Do Disaster Experience and Knowledge Affect Insurance Take-up Decisions?

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- Using a field experiment in rural China, we study the effect of two factors on weather insurance adoption:
  - Experience of disasters: use insurance games to simulate hypothetical experience with disasters
  - Knowledge of expected returns: reveal true probability of disasters

Literature Review and Contributions

I. Insurance demand literature:

- Existing explanations for low insurance demand:
  - Cai et al 2015: Lack of financial literacy
  - Cole et al. 2013: Liquidity constraint, lack of trust
  - Bryan 2010: Ambiguity aversion

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  - Bryan 2010: Ambiguity aversion
- This paper:
  - Shows that the lack of experience of disasters and insufficient understanding of the true expected value of the insurance product contribute to the low take-up

II. Literature on the effect of experience:

- Existing literature on the effect of experience:
  - Consumer behaviors (Haselhuhm et al. 2009)
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  - Consumer behaviors (Haselhuhm et al. 2009)
  - Financial market (Malmendier and Nagel 2011)
- This paper:
  - Analyzes the effect of personal experience on insurance demand and disentangles it from other confounding effects
  - Shows that even simulated hypothetical experience has an impact on real household financial decision making

Outline

- **I. Background**
- II. Experimental design
- III. Estimation strategies and results
- IV. Conclusion

I. Background: Rice Insurance

- A program initiated by the People's Insurance Company of China (PICC)
- Insurance contract:
  - Price : 3.6 RMB after subsidy (actuarially fair price 12 RMB = 2 dollars)
  - Responsibility: 30% or more loss in yield caused by:
    Heavy rain, flood, windstorm, drought, etc.
  - Indemnity Rule: 200 RMB $\times$ Loss%
- The maximum payout covers 30% of the gross rice production income or 70% of the production cost

I. Background: Experimental Sites

- 16 randomly selected villages with 1700 households in Jiangxi, China
- On average, around 70% household income comes from rice production
- No similar types of insurance provided before

Outline

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- **II. Experimental design**
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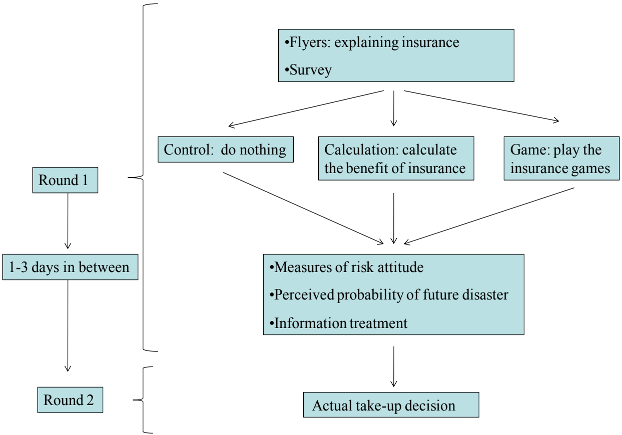
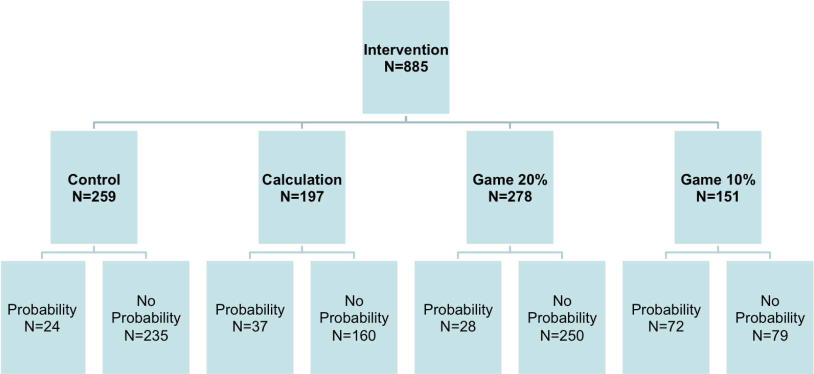
II.1. Experimental Design: Timeline

- Two rounds of household visit: 1 or 3 days gap
  - Round1: Distribute and explain insurance flyer + Survey + Intervention
  - Round2: Make real take-up decision



II.2. Experimental Design: Overview

- The experiment has a 4 by 2 design:
  - Four groups that differ in how the insurance contract is explained: control, calculation, game (10% or 20%)
  - The information treatment about the true probability of disasters



II.2. Experimental Design: Calculation Treatment

- Calculation treatment: Explain insurance => Survey (background, risk aversion, disaster perception, etc.) => calculation of insurance benefits

