Efficiency of Water Use in Groundwater Markets: The case of Peninsular India
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Introduction
In India, the green revolution, which was responsible for countering the country’s food deficit, has largely been successful due to groundwater irrigation.

About, 90 sample farmers, 30 in each category (water sellers, water buyers & control farmers/neither buyers nor sellers) were randomly selected from Malur taluk of Karnataka located in Peninsular India.

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Data and Model

In the light of this backdrop, this paper examines whether groundwater markets contribute to improved efficiency by introducing a price.

Data pertaining to 2007-08 agricultural year.

Data Envelopment Analysis (DEA), is non-parametric and deterministic, applies mathematical programming to measure efficiency.

Input oriented approach and Constant Returns to Scale(CRS) & Variable Returns to Scale(VRS) specifications considered.

The DEA model to calculate the technical efficiency (TE) is found using the equation (Speelman et al., 2008):

\[ \min \theta_k \theta \]

Subject to:

\[-y_i + \sum_{k=1}^{K} x_{i}^k \theta_k \geq 0 \]

\[ \theta_k x_i^k \geq \sum_{k=1}^{K} x_i^k \theta_k \geq 0 \]

\[ x_{i}^{n-k} - \sum_{k=1}^{K} x_i^k \theta_k \geq 0 \]

\[ N \lambda = 1 \]

\[ \lambda \geq 0 \]

Where \( \theta \) is a scalar and \( \lambda \) is an vector of constants. Using the variables \( \lambda \) and \( \theta \), the model is solved once for each farm.

\( \theta \) is the maximum possible reduction of input \( k \) keeping all other inputs and output constant.

The statistical significance of the difference in subvector efficiency is estimated using a non-parametric Kruskal-Wallis test.

Results

83% of water sellers are large farmers & 61% of buyers are small farmers, thus promoting equity in water use.

Water sellers and control farmers used higher inputs (water, labour, machines for land operations, manure and fertilizers) compared to water buyers.

The average Water Use Efficiencies (WUE) are highest among the water buyers (0.77-CRS and 0.84-VRS), followed by the water sellers (0.73-CRS and 0.77-VRS). The control group has the lowest WUE (0.67-CRS and 0.72-VRS).

Conclusions

Farm efficiency is higher for farmers engaging in water markets
In the light of proposed changes in groundwater legislation and policies for improving water use efficiency these results provide crucial information to policy makers.

Reference