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Hog Producers' Risk Management Attitudes and Desire for Additional Risk Management Education

George F. Patrick, Amy J. Peiter, Thomas O. Knight,
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Hog producers in Indiana and Nebraska were surveyed about sources of risk, effectiveness of risk management strategies, and prior participation in and desire for additional risk management education. Ownership of hogs by the producer, size of the operation, and age did have significant effects on ratings of both sources of risk and effectiveness of risk management strategies. Probit analysis found age, prior attendance, knowledge and prior use of the tool, level of integration, and concern about price and performance risk have significant effects on interest in further education about production contracts, futures and options, packer marketing contracts, and financial management.

Key Words: financial management, futures and options, packer marketing contracts, production contracts, risk attitudes, risk management

JEL Classifications: D81, D83, Q12, Q16

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Hog producers have seen countless changes in their industry and this has changed the risk environment for hog producers. Boehlje and Lins described these changes as a transition from traditional to industrial-type production. They reported the 40 largest producers produced 5% of the total pork supply in 1986, while just ten years later the 40 largest producers were producing 31% of the pork supply. Lawrence and Grimes found that operations marketing more than 5,000 hogs a year produced nearly 80% of the hogs in 2000. Another change in the hog industry has occurred in marketing. Hog production prior to this industrialization was characterized by small producers and cash markets. As discussed by Lawrence and Hayenga, the industry has moved to vertical coordination and the use of marketing contracts.

Size of operations and marketing practices were not the only changes in the industry; production practices have also seen drastic transformations. Lawrence and Hayenga noted that 2,400 to 5,000 sow production units were common, while 25 years ago 500 sow units were regarded as large operations. The production process is highly specialized; hogs are placed in confinement buildings and many specialized practices are followed. A higher percentage of producers specialize in one or limited phases of hog production as compared with farrow-to-finish production (Lawrence and Hayenga).

In recent years, policymakers have placed more emphasis in agricultural legislation on risk management and education of producers to manage these risks. The Agricultural Risk Protection Act of 2000 demonstrated the increased emphasis on risk management by providing funding for research and development of programs to assist producers in managing risks. Another key element of the act was the proposed partnership among government and the private sector as well as public organizations to further risk management for producers. This partnership was aimed at developing programs "increasing the availability of loss mitigation, financial, and other risk management tools for producers..." (United States Congress Sec 131). The Act also called for the implementation of pilot programs for livestock producers to protect against marketing and price risks as well as production losses and established a grant program with the purpose of educating producers in the area of risk management. These measures demonstrate the increased importance placed on assisting producers in managing risks.

The current risk environment is a challenging one. Changes in the hog industry have forced producers to reevaluate their business and management practices and risk management is receiving increased attention. However, there is limited information regarding hog producers' perceptions of risks they face, the effectiveness of risk management strategies, and producers' desires for additional risk management education. This paper provides

empirical results from a survey of hog producers in Indiana and Nebraska. Producers' views on the sources of risk, effectiveness of alternative risk management strategies, participation in past risk management education activities, and ratings of alternative learning methods are presented. The views of producers who owned all of the hogs they produced are compared with producers who did not own all of the hogs they produced. Hereafter, these groups are referred to as independent and contract producers, respectively. The effects of size of the operation and age of the operator are also analyzed. Probit models are used to analyze producers' interest in additional training in four areas of risk management including production contracts, futures and options, packer marketing contracts, and financial management. Results of this analysis are compared with similar analyses of crop producers (Knight et al.) and cow-calf producers (Hall et al.).

Previous Research on Risk Management Education

Agricultural economists have conducted research evaluating tools and strategies to manage risk in agriculture. However, there has been a gap between research and applying that research to assist producers (Selley and Wilson; Walker and Nelson; Anderson and Mapp). Patrick and DeVuyst suggested that in spite of the extensive research in risk management, little had been incorporated into educational programs for producers. Reasons stated for the gap include lack of funding for research of applicable producer problems and data availability (Selley and Wilson). Selley and Wilson suggested joint research and Extension faculty appointments were helping to bridge the gap. Boehlje and Trede argued that understanding the producers' risk preferences will aid in developing strategies to manage risk, while Anderson and Mapp emphasized the importance of remembering the range of producers when presenting risk management concepts.

Delivery methods are a vital element in effective risk management educational pro-

grams and assisting producers in managing risks. Both producers and Extension personnel perceived farm magazines and newsletters as effective learning methods, but there were differences among their preferences (Buzby, Skees, and Benson; Carter and Batte; Knight et al.). Carter and Batte and Knight et al. found that producers rated largely self-study materials as the most preferred method of education. Producers also saw personal contact with Extension personnel as an effective means of education, while Extension educators perceived in-depth training by risk management experts to be the most effective (Carter and Batte; Vergara et al.). These studies suggest that producers and educators, although they had some similar preferences for effective learning methods, still had some apparent differences.

Several studies of producers' desire for risk management education have employed a model of human capital investment. Ben-Porath stated that most investments in human capital often occur at a young age and are associated with forgoing earnings during the investment period. If investments are made at a young age, the individual has a longer period to accumulate the returns and the earnings forgone may be low compared to experienced producers. Age, as a measure of planning horizon, is expected to be a key issue in hog producers' preferences for additional educational training. Previous studies found that age had a significant negative impact on a producer's desire for additional risk management education (Hall et al.; Knight et al.). Goodwin and Schroeder found similar results using experience in place of age.