Number of disasters in 10 years	Total ten years' income if you purchased insurance every year	Total ten years' income if you did not purchased insurance in any year
0	99640=10000-3.6*10mu*10year	100000=1000*10mu*10year
1	96440=96000-360+200*40%*10mu*1year	96000=100000-400*10mu*1year
2	93240=92000-360+200*40%*10mu*2year	92000=100000-400*10mu*2year
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    - Production area equals 10mu
    - Total income equals 10000 RMB if no disaster
    - Total income equals 6000 RMB if disaster happened

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  - Assume:
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    - Total income equals 6000 RMB if disaster happened
  - Calculate income in 10 years if there are 0/1/2/3 disasters
  - Compare between:
    Always purchase insurance vs. always not purchase insurance

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II.2. Experimental Design: Game Treatment

- Game treatment: Explain insurance => Survey (background) => Insurance game => Survey (risk aversion, disaster perception)

Up-take	Disaster	Income (RMB)	Note
NO	NO	10000=1000*10 mu	Assume when there's no disaster, the gross income per mu is 1000 RMB
NO	YES	6000=600*10	Assume if a 40% disaster happened, the gross income per mu is 600 RMB
YES	NO	9964=1000*10-3.6*10	Assume when there's no disaster, the gross income per mu is 1000 RMB, and the premium is 36 RMB in total.
YES	YES	6764 = 600*10 - 36 + 200*40%*10	Assume if a 40% disaster happened, the gross income per mu is 600 RMB, and the premium is 36 RMB in total, The payout per mu is 200*40%=80 RMB.

II.2. Experimental Design: Game Treatment

- Game treatment: Explain insurance => Survey (background) => Insurance game => Survey (risk aversion, disaster perception)
  - Hypothetical decisions for 10 years (10 round game)
  - Each round: Insurance decision => draw card => calculate income
  - Assume:
    - Production area equals 10mu
    - Total income equals 10000 RMB if no disaster
    - Total income equals 6000 RMB if disaster happened

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- Repeat the game for 10 times:

Year	Do you buy insurance?	Have you experienced disaster in this year?	Income in this year
2011			
2012			
..			
2020			

II.2. Experimental Design: Game Treatment

- Repeat the game for 10 times:

Year	Do you buy insurance?	Have you experienced disaster in this year?	Income in this year
2011			
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..			
2020			

- Gave households the same information as in the calculation group
- Compare the farmer's income if always purchase insurance and income if always not purchase insurance

II.2. Experimental Design: Probability Treatment

- Randomize whether househeolds are informed of the actual probability of disasters
- Test whether the treatment reduces uncertainty about the value of insurance and consequently increases the insurance take-up

Outline

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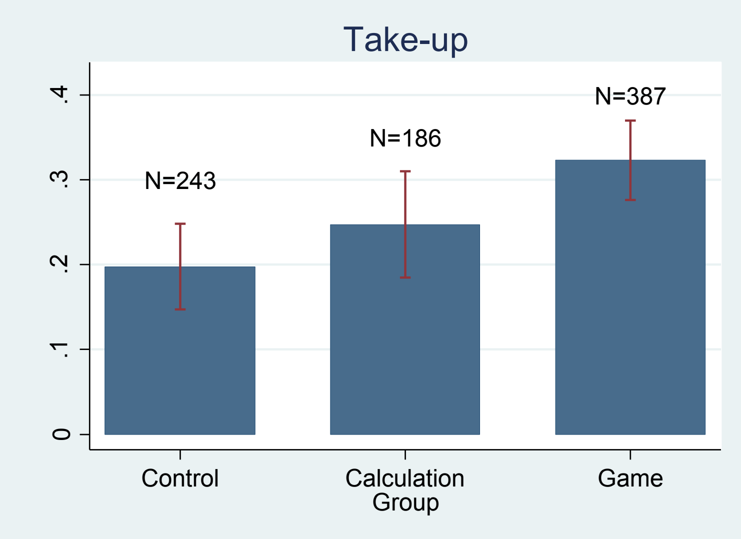
III.1. Estimation Strategy and Results: Take-up



III.1. Estimation Strategy and Results: Take-up

- Estimate the effect of calculation/game on take-up:

$$buy_{ij} = \alpha_j + \alpha_k + \beta_g Tg_{ij} + \beta_c Tc_{ij} + \phi X_{ij} + \epsilon_{ij} \quad (1)$$

