Demonstrating Differences in Risk Attitudes

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Abstract

Differences in individuals' risk attitudes often affect farm management decisions. In this paper, agricultural choice dilemmas are used to illustrate sources of risk, risk-returns trade-offs and a scale of risk attitudes. This scale has been used with farmers, professional farm managers, and agricultural lenders and can be useful in group decision situations.

Risk in Agricultural Production

Agriculture is inherently risky. Farm production is a biological process subject to unknown weather, diseases, and biological pests. Weather and spatial dispersion of production particularly affect crops and grazing livestock. In contrast, confinement production of animals partially controls production risk. Price uncertainty in crops is mirrored in livestock and poultry feed price uncertainty, causing output price uncertainty even for confined livestock and poultry production. Termination of high price support commodity programs, globalization of markets, increased managerial complexity, increased urban/rural conflicts, and increased governmental regulations are fundamental shifts in the risk environment of farmers in the past 50 years.

Various management responses can be used to manage these risks. Choosing among these responses is a complex decision. Part of the complexity arises from the fundamental risk-returns trade-off that is involved with most of these responses. One can usually not reduce risk without simultaneously reducing average profits or returns from the business. Besides recognizing this fundamental trade-off, producers, family members, investors, and those advising them must also recognize that individuals differ in their willingness to take risk. A management decision that is risky, but potentially quite profitable, may be desirable for someone who is willing to assume considerable risk, but someone who is less willing to assume risk might reject the same decision. Recognizing that differences do exist among individuals in

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willingness to take risks is important in evaluating these management options.

Demonstrating that differences in risk attitudes do exist among individuals and that these differences can affect decisions is difficult with a group of individuals who have limited background in economics and statistics. This situation can arise in extension, undergraduate, and beginning graduate education settings as well as in situations involving investors and managers of production firms. Elicitation of utility functions or their derivatives is not an intuitive process with these audiences. In addition, results of elicitation have been demonstrated to have measurement limitations. Among these limitations are that they are not stable over time (Binswanger), have interview errors (Musser and Musser), and can vary with functional form for the equation (Buccola and French; Musser, et. al.). With all of these problems, estimation of utility functions is often not considered a useful approach (Young).

This paper presents a scale based on agricultural choice dilemmas that has been adapted from the psychological literature. This scale has been used in the classroom and in extension programs to demonstrate differences in risk preferences of individuals and the impact of these preferences on decisions. This paper includes the results of administration of the scale to farmers, professional farm managers, and agricultural lenders. The results suggest that, on average, producers, farm managers, and agricultural lenders do not have significant differences in their willingness to assume risk. However, within each group there is a wide range in the willingness of individuals to assume risk. Although measures from this scale cannot be used in economic optimization models, the scale can be useful for pedagogical purposes. The choice dilemma scale can also be useful in group settings involving multiple managers and/or investors to help the individuals understand their risk attitude differences.

Background on the Scale

Psychologists developed the original choice dilemma scale about 1960. The number of choice dilemmas and their structure are the same as the scale discussed in this paper. The choice dilemmas concerned life situations including chess match, investment, career, and health decisions in which risk was important (Kogan and Wallach; Wallach and Kogan). An agricultural version using farm management and marketing decisions for the Eastern Cornbelt was developed. Both the original psychological and agricultural versions were administered to a group of corn and soybean farmers attending a three-day workshop at Purdue University (Patrick, Musser, and Ortmann). These two versions were also randomly administered with a mail survey to members and friends of the Indiana Chapter of Farm Managers and Rural Appraisers and of agricultural lenders on the Indiana Bankers School list. Useable responses were obtained from 50.4 percent of the farm managers and 43.8 percent of the lenders (Patrick and Ullerich).

A version with horticultural decisions that are similar to those in the Cornbelt version was developed in 1999 for use in a series of in-service programs on horticultural risk management that was given across the Northeastern U.S. and the Eastern Cornbelt (Musser, Patrick, and Ullerich). This version was subsequently used in a risk research meeting, at a national extension risk management education conference, and in an undergraduate class. Both versions are available from the authors and on the web (Musser and Patrick; Patrick and Musser). The agricultural version is the subject of this paper.