Higher levels of education have also shown a significant positive effect on interest in additional training (Goodwin and Schroeder; Knight et al.). Other variables that were significant and increased the likelihood of producers exhibiting interest in risk management education were previous attendance at an educational program, prior use of the risk management strategy, and risk attitudes (Hall et al.; Knight et al.). Presumably, more highly educated individuals and those with previous experience could make more effective use of

additional information. Somewhat surprisingly, Goodwin and Schroeder found producers with a preference for risk in their operation had an increased likelihood of desiring risk management education. A lender's recommendation, percentage of borrowed money in the operation, and the perception of high price risk in their operation were significant positive indicators of crop producers' interest in risk management education (Knight et al.). Beef producers with a high level of knowledge about a risk management strategy were also more likely to exhibit interest in additional education (Hall et al.).

The size of the farm operation may also impact the desire for additional education. Operators of larger farms have the potential for a larger return to a specific educational investment, but could also have larger earnings forgone. There are conflicting empirical results. Goodwin and Schroeder found size to be a significant and positive indicator, while Hall et al. found size to have no significance. Knight et al. found size was consistently positive, but significant in only two of five models estimated.

Integration is increasing in the hog industry. This analysis extends previous studies by considering effects of hog ownership on producers' perceptions of sources of risk, effectiveness of risk management strategies, and desire for additional risk management education.

Survey Procedures

This analysis employs data collected from hog producers in Indiana and Nebraska as part of a four-state project.¹ A sample, stratified by size based on "the number of hogs owned or number of hogs on the operation," was obtained from USDA, National Agricultural Statistics Service (NASS). The stratified sam-

¹Data collection was supported by a USDA/CREES grant for the project, "Understanding Farmer Risk Management Decision Making and Educational Needs." Indiana, Mississippi, Nebraska, and Texas were included in the project and resources limited the hog producer survey to Indiana and Nebraska.

ple of 1,479 operations involved in hog production in Indiana and 1,458 in Nebraska were sent mail surveys by NASS in mid-March 2000. Nonrespondents were sent another mail survey three weeks after the first mailing; two weeks later telephone calls were made to the remaining nonrespondents to request their participation. Nearly 600 responses were received indicating that the operation was no longer involved in hog production. A total of 330 usable responses were received from Indiana and 300 from Nebraska. As percentage of operations in business in 2000, response rates were 27.4% for Indiana and 26.2% for Nebraska.²

The questionnaire was developed in collaboration with NASS survey specialists and was initially based on Patrick et al. An advisory group reviewed parts of the entire questionnaire and the revised version was tested with selected hog producers.³

Survey responses were categorized in various ways for analysis. These included four sizes of operation: 100 to 999 head, 1,000 to 1,999, 2,000 to 4,999, and 5,000 head and more.⁴ Age of the respondent was categorized in four strata: age 40 and under, 41 to 50, 51 to 60, and over 60 years of age.⁵ Information was also obtained on the percentage of the operation's production from animals that the operation did not own. There were 524 independent operations that owned all of the hogs they produced. The 80 contract operations included 66 that owned none of hogs and 14 operations that owned some of the hogs they produced.⁶

²This compares with a response rate of 32.8% for the beef producers in Hall et al. and 26.6% for crop producers in Knight et al.

³The questionnaire is available from the authors upon request.

⁴The number of head of hogs on hand does not represent the annual production of the operation. There were 161, 243, 161, and 65 operations in Strata 1 to 4, respectively.

⁵There were 152 producers in Stratum 1, 245 producers in Stratum 2, 152 producers in Stratum 3, and 64 producers in Stratum 4.

⁶The number of observations does not total 630 because of missing information.

Producers' Perceptions of Risk

Determining producers' perceptions of risk can aid in understanding of the audience and in designing risk management education. Producers used Likert-type scales (Likert) to rate (1 = low, 5 = high) each source of risk in terms of its potential to affect their operation's income from hogs. Table 1 presents the mean values for independent and contract producers.⁷ Of the 14 sources of risk considered, independent producers perceived hog price variability, with a mean rating of 4.40, to have the greatest effect on their hog operation's income. For contract producers, a change in environment regulations, at 3.85, was the highest rated source of risk. Other risk sources rated moderately high by independent producers included: disease in hogs, 3.95; environmental regulations, 3.94; market access (having a place to sell hogs), 3.82; and changes in input costs, 3.77. Contract producers generally rated the sources of risk lower than independent producers, and the differences were statistically significant for hog prices, disease, market access, input costs, farm programs, and arrangements with purchasers. Only failure of a contractor to fulfill the terms of the contract was rated significantly higher by contract producers.

Hog price variability was the highest-rated source of risk for the both the largest (5,000 head or more) and smallest (100–999 head) producers at 4.22 and 4.26, respectively. The means of the largest stratum were significantly higher than the smallest stratum for the following sources of risk: disease in hogs (4.11 vs. 3.63); environmental regulation (3.92 vs. 3.63); community acceptance (3.31 vs. 2.82); labor/personnel (3.36 vs. 1.84); attitude of lenders (2.88 vs. 2.52); demands on management (2.86 vs. 2.52); environmental accident (2.80 vs. 2.32); and failure of a con-

⁷Contract producers had significantly larger hog operations, but smaller crop operations than independent producers. There were no statistically significant differences in age, education or percent debt of the two groups of producers, but the contract producers were significantly less willing to assume risk.

