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Risk Research and Public Outreach: A Tale of Two Cultures?

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Agricultural economists have been challenged in recent years, by voices inside and outside the profession, to evaluate the integrity of the operational bridge between research and extension activities in the land grant system. This essay investigates links between the work of risk researchers and outreach programs. Survey results indicate that (*a*) a significant number of risk researchers are involved in extension activities; (*b*) extension economists are less frequently involved in risk research than their colleagues with no extension appointment; (*c*) full-time extension economists use less sophisticated risk tools in their outreach efforts than used in their research; and (*d*) all respondents, regardless of appointment, see a need for more applied risk analysis. Major challenges include a lack of financial support to close the data gap and to conduct relevant applied analysis. Also, the complexity of the problems and the analytical methods involved in risk analysis present a major communication challenge for outreach programs.

Key words: extension, research, risk

Introduction

Risk has been a popular topic in the agricultural and resource economics literature during the last two decades. Many risk analysis concepts and tools are now standard fare in our graduate schools and even undergraduate classrooms. Extension economists have also tried to inform and improve firm-level decision making under uncertainty over the same time period (Walker and Nelson; Patrick). Much of the conceptual content for these educational activities has evolved from the results of publicly funded research programs investigating risk in agriculture (Barry 1984; Musser 1994).

How much of the risk research is used in extension educational programs? How much of the research has addressed applied problems that matter? Is the traditional bridge between research and extension in need of minor or major repair, or does the bridge even exist? Have many of us adopted methods in search of applications with only a research product in mind? These fundamental questions are broader than the topic of risk analysis alone, but decision making under uncertainty provides a useful case study.

These questions are not being asked for the first time. Ruttan, Bonnen, and Just and Rausser all explored agricultural economics research and extension, and evaluated the performance of the profession. These self-evaluations emphasized the need to maintain and support an operational bridge of communication and information between research

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and extension. More recently Barry (1993) argued that the coordination of the research and extension systems is a critical component of a viable land grant university. Barry also argued that our programs should be vertically integrated to ensure that relevant educational products are delivered to users.

Often we take on faith that the advances in risk modeling and analysis have benefited the public. Just and Rausser and Castle question the validity of this belief by challenging the profession to produce educational products that have public good characteristics. The vertical integration chain is weak or broken in places according to these authors because (*a*) our research is not packaged to make it useful to the users, except other economists; (*b*) models are not understood by users; (*c*) little of our research is forward-looking analysis; and (*d*) most extension activities are out of step with industry, government, and societal needs. Patrick and DeVuyst note the weak correlation between the impressive volume of risk-related research in the profession and the application of these analytical methods in extension and education programs. Anderson and Mapp observe a wide gap between the theory and practice of decision making under risk. Until agricultural economists correct these deficiencies, we may find it increasingly difficult to justify continued public funding for our work. This article uses risk analysis as the vehicle for investigating concerns of bridging, coordination, integration, and public goods production in our profession. Specifically, we measure the nature and extent to which risk analysis techniques are used to analyze decisions in our public outreach programs.[1]

Data Sources: Survey and Response

The principal objective of the survey reported here was to obtain faculty perceptions regarding our profession's effectiveness in integrating and coordinating risk research and outreach activities. We obtained mailing lists from two sources. First, we compiled names of faculty involved in risk-related regional projects for the last two decades, hereafter referred to as "researchers." Over this time period 104 professionals were involved in regional projects W-149 (An Economic Evaluation of Managing Market Risks in Agriculture), S-180 (An Economic Analysis of Risk Management Strategies for Agricultural Production Firms), and S-232 (Quantifying Long-Run Agricultural Risks and Evaluating Farmer Responses to Risk). Mailing lists from the U.S. Department of Agriculture (West and Bahn) of 214 key farm management and marketing extension faculty were the second source of potential respondents, hereafter referred to as "specialists." Duplication between the two lists was noted and faculty on both lists were omitted from the specialist list and retained on the researcher list. A sample of specialists was defined, after the receipt of completed questionnaires, by selecting only those respondents from the specialist list with Ph.D.–level training in economics or agricultural economics and an active extension program in either farm management or marketing. It is noteworthy that 10% of the extension respondents were specialists outside agricultural economics (e.g., animal science, agronomy), who reported having significant statewide responsibilities in farm management or marketing programs.

