

Environmental Benefits as a Reason to Adopt Precision Farming Technologies

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Presentation Overview

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Precision Farming Technology (PF)

- **Site Specific Information Gathering Technology (SSIG):** Tools that identify spatial within field heterogeneity such as
 - ① yield monitors w/o GPS,
 - ② grid sampling,
 - ③ aerial photography etc.
- **Variable Rate Technology (VRT):** Application of Inputs (e.g. fertilizers, pesticides etc) at a variable rate based on location needs, contrary to a single uniform rate (URT), which is based on average conditions of the field².
- Successful Implementation of VRT requires the use of at least one SSIG technology.

²URT may lead to overapplication or underapplication in some parts of the field

- Pandit (2011) identified farm and farmer characteristics that affect reasons for precision technologies
- Larkin (2005) studied the factors affecting the perceived improvement in environmental quality after the PF adoption
- Lohr (1999) and Hite (2002) found that farmers are willing to forego some yields in order to achieve higher environmental benefits

Factors Affecting Reasons of PF Adoption

Problem 1: Reasons for PF Adoption

- Profit Maximization
- Environmental Benefits
- Be at the forefront of technology

Method

- Seemingly Unrelated Ordered Probit Model
- Use of Scale from 1 (Not Important) to 5 (Very Important)
- Allows for errors in 3 equations to be correlated

Socially Conscious Farmers versus Profit Maximizers

Farmers

Problem 2: Socially Conscious Farmers

- Farmers who value environmental benefits from PF more than profit maximization solely

Method

- Multinomial Logit Model, in which the dependent variable is defined as:
 - 1 $Y_i=1$ if Profit > Environment & Profit > Technology
 - 2 $Y_i=2$ if Environment > Profit & Environment > Technology
 - 3 $Y_i=3$ if Technology > Profit & Technology > Environment
 - 4 $Y_i=4$ if Profit = Environment = Technology or Profit = Environment or Profit = Technology or Environment = Technology

Socially Conscious Farmers versus Profit Maximizers Farmers

Distribution

	2001 (N ^a =263)	2005 (N=366)	2009 (N=672)
PROFIT	51.3%	52.4%	54.7%
ENVIRONMENT	1.9%	1.9%	2%
TECHNOLOGY	1.5%	3.5%	4%
SAME	45.2%	42%	38%

^anumber of farmers who answered this question

Survey Data

- Cotton Board in Memphis, TN mailed a survey to farmers in 5 Southeastern states in 2001, 11 in 2005, and 12 in 2009
- First round on February, reminder post-card on March of each year
- Marketing years were 1999-2000, 2003-2004 and 2007-2008
- The response rates were 19% in 2001, 10% in 2005 and 12.5% in 2009³.
- Questions to be answered:
 - ① PF technology (sources of information, expectations, ways of applying inputs)
 - ② farm and production data (location, acres, yields)
 - ③ socioeconomic characteristics (age, farming experience, education, income)

³Some farmers had retired, some had switched to other crops, some passed away or simply denied participation

Seemingly Unrelated Ordered Probit

	PROFIT			ENVIRONMENT			TECHNOLOGY		
	2001	2005	2009	2001	2005	2009	2001	2005	2009
AGE	0.03*	—	-0.02**	0.05**	—	-0.01*	—	—	-0.02*
EDUC	—	—	—	—	-0.07*	-0.03*	—	—	—
ACRES	—	—	—	—	—	—	—	—	-0.0001*
INCOM	—	-0.009*	—	—	—	—	-0.007*	—	—
YIELD	—	0.0002*	—	—	—	—	—	—	—
COMPU	—	—	0.21*	—	—	—	—	—	—
PROF	—	—	—	—	—	—	—	—	0.29**
ENV.BEN	—	—	—	—	1.16***	0.55***	—	0.3**	—
INFO	—	—	0.26**	—	—	—	—	0.58***	—
PLAN	—	—	0.08**	—	—	—	—	—	—
AL	—	—	—	—	—	0.42**	—	—	—
FL	—	—	—	—	—	0.52**	—	-1.94**	-0.91**
GA	—	—	—	-1.38**	—	0.35**	—	—	—
MS	—	—	—	—	—	0.48**	—	—	—
NC	—	—	—	-1.34**	—	0.63***	—	—	—
TN	—	—	—	-1.16*	—	0.56***	—	—	—

***, **, and * denote significance levels of 1%, 5%, and 10% respectively

Parameter Estimates of the MNL

Table: Multinomial Logit for the 2009 Data

	Profit		Environment		Technology	
	Coeff	ME	Coeff	ME	Coeff	ME
EDUC **	0.124	0.025	–	–	–	–
EXPER *	–	–	–	–	0.099	0.003
INFO **	–	–	-1.624	-0.035	–	–
ENV.BEN **	-0.005	-0.001	0.015	0.0003	–	–
AL **	-1.401	–	–	–	–	–
FL *	1.969	–	–	–	–	–
GA *	–	–	2.021	0.040	–	–
NC *	-0.713	-0.195	1.712	0.042	–	–

Discussion

- Potential Multicollinearity because of the high number of discrete explanatory variables
- Share of Older Farmers Increases and share of those with College degree Decreases as we move from 2001 to 2009
- Different respondents in every survey
- Results from Ordered Probit for the Pooled Data are consistent with the SUR Ordered Probit

next steps...

- Weighted Estimation to mitigate the effect of over-representation of large farms
- Duration Analysis
- Check IIA Assumption for the MNL model
- Apply a Pseudo-Panel Approach

Thank you!