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.

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.
• 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 ; χ² = 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.

<table>
<thead>
<tr>
<th></th>
<th>(1) Random effects</th>
<th>(2) Random effects</th>
<th>(3) Fixed effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership treatment</td>
<td>0.1816 (0.2644)</td>
<td>0.0598 (0.2344)</td>
<td>0.0450 (0.2385)</td>
</tr>
<tr>
<td>Groupsize treatment</td>
<td>0.0965 (0.3423)</td>
<td>-0.2094 (0.3439)</td>
<td></td>
</tr>
<tr>
<td>Interaction term</td>
<td>-0.4665 (0.3136)</td>
<td>-0.2497 (0.2609)</td>
<td>-0.2907 (0.2834)</td>
</tr>
<tr>
<td>Choice previous round</td>
<td>-0.3812 (0.1800)</td>
<td>-0.3803 (0.1632)</td>
<td>-0.7373 (0.1569)</td>
</tr>
<tr>
<td>Sum capacitors</td>
<td>-0.0483 (0.0545)</td>
<td>0.0664 (0.0500)</td>
<td>0.0234 (0.0538)</td>
</tr>
<tr>
<td>Avg. mthly farm income</td>
<td>0.0887 (0.0306)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-0.0109 (0.0129)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years of education</td>
<td>-0.0441 (0.0328)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knew capacitor before</td>
<td>0.3750 (0.3302)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor burnouts last year</td>
<td>0.2374 (0.1525)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Own bicycle</td>
<td>-0.5508 (0.2620)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Own computer</td>
<td>0.7936 (0.4482)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large farmer</td>
<td>-0.7470 (0.2936)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>1.0113 (0.8481)</td>
<td>0.5344 (0.3087)</td>
<td></td>
</tr>
</tbody>
</table>

N: 1133
pseudo R²: 0.025
Log lik: -631.0252
Chi-squared: 29.7844

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

Literature: