



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

# Land Tenure and Adoption of Straw Retention: Evidence from Chinese Grain Crop Growers

**Yingdan Mei\*, Li Gao\*\*, and Wendong Zhang\*\*\***

\*: School of Business Administration  
China University of Petroleum (Beijing), Beijing, China  
[meiyingdan@vip.sina.com](mailto:meiyingdan@vip.sina.com)

\*\* : Department of Agricultural, Environmental and Development Economics,  
The Ohio State University, Columbus, OH 43210, USA  
[gao.456@osu.edu](mailto:gao.456@osu.edu)

\*\*\*: Department of Economics  
Iowa State University, Ames, IA 50010, USA  
[wdzhang@iastate.edu](mailto:wdzhang@iastate.edu)

*Selected Poster prepared for presentation at the Agricultural & Applied Economics Association's 2017 Annual Meeting,  
Chicago, IL, July 31 – August 3, 2017.*

*Copyright 2017 by Yingdan Mei, Li Gao, and Wendong Zhang. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.*



# Land Tenure and Adoption of Straw Retention: Evidence from Chinese Grain Crop Growers

Yingdan Mei\*, Li Gao\*\*, and Wendong Zhang\*\*\*

\*: China University of Petroleum (Beijing) \*\*: The Ohio State University \*\*\*: Iowa State University



## Abstract

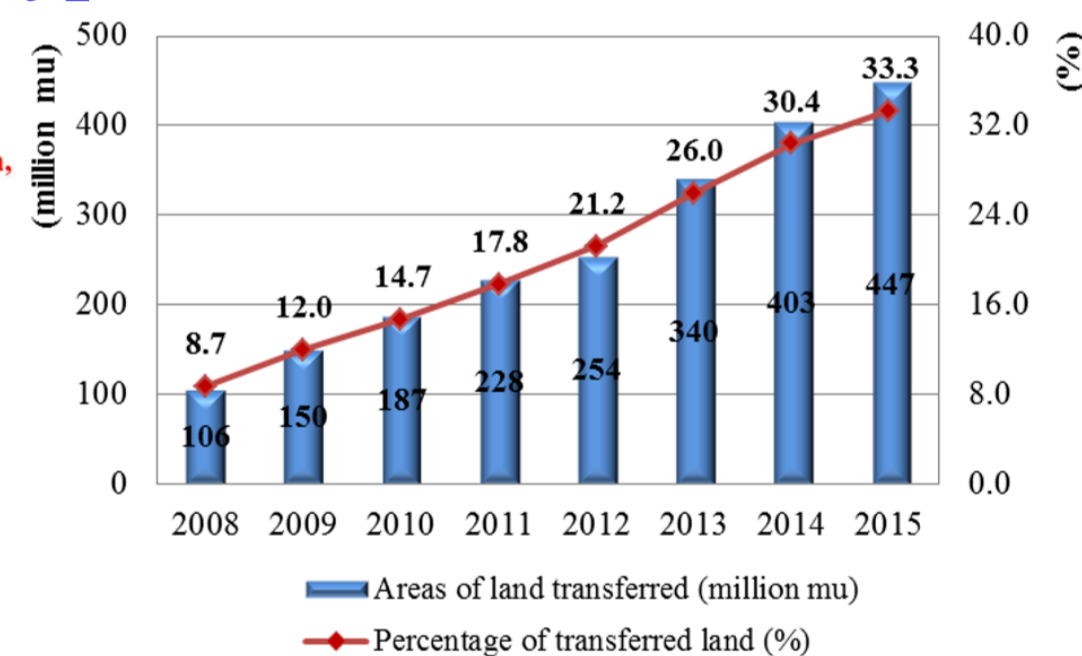
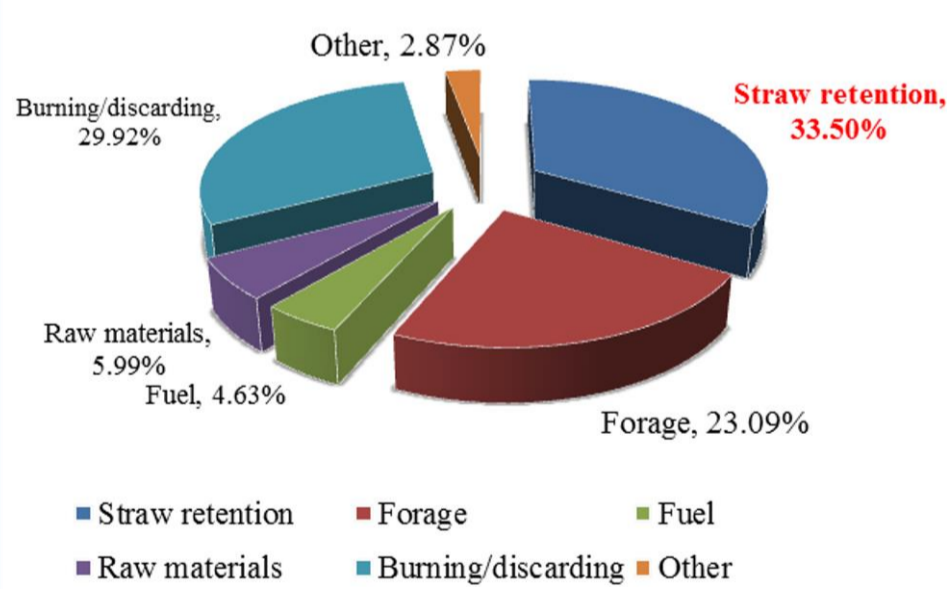
**Straw: To burn, or not to burn? it is a question!**



