Impact of Adoption of ICT on Commercial Orientation and Productivity in Rural China

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Background

- The transformation from subsistence small farms to agricultural commercial orientation is an essential path to realize agricultural development and economic growth in developing countries.
- Chinese small farmers still face high transaction costs for market participation due to a lack of infrastructure and institutions to support transactions and negotiations and face high information asymmetry, price discrimination and risks in agricultural markets.
- Information and Communication Technologies (ICTs), including smartphones, the Internet, and other digital technologies, are spreading rapidly and accessible to most of the world's population. A
- As of June 2023, there were 0.301 billion Internet users in rural China, accounting for 27.9 percent of total Internet users in China. The Internet penetration rate in rural areas is 60.5%.

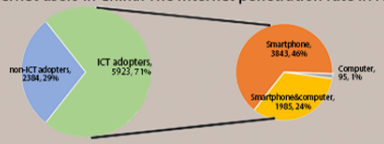

Figure 2. Characteristics of Chinese rural households' ICT adoption
Source: Chinese Household Database (CFD)

Objectives

- This study investigates the impact of ICT adoption, particularly smartphone and computer with internet usage, on Chinese smallholders' agricultural commercialization and productivity (land and labor productivity).
- We examine the role of agricultural commercialization in promoting ICT adoption and improving agricultural performance.
- To our knowledge, this is the first attempt to link the adoption of ICT by Chinese smallholders on the commercial-orientated behavior.

Theoretical framework

- Figure 1 portrays the potential pathways by which ICT adoption, agricultural commercialization, and productivity can be jointly determined.
- Pathway I is the interaction of ICT adoption and agricultural commercialization.
- Pathway II shows how ICT adoption impacts agricultural productivity.
- Pathway III shows how agricultural commercialization impacts agricultural productivity.

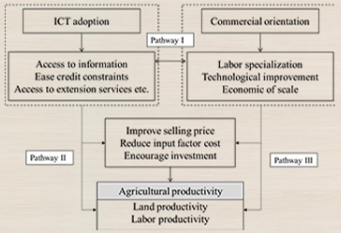

Figure 1. Potential relationship between ICT adoption, agricultural, commercial orientation and productivity
Source: Authors

Data

- The study uses a nationally representative survey data from the Chinese Family Database (CFD) of Zhejiang University and the China Household Finance Survey (CHFS) of the China Family Finance Survey and Research Center of the Southwestern University of Finance and Economics implemented in 2017.
- A sample of farm households living in rural areas and employed agricultural production in the 2016 and 2017 production years was first retained.

Then, the sample dataset of household-level and village-level surveys were combined, and finally, 8,307 valid samples were obtained.

Method

- In the empirical part, we first model the impact of ICT adoption on agricultural commercialization. To solve the potential endogenous problem, a two-step control function (CF) approach was adopted.

$ICT_i^* = \beta_0 + \beta_1 S_i + \delta_i$, with $ICT_i = \begin{cases} 1 & if\ \ ICT_i^* > 0 \\ 0 & otherwise \end{cases}$ first stage, the probability of ICT adoption.

$Commercial_i = \alpha_0 + \alpha_1 ICT_i + \alpha_2 X_i + \varepsilon_i$ second stage, the effect of ICT adoption on agricultural commercialization.

- Then, to examine the joint effect of ICT adoption and commercial orientation on agricultural productivity, a two-stage selectivity-corrected OLS model was employed to estimate the unbiased impacts of ICT adoption and commercial orientation on agricultural productivity.

$AP_i = \lambda_0' + \lambda_1' ICT_i^{predicted} + \lambda_2' Commercial_i^{predicted} + \lambda_3' X_i + \gamma_i'$

- $ICT_i^{predicted}$ and $Commercial_i^{predicted}$ are predicted ICT adoption and predicted commercial orientation variables, respectively.
- The seemingly unrelated bivariate probit (SUBP)model was adopted to simultaneously estimate ICT adoption and commercial orientation equations.

Results and discussion

- Farm households' ICT adoption has improved their probability of being commercial-oriented by approximately 3.1%. In other words, farm households adopting ICT increased the percentage of marketed farm output in total farm production, are more commercialized, and have an increased tendency to maximize profits in agricultural production.
- Land endowment, the heads' characteristics, family labor force and physical assets all have impact on farm households' probability of being commercial-oriented.
- Farm households' access to ICTs (smartphones or computers with the Internet) has a significantly positive effect on land productivity and labor productivity. The adoption of ICT increases farm households' land productivity by about 79.8% and labor productivity by about 94.5%, respectively.
- We have only proved the significant impact of agricultural commercialization on labor productivity.

Factors affecting smallholder's agricultural commercial orientation, China 2017

Variable	Coefficients	Marginal Effect
ICT adoption	0.096**	0.031**
	(0.043)	(0.014)
Control variables	Controlled	
IMR	0.233**	
	(0.109)	
Province Dummy	Controlled	
Constant	-0.772***	
	0.283	
Pseudo R^2	0.1570	
Number of Observation	8,307	

ICT adoption, commercial orientation and agricultural productivity, China 2017

Variable	Land productivity (log)	Labor productivity (log)
ICT adoption (predicted)	0.798**	0.945***
	(0.357)	(0.307)
Commercial orientation (predicted)	-0.221	0.375*
	(0.245)	(0.210)
Control variables	Controlled	Controlled
Province Dummy	Controlled	Controlled
Constant	3.660***	0.657
	(0.844)	(0.725)
Adjusted R^2	0.060	0.146
Number of Observation	8,307	8,307

Source: China Household Database (CFD) and the China Household Finance Survey and Research Center (CHFS) in 2017. Standard errors are in parentheses.
Significant at 10, 5, and 1 percent levels, respectively. Standard errors are in parentheses.

Conclusions

- The adoption of ICT by Chinese farmers increased the commercial orientation of farming.
- Adopting ICT increases land and labor productivity by about 79.8% and 94.5%, respectively.
- Farm households' commercial orientation improved land productivity by about 37.5%.

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