

Lessons from the Adoption of Irrigation Technology

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Applied vs. Effective Water

- Basic distinction between applied water and effective water
- $y = f(e)$
- $e = h_i(\theta)a$
- Efficiency: $e/a = h_i(\theta)$
 - Function of both technology used and land quality

Applied vs. Effective Water

- Optimal applied water
 - $Pf_e = w/h_i(\theta)$
 - VMP of applied water = price of effective input
- Increase in h

Threshold Model of Adoption

- Profit with technology i and land quality θ : $\pi(i, \theta)$
- Adopt technology 1 if $\pi(1, \theta) > \pi(0, \theta)$
- There is a threshold level of land quality beyond which the modern technology will be adopted
- More than just input price matters

Geography Matters

- In the case of irrigation technology, consider gravity and drip
- Modern technology most likely to be adopted on
 - Sandy soils
 - Steep fields
 - Hot areas
- Traditional technology will prevail in areas with favorable environmental conditions
- Modern technology is land-quality augmenting

Economic Value Matters

- Adoption of modern technology is likely if
 - Price of water is high
 - Crop is valuable
- Other input prices can matter as well (i.e., labor, energy)

Yield Effect is the Major Cause of Adoption

- Adoption of the modern technology results in a yield effect
- In CA, adoption of drip occurred first in areas where the yield effect was largest
 - Not necessarily in areas with the highest price of water

Improved Water Productivity Leads to Expansion of the Land Base

- Modern irrigation technology makes production profitable in marginal areas
 - Deserts
 - Hillsides
 - Sandy soil
- Modern technology can expand land base in high-quality areas due to increase in productivity

Countercyclical Yield Effects are Important

- Yield effect from new technology is most valuable when price is high
- Drought resistant varieties increase relative yield during dry periods when supply is restricted

High Fixed Costs Deter Adoption

- Less likely to clear hurdle (threshold) with high fixed costs
- Poor farmers less likely to adopt
- Subsidies and loans can counteract this

Adoption of Water Use Technology Changes the Use of Other Inputs

- Chemigation
- Weeding

Human Capital Matters

- Numerous studies have shown that educational attainment increases adoption
- Generational change also interesting