Table 1. Mean Ratings and Standard Deviations of Sources of Risk on Potential Effect on the Operation's Income from Hogs for Independent and Contract Producers^a

Source of Risk	Independent <i>n</i> = 523	Contract <i>n</i> = 79	<i>t</i> value ^b
Hog price variability	4.40 (0.88)	3.56 (1.31)	7.38***
Disease in hogs	3.95 (1.07)	3.59 (1.29)	2.32**
Environmental regulations	3.94 (1.09)	3.85 (1.14)	0.68
Market access for hogs	3.82 (1.19)	2.92 (1.34)	6.15***
Input costs	3.77 (0.91)	3.06 (1.28)	6.05***
Arrangements with purchasers	3.37 (1.22)	2.91 (1.25)	3.13**
Variability in hog performance	3.28 (1.02)	3.42 (1.09)	1.11
Community acceptance of hogs	2.90 (1.21)	2.70 (1.34)	0.03
Government farm programs	2.85 (1.23)	2.52 (1.38)	2.19**
Demands on management	2.70 (1.04)	2.60 (1.16)	0.52
Attitude of lenders	2.67 (1.25)	2.51 (1.28)	0.03
Environmental accident	2.47 (1.23)	2.36 (1.37)	0.60
Labor/personnel	2.36 (1.20)	2.24 (1.23)	0.84
Failure of contractor to fulfill terms of contract	1.96 (1.23)	3.13 (1.53)	7.57***

^a Ratings are on a Likert-type scale of 1 (low potential effect) to 5 (high potential effect).

^b The *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

tractor to fulfill contract (2.16 vs. 1.85). There were no statistically differences on the largest and smaller producers on hog price variability (4.21 vs. 4.26); input costs (3.78 vs. 3.46); market access (3.31 vs. 3.95); performance variability (3.22 vs. 3.24); arrangements with purchasers (3.14 vs. 3.17); and government farm programs (2.62 vs. 2.78).⁸

Age had only very limited effects on the ratings of sources of risk. The ratings by producers over 60 years of age were significantly lower than other age strata for disease in hogs (3.52 vs. 3.95) and attitudes of lenders

(2.36 vs. 2.83), and lower than the youngest age stratum for variability in performance of hogs (3.06 vs. 3.41).

Perceived risks for hog producers are similar to those of beef and crop producers, who rated price variability as the highest and second highest source of risk, respectively (Hall et al.; Coble et al.). Disease may have a major effect on a hog operation's sole source of income as some diseases may require depopulation of the operation. Thus, it is understandable that producers rated disease as one of the top sources of risk. Environmental regulations have become prevalent in the production of hogs with changes necessitating expenditures to ensure hog operations are in compliance.

⁸ Complete tabulations are available from the authors upon request.

Table 2. Mean Ratings and Standard Deviations of Effectiveness of Responses to Risk in Hog Operations for Independent and Contract Producers^a

Response to Risk	Independent <i>n</i> = 523	Contract <i>n</i> = 79	<i>t</i> value ^b
Maintain good herd health	4.28 (0.83)	4.10 (1.06)	1.75*
Be a low-cost producer	4.21 (0.94)	3.84 (1.19)	3.18***
Maintain credit/financial reserves	3.63 (1.03)	3.73 (1.13)	0.86
Diversify farming operation	3.54 (1.20)	3.35 (1.19)	1.36
Have off-farm investments	3.26 (1.22)	3.18 (1.37)	0.58
Be involved in value-added production	3.12 (1.22)	2.96 (1.28)	1.03
Contracting feed requirements	3.10 (1.08)	2.87 (1.26)	1.70*
Hedging price on part or all of production	2.92 (1.13)	2.71 (1.39)	1.52
Use a marketing contract with a packer	2.83 (1.17)	2.85 (1.41)	0.09
Have off-farm employment	2.58 (1.36)	3.06 (1.52)	2.89***
Specializing in hogs only	2.45 (1.19)	2.56 (1.28)	0.73
Produce under a production contract	2.43 (1.16)	3.45 (1.41)	7.04***
Specialize in one phase of hog production	2.43 (1.19)	3.18 (1.26)	5.21***

^a Ratings are on a Likert-type scale of 1 (low effectiveness) to 5 (high effectiveness).

^b The *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Effectiveness of Risk Management Strategies

Producers were also asked to rate, on a Likert-type scale (1 = low, 5 = high), the effectiveness of 13 management strategies in reducing risk in their hog operation. Table 2 summarizes the mean values of the various strategies for independent and contract producers. Both groups of producers rated maintaining good herd health (4.28 and 4.10) and being a low-cost producer (4.21 and 3.84) as the most effective strategies, although the independent producers gave the strategies significantly higher ratings. These strategies correspond with the top sources of risks affecting the operation, disease in hogs and input costs, and also help protect against low prices. Although hog price variabil-

ity was highly rated as a source of risk, hedging or using a marketing contract with a packer was not highly rated as an effective response to risk. Producing under a production contract and specializing in one phase of hog production, as well as off-farm employment, were rated significantly higher by contract producers. Both groups of producers rated maintaining credit/financial reserves as the third most effective response to risk. Somewhat surprisingly, both groups rated diversifying farm enterprises relatively high and specializing only in hogs as relatively low in effectiveness of responding to risk.

The small producer stratum gave significantly higher ratings than the largest stratum producers to diversifying enterprises (3.63 vs. 2.62), off-farm investments (3.50 vs. 2.83) and off-farm employment (3.33 vs. 1.78). In con-

Table 3. Percentage of Producers Participating in Educational Programs, Amount of Training, and Percentage Taught by Extension

Variable	Risk Management Education Program			
	Alternative Pricing Arrangement	Production Contracting	Agricultural and Financial Risk Management	Any Risk Management Program
Percentage attending	41.5	28.3	40.4	55.1
Average hours of training (attendees only)	12.4	7.7	13.9	23.5
Percent taught by Extension	30.6	30.7	37.5	34.8

trast, the largest producers gave significantly higher ratings to specialization in hogs (3.92 vs. 2.24), use of market contracts (2.91 vs. 2.61), contracting feed requirements (3.19 vs. 2.78), and maintaining credit/financial reserves (4.44 vs. 4.10) than small producers. Differences of other ratings were not statistically significant.