This study aims to examine how land tenure arrangements affect Chinese farmers' adoption of straw retention, a critical conservation practice promoted by the Chinese government to improve soil quality and combat air pollution. Using survey data from 1,659 crop plots in Henan Province in central China conducted last year, we examine the impacts of land tenure on growers' straw retention choices. Results from a heckman selection model reveal that, after controlling for crop choice, harvest season, spatial climate and other plot-level and household-level covariates, farmer households are more likely to adopt straw retention after harvest on own contracted than rented plots throughout 2015.

## Research Question and Hypothesis

Straw Treatment Types in Henan (2010)



## Land tenure insecurity → Less conservation practice adoption

• **US:** conservation tillage (Lee and Stewart, 1983; Soule et al., 2000), contour farming (Soule et al., 2000), conservation crops (Fraser, 2004); stone terraces/soil bunds (Gebremedhin and Swinton, 2003)

• **China:** input use efficiency (Jacoby et al., 2002); contour farming (Liu and Huang, 2013);

## Why straw retention? Why now?

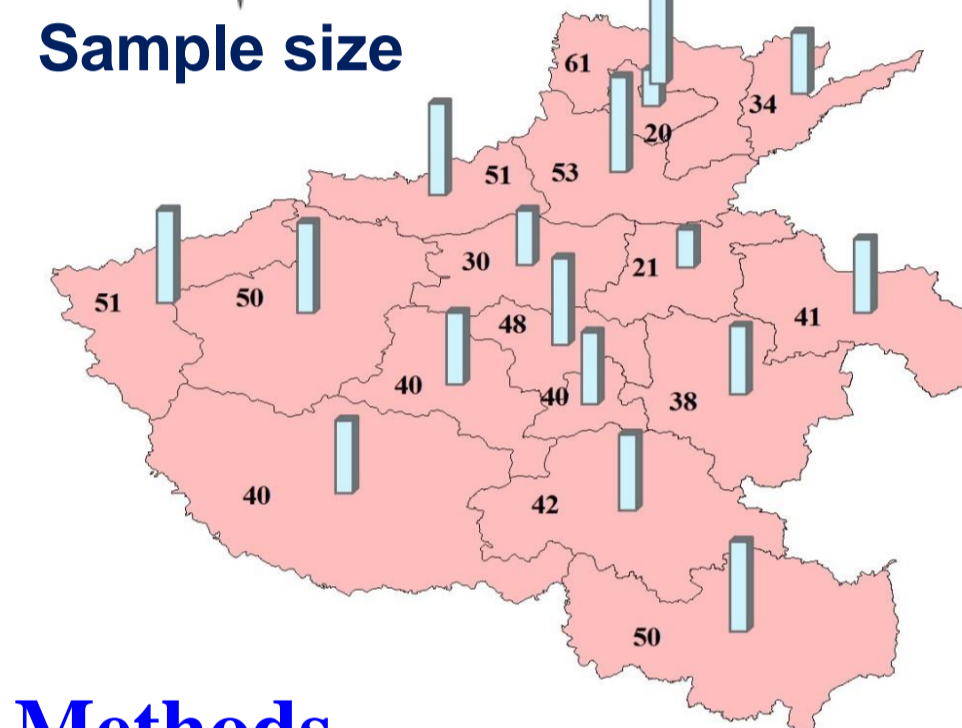
- Renewed concern on air quality impacts from straw burning
- **Analysis of crop residue retention in China is scarce**, the only study we found (Wang et al. 2010) did not consider land tenure
- **Land tenure in a new policy era:** Part of China's rural land reform, the percent of land rented out increased from less than 10% in 2008 to more than 30% nowadays
- **Land tenure insecurity is defined** as fields rented out vs. fields originally allocated by collectives through contract – land is owned by collectives/villages in China

## Data and Study Region - Henan

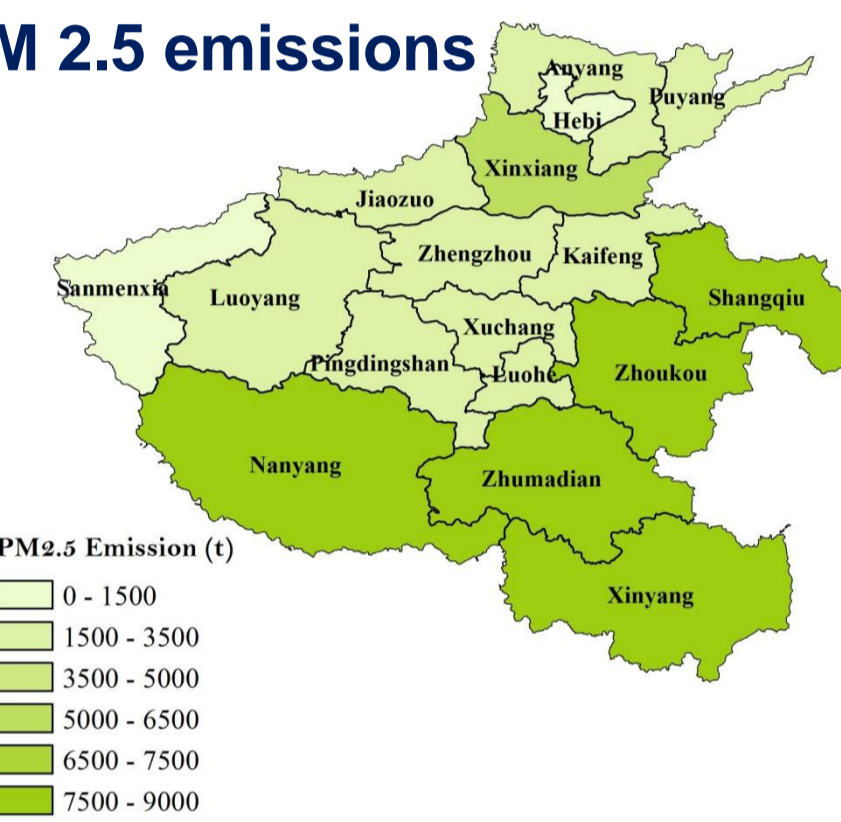
- Major wheat area
- 100 million people
- Severe straw burning



