Time Discounting and Chinese Grape Growers Response to An Upward Trend in Precipitation

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Introduction

The upward trend of precipitation before harvest has threatened grape growers' livelihood in Xinjiang, a region with the highest grape yields and planted areas among China's provinces. As reported by local government, rain showers in August caused 60% of grapes to rot. (Affairs 2018). Considering the trend of climate change and huge losses, the local government is currently providing subsidies to the adopters of rain covers in order to encourage growers to use them to avoid possible economic losses.

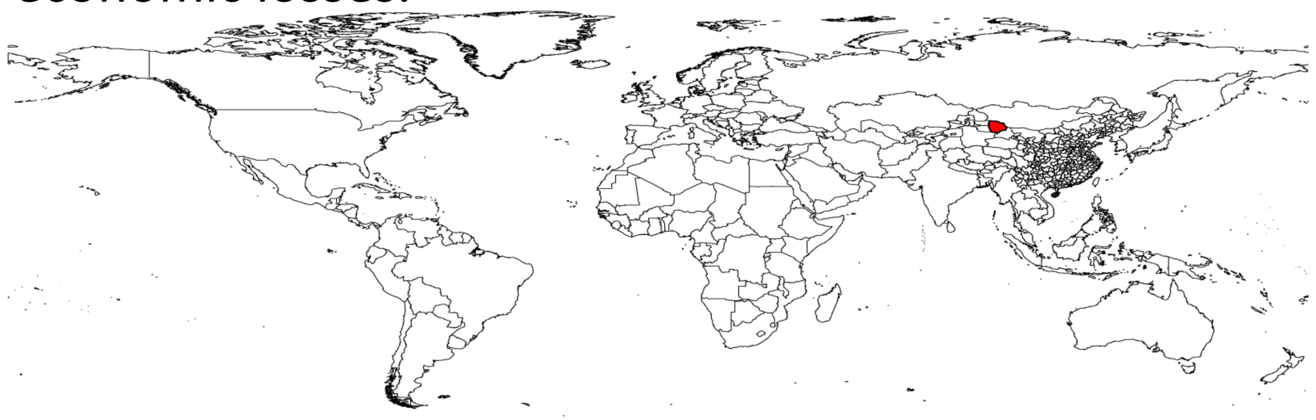


Figure 1. The study area in Hami City, Xinjiang

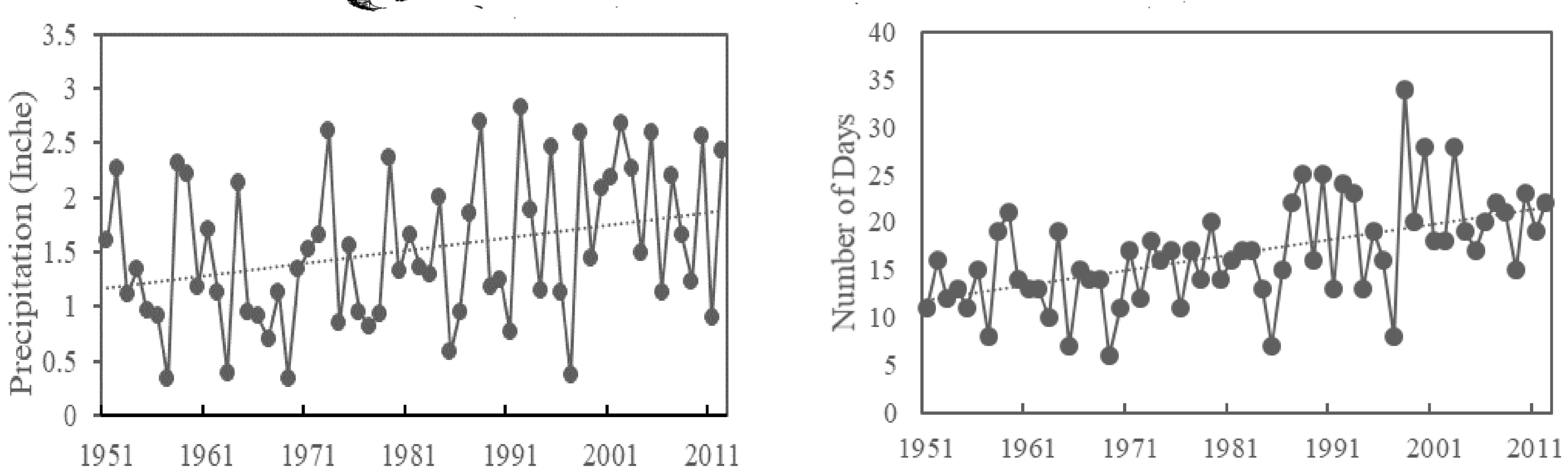


Figure 2. The trend of precipitation and number of rainy days from 1951 to 2012
Data Source: The authors calculated by data from NOAA.