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$$buy_{ij} = \alpha_j + \alpha_k + \beta_g Tg_{ij} + \beta_c Tc_{ij} + \phi X_{ij} + \epsilon_{ij} \tag{1}$$

- buy_{ij} is the indicator that equals 1 if household i in village j buys insurance
- Tg_{ij} is an indicator of the game treatment
- Tc_{ij} is an indicator of the calculation treatment
- X_{ij} are household characteristics
- α_j and α_k are village fixed effects and enumerator fixed effects, respectively

III.1. Estimation Strategy and Results: Take-up

- Playing game has a large and significant effect on actual take-up: take-up increased by 46%

Table 2. The Effect of Game Treatment on Insurance Take-up

Specification:	Logistic regression		
Dep. Var.:	Individual Adoption of Insurance		
Sample:	All Sample		
	(1)	(2)	(3)
Game (1=Yes, 0=No)	0.091	0.096	0.092
	(0.039)**	(0.037)***	(0.038)**
Calculation (1=Yes, 0=No)	0.024	0.028	0.030
	(0.044)	(0.043)	(0.041)
Probability (1=Yes, 0=No)	0.043	0.050	0.046
	(0.050)	(0.051)	(0.049)
%Loss Last Year (self report)		0.216	0.208
		(0.100)**	(0.106)**
Age			0.009
			(0.011)
Education			0.039
			(0.018)**
Household Size			-0.015
			(0.005)***
Area of Rice Production (mu)			0.0015
			(0.0138)
Obs.	816	816	816
Pseudo R-square	0.0927	0.0975	0.1076

III.2. Estimation Strategy and Results: Channels

- Possible explanations of the game effect:

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  - 1. Change of risk attitudes
  - 2. Change of perceived probability of disasters

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- Possible explanations of the game effect:
  - 1. Change of risk attitudes
  - 2. Change of perceived probability of disasters
  - 3. Learning the insurance benefits
  - 4. Experience

III.2.1. Channels: Change of Risk Attitudes I

- Estimation equations:

$$buy_{ij} = \alpha_{2j} + \beta_{risk} risk_{ij} + \beta_{prob} prob_{ij} + \delta_{ij} \tag{2}$$

$$risk_{ij} = \alpha_{3j} + \gamma_{gr} Tg_{ij} + \gamma_{cr} Tc_{ij} + \eta_{ij} \tag{3}$$

$$risk_{ij} = \alpha_{4j} + \beta_{dr} disaster_{ij} + \omega_{ij} \tag{4}$$

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$$risk_{ij} = \alpha_{4j} + \beta_{dr} disaster_{ij} + \omega_{ij} \quad (4)$$

- Hypothesis:
  $\beta_{risk}\gamma_{gr} = \beta_g$
  $1.48\beta_{risk}\beta_{dr} = \beta_g$
  (1.48 is the average number of disasters experienced during games)

III.2.1. Channels: Change of Risk Attitudes II

- The game treatment has no significant effect on risk aversion:

Specification:	OLS Regression		
Dep. Var.:	Insurance Take-up	Risk Aversion	
Sample:	Control & Calculation (1)	All Sample (2)	Game (3)
Risk Aversion	0.035		
	(0.016)**		
Perceived Probability of	0.215		
Future Disaster ([0.1])	(0.110)*		
Game		-0.024	
(=1 if Yes, =0 if No)		(0.182)	
Calulation		0.055	
(=1 if Yes, =0 if No)		(0.165)	
Number of Hypothetical Disasters			0.080
			(0.138)
Obs.	329	697	320
R-square	0.1397	0.1932	0.2022

- Hypothesis $\beta_{risk}\gamma_{gr} = \beta_g$ is rejected at 5% level (p=0.039)
- Hypothesis $1.48\beta_{dr}\gamma_{gr} = \beta_g$ is rejected at 5% level (p=0.044)

III.2.2. Channels: Change of Perceived Disaster I

- Estimation equations:

$$buy_{ij} = \alpha_{2j} + \beta_{risk} risk_{ij} + \beta_{prob} prob_{ij} + \delta_{ij} \tag{5}$$

$$prob_{ij} = \alpha_{3j} + \gamma_{gp} Tg_{ij} + \gamma_{cp} Tc_{ij} + \eta_{ij} \tag{6}$$

$$prob_{ij} = \alpha_{4j} + \beta_{gp} disaster_{ij} + \omega_{ij} \tag{7}$$

- Hypothesis:
  $\beta_{prob}\gamma_{gp} = \beta_g$
  $1.48\beta_{dp}\gamma_{gp} = \beta_g$
  (1.48 is the average number of disasters experienced during games)

