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 inven-
tions that emerged in the early 1860s. The Morrill Act (2 U.S.C. § 1902) established the land-grant
universities in the U.S. Its stated basic purpose has been “to aid the diffusion among the people
of the United States, generally, of knowledge in regard 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 indi-
viduals, households, farms, and governments (Hildreth and Armbruster, 1981). Given
this purpose, it is appropriate to look at what evidence exists about the value of Ex-
\[...\]

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 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
assess the relative role of Extension education and other variables in perceived farm risks in the
West.

Results

Table 2 presents the results of the estimated ordered probit models. A careful inspec-
tion of Table 1 reveals the following: Extension education has statistically significant
effects on production and legal risks, while its impacts on financial, marketing, and hu-
man risk assessments are statistically insignificant. This result is obtained after control-
ling for other factors characterizing the small farms in the rural West.

Table 2. Marginal Effects of Extension Education on Perceived Farm Risks
See Table 1.** Significant at 5% level of Significance. *** Significant at 10% level of Significance.

<table>
<thead>
<tr>
<th>Farm Risks</th>
<th>Prob(Y=1)</th>
<th>Prob(Y=2)</th>
<th>Prob(Y=3)</th>
<th>Prob(Y=4)</th>
<th>Prob(Y=5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production Risk</td>
<td>0.0420**</td>
<td>0.0117**</td>
<td>0.0017</td>
<td>0.0247**</td>
<td></td>
</tr>
<tr>
<td>Financial Risk</td>
<td>0.0114</td>
<td>0.0002</td>
<td>0.0043</td>
<td>0.0035</td>
<td>0.0032</td>
</tr>
<tr>
<td>Marketing Risk</td>
<td></td>
<td></td>
<td></td>
<td>0.0047**</td>
<td>0.0036**</td>
</tr>
<tr>
<td>Human Risk</td>
<td>0.0121</td>
<td>0.0116</td>
<td>0.0023</td>
<td>0.0038</td>
<td>0.0022</td>
</tr>
<tr>
<td>Legal Risk</td>
<td>0.0089</td>
<td>0.0081</td>
<td>0.0013</td>
<td>0.0023</td>
<td></td>
</tr>
</tbody>
</table>

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 Ex-
\[...\]

Acknowledgments
We thank the Western Center for Risk Management Education for providing us with
financial support to carry out this project. The survey data for this research was origi-
nally collected as a part of a multi-state Extension project in collaboration with John P.
Hawelka and Randolph W. Torgler (University of Wyoming), and Jeff Tafanell (Colorado
State University). We also benefited from working with them. Finally, thanks are due to
Mr. Pinar Gunes for excellent research assistance.

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 a framework is the objective of this project. We develop a novel statisti-
cal 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. Using this innovative economi-
\[...\]

Method
Using household- and farm-level data to evaluate the role of Extension education is
based on the possibility 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 yi, i = 1,...,n
\[...\]

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

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Production Risk</th>
<th>Financial Risk</th>
<th>Marketing Risk</th>
<th>Human Risk</th>
<th>Legal Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coeff</td>
<td>SE</td>
<td>Coef</td>
<td>SE</td>
<td>Coef</td>
</tr>
<tr>
<td>Make a profit</td>
<td>-0.019**</td>
<td>0.012</td>
<td>0.039**</td>
<td>0.007</td>
<td>0.058**</td>
</tr>
<tr>
<td>To supplement family income</td>
<td>-0.056**</td>
<td>0.011</td>
<td>0.049**</td>
<td>0.009</td>
<td>0.056**</td>
</tr>
<tr>
<td>Source of information: Internet</td>
<td>0.025</td>
<td>0.005</td>
<td>0.065</td>
<td>0.012</td>
<td>0.078**</td>
</tr>
<tr>
<td>Received information from Cooperative Extension</td>
<td>0.035**</td>
<td>0.012</td>
<td>0.051**</td>
<td>0.014</td>
<td>0.059**</td>
</tr>
<tr>
<td>Source of information: Trade Magazine</td>
<td>0.021</td>
<td>0.008</td>
<td>0.048</td>
<td>0.011</td>
<td>0.069**</td>
</tr>
<tr>
<td>Total acres of land managed in thousands</td>
<td>0.003</td>
<td>0.002</td>
<td>0.009</td>
<td>0.006</td>
<td>0.004</td>
</tr>
<tr>
<td>Productivity measures indicating a specialty market</td>
<td>0.004</td>
<td>0.004</td>
<td>0.009</td>
<td>0.006</td>
<td>0.009</td>
</tr>
<tr>
<td>Land enrolled in Conservation Reserve Program</td>
<td>0.016**</td>
<td>0.009</td>
<td>0.019**</td>
<td>0.012</td>
<td>0.007</td>
</tr>
<tr>
<td>Business type: Sole Proprietorship</td>
<td>0.005</td>
<td>0.002</td>
<td>0.008</td>
<td>0.003</td>
<td>0.007</td>
</tr>
<tr>
<td>Income coming from Agricultural Operation</td>
<td>0.002</td>
<td>0.001</td>
<td>0.003</td>
<td>0.001</td>
<td>0.003</td>
</tr>
<tr>
<td>Whether they have paid employees or not</td>
<td>0.000</td>
<td>0.007</td>
<td>0.036</td>
<td>0.008</td>
<td>0.037</td>
</tr>
<tr>
<td>Operation financed by off-farm income</td>
<td>0.046</td>
<td>0.015</td>
<td>0.071</td>
<td>0.028</td>
<td>0.078**</td>
</tr>
<tr>
<td>Property managed is completely rural</td>
<td>0.064**</td>
<td>0.025</td>
<td>0.056</td>
<td>0.025</td>
<td>0.046</td>
</tr>
<tr>
<td>Whether they hold an off-farm job or not</td>
<td>0.030</td>
<td>0.008</td>
<td>0.013</td>
<td>0.006</td>
<td>0.018**</td>
</tr>
<tr>
<td>Gender of operator</td>
<td>0.056</td>
<td>0.015</td>
<td>0.076</td>
<td>0.016</td>
<td>0.063</td>
</tr>
<tr>
<td>Age of operator</td>
<td>-0.014</td>
<td>0.027</td>
<td>0.081</td>
<td>0.028</td>
<td>0.075</td>
</tr>
<tr>
<td>Level of education</td>
<td>-0.005</td>
<td>0.021</td>
<td>0.039</td>
<td>0.017</td>
<td>0.015</td>
</tr>
</tbody>
</table>

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