DO FARMLAND PRESERVATION PROGRAMS IMPROVE THE PROFITABILITY OF FARMING?

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Introduction
Since the 1970s, states have used purchase of development rights (PDR) programs to protect farmland from conversion to non-agricultural uses. Significant public expenditures are required to acquire conservation easements, therefore warranting evaluation of program outcomes. Enabling legislation for PDR programs generally outlines several societal objectives, including the improvement of farm viability. For example, PDR programs provide capital to participating farms, which could spur farm modernization and help mitigate the “impermanence syndrome” affecting farming in urban-influenced areas. Past research has focused on whether PDR reduces farmland prices (lowering an entrance and expansion barrier) and investigates farmland owners’ use of easement payments to invest in farm modernization. The extent to which PDR programs improve farm profitability has not been directly examined.

Research Questions
1) Do PDR programs improve the profitability of farms?
2) Is farm profitability affected differently across varying levels of program participation (i.e., the percent of preserved acres to total acres operated)?

Data
- New Jersey provides the geographic context. Since 1983, the state PDR program has preserved >2,070 farms and nearly 197,000 acres. To date, >$1.6 billion has been expended through the PDR program1,2.
- Dataset was constructed from farm-level 2007 Census of Agriculture data and other secondary data sources. Each farm record is modified to include PDR program participation status using records maintained by the State Agriculture Development Committee (SADC).
- Profitability of farms is constructed in two ways: (1) profit per acre and (2) net cash income per acre.

Methods
- To address selection bias, the generalized propensity score (GPS) in a continuous treatment setting is used6. Let T denote the level of program participation (treatment) for an individual farm i. Y = Y(T). T denotes its corresponding observed profitability outcome and X_i denotes a vector of covariates. Assuming weak unconfoundedness, selection bias can be removed using a three-step procedure: 1) obtain the estimated GPS by regressing T on X_i; 2) estimate the conditional expectation of Y on T and the estimated GPS; and 3) average the conditional expectation over the distribution of the GPS to obtain the value of the dose-response function (DRF) at the treatment level T.
- Fractional logit model is utilized in the 1st step due to the fractional nature of the treatment variable10, and a cubic flexible parametric form is used in the 2nd step4,8. Overlap condition is imposed4,8 and the balancing property is tested7,9.
- Treatment effect is estimated at two levels: Full sample (3,912 farms with 258 preserved farms) and Subsample of farms with the principal operator spending a majority of work time on farm (2,000 farms with 196 preserved farms).
- Robustness checks: the DRF is estimated using quartic and quadratic flexible parametric forms. A semi-parametric inverse weighting approach13 is also used since there is no reason to commit ex ante to any particular specification.

Results
- Profitability outcomes are likely greater than zero with statistical significance at low levels of participation.
- Treatment effect is estimated at two levels: Full sample (3,912 farms with 258 preserved farms); and Subsample of farms with the principal operator spending a majority of work time on farm (2,000 farms with 196 preserved farms).
- Robustness checks: the DRF is estimated using quartic and quadratic flexible parametric forms. A semi-parametric inverse weighting approach is also used since there is no reason to commit ex ante to any particular specification.

Conclusions
- Farm profitability is effectively improved as the level of program participation increases, but past a particular level of participation (around 10-14%), it begins to decrease.
- By averaging the values of the dose-response function at low levels of participation, there is no conclusive evidence that participation in the PDR program enhances farm profitability; statistically significant positive differences in profit per acre between preserved and non-preserved farms are found at 1-20% and 1-40% levels of participation in both geographies and at 1-60% in the ‘farming occupation’ subgroup. Statistically significant positive differences in net cash income per acre are found at 1-20% and 1-40% levels of participation in the full sample only.

References

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Table 1: Levels of Program Participation (%) and Levels of Program Participation (t=0) Non-Preserved (t=0) Farms

| Levels of Program Participation (%) | Outcome: Profit Per Acre | Full Sample | 485*** | 407*** | 271 | 173 | 119 |
| Levels of Program Participation (%) | Outcome: Net Cash Income Per Acre | Full Sample | 402*** | 299** | 132 | 27 | 14 |

Table 2: Pairwise Differences in Profitability Outcomes Between Different Levels of Program Participation

| Full Sample | Farming Occupation | Levels of Participation (%) | 0 | 1-20 | 21-40 | 41-60 | 61-80 | 81-100 |
| Farming Occupation | 0 | 238 | 206 | 68 | 89 | 81 |
| Farming Occupation | 20% | 20515 | 81-100 | 100% | 100% |

Table 3: Profitability Outcomes of Farms with Levels of Program Participation from 1-20% are higher than those of farms with levels of participation from 41-60%, 61-80%, and 81% for the full sample and 81% for the farming occupation sub-sample.