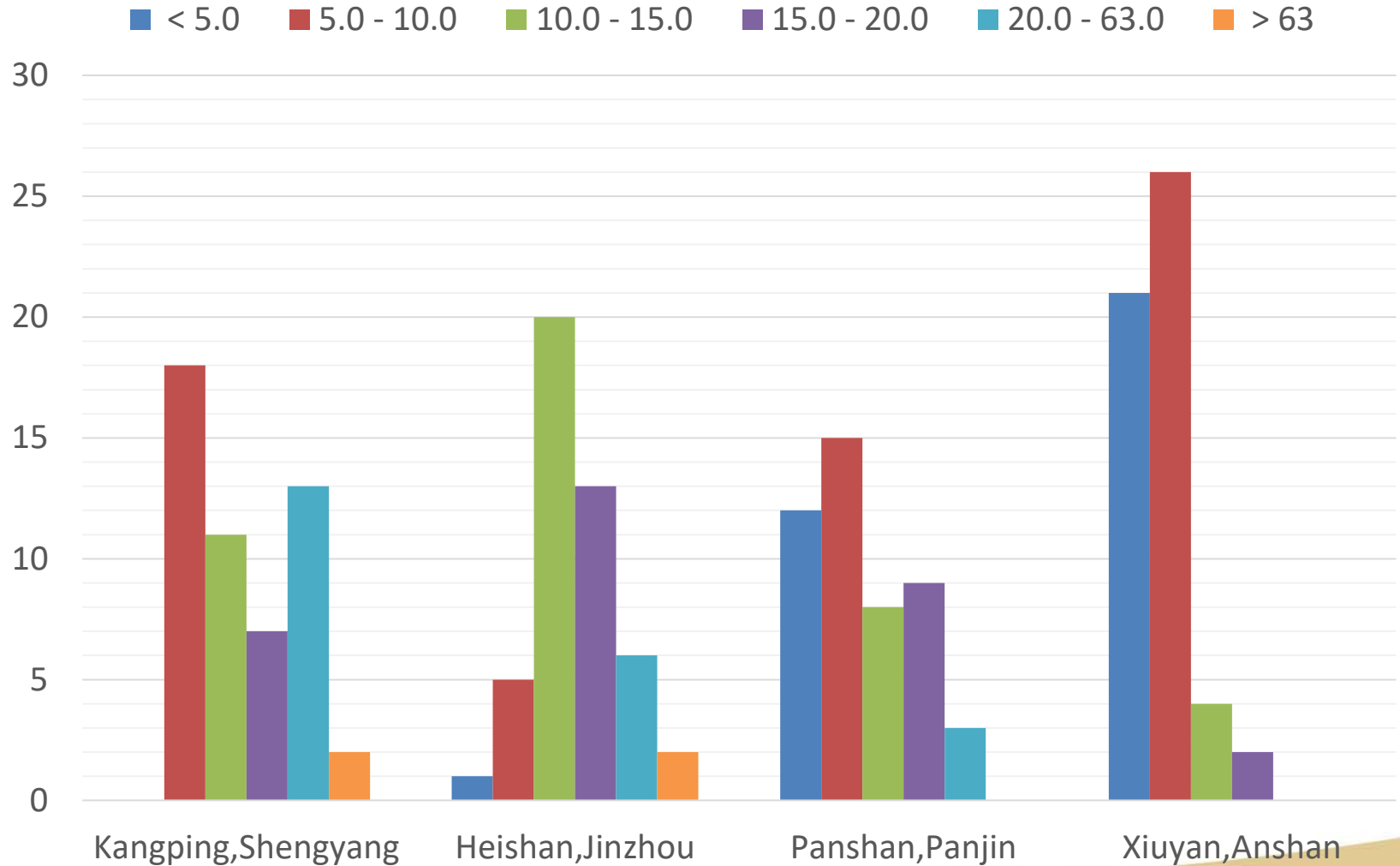
# Data

- 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

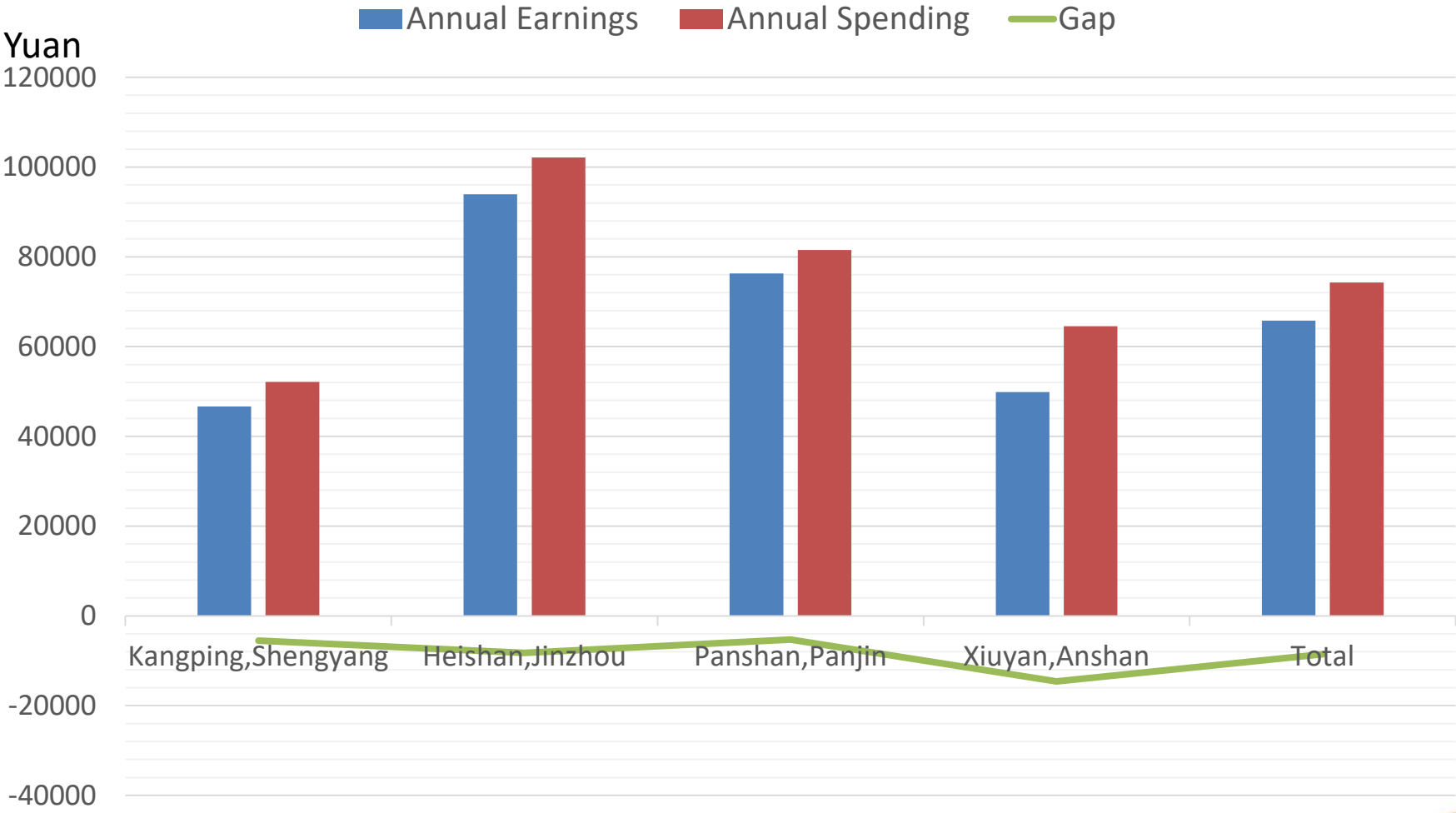
Demographics	Average
Female	37.9%
Age	54.27
College and up education	6.6%
Tech school	11.6%
High School	53.0%
Primary School	28.8%
Family Size	4.3
Number of children	0.6



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



# 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	Not to buy any insurance
Premium	3	13	20	4.5	
Time	long	long	short	long	
Govt. or private	private	private	govt.	private	
Check one only	_____	_____	_____	_____	

- $4 \times 3 \times 9 \times 2 \times 2 = 432$  different combinations
- Random sample design in SAS, D-Efficiency, 48 situations
- Blocked into 6 groups of 8, so each farmer did 8.

# Theoretical Framework

- Lancasterian 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

$$U_i(p, A_1, A_2, A_3, \dots), \partial U / \partial p < 0$$

- 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.