[1] A word about risk is in order before discussing the survey results. Many of the survey responses suggest a risk analysis that considers some sort of trade-off between expected (mean) outcomes and variability of outcomes. However, the survey questionnaire did not always distinguish between considering a risk-return trade-off and considering the variability of possible outcomes to arrive only at mean outcomes.

Table 1. Risk Research Involvement by Extension Allocation and Ph.D. Degree Date

Extension Allocation (%)	n	Risk Research			No-Risk Research		
		Degree ≤ 1975	Degree > 1975	Total	Degree ≤ 1975	Degree > 1975	Total
		(% of respondents)					
0–4	58	9	23	32	0	2	2
5–34	30	4	9	12	3	2	5
35–64	21	2	5	8	4	1	5
65–94	38	4	7	10	7	5	12
95–100	22	3	3	6	3	4	7
All	169	21	47	68	17	15	32

Note: Based on the contingency coefficient, the relation between risk research involvement and percentage extension allocation is significant at the 1% level. The relation between risk research involvement and Ph.D. degree date is also significant at the 1% level. The percentage of respondents are rounded to the nearest whole percent. The row and column totals are totals of row and column elements before rounding and hence may not agree with totals of the rounded numbers.
Source: Siegel.

A questionnaire was developed and pretested to elicit professional views on how developments in risk modeling and analysis are applied in the private and public sectors. The survey instrument emphasized (*a*) the relative degree of use and importance of risk analysis tools in research versus outreach, (*b*) the types of problems/audiences where risk analysis contributed to an extension-type activity, and (*c*) the concerns that limit economists in treating risk in their extension, policy analysis, or consulting efforts. A copy of the questionnaire is available from the authors.

A complete design type process as described by Dillman was followed in the implementation of the questionnaire. An initial cover letter and questionnaire were mailed to each faculty member. A reminder postcard was mailed seven days later to all faculty, and followed two weeks later by another questionnaire and a letter requesting the potential respondent's cooperation. A total of 229 responses were received from the 318 questionnaires mailed, for a 72% response rate. One hundred and sixty-nine (169) returned questionnaires met the selection criteria discussed above and are hereafter referred to as the "respondents."

Table 1 presents a distribution of respondents by extension time allocation (percentage) and Ph.D. degree date. Time allocation does not necessarily correspond exactly to the formal academic appointment of the faculty member. Faculty with formal teaching/research appointments reported participation in outreach programs while extension faculty reported on-campus teaching and research. The respondents were separated into groups based on their time allocated to extension activities.

Risk-related regional project research began with W-149 in 1975. Sixty-eight percent of the respondents noted being involved in risk research during their careers (table 1). The percentage reporting risk research was significantly different between the pre- and post-1975 degree groups. Of those reporting risk research, 69% received their Ph.D. degree after 1975. The "No-Risk Research" group is more evenly divided between the pre- and post-1975 periods. The percentage reporting risk research was also significantly different among the time-allocation groups. Fifty-five percent of the respondents report-

Table 2. Distribution of Time Allocation

Extension Allocation (%)	*n*	Average Allocation of Time (%)				
			Instruction			
		Extension	Undergraduate	Graduate	Research	Other
0–4	58	0.0	18.7	17.2	54.2	9.9
5–34	30	15.1	17.9	12.0	38.2	16.8
35–64	21	49.8	14.9	6.0	21.4	7.9
65–94	38	77.1	5.8	0.5	14.8	1.8
95–100	22	99.7	0.3	0.0	0.0	0.1
All	169	39.2	12.9	9.0	31.7	7.9

ing an extension allocation also reported involvement in risk research. The data indicate over 90% of those with no extension allocation have been involved in risk research while less than 50% of those with 100% extension allocation reported having conducted risk research sometime in their career.

