Developing a Framework for Evaluating the Role of Extension Education in Perceived Farm Risks: An Application of the Multivariate Ordered Probit Model

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Introduction

The Land Grant university and the Extension service were distinctive American inventions (Chin and Benne, 1976). The 1914 Smith-Lever Act launched Extension education in the U.S. Its stated basic purpose has been "to aid the diffusion among the people of the United States useful and practical information on the subjects relating to agriculture and home economics and to encourage the application of the same." An underlying purpose of this diffusion of information has been to help bring about changes in behavior and in the economic and social environment designed to promote well-being. In other words, the Extension purpose is to foster change in society—i.e., change by individuals, households, firms, and governments (Hildreth and Armbruster, 1981). Given this purpose, it is to appropriate to look at what evidence exists about the value of Extension in meeting its stated objective and the needs of today's society.

There are several studies that have examined the contribution of Land Grant university research and Extension efforts to agricultural productivity and the rate of technical change in agriculture (Sim and Gardner, 1980; Araji, 1980; Paterson and Hayami, 1977; and Huffman, 1981). However, these studies do not give much insight into the possibilities for improving the value of Extension through changes in program delivery. Moreover, since the introduction of Extension, there have been dramatic changes in agricultural production and the rural communities which Extension serves. The make-up of farm operators has altered significantly and agricultural operations are increasingly at greater production, financial, marketing, legal/institutional, and human risks. Therefore, the role of and demand on Extension education has changed.

Objective

In order to remain a viable educational force, Extension has to demonstrate its value and enhance its effectiveness through improvement in program delivery. Doing so requires at least two things: (1) there is a need for a suitable econometric framework that allows us to examine the effectiveness of Extension education and demonstrate its value to agriculture and rural communities; and (2) developed framework and analyses should have the capability to provide, unlike past approaches and studies, insight into the possibilities for improving the value of Extension through changes in program delivery. Such are the objectives of this project. We develop a novel statistical framework that enables us to examine two components: (1) the value of Extension education for agriculture and rural communities, when data are available on two social groups (those who have received Extension education, and those who have not); and (2) producers' self-evaluation of agricultural risks. Then using the proposed econometric framework, we analyze the role of Extension education in perceived farm risks (i.e., production, financial, marketing, legal/institutional, and human) in the rural West.

Method

Using household- and farm-level data to evaluate the role of Extension education is possible on the basis of two key information components: first, data on two social groups (i.e., those who have received any information from Extension education and those who have not); second, data on measures of perceived farm risks. Let y_i, $i = 1,\ldots,5$ denote five perceived farm risks (i.e., production, financial, marketing, legal/institutional, and human), with each measured using a Likert scale of 1 to 5, where 1 is the most important or critical to the operation, and 5 is the least. Let binary variable z denote whether a farm operator has ever received information from Extension education, and x denote a vector of other causal or control variables. The starting point for the method is conceptualization of perceived farm risks as a function of a scalar variable z, and a vector of causal variables x, as $y_i = f_i(z, x, u_i)$ where u_i are stochastic discrepancies.

The nature of the perceived risk rating variable is of the "ordered discrete" type since it takes ordered discrete values from 1 to 5. For "ordered discrete" data, the suitable probability model is an ordered probit model. Since there are five types of risks, the proposed model is an application of the multivariate ordered probit model. The implied model is estimated by using a simulated maximum likelihood procedure.

Data

We use household- and farm-level survey data of 2,645 farm operators (with annual sales of less than $50,000) in three Western states of the U.S. (Arizona, Colorado, and Wyoming). A total of 4,939 survey instruments were mailed to small farm operators in these states. In order to ensure a representative sample from each state, the numbers of survey instruments mailed to states were allocated based on the population of small farm operators in each state. The total response rate was 53.6%. A total 2,645 surveys were completed, which constitutes the sample size of our empirical analyses. Data were collected on small operators' demographics, reasons for involvement in the rural family ventures, sources of risks, vulnerability factors, information sources and preferences, resource management, and income status, thus enabling us to empirically examine the role of Extension education and other variables in perceived farm risks in the West.

Results

Table 1 presents the results of the estimated ordered probit models. A careful inspection of Table 1 reveals the following: Extension education has statistically significant effects on production and legal risks, while its impacts on financial, marketing, and human risk assessments are statistically insignificant. This result is obtained after controlling for other factors characterizing the small farms in the rural West.

Table 2 presents the marginal effects of Extension education on perceived farm risks. As we noted earlier from Table 1, Extension education has statistically significant effects on farmers' perceived production and legal risks. That is farmers who have received Extension education from university outreach programs have a higher probability of identifying production risk as the most important source of farm risks, as compared to farmers who have never received Extension education.

Similarly, farmers who have received Extension education from university outreach have a lower probability of identifying financial risk as their second and third most important sources of farm risks, as opposed to farmers who have never received Extension education.