Age had relatively little effect on the ratings of effectiveness of risk management strategies. The oldest age stratum gave significantly lower ratings than the other age strata to hedging (2.43 vs. 2.94), use of market contracts (2.43 vs. 2.88), contracting feed (2.57 vs. 3.12), and involvement in value-added production (2.67 vs. 3.15). The two older age strata gave lower ratings to off-farm investments (3.09 vs. 3.32), off-farm jobs (2.46 vs. 2.75), and maintaining reserves (3.62 vs. 3.71) than producers in the two younger strata. The ratings given to using a production contract declined with each age stratum (2.75, 2.62, 2.42, and 2.26 respectively), although only the difference between the oldest and youngest strata was significant.

Several of the strategies rated as more effective were financially related, indicating that producers perceive financial management as an important aspect of their operation. There is considerable similarity in the perceived effectiveness of responses to risk of beef producers (Hall et al.), although there are many differences between the two industries.

Risk Management Education

Previous participation in risk management education activities can also provide insight

into risk management attitudes. Producers were surveyed on their attendance during the prior three years at programs in three risk management areas. Overall, 55.1% of producers had attended at least one risk management program in the past three years (Table 3). Programs on alternative pricing arrangements and programs with a focus on agricultural and financial risk management were attended by over 40% of producers. Production contracting educational programs were attended by about 28% of producers.

There were no significant differences in previous participation between independent and contract producers. Attendance at educational programs tended to decrease as age increased past 50 years. However, the differences were not statistically significant. Larger scale producers were more likely to attend risk management training programs. The percentages attending programs were 44.1%, 53.4%, 62.8%, and 68.8% for the smallest to largest size strata, respectively.

The average number of hours of training in the last three years for program participants was 13.9 hours for agricultural and financial risk management programs and 12.4 hours for alternative pricing arrangement programs, as compared with 7.7 hours for production contracts. Nearly two-thirds of the producers who attended a risk management educational program had attended multiple programs and had received an average of 23.5 hours of training in the last three years. In each topic area, the older producers had attended fewer hours of educational programs, as would be expected

Table 4. Mean Ratings and Standard Deviations of Level of Knowledge and Interest in Obtaining Additional Information for Independent and Contract Producers^a

Risk Management Tool	Level of Knowledge		<i>t</i> value ^b	Interest in More Information		<i>t</i> -value
	Independent <i>n</i> = 523	Contract <i>n</i> = 79		Independent <i>n</i> = 523	Contract <i>n</i> = 79	
Production contracts	2.59 (1.16)	3.11 (1.40)	3.49***	2.85 (1.26)	2.72 (1.28)	0.80
Futures and options	2.88 (1.22)	2.67 (1.23)	1.42	3.33 (1.24)	2.84 (1.29)	3.22***
Packer marketing contracts	2.75 (1.14)	2.43 (1.33)	2.25**	3.24 (1.26)	2.50 (1.23)	4.77***
Financial management	3.59 (0.95)	3.48 (1.18)	0.88	3.43 (1.19)	3.36 (1.36)	0.44

^a Ratings are on a Likert-type scale of 1 (low knowledge/interest) to 5 (high knowledge/interest).

^b The *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

because their planning horizons are shorter and anticipated returns are likely to be lower than for other producers.⁹

As a measure of the role that Extension has played in past risk management educational programs, producers were also asked to indicate the percentage of training programs they had attended that had been taught by Extension personnel. The mean percentage of Extension taught programs was 34.8%. The agricultural and financial risk management programs had the highest level of Extension involvement in the program, with 37.8% taught by Extension. This suggests that, in spite of the emphasis given to risk management education by Extension, nearly two-thirds of the risk management training programs were from non-Extension sources.

Producers were asked to self-assess their knowledge of the following risk management tools: production contracts, futures and options, packer marketing contracts, and financial management. Likert-type scales (1 = low knowledge, 5 = high knowledge) were used and results are reported for independent and contract producers in Table 4. Financial management was the tool with the highest

level of knowledge (3.59 and 3.48) for both groups. The contract producers rated their knowledge of production contracts significantly higher than independent producers (3.11 vs. 2.59). The situation was reversed for packer marketing contracts (2.75 vs. 2.43).

The larger-scale producers consistently gave higher ratings to their level of knowledge than the smaller-scale producers did.¹⁰ Producers in the over 60 age group rated their knowledge significantly lower than the self-assessments of producers in the younger strata, except for the financial management area.¹¹

Hog producers also indicated their level of interest in obtaining additional training on the same four risk management tools: production contracts, future and options, packer marketing contracts, and financial management. A Likert-type scale (1 = low interest, 5 = strong

¹⁰ Means of the largest stratum operations were 3.27 for knowledge of production contracts, 3.35 for futures and options, 3.28 for packer marketing contracts, and 4.00 for financial management. The means for the smallest size strata were 2.36, 2.50, 2.33, and 3.41, respectively.

¹¹ Means for the oldest producer strata versus other producers for knowledge of risk management tools were 2.19 vs. 2.70 for production contracts, 2.53 vs. 2.89 for futures and options, 2.30 vs. 2.74 for packer marketing contracts, and 3.32 vs. 3.57 for financial management.

