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Effects of groundwater management on groundwater use under policy changes

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INTRODUCTION

- Groundwater use organized at the village level in rural China.
- Two main forms of groundwater management
 - ❖ Collective well management: village leaders make decisions on water allocations.
 - ❖ Private well management: individual farmers or groups of farmers make their own pumping decisions without any regulations.
- National and provincial policies have significantly reduced the power of village leaders: the 2004 tax-for-fee reform took away the authority of village leaders to levy any charges or fees on farmers; agricultural tax completely eliminated by the end of 2006; removal of the power village leaders used to have to use village labor for free in providing public goods.
- Other changes such as migration are also taking place in rural area.
- These changes are likely to affect the pumping behavior of farmers and may negatively affect their capacity to manage groundwater.

RESEARCH QUESTIONS

- Do pumping behavior differ under different forms of management?
- How do policy changes affect pumping behavior?
- Following previous study (Huang et al., 2013), the analysis will be done accounting for whether a village is hydrologically isolated or connected to neighboring villages.

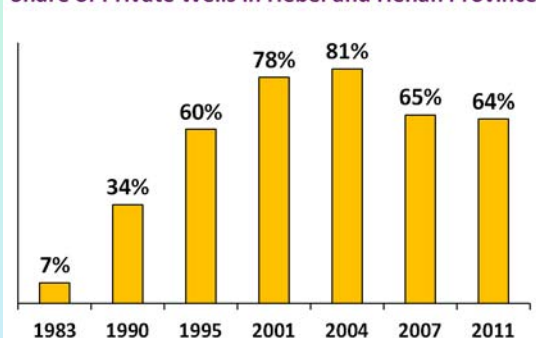
DATA

- A set of panel data the authors have collected in four years (2001, 2004, 2007 and 2011).
- The survey tracked rural households in 80 villages in three provinces in China .
- The survey collected detailed plot-level and household-level information on agricultural production and water use.
- If the village leader answered Yes to the question “Does pumping in neighboring villages affect water levels in your village?”, the village defined as connected. We also use hydrology records and information from county water resources bureaus to double check. The interviewed-based and hydrology-based measures are highly correlated (correlation coefficient of 0.75).

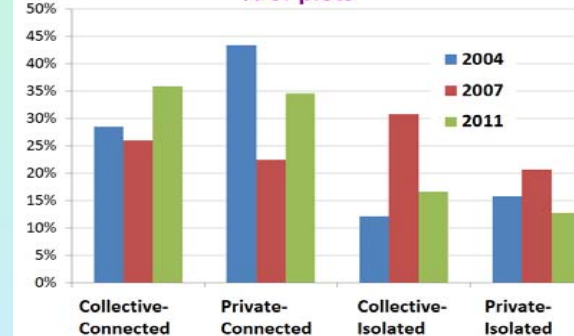
ESTIMATION

- Dependent variable: Plot level pumping rate (to irrigate wheat), log.
- Key RHS variables: Interaction dummies: Collective*Connected, Private*Isolated; Private*Connected. These variables are interacted with year 2004, 2007 and 2011. Base group: Collective*Isolated
- Control variables:
 - ❖ Economic factors: cost of water; crop price;
 - ❖ Plot: size, soil type, distance to well, drought-tolerant, flood irrigation, lined
 - ❖ Household: age, education , % female labor, % off-farm.
 - ❖ Water: amount surface water used, water shortage, # of users per well, well density, % time irrigation delayed.
 - ❖ County fixed effects and Year dummies
- Instrumental variables for well ownership: policy efforts by upper level government to encourage private wells (e.g., meetings or directives, fiscal subsidies); value of house per capita; household land per capita; share of groundwater irrigated area in previous survey year.

Share of Private Wells in Hebei and Henan Provinces



% of plots



RESULTS AND DISCUSSION

- Consistent with Huang et al. (2013), in year 2004, when a village is hydrologically isolated, farmers pump more under private well management. When a village's aquifer is connected to those of neighboring villages, the rate of pumping increases significantly even under collective well management.
- The differences between private and collective well management, however, disappear in year 2007 and 2011. this provides some evidence that policy changes after 2004 have reduced the degree to which leaders can exert control on villagers in conserving groundwater.
- % of family labor that works off-farm negatively affects pumping levels. Off-farm employment reduces farmers' reliance on groundwater since it generates wage income and remittances. It may also because less labor is available to carry out irrigation activities.