The respondents represent a rich portfolio of professional time allocation (table 2). Those with no extension responsibility (group 0–4%) on average, distribute their instructional time equally between undergraduate and graduate instruction. They allocate slightly over 50% of their professional time to research activities. Several teaching/research faculty reported significant administrative and service responsibilities ("Other"). Respondents with extension allocations of at least 5% represent a wide range of job descriptions. Those with extension allocations of less than 35% demonstrate a breadth of activities integrating some combination of extension, teaching, research, and in some cases, administrative activities. Respondents with a half-time extension allocation typically demonstrate some involvement with the on-campus departmental instructional program. They also report that research activities take up over 20% of their time. Over 80% of those allocating time to extension activities report a mix of professional activities. Approximately one-third of all respondents allocated most of their time (65% or more) to extension activities. For the most part, these individuals do not participate actively in the on-campus instructional program and report limited research activities. Yet as we noted in table 1, nearly half of these specialists reported past involvement in risk research.

Results and Analysis

Tools

The agricultural economics profession has been involved in developing and/or using numerous analytical tools which incorporate risk. The tools considered here include those used in evaluating agents' risk preferences (e.g., expected utility theory) as well as tools used to search for solutions to a decision problem such as MOTAD and dynamic programming.

Respondents were asked to rank fifteen analytical tools under two different circumstances (table 3). First, they ranked the most frequently used tools in their research

Table 3. Group Rankings of Research Use and Outreach Importance of Analytical Tools by Extension Allocation

Analytical Tool	Have Not Used Tool (%)	Extension Allocation (%) <5 Research Use	<5 Outreach Importance	5–34 Research Use	5–34 Outreach Importance
Bayesian probability	61	13	14	10.5	11.5
Capital asset pricing models	50	11	13	7	8
Dynamic programming	48	8	12	4.5	5
Econometric modeling	16	2.5	3	2	4
Expected frequencies/probabilities	12	2.5	1	1	1
Expected utility	36	1	6	8	7
Generalized stochastic dominance	47	7	7	9	11.5
Mean-variance analysis	15	5	2	6	6
MOTAD	63	15	10	15	15
Quadratic programming	54	9.5	10	12.5	13
Risk-adjusted discounting	58	9.5	8	14	14
Safety-first modeling	58	13	10	12.5	9.5
Sensitivity/scenario analysis	25	6	4	4.5	3
Simulation (e.g., crop growth, biophysical, Monte Carlo)	30	4	5	3	2
Stochastic programming	57	13	15	10.5	9.5
Spearman rank correlation		0.81*		0.95*	
Number of respondents		28		13	

Note: Respondents scored the tools from 0 to 3 for research use to indicate "not used" to "used frequently." Respondents scored them from 0 to 3 for outreach to indicate "not important" to "very important." Those scores were totaled for each tool for only those respondents scoring all tools for both research and outreach and the group score totals ranked with a rank of 1 indicating most frequent use (research) or very important (outreach). Tied score totals are reflected in identical rankings that are an average of the ranks that would have been assigned had no ties occurred. An asterisk denotes significantly different from zero at the 1% level. Source: Siegel.

programs. Second, the respondents ranked the importance of the tool in their efforts to provide risk-related results to decision makers in their outreach program (e.g., extension, policy analysis, consulting). The rankings of 63 respondents are reported in table 3. One hundred fifteen of the 169 respondents reported risk research, but 15 respondents reported no effort to extend their research to decision makers and as a result are excluded from table 3. The responses from 91 others were omitted from table 3 because they did not rank all 15 analytical tools for frequency of use in both research and outreach.