Structure of the Scale

The choice dilemmas scale of willingness to assume risk is based on twelve risky farm decision dilemmas. One of the dilemmas can be used to illustrate the scale structure:

> Mr. L is in the middle of corn harvesting when his combine has a major breakdown and it begins to rain. Mr. L could purchase a new combine that is currently available from his machinery dealer to be delivered in the morning. On the other hand, Mr. L could arrange for the repair of his combine that would be much less costly than a new combine. The combine would have several years of life remaining after the repairs. However, the machinery dealer does not know when the needed parts will be obtained and repairs can be completed. If Mr. L is unable to resume harvesting after the rain, there will be extra harvesting losses.
>
> Imagine that you are advising Mr. L. Listed below are several probabilities or odds that the repairs will be completed before Mr. L would be able to

resume harvesting and avoid extra harvesting losses. Please check the lowest probability that you would consider acceptable for Mr. L to repair the old combine.

_____ Place a check here if you think Mr. L should not consider repair to the old combine no matter what the probabilities.

_____ The chances are 9 in 10 that the combine will be repaired before harvesting can be resumed.

_____ The chances are 7 in 10 that the combine will be repaired before harvesting can be resumed.

_____ The chances are 5 in 10 that the combine will be repaired before harvesting can be resumed.

_____ The chances are 3 in 10 that the combine will be repaired before harvesting can be resumed.

_____ The chances are 1 in 10 that the combine will be repaired before harvesting can be resumed.

Each of the choice dilemmas has two options. The option with the more desirable outcome, repairing the combine above, has a lower probability of success than the less desirable option, buying a new combine. One response is not to choose the risky choice no matter the probabilities of the outcome and to buy the new combine. The risky alternative, repairing the combine, can be chosen with different probabilities that the parts will be available. The response selected may partially depend on the magnitudes of gains and losses of the combine not being available when needed, which are not specified. However, the choice also depends on the respondent's willingness to assume risk. Thus, risk preferences influence the decision made by the respondent. Two individuals may face what appears to be identical situations and make different decisions. Determination of the appropriate decision for individuals requires taking into account their risk preferences. The same decision is made for the other eleven choice dilemmas.

The choice dilemmas are concerned with the wide range of risks that occur in farming. Baquet, Hambleton, and Jose identify the five major sources of risk as production, marketing, finance, legal and environmental, and human resources. The choice dilemmas include ALL five sources of risk. Some can be easily classified as to an individual source, but others have several sources interacting. Production is the suggested source of risk for the above choice dilemma situation.

Calculation of individual scores can be illustrated with the score sheet in Appendix A. The score for an individual is based on the twelve choice dilemmas. Responses with probabilities of *one out of ten* are scored as a one. Responses of *three out of ten* are scored as a three and so on. The response that the risky choice is never taken is scored as ten. Then, the scores on the twelve individual choice dilemmas are summed for a total score. One should not interpret a response to any one choice dilemma individually; only the summed responses to all the choices should be interpreted as a willingness to assume risk.

The range of possible scores is easy to interpret. With 12 choice dilemmas, the maximum score is 120 (12 times 10) and the minimum score is 12 (12 times 1). A score of 120 indicates an unwillingness to assume ANY risk. A score of 12 indicates an extreme willingness to assume risk. In practice, these extremes will seldom if ever be encountered. Most people have scores somewhere in between these extremes, which suggests that most people are moderate risk takers.

Scores from Past Uses

The averages and distribution of scores for both the original psychological and Cornbelt agricultural versions for the farmers, professional farm managers, and agricultural lenders are presented in Table 1. Several aspects of these means are striking. First, Wallach and Kogan reported averages of 76.6 and 76.3 for men and women, respectively, in a general population. The average score of farmers in Table 1 is quite similar for the traditional version. This similarity suggests that the willingness of farmers to assume risk is not significantly greater than the general population. Similar conclusions can also be drawn for farm managers and agricultural lenders. Second, the averages are almost identical for the original and the agricultural versions for all three groups. We had originally expected all three groups to be more willing to assume risks in the agricultural situations with which they were familiar. This lack of significant differences suggests the agricultural version was a successful adaptation of the ear-

Table 1. Distributions of Total Scores on Original and Agricultural Choice Dilemmas of Farmers, Lenders and Farm Managers.