## Sample size



## PM 2.5 emissions



## Methods

### Conceptual framework

- **A grower adopts straw retention only if**

$$\pi_s - C_s + \lambda V_s / (1 + r) > \pi_n - C_n + \lambda V_n / (1 + r)$$

**short-term profit loss < long-term land value improvement**

- **Short-term cost:** Straw retention decreases short-term profitability  $\pi$  through increased treatment cost and pest pressure  $C$ .
- **Long-term profit:** Straw retention can reduce soil runoff, improve the fertility and productivity over time, and better retain the long-term value of the land  $V$ .

### Heckman selection model

- **Selection Equation: to rent or not**

### Exclusion restrictions

- **Distance to larger cities:** closer to cities, easier to get off-farm employment opportunities → higher chance of being rented out, but not necessarily affect conservation
- **Distance to nearest counties:** farther away from county centers → harder to sell grains → higher cost for owned plots

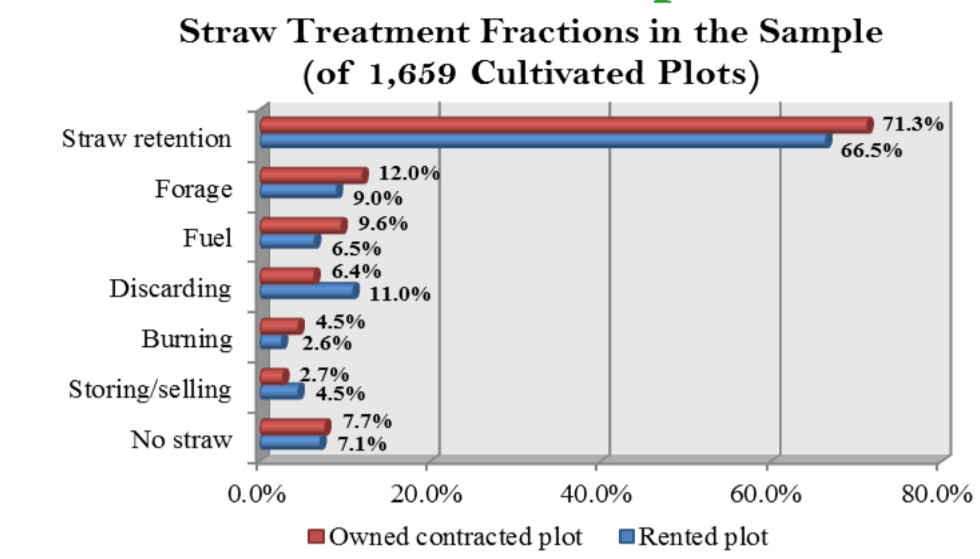
**(Why control for selection: growers who do not have sufficient time to manage production and conservation may be more likely to rent out their farmland)**