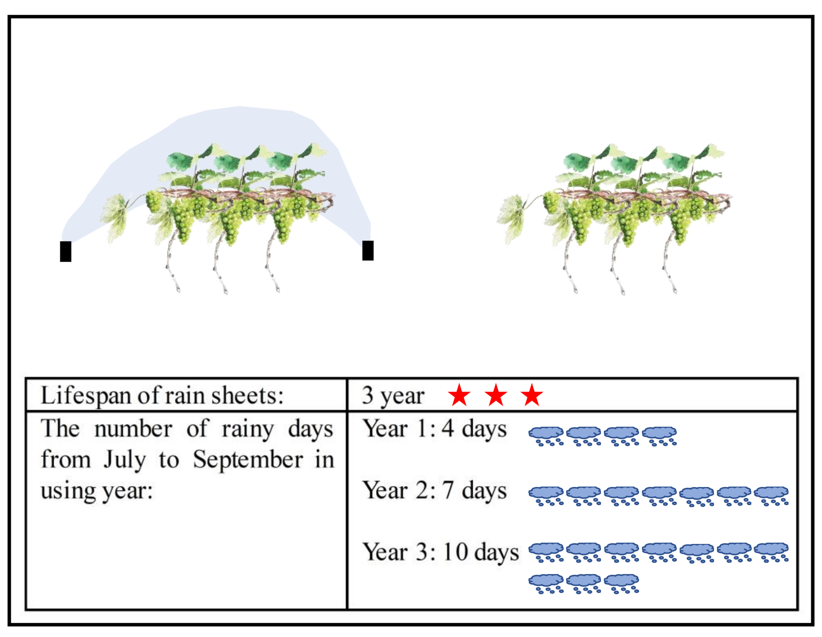
However, this subsidy policy did not work well. Despite proven benefits, few farmers are using these rain covers. So, we want to know why the adoption rate is low and why the subsidization did not work well?

We come up with our research questions: 1. Whether local farmers give more weight on present or sooner benefits rather than later benefits. 2. Due to their positive time discounting, farmers tend to respond after rain rather than make a one-time investment for rain covers in advance for uncertain positive benefits. This possibly influences farmers' likelihood to adopt rain covers in the future.

Methods

1. Multi-bounded contingent valuation approach

Provided for Grape Growers



Provided for Interviewers

Cost (yuan/mu)	Accept/Not accept
200	
400	
600	
800 (starting point)	
1000	
1200	
1500	

Figure 3. Example of a choice card and a corresponding price card

2. Hierarchical Bayesian approach

$$\ln(MWTP_i) = \ln\left(\pi_i \sum_{t=1}^{T} (1+\gamma_i)^{-t} \left(1-(1-\delta_i)^{y_t}\right)\right) + e_i$$

$MWTP_i$: maximum willingness to pay.
π_i: expected profit of grapes per unit farmland in one period if there was no rain.
γ_i: time discount rate of the ith farmer.
δ_i: subjective "rotten rate" from a rain day if there is no cover for ith farmer.
y_t: subjective number of rainy days in period t.
T: the lifespan of rain covers.

3. Ordered Probit regression

$$LA_i = \alpha\gamma_i + \beta Characteristics_i + \mu_i$$

LA_i: likelihood to adopt in the next five years.
$Characteristics_i$: age, education, gender, gender of main decision-maker in the household, percent of loss from the rain last year, vineyard area, income from grapes.

Results

Table 1. The distributions of the mean value of estimated parameters (γ, δ, π) for each farmer.