The most frequently used risk research tool was expected frequencies/probabilities. Mean-variance analysis, econometric modeling, simulation, and sensitivity/scenario were the other risk research tools used frequently by the respondents. Mathematical programming tools, as a group, were used by a smaller number of respondents. The respondents ranked the top five analytical tools for risk research as the five most important tools for their outreach programs. There seems to be agreement among the respondents between the degree of use of a tool in research and its importance in an outreach program. The

Table 3. Extended

Extension Allocation (%)							
35–64		65–94		95–100		All	
Research Use	Outreach Importance	Research Use	Outreach Importance	Research Use	Outreach Importance	Research Use	Outreach Importance
15	14.5	14	15	10	14	14	15
7	5	4.5	5	14.5	14	9	10
6	7	14	14	10	7	7	8
4.5	3	6	8.5	6.5	4.5	2.5	5
3	1.5	1	1	1	2	1	1
4.5	5	12	10.5	13	10.5	6	6
12.5	13	10	6.5	6.5	10.5	8	7
2	5	3	2	2	1	2.5	2
14	14.5	8	10.5	10	3	15	13
10	12	14	8.5	10	10.5	11	12
10	8	10	6.5	14.5	7	12	9
10	10	10	12.5	10	4.5	13	11
1	1.5	4.5	4	3.5	14	5	3
12.5	10	2	3	3.5	7	4	4
8	10	7	12.5	5	10.5	10	14
0.93*		0.80*		0.36		0.91*	
5		9		8		64	

greatest disagreements between frequency of use in research and importance in outreach occurred for risk-adjusted discounting (12th in research and 9th in outreach) and stochastic programming (10th in research and 14th in outreach).

The extension allocation negligibly differentiates rankings of analytical tools for the 0–94% groupings. Those economists allocating less than 100% of their time to extension activities demonstrate a remarkably consistent mapping of research use and outreach importance for the analytical tools with a correlation of 0.8 or above (table 3). If a tool is used frequently, it also is judged as important in the economist's outreach program. Analytical tools which are infrequently used by "part-time extension" economists also have lower importance rankings.

Consistency between research use and outreach does not hold for full-time extension economists. As a group these respondents used sensitivity analysis, simulation, stochastic programming, and generalized stochastic dominance in their risk research, but found these tools less important in their outreach programs. Possibly these economists used these tools in their Ph.D. dissertations and further research but find the applicability of these techniques to their extension responsibilities less important. As a group, these same individuals ranked MOTAD, safety-first models, and risk-adjusted discounting relatively higher in terms of importance in outreach programs. In summary, economists with no or partial allocation of time in extension activities generate a relatively homogeneous ranking of analytical tool importance and its usefulness in helping decision makers.

Economists who allocate 100% of their time to extension activities view the bridging between research and extension activities in a less consistent manner. This group represents 13% of the respondents in this study.

Types of Decision Problems

The survey results indicate approximately 15% of the respondents felt none of the decision problems treated in their research and/or extension efforts in recent years were significantly influenced by risk considerations (no table shown for data reported in this section). The remaining 143 respondents listed the decision problems they felt were most influenced by risk considerations and reported whether they attempted to quantify the risk or rank the alternatives according to risk. About 70% of the risk problems listed by the risk project participants (risk researchers) were analyzed in an attempt to quantify risk, while 15% of those listed were analyzed without treating risk. In contrast, respondents from the extension specialist mailing list attempted to quantify risk for about 50% of the risk problems they worked on and ignored risk over 35% of the time. Both the risk researchers and the extension specialists ranked alternatives according to risk 15% of the time.

Over 80% of the extension specialists have made risk presentations to an extension audience or policymakers or as consultants. Over 70% of the risk researchers reported risk outreach presentations. Marketing (commodity pricing) issues were most frequently listed as presentation topics, followed by government program participation, crop mix decisions, crop insurance, financial management, and general risk management. The remaining types of presentations listed by the respondents included various investment decisions including evaluating alternative machinery systems and a variety of crop and livestock management problems including pest management, time of planting, and culling cows. Actual risk presentations included relatively more farm program topics, a similar proportion of marketing, crop insurance, and cropping and livestock systems issues, and relatively fewer investment, financial management, and general risk management topics than reported by the group as risk relevant decisions problems.