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

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

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

# Theoretical Framework

- Random Utility Model
  - $U_{nit} = V_{nit} + \varepsilon_{nit}$  , n for individual 1~198, i for alternative 1 ~5, and t for situation 1 ~ 8
  - $V_{nit} = \beta' x_{nit}$  is the deterministic part, and  $\varepsilon$  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,  $\beta$ 's, are random to allow heterogeneity
  - Continuous heterogeneity

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

- Willingness-to-pay

$WTP_{ki} = -2 \beta_{ki} / \beta_{1i}$  ,  $k=2,\dots,4$ , the 2 is a result of effect coding

$WTP_{5i} = -\beta_{5i} / \beta_{1i}$ , the loss of not having this insurance

# Results

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

Price Insurance	Coefficient	Standard Deviation	WTP (¥/Mu)
Premium	-0.07427 (0.0372)**	0.16026 (0.0589)***	
Coverage	0.00156 (0.0007)**	0.0026 (0.0012)**	0.042
Short	0.58430 (0.1371)***	0.63936 (0.1660)***	15.73
Government	0.99540 (0.1698)***	0.73238 (0.2154)***	26.80
Rasc	-1.19709 (0.3565)***	1.60864 (0.4532)***	-16.12



# Results

- 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

# Results

- 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.

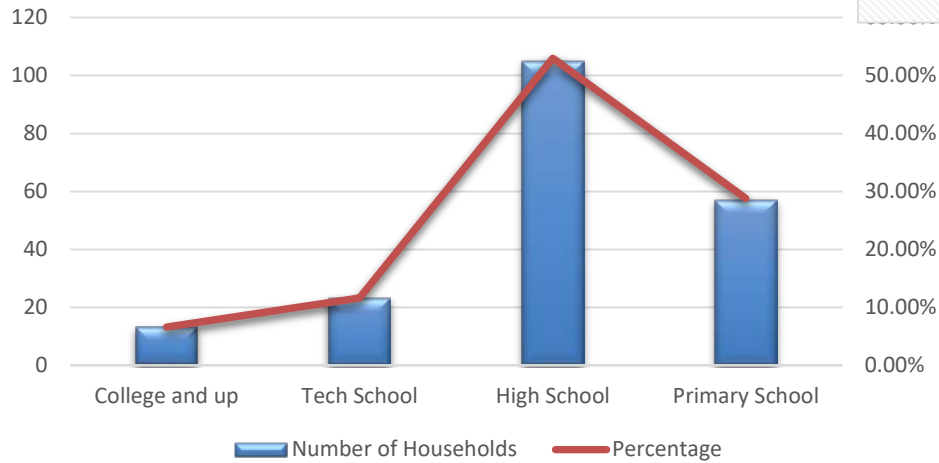
# Conclusion

- 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

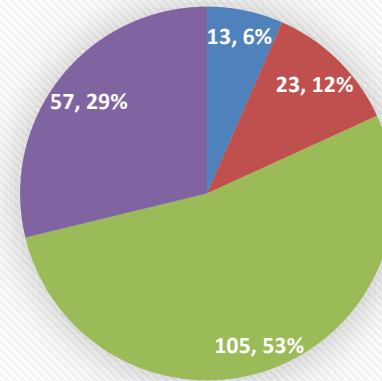
# Further Research

- 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

## Education Background



## Education Background



■ College and up
 ■ Tech School
 ■ High School
 ■ Primary School

# 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.

# Results

Revenue Insurance	Coefficient Estimates	Standard Deviation Estimates	Willingness to Pay (¥/contract)
Premium	-0.13286 (0.02945)***	0.11386 (0.05909)*	
Coverage	0.00311 (0.00051)***	0.00114 (0.00077)	0.047
Time	0.42753 (0.09079)***	0.16359 (0.15380)	6.44
PP	0.97936 (0.14519)***	0.97106 (0.83427)	14.74
Casc	-1.13848 (0.30127)***	1.77626 (0.45253)***	-17.14

# Results

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	



# Results

index	Coefficient Estimates	Standard Deviation Estimates	Willingness to Pay (¥/contract)
Insurance			
Premium	-0.11320 (0.04538)**	0.17274 (0.06268)***	
Coverage	0.00194 (0.00078)**	0.00264 (0.00113)**	0.034
Time	0.17853 (0.11967)	0.17120 (0.28891)	3.15
Public	1.66949 (0.33027)***	1.32006 (0.39693)***	29.50
Dasc	-2.41218 (0.51780)***	2.08719 (0.62612)***	-21.31

# Results

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

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