⁹ A reviewer noted that older producers might have lower opportunity costs than younger producers with school-age families. Some older producers also might view the hog operation as a multi-generation business.

Table 5. Means and Standard Deviations (in parentheses) Producers' Learning Method Preferences for Risk Management Education (Overall and by Age Category)^a

Learning Method	Overall Mean and SD (<i>n</i> = 570)	Age Category of Operators			
		40 and under (<i>n</i> = 145)	41 to 50 (<i>n</i> = 235)	51 to 60 (<i>n</i> = 136)	Over 60 (<i>n</i> = 54)
In-depth training with experts	2.96 (1.26)	2.86 ^{1b} (1.23)	3.15 ¹ (1.23)	2.99 ¹ (1.31)	2.41 ² (1.21)
In-depth material for self-study	3.11 (1.15)	3.23 ¹ (1.07)	3.07 ¹ (1.18)	3.21 ¹ (1.10)	2.70 ² (1.26)
Magazine/newsletters	3.02 (1.04)	3.13 ¹ (1.00)	2.94 ¹ (1.01)	3.10 ¹ (1.03)	2.89 ¹ (1.27)
Computer/Internet	2.56 (1.21)	2.77 ¹ (1.22)	2.72 ¹ (1.21)	2.34 ² (1.15)	1.81 ³ (1.08)
Marketing clubs/producer groups	2.68 (1.21)	2.74 ¹ (1.14)	2.83 ¹ (1.20)	2.71 ¹ (1.28)	1.83 ² (0.97)

^a Ratings are on a Likert-type scale of 1 (low preference) to 5 (high preference).

^b Means, within a row, with the same superscript number are not significantly different.

interest) was used. Overall, 68.9% of producers surveyed indicated strong interest in at least one of the four risk management educational programs. Table 4 presents the producers' interest by hog ownership. Independent producers indicated significantly higher interest than contract producers in learning more about both futures and options and packer marketing contracts. Larger-scale producers were also significantly more interested in futures and options and packer marketing contracts (3.41 and 3.35) than smaller-scale producers (2.96 and 2.88). Producers over age 60 exhibited statistically significantly lower interest in additional training, lower than all other age strata for each of the risk management tools.¹² As age increased, or the planning horizon decreased, producers exhibited less interest in additional risk management education, which is consistent with the human capital investment model.

Another important aspect of risk management education is the learning method used. Hog producers were asked to rate their preferences (1 = low, 5 = high) for five different learning methods using a Likert-type

scale.¹³ Although there were no significant differences in the ratings of learning methods based on ownership of hogs, both size of the operation and age of the operator did have significant effects. The largest operations gave a significant higher rating to in-depth training by risk management experts (3.49 vs. 2.43) and significantly lower ratings (2.71 vs. 3.11) to farm magazines/newsletters and to marketing clubs or producer groups (2.43 vs. 2.89) than did the smaller-scale operations.

Table 5 analyzes whether producers' preferences for learning methods vary with age. In-depth self study material was the most preferred method, with mean ratings ranging from 2.70 to 3.23 by age category. Magazines/newsletters and in-depth expert training had similar ranges of ratings of 2.94 to 3.10 and 2.41 to 3.15, respectively. Producers over age 60 had a preference for farm magazines/newsletters and this was the only method for which the oldest group's rating was not significantly lower than some of the other categories. Computer/Internet-based education and marketing clubs or producer groups were especially unattractive to the older producers.

¹² Means for the oldest producer stratum versus other producers for interest in learning about risk management tools were 2.24 vs. 2.90 of production contracts, 2.65 vs. 3.32 for futures and options, 2.44 vs. 3.22 for packer contracts, and 2.71 vs. 3.49 for financial management.

¹³ For the overall sample, the 3.11 rating of in-depth materials was not significantly higher than the 3.02 for magazines/newsletters or the 2.96 of in-depth training. These three delivery methods did rate significantly higher than the 2.68 for clubs and the 2.56 for computer/Internet.

Materials that allow producers to study the risk management tools on their own, such as self-study materials or farm magazines/ newsletters, both rated among the most preferred methods for all age categories. However, choice of the learning method for a risk management educational effort can result in the program having appeal to different producer groups. For example, the larger producers had a preference for the in-depth training by experts. Computer/Internet-based programming or education through marketing clubs/producer groups is less likely to attract older producers.

Producers' Interest in Additional Risk Management Education

Identifying the factors that affect producers' interest in risk management educational programs can aid educators in program design. Probit model estimation, using LIMDEP, was used to determine producer and hog operation characteristics that affect producers' interest in additional risk management education. Separate models were estimated for each of the following risk management tools: production contracts, futures and options, packer marketing contracts, and financial management. Table 6 provides the definitions of the variables employed in the analysis as well as their means and standard deviations. Dependent variables were binary variables indicating producers exhibited strong interest on a specific risk management tool.

Producers indicating strong interest, defined as a 4 or 5 on the Likert-type scale, in additional training on financial management represented 55% of producers surveyed, while producers with a strong interest in futures and options and packer marketing contracts were 48% and 44%, respectively. Only 32% of producers indicated a strong interest in additional risk management education on production contracts.

