DO FARMLAND PRESERVATION PROGRAMS IMPROVE THE PROFITABILITY OF FARMING?

Witsanu Attavanich[1,3], Brian J. Schilling[1], Kevin P. Sullivan[2], Lucas J. Marxen[2]

1) Department of Agricultural, Food and Resource Economics, Rutgers University
2) Food Policy Institute, Rutgers University
3) Department of Economics, Kasetsart University

Poster prepared for presentation at the Agricultural & Applied Economics Association's 2012 AAEA Annual Meeting, Seattle, Washington, August 12-14, 2012

Do Farmland Preservation Programs Improve the Profitability of Farming?

Witsanu Attavanich, Brian J. Schilling, Kevin P. Sullivan, Lucas J. Marxen

Rutgers New Jersey Agricultural Experiment Station

Food Policy Institute

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.[5] 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[3]. Past research has focused on whether PDR reduces farmland prices (lowering an entrance and expansion barrier)[9], and investigates farmland owners' use of easement payments to invest in farm modernization[8]. 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

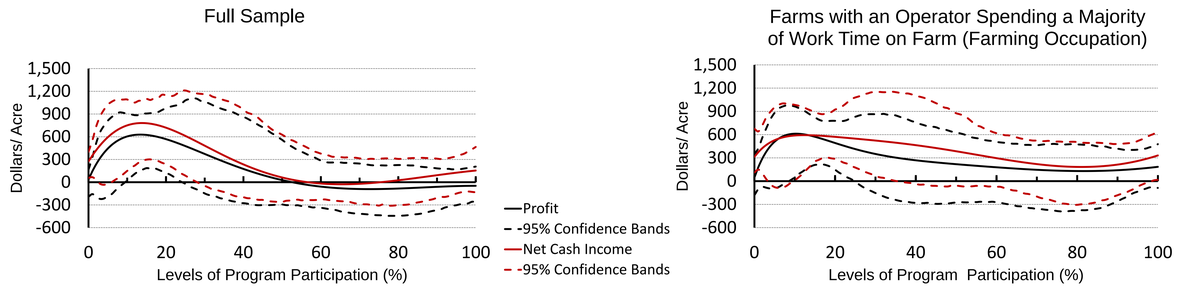
- New Jersey provides the geographic context. Since 1983, the state PDR program has preserved > 2,070 farms and nearly 197,000 acres. To date, >$1.6 billion has been expended through the PDR program[1,2].
- Dataset was constructed from farm-level 2007 Census of Agriculture data and other secondary data 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 used[6].
- Let T_i denotes the level of program participation (treatment) for an individual farm i. $Y_i=Y_i(T_i)$ 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_i 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 variable[10], and a cubic flexible parametric form is used in the 2nd step[4,6]. Overlap condition is imposed[4] and the balancing property is tested[6,7].
- 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 quadratic and quartic flexible parametric forms. A semi-parametric inverse weighting approach[4] is also used since there is no reason to commit ex ante to any particular specification.

Results

(a) Dose-Response Function on Two Profitability Outcomes (Cubic Form)



- Profitability outcomes are maximized at levels of program participation around 10-14%.
- Profitability outcomes are likely greater than zero with statistical significance at low levels of participation.

(b) Differences in Profitability Outcomes between Preserved (t>0) and Non-Preserved (t=0) Farms

	Levels of Program Participation (%)				
	1-20	1-40	1-60	1-80	1-100
Outcome: Profit Per Acre					
Full Sample	485***	407***	271	173	119
Farming Occupation	472**	390**	317*	263	231
Outcome: Net Cash Income Per Acre					
Full Sample	402**	299**	132	27	-14
Farming Occupation	238	222	170	105	68

*, **, and *** indicate statistically significant estimates at the 90%, 95%, and 99% level.

- Overall (1-100%), profitability outcomes of preserved farms are not statistically different from those of non-preserved farms.
- However, at low levels of program participation, profitability outcomes of preserved farms are likely greater than those of non-preserved farms (except for the net cash income per acre of the farming occupation subsample).

(c) Pairwise Differences in Profitability Outcomes between Different Levels of Program Participation

Full Sample

Levels of Participation (%)	0	1-20	21-40	41-60	61-80	81-100
0	0	402**	195	-203	-286*	-180
1-20	485***	0	-207	-748**	-688***	-582***
21-40	329	-157	0	-398**	-481	-375
41-60	-3	-488*	-331*	0	-84	23
61-80	-119	-605***	-448	-117	0	106
81-100	-97	-582***	-425	-94	23	0

Farming Occupation

Levels of Participation (%)	0	1-20	21-40	41-60	61-80	81-100
0	0	238	206	66	-89	-81
1-20	472**	0	-32	-171	-327	-319*
21-40	309	-163	0	-139	-295	-287
41-60	171	-300	-137	0	-156	-147
61-80	101	-370	-207	-70	0	8
81-100	101	-370**	-208	-70	0	0

Profit

Net Cash Income

- Profitability outcomes of farms with levels of participation from 1-20% are higher than those of farms with levels of participation from 41-60%, 61-80%, and 81-100% for the full sample and 81-100% for the farming occupation subsample .

Conclusions

- Farm profitability is effectively improved as the level of PDR 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 a particular range, we find that:
  - profitability outcomes of preserved farms are generally greater than those of non-preserved farms at low levels of participation;
  - considering all levels of participation (1-100%), 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 groups 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

1) American Farmland Trust. 2011a. *Fact sheet status of state PACE programs.* Farmland Information Center, MA.
2) ———. 2011b. *Fact sheet status of local PACE programs.* Farmland Information Center, MA.
3) Berry, D. 1978. Effects of suburbanization on agricultural activities. *Growth and Change* 9(3): 28.
4) Flores, C. A., A. Flores-Lagunes, A. Gonzalez, and T. C. Neumann. 2012. Estimating the effects of length of exposure to instruction in a training program: The case of job corps. *Review of Economics and Statistics* 94(1): 153-71.
5) Hellerstein, D. *et al.* 2002. *Farmland protection: The role of public preferences for rural amenities*. Agricultural Economic Report No. AER815. Washington DC: USDA ERS.
6) Hirano, K., and G. W. Imbens. 2004. The propensity score with continuous treatments. In *Applied Bayesian modeling and causal inference from incomplete-data perspectives*., ed. Andrew Gelman and Xiao-Li Meng, 73-84. John Wiley & Sons Ltd., West Sussex, UK.
7) Imai, K and D. van Dyk. 2004. Causal inference with general treatment regimes: Generalizing the propensity score. *Journal of the American Statistical Association* 99(467): 854-66.
8) Lynch, L. 2007. Economic benefits of farmland preservation. In *The economic benefits of land conservation.*, ed. Constance T. F. de Brun, 13-23. The Trust for Public Land, San Francisco, CA.
9) Nickerson, C. J., and L. Lynch. 2001. The effect of farmland preservation programs on farmland prices. *American Journal of Agricultural Economics* 83(2): 341-51.
10) Papke, L.E. and J. M. Wooldridge. 1996. Econometric methods for fractional response variables with an application to 401(K) plan participation rates. *Journal of Applied Econometrics* 11(4): 619-32.

ACKNOWLEDGEMENTS

Funding Support:
- Agriculture and Food Research Initiative Competitive Grant No. 2010-85211-20515 from the USDA National Institute of Food and Agriculture

Data Support:
- The New Jersey Field Office, National Agricultural Statistics Service

Corresponding Author: Brian J. Schilling, Ph.D.
schilling@aesop.rutgers.edu