Conclusions

- Extension education has been able to bring about changes in producers' assessment and management of production and legal risks. Therefore, there is great value of Extension in meeting the needs of today's society.
- Results suggest that it is essential to support and increase Extension funding, not undermine it.
- Results point to ways in which Extension education can be improved through changes in program delivery. In particular, Extension educators should give additional emphasis to financial, marketing, and human risks components of their education program.

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Table 1. Determinants of Perceived Farm Risks and the Role of Extension Education: Estimated Ordered Probit Models

Explanatory Variables	Production Risk		Financial Risk		Marketing Risk		Human Risk		Legal Risk	
	Coeff	*S.E*	*Coeff*	*S.E*	*Coeff*	*S.E*	*Coeff*	*S.E*	*Coeff*	*S.E*
To make a profit	-0.099**	0.057	-0.043	0.059	-0.093**	0.057	0.180*	0.059	0.117*	0.059
To supplement family income	-0.089	0.056	-0.100**	0.057	-0.172*	0.056	0.104**	0.057	0.153*	0.057
Source of information: Internet	0.167*	0.056	0.005	0.057	0.178*	0.055	-0.113*	0.057	-0.167*	0.057
Source of information: Trade Magazine	0.033	0.054	-0.238*	0.056	-0.016	0.054	0.109*	0.055	-0.002	0.055
Received information from Cooperative Extension	-0.135*	0.066	0.030	0.068	-0.046	0.066	0.081	0.067	0.111**	0.067
Source of water on the land: Wells	0.160*	0.056	-0.059	0.057	0.033	0.056	-0.029	0.058	0.020	0.057
Source of water on the land: Rural Water System	0.123**	0.069	-0.041	0.071	-0.027	0.069	-0.072	0.071	0.063	0.071
Total acres of land managed in thousands	0.003	0.002	-0.009	0.006	-0.000	0.001	-0.000	0.001	-0.001	0.001
Producing commodities indicating a specialty market	0.077**	0.078	0.046	0.080	-0.007	0.078	-0.159*	0.079	-0.012	0.080
Land enrolled in Conservation Reserve Program	-0.168**	0.098	-0.191**	0.102	0.073	0.097	0.078	0.099	0.258*	0.102
Business type: Sole Proprietorship	0.033	0.022	-0.028	0.023	-0.002	0.022	0.025	0.023	-0.057*	0.023
Income coming from Agricultural Operation	-0.003*	0.001	-0.003*	0.001	-0.003*	0.001	0.002	0.001	0.003*	0.001
Whether they have paid employees or not	0.090	0.074	0.038	0.076	0.085	0.074	-0.034	0.076	-0.132**	0.076
Operation financed by off-farm Income	0.046	0.056	-0.091**	0.058	-0.091	0.056	0.088	0.058	0.038	0.058
Property managed is completely rural	0.084*	0.031	-0.006	0.032	0.044	0.031	-0.022	0.031	-0.066*	0.031
Whether they hold an off-property job or not	0.030	0.068	-0.132	0.069	0.118**	0.068	-0.010	0.070	-0.002	0.070
Gender of operator	-0.056	0.063	0.072	0.065	0.057	0.063	-0.025	0.064	-0.013	0.065
Age of operator	-0.014	0.027	0.081*	0.028	-0.075*	0.027	-0.000	0.028	0.013	0.028
Level of education	-0.005	0.017	0.039*	0.017	0.015	0.017	-0.020	0.017	-0.022	0.017
Log likelihood	-2515.929		-2339.882		-2542.911		-2511.506		-2396.612	
Number of obs	1641.000		1638.000		1633.000		1631.000		1628.000	
LR chi2(25)	69.540		78.490		67.820		48.460		70.830	
Prob> chi2	0.000		0.000		0.000		0.000		0.000	

Note: * Significant at 5% level of Significance; ** Significant at 10% level of Significance

Table 2. Marginal Effects of Extension Education on Perceived Farm Risks

Most Important (Y = 1) to Least Important (Y = 5)

Farm Risks	Prob(Y=1)	Prob(Y=2)	Prob(Y=3)	Prob(Y=4)	Prob(Y=5)
Production Risk	0.0426*	0.0113**	-0.01*	-0.0193*	-0.0247**
	(0.0203)	(0.0062)	(0.0045)	(0.0094)	(0.0127)
Financial Risk	-0.0114	-0.0002	0.0043	0.004	0.0033
	(0.0258)	(0.0003)	(0.0098)	(0.009)	(0.0073)
Marketing Risk	0.0086	0.0081	0.0013	-0.0055	-0.0124
	(0.012)	(0.0116)	(0.0021)	(0.0078)	(0.0179)
Human Risk	-0.0213	-0.0078	-0.0032	0.0035	0.0288
	(0.0181)	(0.0064)	(0.0025)	(0.0033)	(0.0236)
Legal Risk	-0.0201	-0.0138**	-0.0083**	0.0022	0.0399**
	(0.0127)	(0.0084)	(0.0048)	(0.0022)	(0.0238)