III.2.2. Channels: Change of Perceived Disaster II

- The game treatment has a significantly positive effect on perceived probability of future disasters:

Specification:	OLS Regression		
Dep. Var.:	Insurance take-up	Perceived Prob. of Future Disaster	
Sample:	Control & Calculation	All Sample	Game
	(1)	(2)	(3)
Risk Aversion	0.035		
	(0.016)**		
Perceived Probability of Future Disaster ([0.1])	0.215		
	(0.110)*		
Game (=1 if Yes, =0 if No)		-0.015	
		(0.008)*	
Calulation (=1 if Yes, =0 if No)		-0.011	
		(0.009)	
Number of Hypothetical Disasters			0.003
			(0.008)
Obs.	329	667	310
R-square	0.1397	0.0990	0.1896

- Both hypotheses are rejected at 5% level

Two strategies:

1. Compare the effects of the game and calculation treatments
   - The calculation treatment does not have significant effect on take-up
   - Insignificant difference between game and calculation treatment: suggestive evidence that learning benefit is not the main channel

Specification:	Logistic regression		
Dep. Var.:	Insurance Take-up (=1 if Yes, =0 if No)		
	(1)	(2)	(3)
Game	0.092	0.096	0.092
(=1 if Yes, =0 if No)	(0.039)**	(0.037)***	(0.038)**
Calculation	0.025	0.029	0.031
(=1 if Yes, =0 if No)	(0.043)	(0.042)	(0.040)
%Loss Last 3 Years		0.207	0.200
		(0.104)**	(0.110)*
Age			0.008
			(0.011)
Education			0.039
			(0.017)**
Household Size			-0.015
			(0.005)***
Production Area (mu)			0.002
			(0.014)
Wald Test: $\beta_g=\beta_c$			
p-value	0.1376	0.1328	0.1568
Obs.	816	816	816
Pseudo R-square	0.0918	0.0962	0.1065

III.2.3. Channels: Learning Insurance Benefits II

2. Test the effect of Game treatment on insurance knowledge

$$Knowledge_{ij} = \alpha_j + \alpha_k + \beta_g Tg_{ij} + \phi X_{ij} + \epsilon_{ij} \quad (8)$$

- The effect of game treatment on knowledge is insignificant
- Learning benefit is not the main channel

Table 5. The Effect of Game Treatment on Insurance Knowledge

Specification:	OLS Regression			
Sample	All Sample			
Dep. Var.:	Insurance Benefit Question 1		Insurance Benefit Question 2	
	(1)	(2)	(3)	(4)
Game (1=Yes, 0=No)	0.00879	0.031	0.0158	0.0248
	(0.00975)	(0.0241)	(0.0219)	(0.0232)
%Loss Last Year (self report)	-0.102		0.0385	
	(0.0807)		(0.0636)	
Number of Hypothetical Disasters		-0.0176		-0.0092
		(0.0177)		(0.00841)
Obs.	658	650	657	649
R-square	0.7692	0.7589	0.6882	0.6757

III.2.4. Channels: Hypothetical Experience I

$$buy_{ij} = \alpha_j + \beta_{disaster} disaster_{ij} + \delta_{ij} \tag{9}$$

$disaster_{ij}$: number of hypothetical disasters experienced during games

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$disaster_{ij}$: number of hypothetical disasters experienced during games

- The more disaster experienced, the more likely to buy insurance

Specification:	Logistic Regression		
Dep. Var.:	Individual Adoption of Insurance		
	(1)	(2)	(3)
Game	0.010		0.047
	(0.059)		(0.046)
Calculation	0.042		0.044
	(0.046)		(0.045)
Number of Hypothetical Disasters	0.059		
	(0.031)*		
Game and No Disaster		0.030	
		(0.060)	
Game and One Disaster		0.046	
		(0.045)	
Game and Two Disasters		0.137	
		(0.043)***	
Game and Three or More Disasters		0.133	
		(0.066)**	
Number of Hypothetical Disasters in First Half of Game (2011-2015)			-0.019
			(0.024)
Number of Hypothetical Disasters in Second Half of Game (2016-2020)			0.070
			(0.033)**
Obs.	804	804	804

III.2.4. Channels: Hypothetical Experience II

$$buy_{ij} = \alpha_j + \beta_0 disaster0_{ij} + \beta_1 disaster1_{ij} + \beta_2 disaster2_{ij} + \beta_3 disaster3_{ij} + \epsilon_{ij} \quad (10)$$