Following Ben-Porath's model of human capital investment, age of the producer was included as an independent variable in the model. Variables indicating more formal education and prior attendance by the pro-

ducer at a similar risk management program are expected to play a positive role in interest in additional education and are included as binary variables. The self-assessed knowledge of the risk management tool and prior use of the tool are binary variables in the model expected to have a positive effect on interest in additional education about that tool.¹⁴ Lack of information on prior use of financial management tools precluded its use in the analysis. Size of the operation, measured in 1,000 head of hogs, is included in this analysis. Expectations are that as size increases, producers are more likely to exhibit a strong interest in risk management education. Increased financial leverage would be expected to have a positive effect on interest in additional education. In contrast, an increase in the percentage of hogs not owned by the operation is expected to be inversely related to interest in additional education. Another characteristic of the operation is whether the producer sells market hogs and this is included as a binary variable with an expected positive effect. Producers' perceptions of risk in their operations and their degree of risk aversion were included, as perceptions of risk are expected to be positive indicators of interest in additional risk management education. Perceptions of high impacts of price variability, hog performance variability, and market access were incorporated in the model as binary variables.

Probit Results

The results of the probit models, presented in Table 7, indicate that numerous producer and hog operation characteristics are significant in determining interest in additional risk man-

¹⁴ Prior attendance at an educational program and higher level of knowledge of a tool by a producer may reflect the importance given to a particular tool and potential problems of endogeneity with a strong interest in additional training. However, it also would not be unexpected that individuals would have a stronger interest in learning about risk management tools that they had not previously used or had not received training in.

Table 6. Summary Statistics of Probit Model Variables

Variable	Description	Mean (SD)
Desire for additional training	Dummy variables equal 1 if respondent indicates strong interest, 4 or 5 on a 1–5 scale, in additional education on following risk management tools:	
	Production contracts	0.32 (0.47)
	Futures and options	0.48 (0.50)
	Packer marketing contracts	0.44 (0.50)
	Financial management	0.55 (0.50)
Age	Age of survey respondent.	42.7 (10.22)
Education	Dummy variable indicating at least some college education.	0.60 (0.49)
Prior attendance	Dummy variable indicating previous attendance at a risk management educational program on following tools:	
	Production contracts	0.28 (0.45)
	Alternative pricing mechanisms	0.42 (0.49)
	Other aspects of agricultural and financial management	0.40 (0.49)
Knowledge of tool	Dummy variable indicating respondent rated knowledge as 4 or 5 on 1–5 scale for following tools:	
	Production contracts	0.26 (0.44)
	Futures and options	0.33 (0.47)
	Packer marketing contracts	0.27 (0.45)
	Financial management	0.58 (0.49)
Size of operation	Number of hogs expected to be produced in 1,000 head of hogs.	8.51 (25.83)
High price risk	Dummy variable indicating respondent rated hog price variability as a 4 or 5 on 1–5 scale of potential effect on operation's income.	0.83 (0.38)
High performance risk	Dummy variable indicating respondent rated variability in hog performance as a 4 or 5 on 1–5 scale of potential effect on operation's income.	0.45 (0.50)
High market access risk	Dummy variable indicating respondent rated market access as a 4 or 5 on 1–5 scale of potential effect on operation's income.	0.64 (0.48)
Market hog interest	Dummy variable indicating respondent does sell market hogs.	0.92 (0.28)
Prior use of tool	Dummy variable indicating respondent had used risk management tool in operation during 1997–1999.	
	Production contracts	0.14 (0.35)
	Futures and options	0.26 (0.44)
	Marketing contracts	0.36 (0.48)
Percentage not owned	Percentage of hog production expected to come from animals not owned by the operation.	0.12 (0.32)
Risk aversion	Dummy variable indicating respondent rated willingness to accept risk as 1, 2, or 3 on 1–5 scale.	0.56 (0.50)

Table 7. Results of Probit Model of Hog Producers' Strong Interest in Additional Risk Management Education

Variable	Production Contracts		Futures and Options		Packer Marketing Contracts		Financial Management	
	Estimate	Marginal Effect ^a	Estimate	Marginal Effect	Estimate	Marginal Effect	Estimate	Marginal Effect
Intercept	-1.0781 ^{b***} (0.4321)		-0.8675 ^{**} (0.4090)		-0.9961 ^{**} (0.4374)		-0.1602 (0.4112)	
Age	-0.0080 (0.0064)	-0.2972 (0.0023)	-0.0115* (0.0061)	-0.0046* (0.0024)	-0.0128 ^{**} (0.0062)	-0.0051 ^{**} (0.0025)	-0.0162 ^{**} (0.0060)	-0.0063 ^{**} (0.0024)
Education	0.0449 (0.1250)	0.0162 (0.0449)	0.0448 (0.1272)	0.0179 (0.0507)	-0.0380 (0.1257)	-0.0151 (0.0500)	0.0360 (0.1258)	0.0141 (0.0492)
Prior attendance	0.2576* (0.1323)	0.0974* (0.0494)	0.4013 ^{**} (0.1215)	0.1590 ^{**} (0.0475)	0.3626 ^{**} (0.1232)	0.1437 ^{**} (0.0483)	0.5538 ^{**} (0.1257)	0.2119 ^{**} (0.0464)
Knowledge of tool	-0.0150 (0.1448)	-0.0054 (0.0520)	-0.0950 (0.1392)	-0.0379 (0.0555)	0.4374 ^{**} (0.1413)	0.1731 ^{**} (0.0549)	0.2398* (0.1239)	0.0939* (0.0485)
Size of operation	-0.0036 (0.0034)	-0.0013 (0.0012)	-0.0004 (0.0023)	-0.0002 (0.0009)	0.0146 ^{**} (0.0073)	0.0058 ^{**} (0.0029)	-0.0017 (0.0023)	-0.0007 (0.0009)
Financial leverage	0.7084 ^{**} (0.2695)	0.2551 ^{**} (0.0968)	1.0561 ^{**} (0.2623)	0.4213 ^{**} (0.1046)	0.7107 ^{**} (0.2735)	0.2826 ^{**} (0.1087)	0.8277 ^{**} (0.2609)	0.3233 ^{**} (0.1019)
High price risk	0.4166 ^{**} (0.1821)	0.1388 ^{**} (0.0550)	0.4969 ^{**} (0.1735)	0.1937 ^{**} (0.0649)	0.3745 ^{**} (0.1799)	0.1454 ^{**} (0.0673)	0.4538 ^{**} (0.1704)	0.1793 ^{**} (0.0667)
High performance risk	0.2316* (0.1214)	0.0836* (0.0439)	0.2191* (0.1193)	0.0872* (0.0473)	0.2845 ^{**} (0.1216)	0.1128 ^{**} (0.0497)	0.1163 (0.1202)	0.0454 (0.0468)