Challenges

As noted in the introduction, our professional leadership has called us not once but numerous times over the last decade to focus relatively more attention on the production of public goods in our research programs. Dobson and Luby (p. 30) call for academic economists to become more responsive "to state and local needs and to needs of action agencies in government." However, the authors recognize that this responsiveness comes at a price because "current incentives reward publishing for a national audience of other agricultural economists . . . ," and "these incentives are deeply embedded in the tenure criteria of universities and the culture of agricultural economics departments." But how do the rank and file of our profession view the tension between responsiveness and academic success? Are these two admirable objectives mutually exclusive?

Respondents were asked to rank their concerns about producing risk research results that are responsive to the needs of decision makers. All respondents involved in risk research, irrespective of their extension allocation, ranked their concerns in a similar manner (no table is provided). In order, the lack of data is ranked as the most important

Table 4. Importance of Concerns That Limit Risk Analysis Application in Outreach Programs

Concern	Group Rankings by Extension Allocation (%)					
	<5	5–34	35–64	65–94	95–100	All
Useful applications are not available in the literature	4	4	4	3	4.5	4
Insufficient research data and/or support available	3	3	3	4	3	3
Tools are too complex	2	2	1	1	2	1
Risk analysis is too complex for noneconomist audiences	1	1	2	2	1	2
Outreach material is difficult to publish	5	5	5	5	4.5	5
χ^2_{calc} [a]	273	204	111	331	60	94
Number of respondents	34	24	14	32	6	110

Notes: Respondents scored concerns from 0 to 3 to indicate "not important" to "very important." Those scores were totaled for each concern for all respondents scoring all concerns. The group score totals were then ranked with a rank of 1 indicating the most important concern.

[a] $\chi^2_{4\ df,\ 0.001} = 18.46$ resulting in rejection of the null hypothesis that the rankings within each group are unrelated where χ^2_{calc} determined based on the Kendall coefficient of concordance, *W*.

Source: Siegel.

problem in producing research results which decision makers value. The second most important concern is the inadequate financial support for applied research directed at specific, local problems. Perceptions about the difficulty of publishing this research and the low weight attached to this research for university promotion, tenure, and merit-pay decisions were ranked third and fourth, respectively, with relatively low importance levels. These respondents are more concerned with the challenging data availability and financial support issues in their applied risk research programs than by the hypothesized disincentives associated with attempting to publish applied research for a national audience.

The economists involved in public outreach were asked to rank the importance of factors limiting them in including risk in their extension, policy analysis, or consulting activities (table 4). On a relative basis, the complexity of risk analysis techniques creates the most concern for effective outreach programs. Typical audiences in outreach programs do not have the background to understand risk-modeling efforts, according to the respondents. The available analytical tools are complex and require a considerable amount of time to explain. An extension workshop on an applied topic in risk analysis may even have difficulty generating an audience. These reported perceptions lend support to the claim (Just and Rausser) that our research is not useful to, or packaged properly for, noneconomist users.

A similar but lower-level concern is the lack of useful applied risk research in the literature which is adaptable to an outreach program. According to some respondents, the profession is not producing risk research which is responsive to local or statewide needs. This response is a logical result of the respondents' concern for the lack of financial support to gather data on issues with a narrow research focus and calls into question the existence of a structurally sound bridge between our research and extension

activities. Concerns about the difficulty of publishing outreach material is given relatively less importance by these economists. Respondents appear to be more frustrated with adequately meeting the needs of local decision makers than the lack of recognition by their professional peers.