Range of Scores[a]	Farmers		Lenders		Farm Managers	
	Original n=52	Agricultural n=51	Original n=53	Agricultural n=57	Original n=24	Agricultural n=38
Less than 40	1	-	-	-	-	-
40-44	-	1	-	-	-	-
45-49	-	1	-	-	-	-
50-54	1	1	2	2	-	2
55-59	1	5	2	2	-	-
60-64	4	3	2	2	3	3
65-69	11	9	2	2	3	5
70-74	6	7	9	11	3	3
75-79	9	4	7	7	5	9
80-84	6	11	13	13	3	3
85-89	6	4	7	9	1	3
90-94	4	2	5	5	1	3
95-99	2	2	2	2	1	3
100-104	1	1	1	1	2	2
105 or more	-	-	1	1	2	2
Mean	**76.0**	**74.0**	**79.2**	**79.2**	**79.8**	**79.5**

[a]Possible scores range from 12 (very willing to accept risk) to 120 (unwilling to assume any risk).

lier scale. Third, the three groups have about the same average scores for both versions. Farmers are a little lower than the other two groups, which indicates a greater willingness to take risk, but these differences are not statistically significant. Although differences might be statistically significant with larger numbers of observations, magnitudes of the differences are small. We conclude that farmers and agribusiness personnel have no differences in risk preferences, implying that there should not be major differences in their evaluations of risk management strategies.

Frequency distributions of responses indicate considerable variability in willingness to assume risk among individuals in all three groups. Distributions for the groups are quite similar. All distributions have at least one score above 100; these individuals are willing to bear very little risk. Those with responses in the nineties also are not willing to bear much risk. The majority of the individuals are clustered around the means---60 to 89. However, a number of individuals have scores below 60, and at least two are below 55 in all groups. These individuals are willing to assume much more risk than those with higher scores. Thus, individuals within these three groups have pronounced differences in willingness to assume risk.

Use of the Scale for Education or Management Advice

Administration and discussion of the scale takes about 40-45 minutes for a group in a workshop setting. Two instructors or an instructor and a data analyst are suggested. The data analyst summarizes scores from the scale as individuals complete the scale and turn in their score sheets; a laptop computer facilitates summarizing the data. While the analyst tabulates the data, the instructor discusses the information in the previous sections of this paper to help the participants understand their scores and some basics of risky decisions. After the tabulations are complete, information similar to the distributions in Table 1 for the respondents are presented and discussed. Important differences in willingness to assume risk are emphasized. For a further discussion of use of the scale in an educational situation see Musser, Patrick and Ullerich.

The number of score sheets that can be analyzed during the discussion limits the maximum number of participants for the above process. For larger groups, participants can be asked to complete the instrument and mail it to the instructors for tabulation before the workshop. This process was used for the producer group in Table 1, partly because the two versions of the scale were being completed.

The process and timing of use of the choice dilemma scale for several individuals involved in management of a farm is different than for groups. The instrument should be completed and the score calculated before it is discussed. As group tabulations are not needed, the amount of discussion can vary. At the minimum, the distribution of scores for a comparison group needs to be discussed to give the respondents a reference for their scores. In a group management setting, differences in the scores among the individuals and the implications of alternative preferences for risky management options should be stressed.

Conclusions

Risk attitudes are related to a number of management questions. Most producers and their advisers are interested in questions such as "What are my risk attitudes?" "How does it compare to other farmers?" and "What effect does it have on my management decisions?" These are complex questions, and the answers are not always the same. Individuals do differ in their risk attitudes, and these differences in risk attitudes can lead individuals in similar circumstances to make different decisions. Differences of risk attitudes among the various individuals involved in a farming operation, such as spouses, parents, children, and partners, also are important and may also impact farm decisions.

While this paper did not demonstrate methods to analyze all these questions, a method of illustrating variations in risk attitudes was presented. The choice dilemma scale in this paper can measure willingness to assume risk across a wide range of typical producer decisions. This scale measures differences in risk attitudes and illustrates the effect of risk preferences on decisions. This use does indicate that differences in risk preferences do account for adoption of alternative management options such as illustrated in the choice dilemmas and in many other farm management situations.

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Appendix A: Score Sheet for Agricultural Choice Dilemmas Questionnaire

SCORE SHEET FOR INDIVIDUAL RESPONSES

Score each situation below based on your response. List the probabilities from one to nine corresponding to your choice for each situation. Score the response that the risky alternative is never chosen no matter the probabilities as ten. Then, sum your scores on the individual situations:

Choice Number	Response Number
1.	____
2.	____
3.	____
4.	____
5.	____
6.	____
7.	____
8.	____
9.	____
10.	____
11.	____
12.	____
Sum of Above	_____