Table 7. (Continued)

Variable	Production Contracts		Futures and Options		Packer Marketing Contracts		Financial Management	
	Estimate	Marginal Effect ^a	Estimate	Marginal Effect	Estimate	Marginal Effect	Estimate	Marginal Effect
High market access risk	0.0785 (0.1329)	0.0281 (0.0473)	-0.0574 (0.1283)	-0.0229 (0.0512)	0.0312 (0.1322)	0.0124 (0.0525)	-0.0730 (0.1284)	-0.0284 (0.0499)
Market hog interest	0.1039 (0.2323)	0.0366 (0.0801)	0.3835 (0.2350)	0.1502* (0.0886)	0.5344** (0.2464)	0.2014** (0.0841)	-0.0068 (0.2256)	-0.0026 (0.0880)
Prior use of tool	0.4510** (0.1970)	0.1711** (0.0777)	0.2298 (0.1462)	0.0914 (0.0577)	-0.0183 (0.1324)	-0.0073 (0.0526)	NA ^c	NA ^c
Percent not owned	-0.5155** (0.2395)	-0.1857** (0.0861)	-0.4508** (0.2116)	-0.1798** (0.0844)	-0.7732** (0.2332)	-0.3075** (0.0926)	-0.0850 (0.2099)	-0.0332 (0.0820)
Risk aversion	0.2218* (0.1211)	0.0794* (0.0430)	0.1434 (0.1189)	0.0572 (0.0473)	0.1042 (0.1211)	0.0414 (0.0481)	0.2160* (0.1201)	0.0844* (0.0463)
Model chi-square ^d	42.55 (0.0001)		76.99 (0.0001)		94.43 (0.0001)		70.55 (0.0001)	
Pseudo-R ^{2e}	0.0338		0.0540		0.0683		0.0508	
% correct predictions	65.34		66.86		65.03		66.14	
N	505		513		509		511	

^a Marginal effects reported are probability changes.

^b Numbers in parentheses are asymptotic standard errors. One asterisk denotes statistical significance at $p \leq 0.10$; two asterisks denote significance at $p \leq 0.05$.

^c NA indicates variable was not included in model, as no measure was taken in survey.

^d Chi-squared test the global null hypothesis that all parameters except the intercept are equal to 0. Numbers in parentheses are associated chi-squared probabilities.

^e Pseudo-R² is given by the following: $L_{\Omega}^{2/n} - L_{\omega}^{2/n} / 1 - L_{\omega}^{2/n}$, where L_{Ω} is the maximum likelihood function and L_{ω} is the likelihood function with respect to the intercept only.

agement education.¹⁵ Age had the expected negative sign in all of the models and was statistically significant in the models for futures and options, packer marketing contracts, and financial management. Using the median ages of the youngest and oldest strata of hog producers, 35.5 and 66 years respectively, the effect of the difference in age shows that the younger group of producers are 14.0% more likely to exhibit strong interest in additional education in futures and options. Younger producers are also 15.6% and 19.2% more likely to exhibit a strong interest in packer marketing contracts and financial management, respectively.

Of the respondents, 60% had attended at least some college. However, although education was positive in three of the four models, it was not statistically significant in any of the models. This is a surprising result, as other studies have found education to be significant in determining desire for further risk management educational programs (Goodwin and Schroeder; Hall et al.; Knight et al.).¹⁶

Prior attendance at a similar educational program has a positive and significant impact on the probability of a strong interest in additional training in all of the models. Producers who had received training on production contract arrangements were 9.7% more likely to exhibit strong interest in further educational programs in that area. Prior training in futures and options increased the likelihood of strong interest in further risk management education by 15.9%, while prior attendance increased likelihood of a strong interest in additional education by 14.4% and 21.2% for packer marketing contracts and financial management, respectively.

Producers' ratings of their knowledge of risk management tools had mixed results. Knowledge was positive and significant for marketing contracts and financial management, with marginal effects of 17.3% and 9.4%, respectively. However, the coefficients

were negative, but not statistically significant for production contracts and for futures and options. These results indicate that producers may still exhibit a strong interest in additional education about that tool. This suggests that producers may see higher returns to continued investment in specific tools rather than diversifying their risk management knowledge.

Size of operation was only significant in the model for packer marketing contracts, with an increase in the likelihood of exhibiting strong interest in additional education of less than 1% for each additional 1,000 head of hogs. The percent of borrowed money invested in the operation had the hypothesized positive impact and was significant in all four models. Producers' probability of expressing strong interest in additional risk management education ranged from 0.25% to 0.42% for each additional percent increase in borrowing, depending on the specific risk management tool. With increased financial leverage, hog producers are more likely to want additional training in risk management tools.

