TECHNOLOGY ADOPTION AND ENERGY EFFICIENCY IN IRRIGATION: FIRST RESULTS FROM A COORDINATION GAME IN ANDHRA PRADESH, INDIA

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1. Introduction

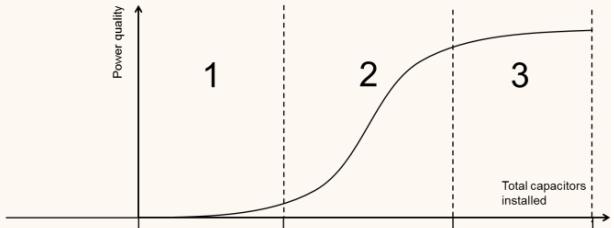
- In India, irrigation from groundwater has contributed to food security and equitable growth in agriculture (Shah, 2009).
- However, water withdrawals have reached alarming levels and the prevalent flat-rate tariffs for electricity undermine farmers' incentives to use energy efficiently.
- Installing shunt capacitors in irrigation pumps can reduce motor burnouts, reduce low tension lines losses and increase energy efficiency.
- In the past, interventions to foster the installation of these small technical devices have often failed which may be explained by an underlying coordination problem.

2. Research Questions

- The positive effect of capacitors can only be enjoyed after a certain threshold of installed capacitors at a distribution transformer is passed which leads to a coordination problem.
  - ➢ Do group size and leadership have an effect on the potential to coordinate investments?
  - ➢ How do socioeconomic factors influence the investment decision?
- An economic field experiment has been developed to study farmers' adoption of capacitors in Karimnagar district of Andhra Pradesh.

3. The Coordination Problem

- Power quality is an s-shaped function of the number of capacitors installed (Kimmich, 2012).
- Buying a capacitor is individually rational only when the marginal increase of one's one added capacitor to the grid is high.



Power Quality	low	medium	high
Marginal increase from additional capacitor	low and increasing	high	low and decreasing
Net individual benefit from a capacitor	negative	positive	negative

4. The Game

- 115 farmers were asked to take 12 times a binary decision: Either invest or not invest into a capacitor following the depicted payoffs.

	Other Farmers Buying Capacitor		
Group Size 5 (10)	**0-1 (0-3)**	**2-3 (4-7)**	**4 (8-9)**
Buy Capacitor	-10 ₹	4 ₹	5 ₹
No Capacitor	0 ₹	2 ₹	6 ₹

- To study the effect of the number of connected farmers, the game was played with different group sizes of 5 and 10 farmers (*group size treatment*) and complemented by a *leadership treatment*, where one farmer takes anonymously the "lead decision".

5. Results

- Participants in the small groups choose to buy a capacitor more often (60.95%) as compared to large groups (58.44%) [Two-sample test of proportions; z = 0.8747; p = 0.3817].
- Participants choose a capacitor in 60.72% of the cases when there is no leader and in 57.68% of the cases when there is a leader [McNemar's test btw round 6 & 7 ; $\chi^2 = 0.58$; p = 0.4458].
- Socioeconomic factors also explain individual decisions as shown in the panel logit regression table below with the capacitor choice as the dependent variable.

	(1) Random effects	(2) Random effects	(3) Fixed effects
Leadership-treatment	0.1816(0.2644)	0.0598(0.2344)	0.0450(0.2385)
Groupsize-treatment	0.0965(0.3423)	-0.2094(0.3439)	
Interaction term	-0.4665(0.3136)	-0.2497(0.2800)	-0.2907(0.2834)
Choice previous round	-0.3812**(0.1800)	-0.3803**(0.1632)	-0.7337***(0.1569)
Sum capacitors previous round	-0.0483(0.0545)	0.0664 (0.0500)	0.0234(0.0538)
Avg. mthly farm income [k.INR]	0.0887***(0.0306)		
Age	-0.0109(0.0129)		
Years of education	-0.0441(0.0328)		
Knew capacitor before	0.3750(0.3302)		
Motor burnouts last year	0.2374(0.1525)		
Own bicycle	-0.5508**(0.2620)		
Own computer	0.7936*(0.4452)		
Large farmer	-0.7470**(0.2936)		
Constant	1.0113(0.8481)	0.5344*(0.3087)	
N	1001	1265	1133
pseudo R^2			0.025
Log lik.	-631.0252	-800.5488	-517.6253
Chi-squared	29.7844	7.8865	26.6598

Standard errors in parentheses
* p < 0.10, ** p < 0.05, *** p < 0.01

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