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Dep. Var.:	Individual Adoption of Insurance		
	(1)	(2)	(3)
Game	0.010		0.047
	(0.059)		(0.046)
Calculation	0.042		0.044
	(0.046)		(0.045)
Number of Hypothetical Disasters	0.059		
	(0.031)*		
Game and No Disaster		0.030	
		(0.060)	
Game and One Disaster		0.046	
		(0.045)	
Game and Two Disasters		0.137	
		(0.043)***	
Game and Three or More Disasters		0.133	
		(0.066)**	
Number of Hypothetical Disasters in First			-0.019
Half of Game (2011-2015)			(0.024)
Number of Hypothetical Disasters in			0.070
Second Half of Game (2016-2020)			(0.033)**
Obs.	804	804	804
Pseudo R-square	0.0599	0.0864	0.0884

III.2.4. Channels: Hypothetical Experience III

$$buy_{ij} = \alpha_j + \beta_{f5} disasterfirst5_{ij} + \beta_{15} disasterlast5_{ij} + \delta_{ij} \quad (11)$$

Specification:	Logistic Regression		
Dep. Var.:	Individual Adoption of Insurance		
	(1)	(2)	(3)
Game	0.010		0.047
	(0.059)		(0.046)
Calculation	0.042		0.044
	(0.046)		(0.045)
Number of Hypothetical Disasters	0.059		
	(0.031)*		
Game and No Disaster		0.030	
		(0.060)	
Game and One Disaster		0.046	
		(0.045)	
Game and Two Disasters		0.137	
		(0.043)***	
Game and Three or More Disasters		0.133	
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Number of Hypothetical Disasters in Second Half of Game (2016-2020)			0.070
			(0.033)**
Obs.	804	804	804
Pseudo R-square	0.0599	0.0864	0.0884

- The probability treatment increases insurance take-up significantly

Table 8. The Effect of Probabiity Treatment on Insurance Take-up

Specification:	Logistic Regression			
Dep. Var.:	Individual Adoption of Insurance			
Sample:	Control		All Sample	
	(1)	(2)	(3)	(4)
Probability (1=Yes, 0=No)	0.294	0.298	0.184	0.183
	(0.136)**	(0.141)*	(0.0134)	(0.0138)
Game (1=Yes, 0=No)			0.120	0.119
			(0.0395)***	(0.0416)**
Calculation (1=Yes, 0=No)			0.0105	0.0100
			(0.0438)	(0.0406)
Game × Probability			-0.209	-0.214
			(0.155)	(0.164)
Calculation × Probability			-0.0293	-0.0186
			(0.172)	(0.179)
Obs.	243	243	816	816
R-square	0.1609	0.1900	0.1100	0.1268

III.3. The Impact of Probability Treatment

- The probability treatment increases insurance take-up significantly
- However, the game treatment effect is much smaller with the probability treatment: farmers may value the game less if it does not coincide with the real disaster probability

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Dep. Var.:	Individual Adoption of Insurance			
Sample:	Control		All Sample	
	(1)	(2)	(3)	(4)
Probability (1=Yes, 0=No)	0.294	0.298	0.184	0.183
	(0.136)**	(0.141)*	(0.0134)	(0.0138)
Game (1=Yes, 0=No)			0.120	0.119
			(0.0395)***	(0.0416)**
Calculation (1=Yes, 0=No)			0.0105	0.0100
			(0.0438)	(0.0406)
Game × Probability			-0.209	-0.214
			(0.155)	(0.164)
Calculation × Probability			-0.0293	-0.0186
			(0.172)	(0.179)
Obs.	243	243	816	816
R-square	0.1609	0.1900	0.1100	0.1268

V. Conclusion

- This paper studies the impact of disaster experience and knowledge on weather insurance take-up
  - Playing an insurance game incrases the real insurance take-up rate by 46%, and exposure to hypothetical disasters is the main explanation
  - Providing information about the payout probability has a strong positive effect on insurance take-up
  - When households receive both treatments, the probability information has a greater impact on take-up than does the disaster experience

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    - Playing an insurance game incrases the real insurance take-up rate by 46%, and exposure to hypothetical disasters is the main explanation
    - Providing information about the payout probability has a strong positive effect on insurance take-up
    - When households receive both treatments, the probability information has a greater impact on take-up than does the disaster experience
- Policy implications:
    - Interventions similar as the game treatment can be used to influence the adoption of other financial products that involve uncertainty and require some time to experience the gain or loss
    - Providing information on the true expected values of financial assets could be important in improving the effectiveness of financial education