High ratings of the potential impact of three sources of risk were significant in numerous models with the hypothesized positive effects. High price risk was significant in all of the models and high performance risk was significant in all models except financial management. In contrast, high market access risk was not significant in any of the models. High price risk had the greatest impact in increasing the likelihood of strong interest with marginal effects ranging from 10.5% to 19.4%, while the marginal effects for high performance risk were from 8.4% to 11.3%.

Making sales of market hogs had a positive and significant effect, as expected, in the marketing contracts model. The probability of exhibiting a strong interest in education programs on packer marketing contracts is 20.1% higher for producers selling market hogs than those producers who do not sell market hogs. Prior use of the risk management tool was expected to have a positive impact on interest in additional training. The use of production contracts in the past three years was significant and positive in its impact on production contracts, with a 17.1% increased probability

¹⁵ Because parameter estimates of Probit models are not directly interpretable, the marginal effects of probability change are indicated in Table 7.

¹⁶ Alternative specifications of the education variable did not result in statistical significance.

of a strong interest in additional educational programs for producers with prior use of the tool. However, the prior use of futures and options and packer marketing contracts were not significant in their respective models.

The percentage of hogs not owned by the producer had a negative impact, as hypothesized, and the variable was significant in all of the models except financial management. This implies that as producers own a smaller percentage of the hogs produced by the operation, they are less likely to exhibit an interest in risk management training. This is consistent with the concept that as the producer relinquishes ownership of hogs produced, less risk is retained by the producer and the producer has less desire for risk management education. For an additional 10% increase in percentage of hogs not owned, producers were 2% to 3% less likely to indicate strong interest in additional risk management education.

The risk aversion variable was positive in all of the models and was significant in production contracts and financial management models. The probability of strong interest in future educational programs was 7.9% and 8.4% more likely for production contracts and agricultural and financial risk management, respectively. As producers are less willing to accept risk in their operation, they are more likely to desire additional training in risk management.

Conclusions

The hog industry has changed dramatically with large increases in the size of operations and increased integration in production. Both of these changes had impacts on hog producers' perceptions of sources of and responses to risk. Independent producers gave significantly higher ratings to hog price variability, market access, input costs, arrangements with purchasers, and disease as sources of risk affecting their income than contract producers. This latter group was significantly more concerned about the failure of a contractor to fulfill the terms of the contract. Larger-size hog operations generally gave higher ratings to the various sources of risk than the smaller-scale producers, and many of the

differences were statistically significant. In contrast, age of the producer had little effect on the ratings of sources of risk.

Contract producers rated specializing in one phase of production and producing under contract significantly higher in effectiveness in managing risk than independent producers. Independent producers rated being a low-cost producer as their most effective response to risk. Large-scale producers rated being a low-cost producer, specializing in hogs, and using contracts as significantly more effective in responding to risk than did small-scale producers. Older producers generally rated the responses to risk as less effective than the younger producers.

These results indicate that there is considerable diversity within the community of hog producers. This diversity implies that the content of risk management educational programs will need to be targeted to specific producer groups. Attempts to cover all hog producers with a single risk management education program are not likely to meet the needs of many producers.

Although there are no statistical differences across the age strata for past attendance at risk management programs, there are age and size-related differences in self-assessed knowledge of the tools, interest in additional training, and preferences for learning methods. Older producers considered themselves less knowledgeable about risk management tools, have lower levels of interest in additional information, and have lower levels of preferences for all educational methods. It is clear that age-related differences do occur in risk management perceptions and educational interests. Risk management programs should be targeted to younger hog producers for the greatest attendance. The older producers have relatively more interest in financial management than other educational topics. Although not addressed specifically in the survey, perhaps older producers have different educational needs (i.e., succession and estate planning, retirement, etc.) which should be targeted. Larger-scale producers rate themselves as being more knowledgeable in using risk management tools, have higher levels of interest in additional risk management education, and are more interested in in-depth training by

experts than through clubs or producer groups as compared with smaller-scale producers.

Financial leverage is a source of concern in a hog operation and is an important factor in desiring additional risk management education. The perception of high risks in hog prices, hog performance variability, and market access results in greater demand for risk management education. This is also consistent with the findings of Hall et al. and Knight et al. Contract producers generally expressed significantly less interest in risk management education than independent producers. However, this was not the case with respect to financial management, suggesting that contract producers continue to have risk management education needs that were not completely identified in this study.

Prior use and knowledge of a risk management tool and prior attendance at risk education programs are all associated with interest in additional education in that area. Past participants in risk management education programs are most likely to be future participants. This suggests that at least some programs should focus on deepening the knowledge that producers have, rather than just providing an introduction to risk management tools and their use.

The challenge that this presents is how to increase attendance by producers, especially young producers, who have not previously participated. Knight et al. found the lender's attitude was important in a crop producer's desire for additional training, which may provide insight into increasing producer attendance. Perhaps highlighting risk management in newsletters and mass media could be a useful first step as these were among the highly ranked means of obtaining information. Risk management educators would benefit from further studies addressing this issue. Analyzing why these producers do not attend risk management educational programs would allow educators to develop programs that better serve these producers. Some educational programs could explicitly target producers who have had little or no training in risk management tools.

Overall, this study confirms many of the findings of Hall et al. and Knight et al. There are many similarities in the sources and

responses to risk. All types of producers rate the price of the commodity they produce and factors that affect production as the most important sources of risk they face. Producers rate being low-cost producers and maintaining credit and financial reserves as the most effective responses to risk. Livestock producers stress maintaining herd health. There are also many similarities in the effect of variables in the probit models. However, this study suggests that there is considerable diversity among hog producers with respect to their risk management education wants and needs. Effective risk management education for hog producers will need to clearly identify and target the needs of specific producer groups.

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