- **Outcome equation: to adopt straw retention or not**

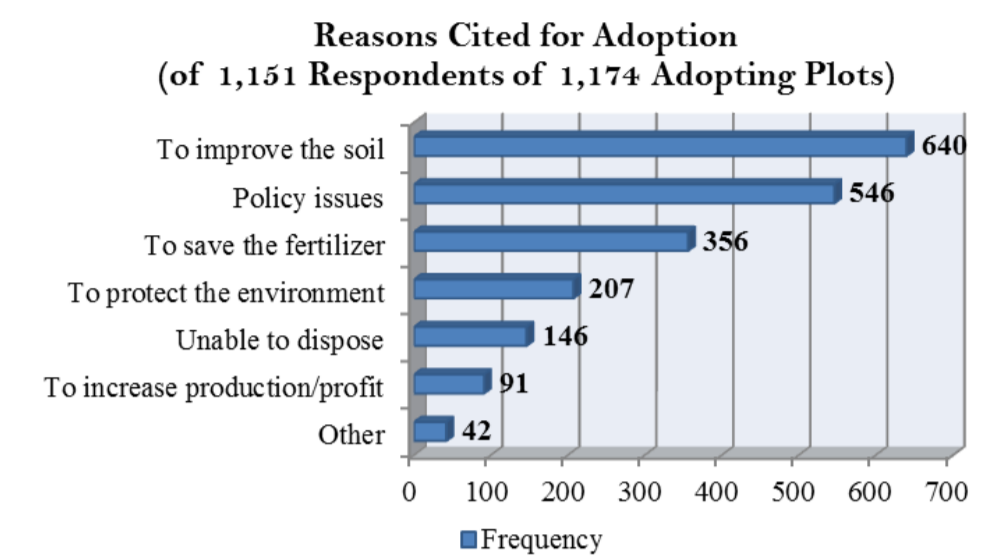
- **Control variables:** household head's age, farming experience; family education, income, participation in farmer organization, training, # laborers, purchase of insurance; plot size
- **Variables only in 2nd-stage outcome equation:** July temperature and precipitation (May-July is wheat harvesting season), harvest season, crop choice

## Results

- **Straw treatment choices for rented and owned contracted plots**



- **Why do growers adopt straw retention?**



## Heckman selection model results

Model Variable	Selection - Rent or Not Coef.	Selection - Rent or Not Marg. Eff.	Adoption Model Coef.	Adoption Model Marg. Eff.
Age	0.0267***	0.0039	-0.0015	-0.0001
Farming experience	-0.0171***	-0.0025	0.0044	0.0004
Education	0.035**	0.0052	0.0366	0.0032
Number of laborers	-0.0815**	-0.0121	0.2617***	0.0226
Income	0.042***	0.0062	-0.0191	-0.0017
Organization	0.0616	0.0091	0.1511	0.0131
Insurance	0.5338***	0.0790	-0.2338	-0.0202
Training	-0.1799	-0.0266	0.4725	0.0409
Plot size	0.0716***	0.0106	-0.0236**	-0.002
July temperature			0.3783	0.0327
July precipitation			0.0029**	0.0003
Winter season			-0.033	-0.0029
Distance to city	-0.0044***	-0.0006		
Distance to county	0.0029	0.0004		
$\rho$	-0.9523**	0.0739		
Observations				1,659

## Conclusion and Policy Implication

- Our empirical results reveal a significant effect of land tenure structure on farmer's decision to adopt straw retention in Henan: being a renter is associated with lower probability ( $\rho < 0$ ) of adoption.
- To encourage adoption of conservation practices like straw retention, the government may need to improve the land tenure security for rented farmland by:

- ✓ enforcing more stable, formal leasing agreement contract;
- ✓ Loosening restrictions on land eligible for rental and transfer

## References

Fraser, E.D.G. 2004. "Land Tenure and Agricultural Management Soil Conservation on Rented and Owned Fields in Southwest British Columbia." *Agriculture and Human Values* 21: 73-79.

Liu, H. and Q. Huang. 2013. "Adoption and Continued Use of Contour Cultivation in the Highlands of Southwest China." *Ecological Economics* 91: 28-37.

Jacoby, H.G., G. Li, and S. Rozelle. 2002. "Hazards of Expropriation: Tenure Insecurity and Investment in Rural China." *The American Economic Review* 92(5): 1420-1447.

Wang, J., X. Wang, M. Xu, G. Feng, W. Zhang, and C. Lu. 2015. "Crop Yield and Soil Organic Matter after Long-term Straw Return to Soil in China." *Nutrient Cycling in Agroecosystems* 102(3): 371-381.

Gebremedhin, B. and S.M. Swinton. 2003. "Investment in Soil Conservation in Northern Ethiopia: The Role of Land Tenure Security and Public Programs." *Agricultural Economics* 29(1): 69-84.