Respondents provided a number of additional reasons for failure of risk research to be communicated to decision makers including the following:

1. most audiences are not concerned with risk, unless looking at large amounts of debt financing;
2. providers do not view risk as research economists often define risk and do not make decisions based on the assumptions often used in risk modeling;
3. lack of desire on the part of researchers to develop outreach materials and extension faculty's lack of interest or familiarity with the research (also declining incentives to integrate research and extension); and
4. although the major concern was lack of useful applied research, several respondents indicated if it is understandable enough to be useful, it is difficult to publish.

The above responses are perceptions, not necessarily fact and not necessarily shared. Nearly 30% of the respondents, however, cited one or more of the above reasons for lack of outreach efforts in risk.

Implications for Agricultural Economics

We were surprised by the diverse allocation of time by most of the respondents in our survey. Teaching/research faculty reported significant extension activities while those with major extension programs teach undergraduate classes. This diverse portfolio of professional activities would appear to bode well for integration or bridging possibilities in the profession (Barry 1993), although split appointments are not the only, or necessarily the most productive, path to integration. In addition, 90% of the risk research respondents had attempted to extend their research results to other users. Further bridging could be promoted by encouraging, through formal appointments, financial incentives, release time, and such, an optimal departmental portfolio of activities. However, those economists allocating 100% of their time to extension activities appear to be less involved in risk research and more uncertain about the usefulness of risk research tools than their more diversified colleagues. Is society better served by faculty with diversified activities, by subject matter specialists without major research or teaching responsibilities, or by some combination? Or should we move to "an ideal system," as argued by Beattie, where all faculty have formal research and on- and off-campus teaching responsibilities and extension specialists as distinctively different faculty cease to exist?

Relatively simple analytical tools such as probabilities, forecasts, scenario analysis, and trade-offs between expected returns and risk constitute important skills in our risk analysis toolkit. The substantial research efforts directed to relatively more complex methods (e.g., generalized stochastic dominance, dynamic programming) may be ranked less important for both research and outreach because of concerns that these tools are too complex, particularly given that respondents frequently reported risk analysis itself as too complex for our noneconomist audiences. Two approaches occur to the authors as ways of dealing with the complexity issue: (*a*) complete the risk analysis incorporating the required complexities, generalize the results to the extent possible, and provide gen-

eral guidance to risk managers (e.g., diversification helps reduce risk when . . .) without attempting to explain the tools used to identify the strategies prescribed; and (*b*) increase efforts to help decision makers understand how alternatives can be evaluated providing them with simple illustrations of the type of analysis required (e.g., calculating an average income and the frequency that income falls below a target to illustrate the development of a risk-return trade-off).

These survey results also focus attention on the lack of problem-specific data and analysis as important constraints in the production of public goods in risk research. Firm-level data are unavailable and/or expensive to collect but are critical to understand decision making in an uncertain economic environment. Without the data, or the money to collect the data, economists are left with aggregated secondary data for their analyses. Our economic understanding lacks physical, institutional, and behavioral specificity.

Conclusions

There has been considerable effort allocated to risk research in the last 20 years. However, those surveyed reported a lack of data as an important problem in producing risk research that decision makers value. Inadequate financial support for the analysis of applied problems was second in their minds.The lack of financial support was considered much more important than the lack of publication outlets, although there is a perception that if the analysis is simplified so it can be understood by an extension audience, it is difficult to publish in peer-reviewed journals. However, the complexity of the risk problems and the analytical models was cited as the greatest challenge in communicating the results to an extension audience.

The sophisticated research tools developed more recently are reported as less important than the basic tools, suggesting a lag in adoption. A more pessimistic conclusion would be that the new tools are less useful, but that conclusion appears inconsistent with the finding that these tools are equally important in research and outreach for all but full-time extension economists.

The frequent failure of full-time extension economists to bridge the gap between research and extension activities as suggested by the survey results is a cause for concern as is the general lack of applied risk analysis. Joint research and extension appointments appear to help bridge the gap. As society demands more accountability from the land grant system, including departments of agricultural economics, funding authorities may redesign professional appointments to further integrate research and extension responsibilities, and possibly include instruction as well. Students on and off campus will, hopefully, benefit from these efforts.

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