	Discounted rate(γ)	Rotten rate(δ)	Expected profit (yuan/mu) (π)
Average	0.17	0.55	532.04
Standard deviation	0.03	0.06	28.05
Minimum	0.07	0.37	434.18
Maximum	0.30	0.84	642.92
Observations	16000	16000	16000

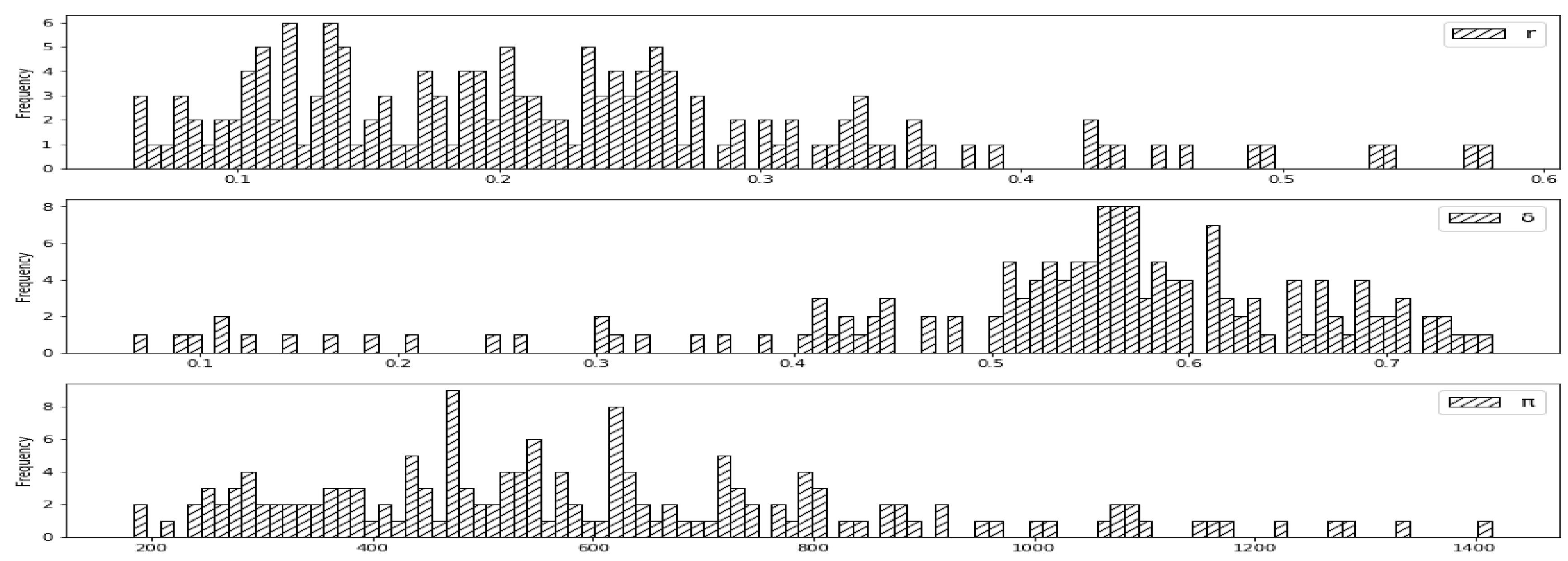


Figure 4. The frequency distribution of estimated parameters for all farmers

Table 2. Estimation of the relationship between the discount rate and possibilities to adoption

Variables	Estimate	Standard deviation	z-test statistic
Discount rate	0.94	0.79	1.19
Age	0.19**	0.09	2.18
Education	-0.09	0.10	-0.89
Gender	0.27	0.19	1.46
Gender of the main decision-maker in the household	0.05	0.21	0.28
Percent of loss from the rain last year	-0.14*	0.07	-1.85
Vineyard area	-0.03	0.11	-0.25
Income from grapes	-0.02	0.08	-0.27

Notes: *** p<0.01, ** p<0.05, * p<0.1

Conclusions

1. This research has found extremely high discount rates on the part of Chinese grape farmers.
2. Farmers tend to underestimate the benefits of adopting covers, and their purchase decisions largely depend on their past actual losses rather than future anticipated losses.
3. Farmers have considerable heterogeneity in both their willingness to pay and discount rates, policies may need to target those who have higher discount rates and lower anticipated benefits from adoption.

References

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Acknowledgements

The authors would like to acknowledge the research fund from University of Reading/China Scholarship Council PhD Funding.